March 2005

Elsinore Valley Municipal Water District

Elsinore Basin Groundwater Management Plan

Final Report

Elsinore Valley Municipal Water District

MWH

ELSINORE VALLEY MUNICIPAL
WATER DISTRICT

Elsinore Basin Groundwater Management Plan

March 2005

MWH

ACKNOWLEDGEMENTS

The development of the Elsinore Basin Groundwater Management Plan could not have been possible without the dedication of the project team and the support of the District staff and Technical Review Committee. MWH would like to acknowledge the following people for their support and assistance in completing the project.

Elsinore Valley Municipal Water District
Ronald E. Young, General Manager
Phillip M. Miller, Director of Engineering
Margie Armstrong, Controller
Joe Mouawad, Senior Engineer
Greg Morrison, Director of Legislative and Community Affairs

Technical Review Committee
Behrooz Mortazavi, Eastern Municipal Water District
Carl Hauge, California Department of Water Resources
Roger Shintaku, Elan Associates
Roy Herndon, Orange County Water District

MWH Project Staff
Ajit Bhamrah, Principal-In-Charge
Mark Abbott, Project Manager
David Ringel, Senior Technical Advisor
Don Evenson, Criteria Committee
Harold Glaser, Criteria Committee
Chris Peterson, Criteria Committee
Inge Wiersema, Project Engineer
Matthew Hacker, Project Hydrogeologist
Dawn York, Project Administrator
Beth McDonough
Adam Norris
Matthew Huang
Alok Pandya
Bonnie Lind
Christine Geasler
Genevieve Fernandez
Lissa McVean
Tracy Wilcox

California Department of Water Resources
Dale Schafer, Center for Collaborative Policy
Eric Hong, Supervising Engineer
Mansour Hojabry, Civil Engineer
Samson Haile-Selassie, Water Resources Engineer

Table of Contents

Section Name **Page Number**

Executive Summary

Study Area ES-1
Need for Groundwater Management Plan ES-2
Hydrogeologic Understanding of the Elsinore Basin ES-3
Fault System....ES-4
Geology....ES-4
Groundwater Balance....ES-5
Water Quality....ES-6
Baseline Conditions ES-6
Groundwater Management Issues....ES-8
Groundwater Management Strategies....ES-8
Description of Alternatives....ES-9
Alternative 1....ES-9
Alternative 2....ES-9
Alternative 3....ES-10
Alternative 4....ES-10
Evaluation of Alternatives ES-10
Ability to Reduce Overdraft....ES-17
Estimated Cost ES-18
Conclusion of Alternative Evaluation....ES-18
Implementation Plan ES-19
Conjunctive Use with Dual-Purpose Wells ES-19
Lake Replenishment with Recycled Water....ES-19
Basin Monitoring Plan ES-21
Advisory Committee....ES-22
Septic Tank Conversion Policies ES-22
Cost of Recommended Plan....ES-22
Stakeholder Involvement ES-22
GMWP Adoption....ES-22
Conclusions....ES-23

Section 1 - Introduction

Scope of Work 1-1
Study Area 1-1
Project Background.... 1-7
Project Objectives 1-8
Regional Setting of Elsinore Basin 1-9
Elsinore Groundwater Basin 1-9
Lake Elsinore 1-10
Canyon Lake 1-11

Imported Water Supplies 1-12
Wastewater and Recycled Water 1-12
Potable Demands 1-12
Non-Potable Demands 1-12
Stakeholder Involvement 1-12
GMWP Adoption 1-14
Summary 1-12
Planning Changes 1-14
Report Overview 1-16

Section 2 - Hydrogeologic Setting

Background 2-1
Previous Work 2-1
Data Collection 2-2
Data Organization 2-2
Data Sources 2-2
Well Information 2-3
Data Assessment 2-5
Geology and Structure 2-5
Geologic Setting 2-5
Hydrostratigraphy 2-5
Recent Alluvium 2-7
Older Alluvium 2-9
Fernando Group 2-9
Bedford Canyon Formation 2-9
Undifferentiated Basement Complex 2-9
Structure 2-9
Faults 2-10
Conceptual Hydrogeologic Sections 2-10
Aquifer Characteristics 2-17
Groundwater Levels 2-19
General Groundwater Flow 2-19
Historical Groundwater Levels 2-20
Fernando Group 2-23
Alluvium and Fernando Group 2-23
Groundwater Budget 2-24
Inflows 2-25
Precipitation Recharge 2-25
Surface Water Recharge 2-29
Recharge through Water Use 2-33
Outflows 2-34
Evapotranspiration by Phreatophytes 2-34
Groundwater Pumping 2-34
Surface Outflows 2-35
Subsurface Outflows 2-35
Water Budget Summary 2-36

Groundwater Quality 2-37
Summary 2-41

Section 3 - Groundwater Model

Model Construction 3-1
Model Domain 3-1
Model Layer Discretization 3-3
Aquifer Parameters 3-5
Boundary Conditions 3-8
Hydrologic Stresses 3-8
Model Calibration 3-9
Calibration Wells 3-12
Results 3-12
Lincoln Street Well 3-12
North Island Well 3-12
South Island Well 3-13
Cereal 4 Well 3-13
Cereal 3 Well 3-13
Cereal 1 Well 3-13
Corydon Well 3-13
Olive Street Well 3-14
Palomar Well 3-14
Calibration Analysis 3-14
Sensitivity Analysis 3-15
Summary 3-16
Model Limitations 3-16
Summary and Recommendations 3-17

Section 4 - Baseline Conditions

Introduction 4-1
Baseline Conditions 4-2
Baseline A – Current Basin Conditions 4-3
Planning Assumptions 4-4
Groundwater Balance 4-6
Water Levels 4-7
Baseline B – Year 2020 Basin Conditions 4-8
Planning Assumptions 4-9
Groundwater Balance 4-12
Water Levels 4-13
Need for Management Plan 4-15

Section 5 - Management Issues and Strategies

Introduction 5-1
Groundwater Management Issues 5-2
AB 3030 Issues and Components 5-3
1. Saline Water Intrusion 5-3
2. Wellhead Protection 5-3
3. Migration of Contaminated Groundwater 5-5
4. Well Construction Policies 5-7
5. Well Abandonment and Destruction 5-7
6. Construction of Groundwater Projects 5-8
7. Impact of Land Use Plans on Groundwater Contamination 5-9
8. Mitigation of Overdraft Conditions 5-9
9. Replenishment of Extracted Groundwater 5-10
10. Monitoring of Groundwater Production, Levels, Storage, and Water Quality 5-11
11. Facilitating Conjunctive Use Operations 5-11
12. Develop Relationships with Regulatory Agencies 5-11
Other Management Issues 5-12
1. Compliance with Drinking Water Quality Regulations and Basin Plan Objectives 5-12
2. Doubling of Water Demand in the Next 20 Years 5-14
3. Lake Replenishment Requirements 5-14
4. Impact of Future Basin Operations on Hot Springs 5-14
5. Risk of Liquefaction 5-14
Groundwater Management Strategies and Activities 5-15
Dual Purpose Wells 5-15
Possible Locations 5-16
Recharge Potential 5-18
Operation 5-19
Implementation 5-20
Surface Spreading 5-20
McVicker Canyon 5-21
Leach Canyon 5-23
Railroad Canyon 5-24
In-Lieu Recharge 5-25
New Sources of Supply 5-25
San Jacinto Raw Water Turnout 5-26
Local Runoff 5-26
Regional WWTP 5-27
Wastewater from EMWD 5-27
Water Conservation 5-27
Low Water Use Landscaping 5-28
Increase Awareness and Financial Incentives 5-29
Basin Monitoring 5-31
Stakeholder Involvement 5-31
Groundwater Quality Protection Programs and Policies 5-32

Wellhead Protection Program 5-32
Well Construction and Abandonment Program 5-32
Septic Tank Conversion Policies 5-33
Land Development Plans 5-33
Activities Not Considered 5-33

Section 6 - Description of Alternatives

Modeling Assumptions 6-1
Groundwater Model 6-1
Hydraulic Model 6-6
Alternative 1 – Dual Purpose Wells 6-7
Water Demands 6-7
Water Supplies 6-7
Septic Tanks 6-11
Lake Replenishment 6-11
Alternative 2 – Surface Spreading 6-11
Water Demands 6-11
Water Supplies 6-12
Alternative 3 – In-lieu Recharge 6-17
Water Demands 6-17
Water Supply 6-17
Alternative 4 – Combination Alternative 6-19
Water Demands 6-19
Water Supplies 6-19
Lake Replenishment 6-21

Section 7 - Evaluation of Alternatives

Introduction 7-1
Evaluation Criteria 7-1
Ability to Reduce Overdraft 7-3
Expected Cost 7-3
Environmental Impacts 7-6
Risk 7-6
Legal and Regulatory Issues 7-6
Public Acceptability 7-7
Funding 7-7
Reliability 7-7
Water Quality 7-8
Flexibility 7-8
Ease of Implementation 7-8
Evaluation of Alternatives 7-9
Ability to Reduce Overdraft 7-9
Expected Cost 7-15
Environmental Impacts 7-18
Risk 7-19

Legal and Regulatory Issues 7-21
Public Acceptability 7-23
Funding 7-24
Reliability 7-25
Water Quality 7-25
Flexibility 7-26
Ease of Implementation 7-27
Selection of Preferred Alternative 7-28

Section 8 - Implementation Plan

Introduction 8-1
Components of the Recommended Plan 8-1
Water Conservation 8-1
Minimizing Basin Pumping 8-4
Groundwater Recharge with Dual Purpose Wells 8-4
Other Facilities 8-4
Lake Level Maintenance 8-5
Surface Spreading 8-5
Use of Recycled Water 8-5
Advisory Committee 8-6
Monitoring Program 8-6
Well Construction, Destruction and Abandonment Policies 8-8
Septic Tank Conversion Plan and Policies 8-9
Integrated Planning 8-9
Periodic Reporting and GWMP Updating 8-9
Implementation 8-10
Costs of the Recommended Plan 8-10
Funding Options 8-10
Phasing of Activities 8-11
Phasing of Cost 8-12
Operation of the Basin 8-13
Agency Coordination 8-16
Conclusion 8-16

Appendices

Appendix A – References
Appendix B – Abbreviations
Appendix C – Stakeholder Involvement and Management Plan Adoption
Appendix D – Contour Maps
Appendix E – Model Calibration
Appendix F – Lake Analysis
Appendix G – Management Issues
Appendix H – Water Conservation
Appendix I – Cost Information
Appendix J – Model Results
Appendix K - Groundwater Monitoring Plan

LIST OF TABLES

Table Name **Page Number**

Table ES-1 Summary of Baselines A and B 6
Table ES-2 Summary of Alternatives 11
Table ES-3 Summary of Alternatives Evaluation 13
Table ES-4 Cost Summary per Alternative 18
Table ES-5 Summary of Estimated Cost of the Recommended Plan 23
Table 1 1 Operational Data for Lake Elsinore 1-11
Table 2 1 Data Sources 2-3
Table 2 2 Summary of Aquifer Characteristics 2-18
Table 2 3 Summary of Groundwater Elevations – Summer 2002 2-20
Table 2 4 Evapotranspiration Constants for Elsinore Basin 2-29
Table 2 5 Summary of Estimated Groundwater Basin Budget for 1990-2000 2-36
Table 3 1 Aquifer Property Model Input Parameters 3-6
Table 3 2 Summary of Wells in Flow Model 3-9
Table 4 1 Potable Water Demands in the Elsinore Basin – Year 2000 4-1
Table 4 2 Potable Water Demands in the Elsinore Basin – Baseline A 4-4
Table 4 3 Summary of Groundwater Balance – Baseline A 4-6
Table 4 4 Potable Water Demands in the Elsinore Basin – Baseline B 4-10
Table 4 5 Range of Lake Replenishment Requirements – Baseline B 4-12
Table 4 6 Summary of Groundwater Balance – Baseline B 4-13
Table 5 1 List of Potential Management Issues 5-4
Table 5 2 Specific Water Quality Objectives for Elsinore Basin 5-13
Table 5 3 Management Activities and Water Sources Considered 5-16
Table 5 4 Summary of Recharge Potential with Dual Purpose Wells 5-18
Table 5 5 McVicker Canyon Surface Spreading Potential 5-21
Table 5 6 Leach Canyon Surface Spreading Potential 5-23
Table 5 7 Estimated Irrigation Savings with Low Water Use Landscaping 5-28
Table 5 8 Estimated Water Savings with Awareness and Financial Incentives 5-30

Table 6 1 Summary of Alternatives 6-3
Table 6 2 Summary of Average Groundwater Balance for 2020 6-5
Table 6 3 Maximum Injection and Extraction Capacities 6-6
Table 6 4 Projected Average Supplies and Demands for 2020 6-8
Table 6 5 Summary of Projected Lake Elsinore Balance for 2020 6-9
Table 6-6 Cost Comparison Surface Spreading Water Sources 6-14
Table 7-1 Evaluation Criteria 7-2
Table 7 2 Summary of Water Supply Cost 7-5
Table 7-3 Summary of Alternative Evaluation 7-11
Table 7-4 Cost Summary per Alternative 7-16
Table 7-5 Cost Summary per Alternative per acre-foot of overdraft reduction 7-18
Table 7-6 Reliability of Alternatives 7-25
Table 7-7 Estimated TDS Concentration (mg/L) 7-26
Table 7-8 Summary of Alternative Rating 7-28
Table 7-10 Summary of Alternative Ranking 7-29
Table 8-1 Summary of Dual Purpose Wells 8-4
Table 8-2 Summary of Capital and Annual Cost 8-11
Table 8-3 Phasing of Capital Cost (in $1,000) 8-13
Table 8-4 Summary of Agency Coordination 8-16

LIST OF FIGURES

Figure Name **Page Number**

Figure ES-1 Study Area 1
Figure ES-2 Projected Water Demands of EVMWD and EWD 2
Figure ES-3 Location of Wells and Faults in the Elsinore Basin 3
Figure ES-4 Geology of the Elsinore Basin 4
Figure ES-5 Elsinore Basin Groundwater Budget 1990-2001 5
Figure ES-6 Projected Cumulative Groundwater Balance for Baselines A and B 7
Figure ES-7 Projected Groundwater Levels for Baseline B 7
Figure ES-8 Comparison Chart for the North Island Well 17
Figure ES-9 Components of the Recommended Plan 20
Figure ES-10 Water Supply Mix during an Average Rainfall Year 21
Figure 1 1 Study Area 1-4
Figure 1 2 Locations of Key Facilities in the Elsinore Basin 1-5
Figure 1 3 Water Flows in the Elsinore Basin 1-10
Figure 2 1 Wells in the Elsinore Basin 2-4
Figure 2 2 Faults of the Elsinore Basin 2-6
Figure 2 3 Hydrostratigraphy in the Elsinore Basin 2-7
Figure 2 4 Geology of the Elsinore Basin 2-8
Figure 2 5 Location of Cross Sections 2-11
Figure 2 6 Cross Section A-A' 2-13
Figure 2 7 Cross Section B-B' 2-15
Figure 2 8 Cross Section C-C' 2-16
Figure 2 9 Groundwater Contour Map Fernando Group – Summer 2002 2-21

Figure 2 10 Groundwater Level Map Alluvium and Fernando Group– Summer 2002..... 2-22
Figure 2 11 Historical Water Levels in the Fernando Group..... 2-23
Figure 2 12 Historical Water Levels in the Alluvium and the Fernando Group..... 2-24
Figure 2 13 Isohyetal Map of Elsinore Watershed 2-26
Figure 2 14 Historical Annual Precipitation Riverside County Flood Control District – Station 67 2-27
Figure 2 15 Vegetation Distribution in the Elsinore Basin..... 2-28
Figure 2 16 Land Use in Elsinore Watershed 2-30
Figure 2 17 Annual Estimated Groundwater Recharge from Precipitation (1990-2000)..... 2-31
Figure 2 18 Historical Annual Streamflow at San Jacinto River (1916-2000)..... 2-32
Figure 2 19 Estimated Groundwater Recharge from the San Jacinto River (1990-2000)..... 2-32
Figure 2 20 Estimated Groundwater Recharge through Water Use (1990-2000) 2-34
Figure 2 21 Historical Groundwater Pumping in the Elsinore Basin 2-35
Figure 2 22 Total Estimated Inflows and Outflows to Groundwater Basin 2-37
Figure 2 23 Piper Diagram in the Elsinore Basin 2-38
Figure 2 24 Historical Total Dissolved Solids Concentrations in Elsinore Basin Wells..... 2-39
Figure 2 25 Historical Sulfate Concentrations in Wells in the Elsinore Basin..... 2-39
Figure 2 26 Historical Nitrate Concentrations in Wells in the Elsinore Basin 2-40
Figure 2 27 Historical Arsenic Concentrations in Elsinore Basin Wells..... 2-40

Figure 3 1 Model Domain and Grid Discretization 3-2
Figure 3 2 Longitudinal Cross Section Through Flow Model..... 3-4
Figure 3 3 Hydraulic Conductivity Distribution, Model Layers 1 and 3..... 3-7
Figure 3 4 Calibration and Pumping Well Location Map..... 3-10
Figure 3 5 Relative Goodness of Fit for Groundwater Model..... 3-11
Figure 3 6 Modeled Difference in Water Level Between Layer 1 and Layer 3 3-15
Figure 4 1 Summary of Projected Potable Water Demands through 2020..... 4-2
Figure 4 2 Annual Precipitation at Lake Elsinore..... 4-3
Figure 4 3 Summary of Supplies to Meet Projected Demands – Baseline A 4-5
Figure 4 4 Projected Cumulative Groundwater Balance - Baseline A 4-7
Figure 4 5 Projected Water Levels of Baseline A – Existing Conditions..... 4-8
Figure 4 6 Supply Mix to Meet the Projected Year 2020 Demands with Sustainable Groundwater Balance– Baseline A..... 4-9
Figure 4 7 Supply Mix to Meet the Projected Year 2020 Demands – Baseline B 4-10
Figure 4 8 Summary of Lake Replenishment Requirements for Baseline B..... 4-11
Figure 4 9 Projected Cumulative Groundwater Balance - Baselines A and B 4-14
Figure 4 10 Projected Water Levels of Baseline B – Future Conditions..... 4-14
Figure 4 11 Supply Mix to Meet Year 2020 Demands with Sustainable Groundwater Balance– Baseline B 4-15
Figure 5 1 Process to Define Management Alternatives 5-1
Figure 5 2 Septic Tank Risk Zones..... 5-6
Figure 5 3 Location of Dual Purpose Wells..... 5-17
Figure 5 4 Total Replenishment Supplies Available from MWDSC (1961-1998) 5-19
Figure 5 5 Potential Recharge Locations..... 5-22
Figure 6 1 Injection and Extraction Cycles of Alternative 1 6-10
Figure 6 2 Year 2020 Potable Supplies with Alternative 1 6-10

Table of Contents

Figure 6 3 Surface Spreading and Extraction Cycles Alternative 2 6-15
Figure 6 4 Year 2020 Potable Supplies for Alternative 2 6-15
Figure 6 5 Groundwater Pumping and In-Lieu Recharge – Alternative 3 6-18
Figure 6 6 Year 2020 Potable Supplies for Alternative 3 6-18
Figure 6 7 Groundwater Pumping and Injection – Alternative 4 6-20
Figure 6 8 Supply of Year 2020 Demand with Alternative 4 6-21
Figure 7-1 Water Level Comparison – Lincoln Street Well 7-10
Figure 7-2 Water Level Comparison – North Island Well 7-10
Figure 7-3 Water Level Comparison – Corydon Well 7-15
Figure 8-1 Components of the Recommended Plan 8-2
Figure 8-2 Location of Monitoring Wells 8-7
Figure 8-3 Phasing of Activities 8-12
Figure 8-4 Water Supply Mix during an Average Rainfall Year 8-14
Figure 8-5 Water Supply Mix during a Wet Year 8-15
Figure 8-6 Water Supply Mix during a Dry Year 8-15

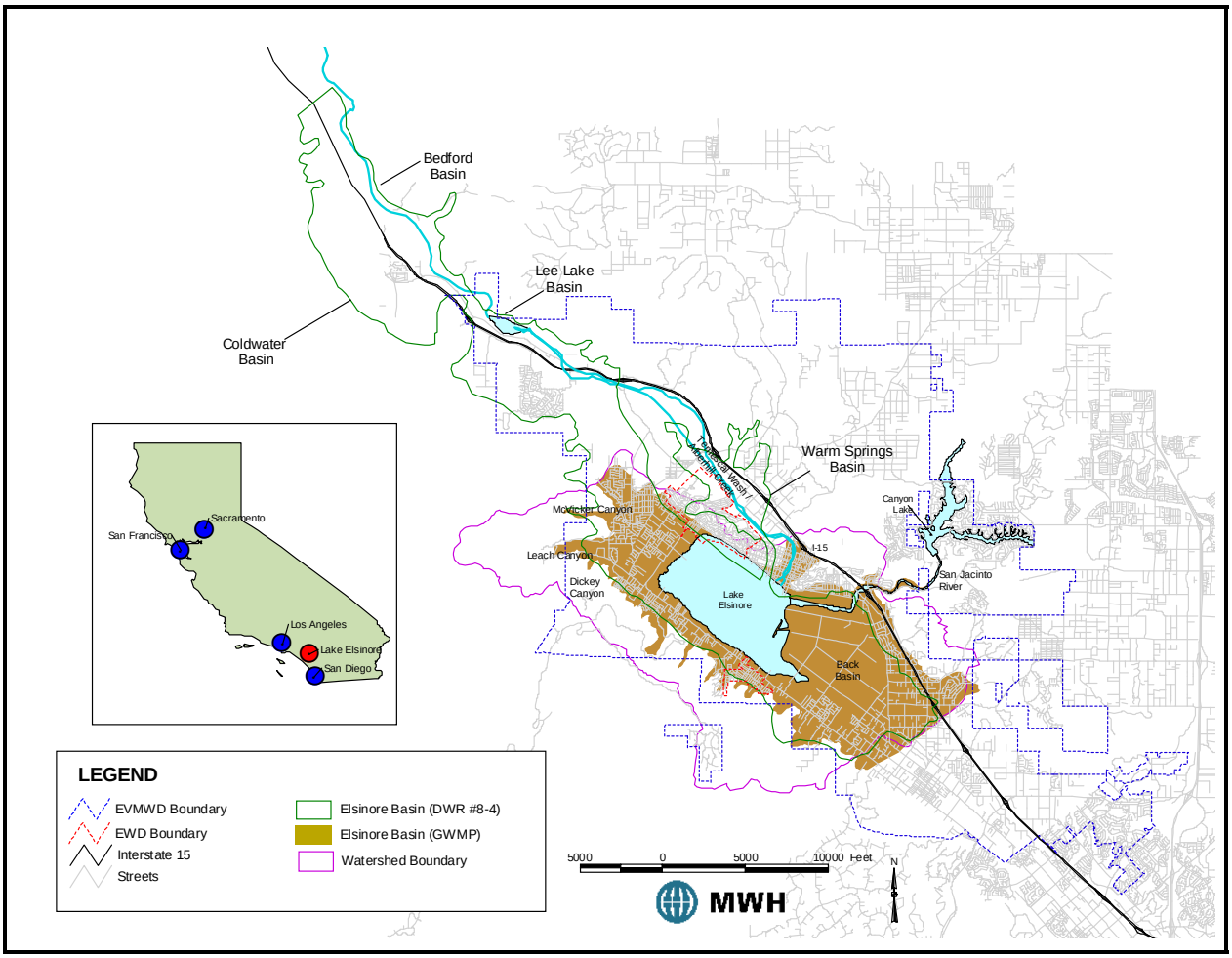
Executive Summary

The objective of this Groundwater Management Plan (GWMP) is to provide an evaluation of the groundwater basin and develop a reliable groundwater supply to meet drought and dry season demands through the year 2020. This plan addresses the hydrogeologic understanding of the basin, the evaluation of baseline conditions, identification of management issues and strategies, and the definition and evaluation of four alternatives. This document concludes with an implementation plan of the recommended plan. This GWMP was adopted by the Elsinore Valley Municipal Water District Board of Directors on March 24, 2005 under the authority of the Groundwater Management Planning Act (California Water Code Part 2.75, §10753) as amended.

STUDY AREA

The study area is the Elsinore Basin (**Figure ES-1**). The surface drainage area shown on this figure consists of approximately 42 square miles, of which about 25 square miles are located

Figure ES-1
Study Area

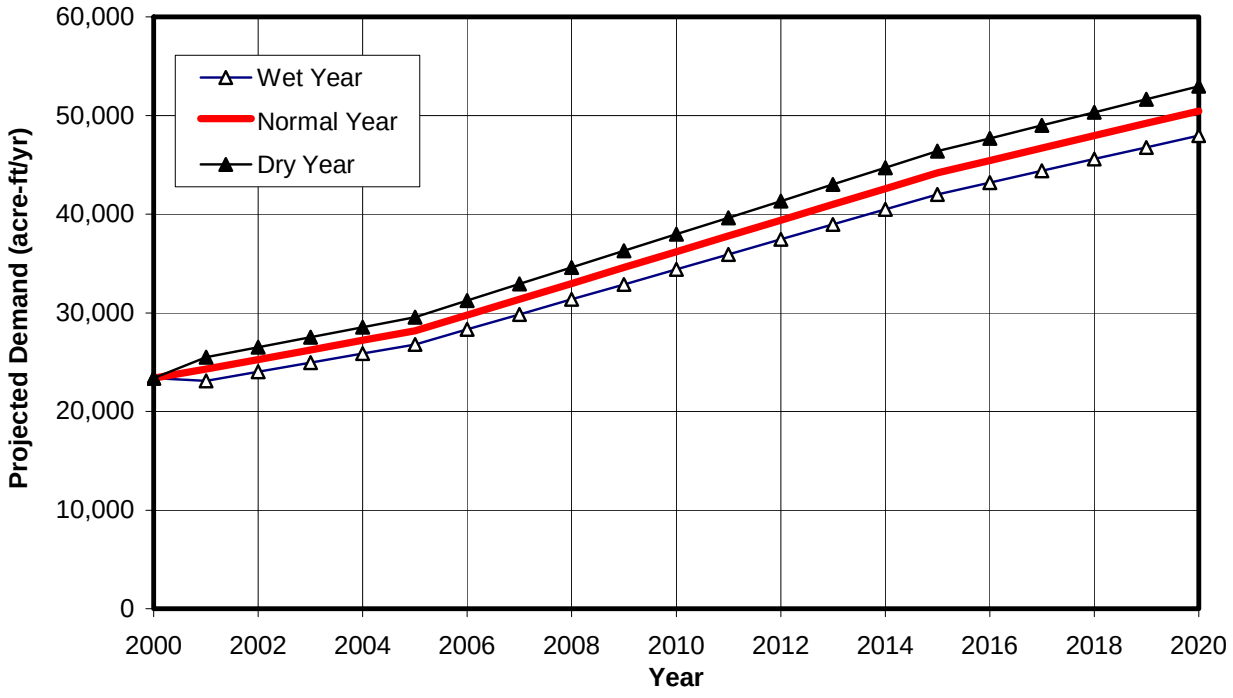


within the basin floor including Lake Elsinore (5 square miles). The remaining portions of the Elsinore Basin include the surrounding highlands and associated streams and canyons. A portion of the area southeast of the lake, referred to as the Back Basin, is part of the flood plain for Lake Elsinore and the San Jacinto River.

NEED FOR GROUNDWATER MANAGEMENT PLAN

The work completed as part of this GWMP illustrates that the Elsinore Basin may be in a state of overdraft (about 4,400 acre-ft/yr). A continuation of the current conditions to year 2020 will result in an increased overdraft (about 6,500 acre-ft/yr) and a significant decline in water levels. Water quality degradation and increased risk of land subsidence are two of the related adverse impacts of declining water levels. In addition to these effects, the demand for groundwater will increase in the future due to 1) the need for lake replenishment and 2) additional potable supplies to meet demands over the next 20 years (**Figure ES-2)**. The adverse effects of declining water levels combined with increased demands make the development of this GWMP critical. The intent of this plan is to provide a guideline that will resolve the overdraft problem and protect the groundwater supply for use by future generations.

Figure ES-2
Projected Water Demands of EVMWD and EWD



The need and goal statement for this GWMP has been developed through the stakeholder process with local agencies, water purveyors and residents involved in the stakeholder process:

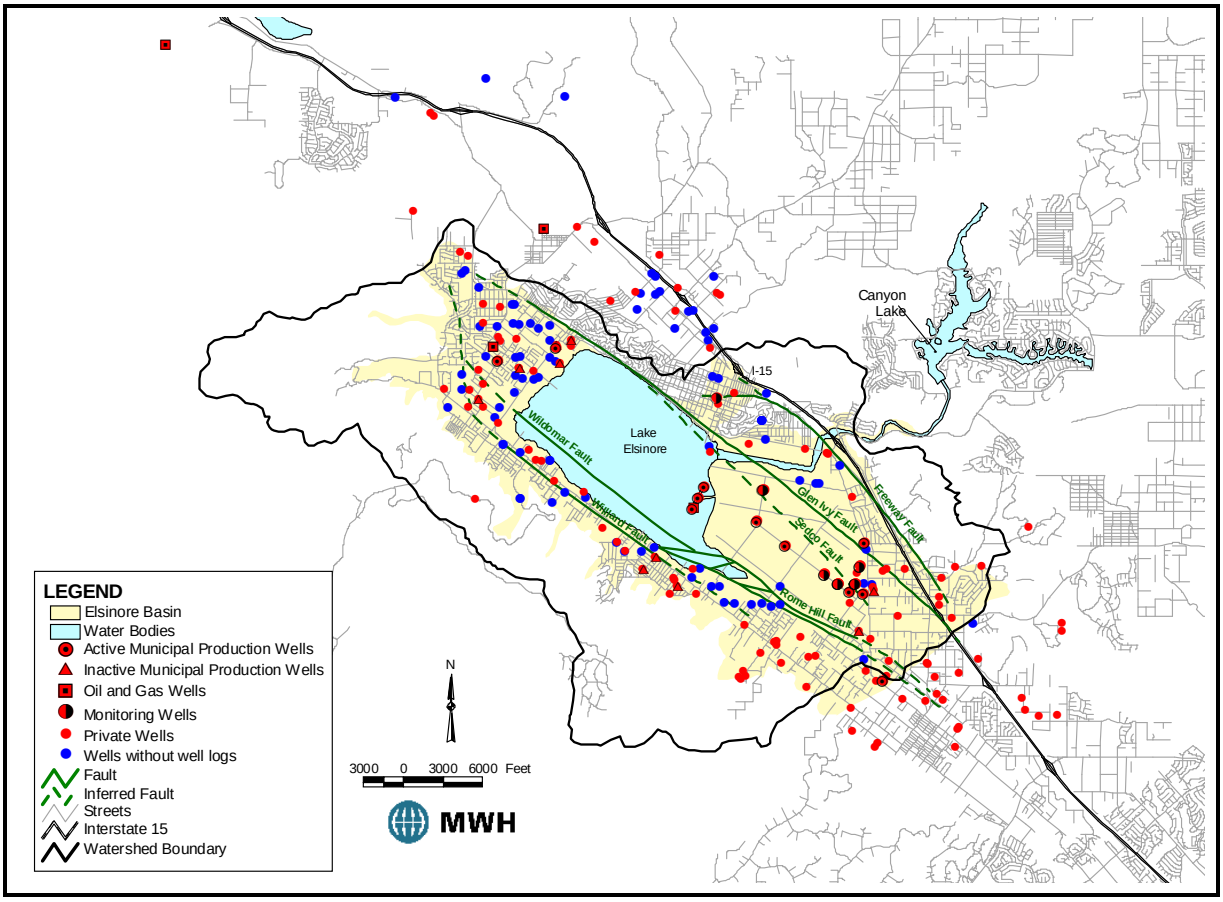
"Because water demand is projected to double in the next 20 years, cooperative groundwater management is required to achieve a sustainable water balance in the Elsinore Basin, the goal of this Groundwater Management Plan is to ensure a reliable, high quality, cost-efficient groundwater supply for the users of the Elsinore Basin in an environmentally responsible manner."

HYDROGEOLOGIC UNDERSTANDING OF THE ELSINORE BASIN

The Elsinore Basin is a major source of water supply for Elsinore Valley Municipal Water District (EVMWD), Elsinore Water District (EWD) and other local groundwater producers. The development of a conceptual understanding of the groundwater basin is an important step in the development of the GWMP and includes the understanding of the geology, fault locations, groundwater flows, groundwater quality and a groundwater budget of the Elsinore Basin.

Figure ES-3 presents the location of the Elsinore Basin, the 239 documented wells, and the location of faults within the Elsinore Basin. There are 151 wells that have well logs, which provide the most comprehensive descriptions of the lithology in the basin.

Figure ES-3
Location of Wells and Faults in the Elsinore Basin



Fault System

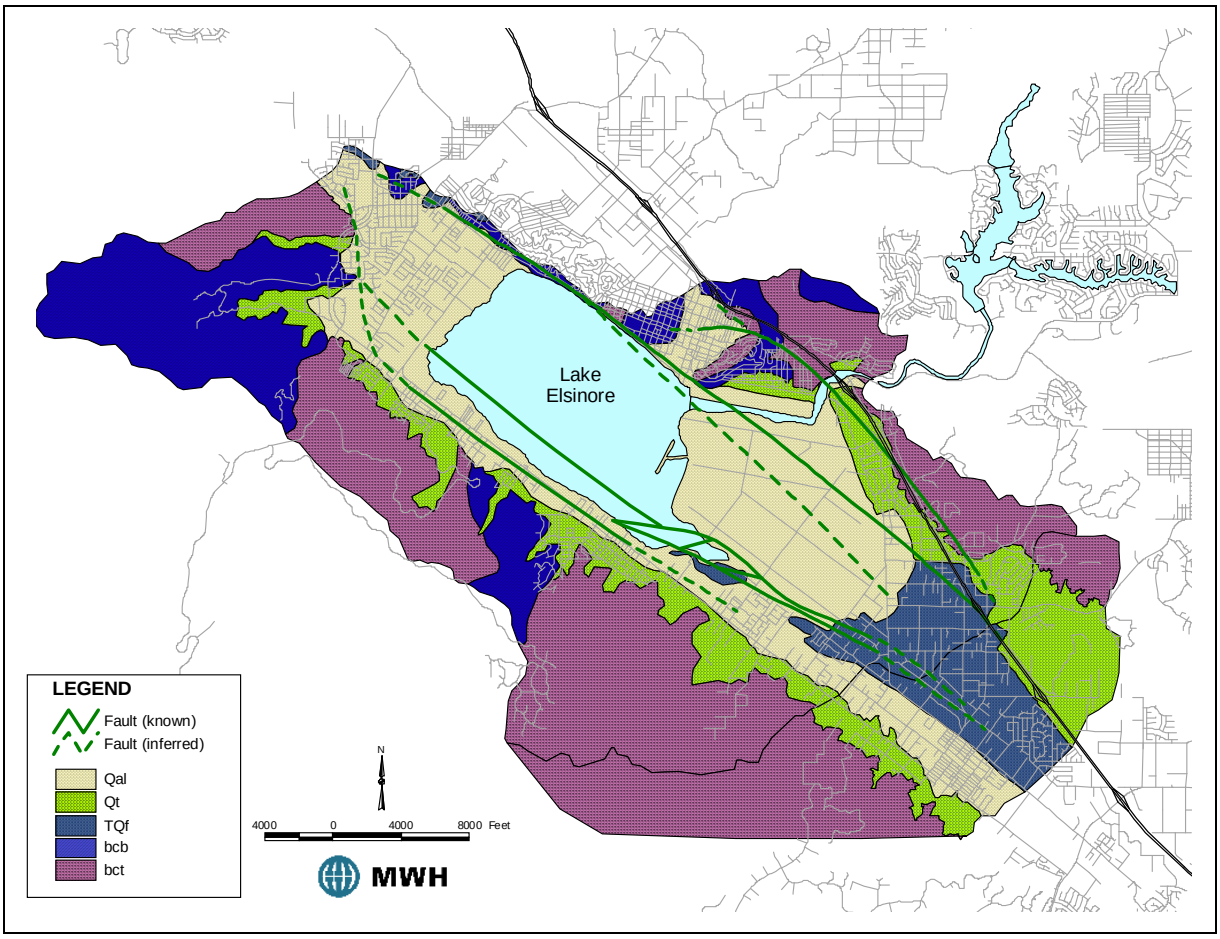
The Elsinore Basin is dominated by two major fault zones, the Glen Ivy Fault Zone which includes the Glen Ivy fault, the Freeway fault and the Sedco fault, and the Wildomar Fault Zone, which includes the Wildomar fault, the Rome Hill fault, and the Willard fault. Of these the Glen Ivy and Rome Hill faults appear to be at least partial barriers to groundwater flow. The Willard and the Wildomar faults do not appear to be barriers to groundwater flow.

Geology

Figure ES-4 shows the geology of the Elsinore Basin, which can be divided into five classifications, also referred to as the hydrostratigraphy of the Basin. These classifications are:

- The Recent alluvium (Qal)
- The Older alluvium (Qt)
- The Fernando Group (TQf)
- The Bedford Canyon Formation (bcb)
- The basement rocks (bct)

Figure ES-4
Geology of the Elsinore Basin



Cross sections are presented in the report that show the relationship between these geologic units. According to the conceptual model developed for this GWMP, the Elsinore Basin is a closed groundwater basin bounded by either bedrock or faults. Inflows to the basin a predominantly from the canyons to the northwest (Leach and McVicker) and the San Jacinto on the northeast. The general groundwater flow direction is from the northwest to the southeast, largely a result of groundwater extraction in the Back Basin.

Groundwater Balance

The groundwater balance prepared for this GWMP covers the period 1990-2001 and consists of the quantification and reconciliation of the following inflow and outflow components:

Inflows

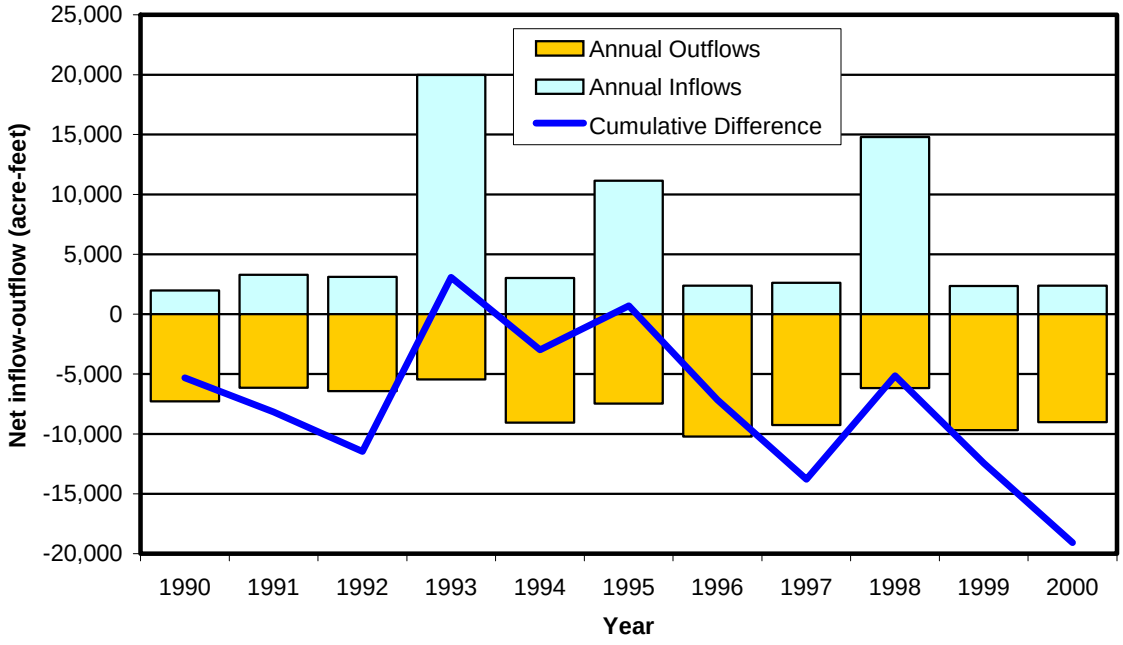
- Infiltration from direct precipitation
- Surface water infiltration
- Infiltration from deep percolation of applied water
- Infiltration from septic tanks
- Underflow into basin

Outflows

- Groundwater pumping
- Flow to surface water
- Underflow out of basin

Based upon this period, the difference between inflows and outflows suggests an average annual groundwater deficit of approximately 1,800 acre-ft/yr over the 11-year period. The estimated cumulative groundwater deficit over the same period was approximately 19,000 acre-ft. **Figure ES-5** shows the estimated annual inflows and outflows over the period, indicating that the Elsinore Basin experienced a groundwater deficit in eight of the 11 years reviewed.

Figure ES-5
Elsinore Basin Groundwater Budget 1990-2001



Water Quality

The water quality of the basin is evaluated based on available data. Although the data shows lateral and vertical variations in water quality, the following general observations can be made:

- Total dissolved solids (TDS) concentrations are generally higher in the area north of Lake Elsinore and along basin margins than in the Back Basin area.
- Highest concentrations of TDS, sulfate and nitrate are found at the Lincoln Street Well.
- Lowest concentrations of TDS and sulfate are found in the Olive Street Well.
- Highest concentrations of nitrate are found in the Palomar Well and these concentrations appear to be increasing.

BASELINE CONDITIONS

The review of historical water conditions indicates that outflows from the Elsinore Basin exceed the inflows. If this condition were to continue in the future, the basin may become overdrafted. To compare the long-term impact of the existing basin operation and the anticipated future operation of the basin, two baseline scenarios (Baselines A and B) are developed. The definition of both baselines is summarized in **Table ES-1**. Baseline B also provides the basis for comparison of the four alternatives developed for this GWMP.

Table ES-1
Summary of Baselines A and B

Baseline A	Baseline B
Year 2000 Demand (average = 25,000 acre-ft/yr)	Year 2020 Demand (average = 50,000 acre-ft/yr)
Year 2000 Land use	Year 2020 Land use
All existing production wells (8)	All existing production wells plus Joy St Well (9)
Canyon Lake WTP at 9 mgd	Canyon Lake WTP at 9 mgd
AVP connection at 24.2 mgd	AVP connection at 24.2 mgd
TVP connection at 12.7 mgd	TVP connection with new PS at 26.5 mgd
No septic tanks conversions	3,000 septic tanks converted to sewer
No Lake make-up	Lake make-up with Island Wells and Recycled Water (7.5 mgd)
No additional new source of supply	Additional new source of supply

Baseline A simulates the current (year 2000) groundwater pumping patterns in the basin, while Baseline B simulates expected pumping conditions in the basin in year 2020 without the implementation of any new groundwater management activities. To evaluate the potential range in groundwater conditions in the basin, the hydrologic conditions for the period October 1960 through September 2001 are used. This 41-year period represents a period of average precipitation and includes a wide range of wet, normal and dry years.

The baseline conditions and the difference in groundwater storage predicted with the groundwater model over the 41-year period are presented in **Figure ES-6** and **Figure ES-7**. As shown in **Figure ES-6**, the basin would experience a storage deficit of about 180,000 acre-ft and 270,000 acre-ft over the 41-year simulation period for Baseline A and Baseline B, respectively.

This corresponds to an average deficit of 4,400 acre-ft/yr for Baseline A and 6,500 acre-ft/yr for Baseline B.

Figure ES-6
Projected Cumulative Groundwater Balance for Baselines A and B

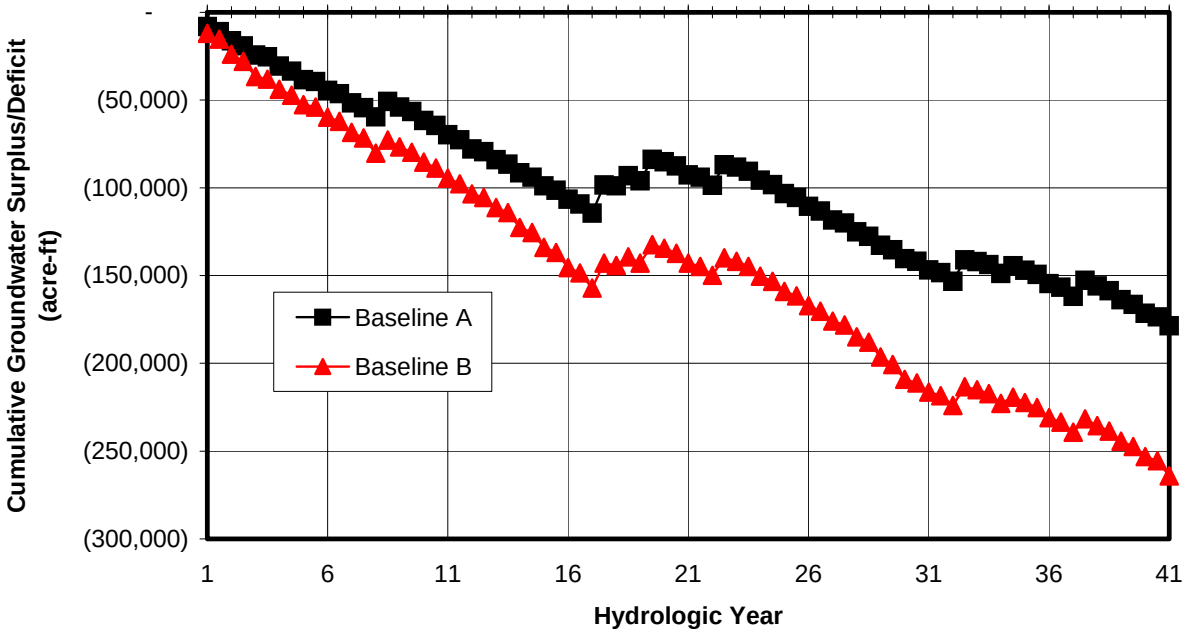
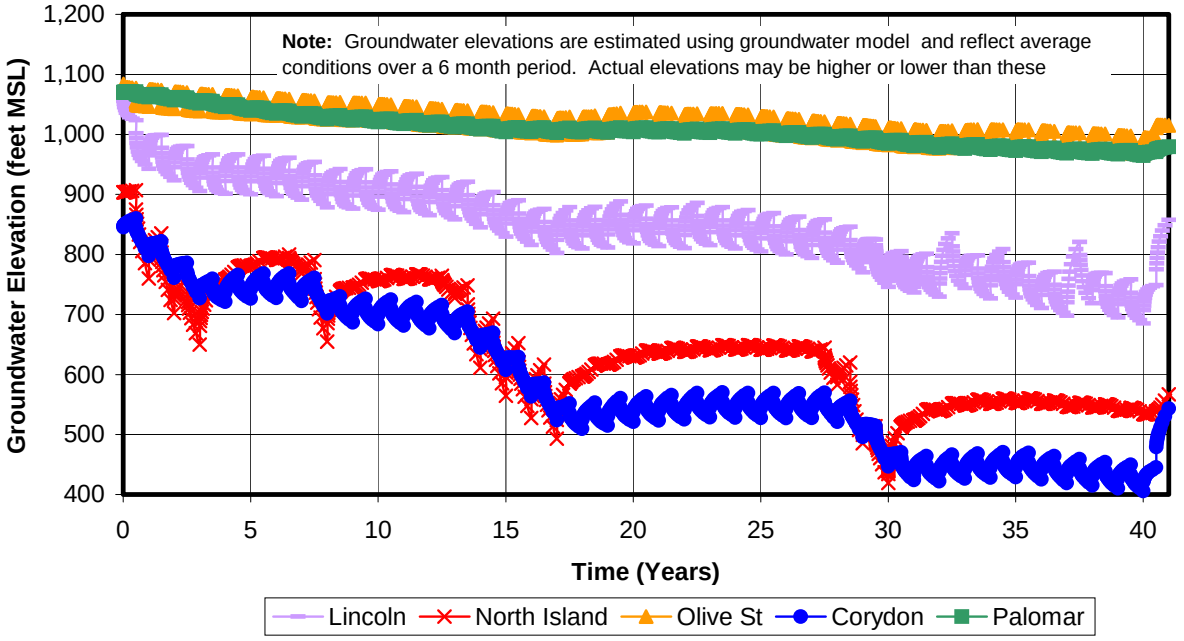


Figure ES-7
Projected Groundwater Levels for Baseline B



As shown in **Figure ES-7**, the water levels are expected to decline throughout the basin. The decrease in water levels is greater under Baseline B conditions than under Baseline A conditions. Under Baseline B conditions, the water levels in the Lincoln Street and Corydon Street wells are projected to drop more than 200 feet and 400 feet over the 41-yr simulation period, respectively. Declining water levels can lead to other detrimental effects such as land subsidence, increased pumping costs, loss of production capacity and water quality degradation.

GROUNDWATER MANAGEMENT ISSUES

This GWMP is prepared in compliance with the Groundwater Management Act, also known as AB3030, which is recently amended by SB1938, which identify twelve specific components and management issues that may be included in a groundwater management plan. These twelve components and five additional potential issues are discussed in detail in **Section 5** and are summarized in **Appendix F**. The following nine main issues pertain to the Elsinore Basin:

- Well head protection
- Groundwater contamination
- Well construction, destruction, and abandonment policies
- Compliance with drinking water regulations and Basin Plan objectives
- Doubling of water demands
- Use of groundwater for Lake Elsinore replenishment needs
- Declining groundwater levels and storage deficit
- Basin monitoring
- Potential of subsidence

GROUNDWATER MANAGEMENT STRATEGIES

A groundwater management strategy is a general approach that addresses one or more of the management issues. The strategies identified in this GWMP are:

- Store imported water by using dual purpose wells
- Increase local supplies by using spreading basins
- Store imported water by using spreading basins
- Store groundwater for dry years by using in-lieu recharge
- Develop new sources of supply
- Reduce supply needs through water conservation
- Measure progress through basin monitoring
- Stakeholder involvement
- Protect groundwater quality by developing programs and policies

These strategies are included in different combinations in the four alternatives that are developed for this GWMP and are compared with Baseline B in the alternative evaluation. Details on these management strategies are presented in **Section 5**.

DESCRIPTION OF ALTERNATIVES

Four alternatives are identified to meet the current and future demands of EVWMD, while achieving a sustainable water balance in the Elsinore Basin. A detailed summary of the components included in the two baselines and the four alternatives is presented in **Table ES-2**. The four alternatives are:

- Alternative 1 – Dual Purpose Wells
- Alternative 2 – Surface Spreading
- Alternative 3 – In-lieu Recharge and Water Conservation
- Alternative 4 – Combination

The average groundwater balance for all four alternatives and the two baselines of the 41-year hydrologic period from 1961 to 2001 is presented in detail in **Section 6** along the water supply balances, and the Lake Elsinore balances. All alternatives are able to meet the year 2020 demands and maintain the Lake level at 1,240 ft MSL by replenishing the Lake with groundwater and recycled water. However, only alternatives 1, 3, and 4 show maintain a balanced groundwater basin (net storage equals zero), while Baseline A, Baseline B and Alternative 2 have an average annual groundwater storage deficit of 4,400 acre-ft, 6,500 acre-ft and 3,800 acre-ft, respectively.

Alternative 1

The purpose of Alternative 1 is to achieve a balanced groundwater basin through a conjunctive use program using the 14 dual-purpose injection-extraction wells. Treated water would be injected during periods when replenishment water is available. The new dual-purpose wells would be used to extract stored groundwater when additional supplies are required to meet the year 2020 demands. The 14 dual-purpose wells are:

- Four conversions of existing deep wells in the Back Basin
- Two new deep dual-purpose wells in the Back Basin
- Five new shallow dual-purpose wells in the Back Basin
- Three new deep dual-purpose wells in the area north of Lake Elsinore.

Injection would take place in 33 of the 41 years and over the 41-year period, an average of 6,700 acre-ft/yr would be injected. Extraction would take place during 22 out of the 41 years. In addition, four peaking wells are required to meet the year 2020 Maximum Day Demands (MDD).

Alternative 2

The purpose of Alternative 2 is to achieve a balanced groundwater basin using spreading basins in Leach and McVicker Canyons to maximize the capture of local runoff water and infiltrate treated imported water. Five new extraction wells would be required in the area north of Lake Elsinore to extract water that is recharged in the spreading basins. Surface recharge would take place every year, ranging from 540 to 6,540 acre-ft in six months.

Extraction would take place during 22 years of the 41-year period and ranges from 0 to 1,930 acre-ft in six months. In addition, 11 extra wells are required to provide peaking capacity to meet the year 2020 MDD.

Alternative 3

The purpose of Alternative 3 is to achieve a balanced groundwater basin using a combination of in-lieu recharge and water conservation. With in-lieu recharge, the amount of imported water used would be maximized to reduce groundwater pumping, hence increasing the basin storage as natural inflows continue. Construction of new facilities is not required for in-lieu recharge, with the exception of the eight new peaking wells that are needed to meet the year 2020 MDD.

Alternative 4

The purpose of Alternative 4 is to achieve a balanced groundwater basin using a combination of dual-purpose wells, in-lieu recharge, and water conservation. The following 14 dual-purpose wells would be installed for this alternative:

- Four conversions of existing deep wells in the Back Basin
- Two new deep dual-purpose wells in the Back Basin
- Five new shallow dual-purpose wells in the Back Basin
- Equipping Joy Street Well as dual-purpose
- Two new deep dual-purpose wells in the area north of Lake Elsinore

During the 41-year hydrologic cycle, about 240,000 acre-ft of imported water would be injected. Lake replenishment from groundwater is insignificant, because more recycled water is used under this alternative (up to 17.7 mgd versus 7.5 mgd in alternatives 1 through 3). In addition, four peaking wells are required to meet the year 2020 MDD.

EVALUATION OF ALTERNATIVES

The process of evaluating the effectiveness of each alternative in meeting the GWMP's goal involves technical analyses coupled with professional judgment and experience. Each management alternative is evaluated using the following eleven criteria:

- Ability to reduce overdraft
- Expected cost
- Environmental impacts
- Risk
- Legal and regulatory implementation
- Public acceptability
- Funding
- Reliability
- Water Quality
- Flexibility
- Ease of implementation

The evaluation and ranking of Baseline B and Alternatives 1 through 4 is presented in **Table ES-3**. Alternatives are rated on a scale of 1 to 5, with 5 being excellent and 1 being a very poor score. In addition, each criterion has a weighting factor ranging from 1 to 3, with 3 used for the

Table ES-2
Summary of Alternatives

Item	Baseline A	Baseline B	Alternative 1 Dual Purpose Wells	Alternative 2 Surface Spreading	Alternative 3 In-Lieu Recharge and Water Conservation	Alternative 4 Combination
Water Demand	Year 2000	Year 2020	Same as Baseline B	Same as Baseline B	Year 2020 with 10% water conservation	Same as Baseline B with 5% water conservation
Water Supplies	Current Supplies: • 8 Existing EVMWD Wells • 4 Existing EWD Wells • Canyon Lake WTP • AVP Connection • TVP Connection	• Same as in Baseline A • Joy Street Well • 11 wells for peaking	• Same as in Baseline A • Joy Street Well • Conversion of 4 existing wells to dual purpose wells • 10 new dual purpose wells • 4 wells for peaking	• Same as in Baseline A • Joy Street Well • 5 new extraction wells • 11 wells for peaking	• Same as in Baseline A • Joy Street Well • 8 wells for peaking	• Same as in Baseline A • Equipping Joy Street Well as dual purpose • Conversion of 6 existing wells to dual purpose wells • 7 new dual purpose wells • 4 wells for peaking
Land Use	Year 2000	Year 2020	Same as Baseline B	Same as Baseline B	Same as Baseline B	Same as Baseline B
Lake Replenishment	None	• 7.5 mgd of Recycled Water • 3 Island Wells	Same as Baseline B	Same as Baseline B	Same as Baseline B	• 17.7 mgd of Recycled Water • 1 Island Wells
Septic Tanks	Existing Septic Tanks	Existing Septic Tanks	Conversion of all Septic Tanks in the High-Risk Zone	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Special Projects (in addition to the peaking wells)	None	• 17.9 miles of 36-inch to 12-inch diameter pipeline to bring in new source water[2] from the Woodcrest Turnout to Lake St. Tank.	Dual Purpose Wells with imported water: • 3 deep wells north of the lake • 6 deep wells south of the lake[1] • 5 shallow wells south of the lake Other Facilities: • 30-inch diameter pipeline (4,000 ft) • 800 HP pumping station between Cal Oaks and the Back Basin	Surface Spreading with imported water: • 25-acre spreading basin in Leach Canyon • 15-acre spreading basin in McVicker Canyon • 5 extraction wells north of Lake • Pipelines and PS to convey add'l water source to spreading basins	• 8 peaking wells	Dual Purpose Wells with imported water: • 3 deep wells n/o the lake[3] • 6 deep wells s/o of the lake[1] • 5 shallow wells south of the lake Other Facilities: • 30-inch diam. pipeline (4,000 ft) • 800 HP pumping station betw. Cal Oaks and the Back Basin
Basin Monitoring	• Water Quality • Groundwater levels • Groundwater production • Lake levels • Surface flow rates • Rainfall	Same as Baseline A	• Expanded monitoring network for parameters of Baseline A and B • Subsidence	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Stakeholder Involvement	None	None	• Formation of a basin advisory committee	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Wellhead Protection	Existing EVMWD Wells	Same as Baseline A	• Expansion to all active wells in the basin	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Well Construction and Abandonment Program	None	None	• Identification of location/status of wells through a well canvass • Development of a Well Construction and Abandonment Program that includes the coordinates of these activities with Riverside County Department of Environmental Health. • Implementation of policies and regulations	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Land Development Plans	None	None	• Coordination with local and regional planning agencies	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table ES-3
Summary of Alternatives Evaluation

Evaluation Criteria	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ability to Reduce Overdraft	1 • Groundwater balance is not achieved. • Zero artificial recharge. • Declining water levels to 400 ft. • Storage Deficit = 6,500 acre-ft/yr.	4 • Groundwater balance is achieved. • 6,700 acre-ft/yr injected. • 600 acre-ft/yr in-lieu recharge. • Stable water levels. • Storage Deficit = 0 acre-ft/yr.	2 • Groundwater balance is not achieved. • 4,800 acre-ft/yr surface spreading. • Declining water levels to 400 ft. • Storage Deficit = 3,800 acre-ft/yr.	3 • Groundwater balance is achieved. • 7,200 acre-ft/yr in-lieu recharge. • Stable water levels. • Storage Deficit = 200 acre-ft/yr.	5 • Groundwater balance is achieved. • 5,900 acre-ft/yr injected. • 600 acre-ft/yr in-lieu recharge. • Slightly increasing water levels. • Storage Deficit = 0 acre-ft/yr.
Expected Costs	4 • $428/acre-ft • $365/acre-ft (without common cost)	3 • $446/acre-ft • $438/acre-ft (without common cost)	3 • $457/acre-ft • $480/acre-ft (without common cost)	5 • $409/acre-ft • $288/acre-ft (without common cost)	4 • $425/acre-ft • $353/acre-ft (without common cost)
Environmental Impacts	1 • Steep declining water levels cause subsidence, which can not be mitigated. • Increase energy usage due to increased pumping lift.	4 • No significant environmental impact other than the construction of wells, pipelines and a PS. • Elimination of overdraft conditions is an environmental benefit.	2 • Use of canyons for spreading basins (30 acres) is likely to cause habitat losses, which may need mitigation. • Overdraft conditions remain, this can not be mitigated.	4 • No negative environmental impact as facilities other than the constructing of peaking wells. • Elimination of overdraft conditions is an environmental benefit. • Water Conservation	5 • No significant environmental impact other than the constructing of wells, pipelines and a PS. • Elimination of overdraft conditions is an environmental benefit. • Water Conservation • Better use of water resources by eliminating groundwater use for lake replenishment
Risk	2 • High risk that wells production will decrease due to declining water levels (resulting in higher cost for additional supplies and decreased reliability). • Moderate risk that additional imported supplies may not be available.	4 • Low risk with injection/extraction technology. • Low risk that the injection capacities are lower than estimated at the time of this GWMP. • Moderate risk that additional imported supplies may not be available.	1 • High risk that surface spreading is not feasible to the extend included in this alternative due to limitations in infiltration (depth to bedrock). • Pilot testing required to determine infiltration rates. • Moderate risk that additional imported supplies may not be available.	3 • Moderate risk that 10 percent water conservation is not achieved. • Moderate risk that additional imported supplies may not be available.	4 • Low risk with injection/extraction technology. • Low risk that the injection capacities are lower than estimated at the time of this GWMP. • Moderate risk that additional imported supplies may not be available.
Legal and Regulatory Issues	2 • Declining water levels are a potential for litigation and may require adjudication of the Elsinore Basin. This causes complex legal and regulatory issues.	3 • Construction permits. • Compliance with 40 CFR Part 144, only water that meets drinking water standards can used for injection. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives.	3 • Construction permits. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives. • Use of recycled water for spreading, is limited to 50 % of the total spreading amount or RO treatment is required.	4 • Construction permits. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore.	2 • Construction permits. • Compliance with 40 CFR Part 144, only water that meets drinking water standards can used for injection. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 17.7 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives.
Public Acceptability	1 • Public is expected to vigorously oppose to unacceptable subsidence.	5 • Public is expected to support most components.	2 • The public is expected to oppose to some degree of subsidence. • The public may oppose to the construction of spreading basins in the canyons. • Public may oppose to use of recycled water for surface spreading.	3 • Public is expected to support most components of the alternative, however, 10 percent water conservation places a burden on public participation. • The alternative requires minimal construction.	4 • Public is expected to support most components.

Table ES-3 (Continued)
Summary of Alternatives Evaluation

Evaluation Criteria	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Funding	1 • Capital Cost $56 million. • Fair distribution of investments.	3 • Capital Cost $30 million. • Uneven distribution of investments.	1 • Capital Cost $57 million. • Fair distribution of investments.	4 • Capital Cost $16 million. • Even distribution of investments.	4 • Capital Cost $24 million. • Fair distribution of investments.
Reliability	3 • 73% of water supply from MWD in consecutive drought years.	3 • 70% of water supply from MWDSC in consecutive drought years.	3 • 70% of water supply from MWDSC in consecutive drought years.	2 • 84% of water supply from MWDSC in consecutive drought years.	4 • 67% of water supply from MWDSC in consecutive drought years.
Water Quality	1 • Upper aquifer: significant increase in TDS concentration • Lower aquifer: increase in TDS concentration	3 • Upper aquifer: no change in TDS concentration • Lower aquifer: increase in TDS concentration	2 • Upper aquifer: significant increase in TDS concentration • Lower aquifer: no change in TDS concentration	3 • Upper aquifer: slight increase in TDS concentration • Lower aquifer: slight increase in TDS concentration	3 • Upper aquifer: no change in TDS concentration • Lower aquifer: increase in TDS concentration
Flexibility	2 • Projects can be implemented in the future if well production declines or subsidence occurs. However, flexibility to adjust to unforeseen circumstances is low as the need for additional supplies increases the longer projects are postponed.	5 • Dual purpose wells provide flexibility to inject/extract more water depending on demands/availability of MWDSC water. • Flexible to use multiple sources, water from Mills WTP, Skinner WTP, and Canyon Lake WTP. • Not flexible to use multiple water sources as injected water needs to comply with Title 22.	3 • Flexible to use multiple water sources for spreading; local runoff, treated imported water, untreated imported water, Canyon Lake WTP water, recycled water from the regional WWTP or EMWD. • Limited capacity of spreading basins to maximize use of replenishment water.	3 • Flexible to adjust to higher demands (lower water conservation) than anticipated with GW pumping. • Poor flexibility to implement new projects, as the need for additional supplies increases the longer projects are postponed. • Moderate flexibility to use replenishment water for in-lieu recharge as this amount is limited by (winter) water demands.	5 • Dual purpose wells provide flexibility to inject/extract more water depending on the availability of MWDSC water. • Flexible to use multiple sources, water from Mills WTP, Skinner WTP, and Canyon Lake WTP. • Not flexible to use multiple water sources as injected water needs to comply with Title 22.
Ease of Implementation	3 • Construction required of 11 wells • Substantial re-equipment of wells • Construction of new pipeline for additional source.	4 • Construction required of 13 wells, 1 pipeline and 1 pumping station.	2 • Construction of spreading basins required in canyons, which is expected to be difficult due to rocks, and difficult accessibility of the upper part of leach canyon. • Construction of 17 wells, pipelines and a booster station. • Substantial re-equipment of wells.	3 • No construction required other than 8 wells. • Implementation of water conservation measures that contribute to 10 percent conservation may be difficult.	4 • Construction required of 11 new wells • Conversion of 6 existing wells to dual purpose. • Construction of 1 pipeline and 1 PS • Implementing water conservation. measured that contribute to 5 percent conservation.
Total Rating **Weighted Rating**	**21** **42**	**41** **81**	**25** **50**	**37** **77**	**45 (highest score)** **92 (highest score)**

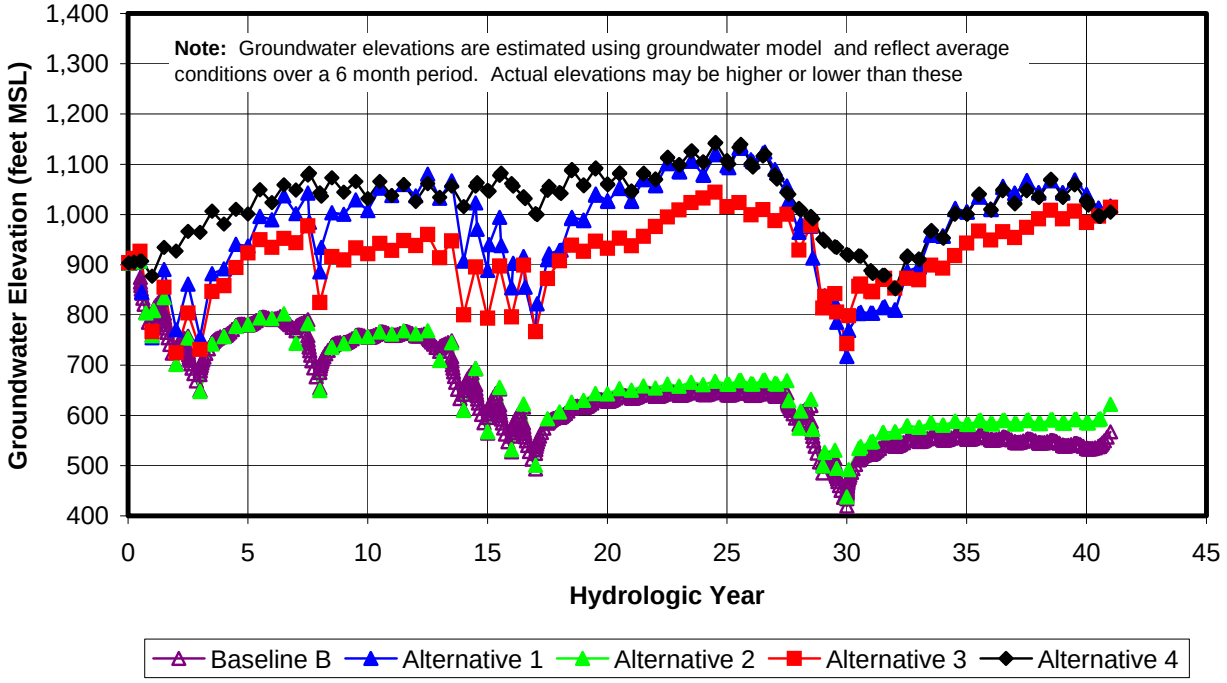
most important criteria and 1 for the least important criteria. A detailed explanation of each criterion and its ranking is provided in **Section 7**.

Ability to Reduce Overdraft

The ability to reduce overdraft is evaluated using the groundwater model. The groundwater levels in Baseline B drop between 100 and 400 feet over the 41-year simulation period depending on the location in the Elsinore Basin. In general, groundwater levels decline more in the Back Basin than in the area north of Lake Elsinore. A comparison graph of the North Island Well, which is located in the center of the Elsinore Basin, is presented in **Figure ES-8**.

As shown in this graph, the water levels in Alternative 2 are only slightly higher than the water levels in Baseline B, with declining water levels of about 300 to 350 feet. The declining water levels in indicate that surface spreading alone is not sufficient to achieve a sustainable groundwater balance and make Alternative 2 the worst alternative. Alternatives 1, 3, and 4 are fairly similar with respect to water levels, although Alternatives 1 and 4 show slightly higher water levels than Alternative 3. This is difference indicates the positive effect of the dual-purpose wells in the Back Basin and shows that in-lieu recharge is not as effective in the south part of the basin as in the north part of the basin due to the lack of natural recharge.

Figure ES-8
Comparison Chart for the North Island Well



Estimated Cost

The estimated capital cost, annual operation and maintenance (O&M) cost, and the annual cost to purchase treated imported water are summarized per alternative in **Table ES-4**. Detailed cost information is presented in **Section 7** and **Appendix H**.

Table ES-4
Cost Summary per Alternative

Item	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Capital Cost	$ 49,970,000	$ 30,020,000	$ 57,380,000	$ 15,760,000	$ 24,310,000
Total Annual Cost (excl. common cost)[1]	$ 4,595,700	$ 5,518,000	$ 6,050,000	$ 3,629,000	$ 4,445,000
Water Supply (acre-ft/yr) (excl. common supplies)[2]	12,600	12,600	12,600	12,600	12,600
Unit Cost ($/acre-ft)	$365	$438	$480	$288	$353

1 – Excludes cost of Canyon Lake WTP, Imported water at Tier 1 rate, and Imported water Tier 2 rate as in Baseline B.
2 – Excludes supplies from Canyon Lake WTP (3,000 acre-ft/yr), Tier 1 (13,320 acre-ft/yr), and Tier 2 as in Baseline B (21,580 acre-ft/yr)

As shown in this table, the capital cost range significantly from $16 million to $57 million, and the unit costs range from $288 to $480 per acre-ft. The unit costs presented exclude the cost and supply amounts that are common in all alternatives to emphasize the differences. Common cost and supplies that are excluded from the unit cost calculations are:

- The cost of Canyon Lake WTP water (same amount for all alternatives and Baseline B)
- The cost of imported water at Tier 1 rate (same amount for all alternatives and Baseline B)
- The cost of imported water at Tier 2 rate as required for Baseline B.

As the actual amount of Tier 2 water varies between the alternatives, the incremental cost difference compared to Baseline B is included in the cost estimates. Alternative 3 is the least expensive followed by Alternative 4 and Alternative 1. Although the unit costs of Baseline B and Alternative 2 are fairly similar to the cost of Alternatives 1, 3 and 4, the effect on the groundwater basin is significantly different, as these alternatives do not achieve a sustainable groundwater balance.

Conclusion of Alternative Evaluation

As shown in **Table ES-3**, Alternative 4 scores the highest with and without the weighted ranking. The second best alternative is Alternative 1. Although Alternative 3 has the lowest unit cost, it is ranked third with based on all evaluation criteria. Alternative 2 does not score much higher than Baseline B. Alternative 4 is selected as the preferred alternative because the unit cost are lower than Alternative 1, and because it includes water conservation and maximizes increase use of recycled water for lake replenishment, which are both in-line with the environmental responsibility stated in the District's mission statement.

IMPLEMENTATION PLAN

The preferred alternative, further referred to as the recommended plan, includes water conservation, dual-purpose wells for basin recharge, the use of recycled water as the primary source for lake replenishment, and a basin monitoring program. In addition, the plan contains recommendations for stakeholder involvement through an advisory committee, wellhead protection, well construction and abandonment procedures, the development of septic tank policies, and agency coordination. Each of these components is discussed more detail in **Section 8**. A map depicting the location of the structural components required for the implementation of the recommended plan is presented in **Figure ES-9.**

Conjunctive Use with Dual-Purpose Wells

The recommended plan contains the installation of 14 dual-purpose wells to recharge the groundwater basin during wet periods and provide storage for dry periods. Seven new dual purpose-wells are will be installed in the Back Basin area (2 deep and 5 shallow), while six existing wells (Lincoln, Machado, Cereal 1, Cereal 3, Cereal 4, and Corydon wells) will be converted to dual-purpose wells. Joy Street Well will also be equipped as dual-purpose well.

In general, injection would take place between October and March in years when replenishment (Long Term Storage; or, LTS) water is available, which depends on the hydrologic conditions of the sources that contribute to MWDSC's overall supply. Injection may be possible year around during wet years if excess replenishment water is available. The dual-purpose wells would be used for extraction in the summer months of dry years when the demands increase and the available imported supply from MWDSC decreases. The operation of the basin under average rainfall year conditions is presented in **Figure ES-10**. The injection amount presented in purple is slightly higher in wet years and zero in dry years.

In addition to dual-purpose wells, in-lieu recharge at about 1,100 acre-ft/yr of is used recharge the groundwater basin to maintain a sustainable groundwater balance. In-lieu recharge can start immediately, as it does not require any construction, providing that LTS water is available.

Lake Replenishment with Recycled Water

Maintenance of water levels in Lake Elsinore would be accomplished with recycled water and groundwater when the lake level drops below 1,240 feet MSL. Recycled water would be used as the primary source of replenishment water up to 17.7 mgd. This is the projected capacity of the Regional Plant in year 2020 minus 0.5 mgd reserved for discharge to Temescal Wash. One of the three Island Wells would be used as the secondary source when the recycled water supply is not adequate to maintain the lake level, while all three wells are required to maintain lake levels before year 2020 when less recycled water is available. EVMWD should continue to pursue Regional Board approval for discharge of Regional Plant effluent into Lake Elsinore when needed to maintain the elevation. This will require a combination of phosphorus removal at the plant and nitrogen offsets to comply with the Lake Elsinore TMDL. EVMWD should gradually reduce the use of Island Well water until the recycled water is sufficient to meet the total lake replenishment need.

Figure ES-9
Components of the Recommended Plan

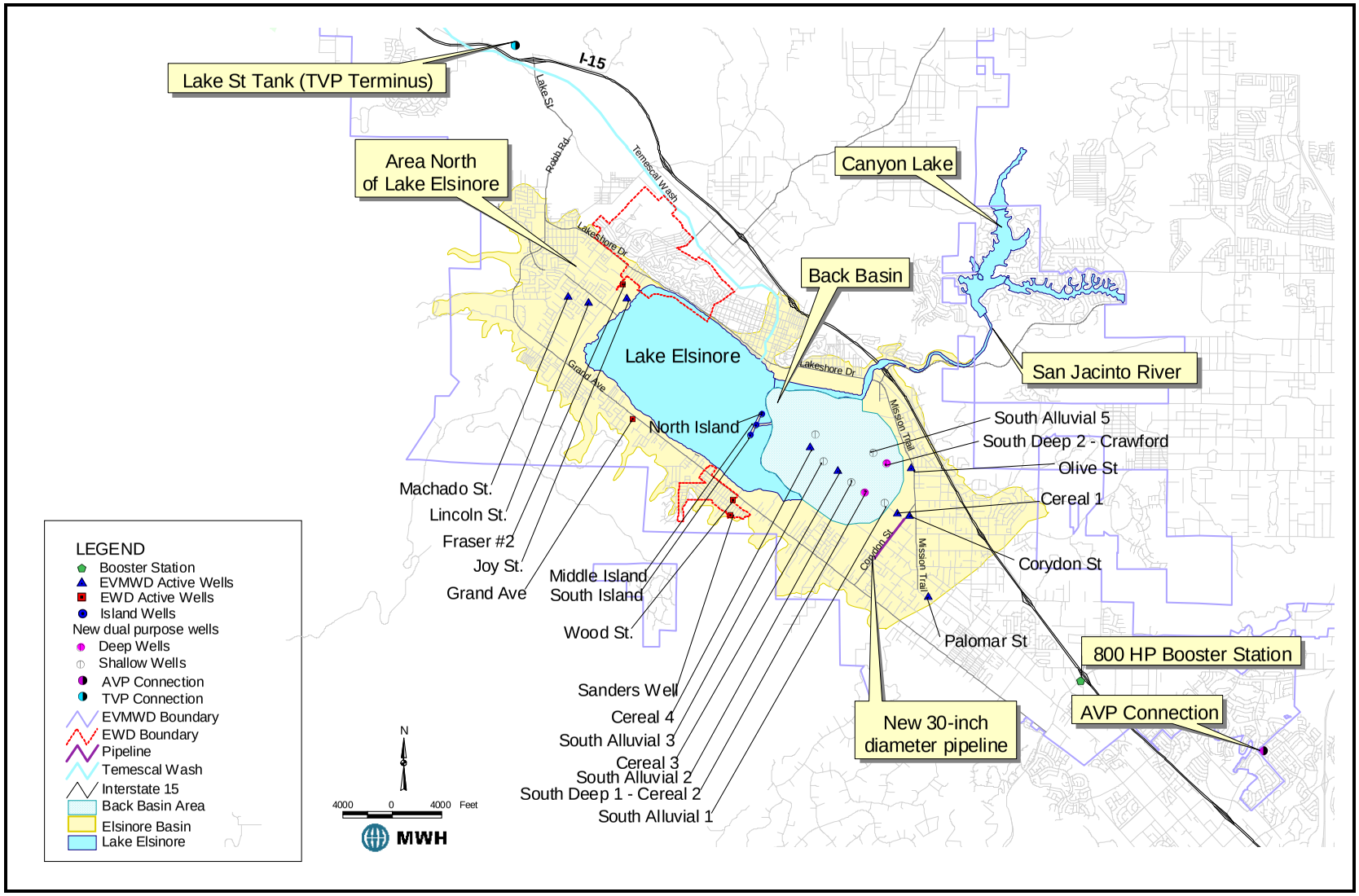
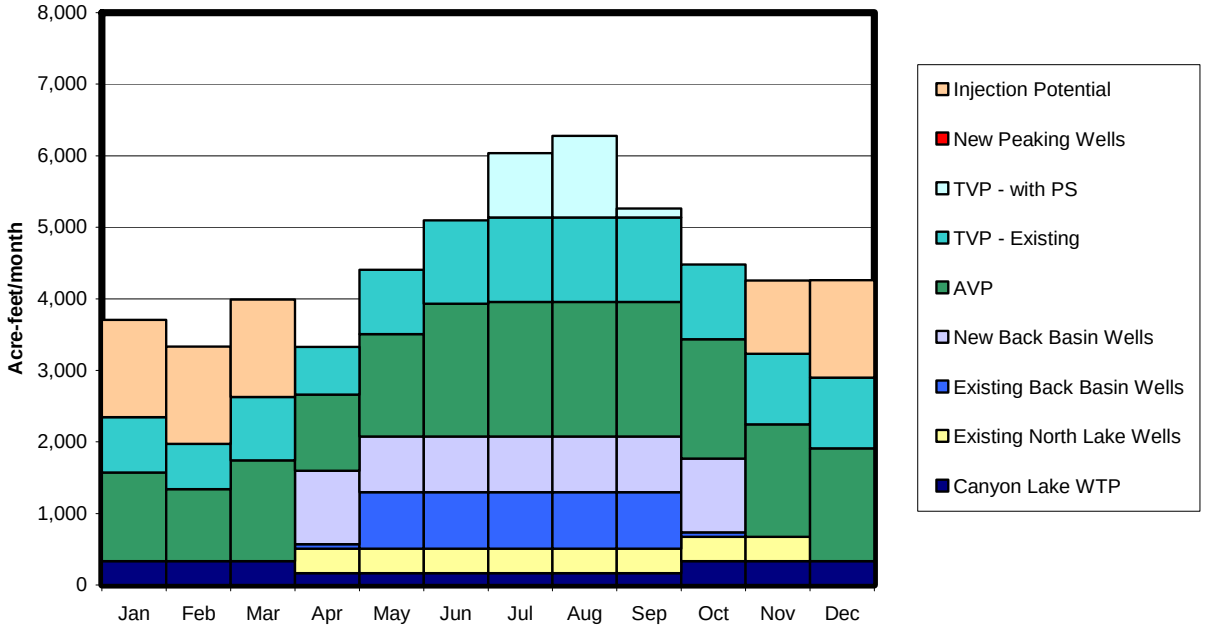


Figure ES-10
Water Supply Mix during an Average Rainfall Year



Basin Monitoring Plan

As part of the GWMP a separate Monitoring Plan is prepared to better understand the groundwater basin and to measure the effects of the activities that are implemented. This monitoring program incorporates the Joint Groundwater Monitoring Program that was established by the May 2000 agreement between EVMWD and EWD. The key components of the monitoring plan are:

- Construction of five new monitoring wells
- Monitor of water levels on a monthly basis.
- Monitor water quality data on an annual basis
- Monitor surface water flows
- Monitor land subsidence
- Conduct a well canvas.
- Conduct spinner logging testing, water quality zone testing, and aquifer testing.

The information collected through this monitoring program will lead to more efficient implementation of management activities, as it would provide guidance for adjusting management parameters according to the results over time.

Advisory Committee

The GWMP recommends that EVMWD's Board of Directors appoint five members to form an Advisory Committee that represents the users of the Elsinore Basin. The Advisory Committee could be involved with the following programs and activities and provide their comments on these activities to the EVMWD Board of Directors:

- Implementation of the Groundwater Management Plan
- Final development and coordination of the Monitoring Program
- Development of Well Construction, Destruction, and Abandonment Policies.

Septic Tank Conversion Policies

The recommended plan presumes that, at a minimum all septic tanks in the high-risk zone, as shown in **Figure 5-2**, should be connected to the sewer system by year 2020. Approximately 2,900 septic tanks, which is about 80 percent of all the septic tanks in the basin, are located in this high-risk zone and should be connected to the sewer system, while no additional septic tanks be added within the high-risk zone. The District is currently developing the policies to accomplish the conversion of septic tanks. An economic analysis that quantifies the cost and benefits of septic tank conversions should be considered as part of the policy development.

Cost of Recommended Plan

A detailed cost breakdown of the capital and annual costs for the recommended alternative are presented in **Table ES-5** The total capital cost is $24.3 million, while the total annual cost is about $21.5 million. With a projected water demand of 50,500 acre-ft/yr in year 2020, these total annual costs correspond to a unit cost of $425 per acre-foot. This unit cost includes all the cost that are common to all alternatives for Canyon Lake WTP, Tier 1 water, and Tier 2 water. When these common costs are excluded, the unit cost of the recommended plan is $353 per acre-foot. As explained in the phasing in **Section 8**, the majority of the capital investments are required between the years 2003 and 2010.

Stakeholder Involvement

Collaboration with area stakeholders was an integral part of developing this GWMP. Key elements of EVMWD's Stakeholder Collaboration Plan included informative mailing describing the GWMP, initial public hearing, a public scoping meeting, informational reports posted on the District's web site and updates at EVMWD Board meetings. Details on stakeholder involvement are described in more detail in **Section 1** and **Appendix C**.

GMWP Adoption

The Groundwater Management Planning Act (California Water Code Part 2.75, §10753), originally enacted as Assembly Bill (AB) 3030 (1992) and amended by Senate Bill (SB) 1938 (2002) specifies the requirements for adoption of groundwater management plans. The EVMWD Board of Directors conducted a public hearing on June 10, 2004 and subsequently adopted a resolution of intent to prepare a groundwater management plan. Following additional

Table ES-5
Summary of Estimated Cost of the Recommended Plan

Cost Type	Project Description	Capital Cost	Annual Cost
Capital Cost	4 Peaking Wells	$ 7,480,000	$ 194,000
	Conversion of 6 Existing Wells to Dual Purpose Wells	$ 600,000	$ 37,000
	Equipping Joy Street as a Dual Purpose Well	$ 100,000	$ 7,000
	7 New Dual Purpose Wells	$ 13,090,000	$ 339,000
	30-inch diameter pipeline on Corydon Street (4,000 LF)	$ 1,360,000	$ 50,000
	800 HP in-line PS (near Clinton Keith Rd./I-15)	$ 1,680,000	$ 103,000
	Subtotal	**$ 24,310,000**	**$ 730,000**
O&M Cost	**Quantity (acre-feet/yr)**	**Cost Item**	**Annual Cost**
	8,188	Groundwater Pumping in Back Basin Area	$ 691,000
	2,132	Groundwater Pumping N/O Lake	$ 166,000
	380	Groundwater Pumping EWD	$ 31,000
	0	Groundwater Pumping for Lake Replenishment	$ -
	3,400	Recycled water for Lake Replenishment	$ 510,000
	3,000	Canyon Lake WTP	$ 690,000
	13,320	Purchase of MWD Water (Tier 1)	$ 5,568,000
	19,880	Purchase of MWD Water (Tier 2)	$ 9,921,000
	5,900	Purchase of MWD Water for Injection	$ 1,770,000
	1,100	Purchase of MWD Water for In-Lieu recharge	$ 330,000
	12,000	Pumping Cost in-line PS (near Clinton Keith Rd./I-15)	$ 232,000
	2,500	Water Conservation	$ 650,000
	Subtotal		**$ 20,559,000**
Total			**$ 21,472,000**

public review and preparation of a mitigated negative declaration pursuant to the California Environmental Quality Act, the EVMWD Board of Directors conducted a second public hearing on March 10, 2005 to receive landowner protests to the adoption of the GWMP. On March 24, 2005, the EVMWD Board of Directors formally adopted the GWMP. Copies of the hearing notices and resolutions are included in **Appendix C.**

CONCLUSIONS

This GWMP has determined that the Elsinore Basin is currently in a state of overdraft, with a cumulative deficit of 19,000 acre-ft/yr over the past 11 years, or approximately 1,800 acre-ft/yr. A detailed evaluation of the baseline conditions for the year 2000 conditions (Baseline A) and the projected year 2020 conditions (Baseline B) predict that this overdraft will increase to an average of 4,300 acre-ft/yr to 6,400 acre-ft/yr, respectively. Based on groundwater model simulations, this GWMP predicts that this storage deficit will result in declining water levels of 200 to 400 feet. These declining water levels may result in significant water quality degradation, land subsidence, or reduced groundwater pumping capacity of existing wells.

This document contains recommendations for activities to better manage the groundwater resources of the Elsinore Basin. The requirements stated in AB3030 and amended by SB1938 have been used for the identification of groundwater management issues and to be in compliance with the Groundwater Management Act. The recommendations are to provide solutions to the basin management challenges. Some key issues are:

- An increase need for groundwater due to lake replenishment needs and a doubling of water demand between 2000 and 2020.
- Significant existing and projected groundwater level declines imposing the risk of water quality degradation and land subsidence
- An increasing trend in nitrate concentrations in areas with septic tanks and a projected increase of TDS concentrations.
- Potential for water quality contamination through the over 200 wells in the basin with an unidentified well status.

Some of the key recommendations presented in this GWMP are:

- Development of an Advisory Committee to continue the Stakeholder involvement process and to help the EVMWD Board of Directors effectively manage the basin.
- Implementation of conjunctive use projects to achieve a sustainable groundwater balance and ensure a reliable water supply.
- Implement a water conservation program to reduce potable water demands by five percent.
- Minimize the use of groundwater for lake replenishment and save the high quality groundwater to serve potable demands
- Expand the monitoring program to enhance the understanding of the groundwater basin and to help manage future conjunctive use operations.
- Develop septic tanks conversion policies and well construction and abandonment policies to protect the basins water quality.

The basin management presented in this GWMP will initiate a proactive approach to groundwater management in the Elsinore Basin and allow the Elsinore Valley to grow and double its demands over the next 20 years, while maintaining a reliable, affordable, and sustainable water supply. The EVMWD Board of Directors adopted this GWMP on March 24, 2005.

Section 1
Introduction

The Groundwater Management Act (California Water Code Part 2.75, §10753), originally enacted as Assembly Bill (AB) 3030 (1992) and amended by Senate Bill (SB) 1938 (2002), provides the authority to prepare groundwater management plans. The intent of AB3030 is to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions. The Elsinore Basin Groundwater Management Plan (GWMP) is jointly funded under a Local Groundwater Management Assistance Act of 2000 (AB303) grant by the California Department of Water Resources (DWR) and the Elsinore Valley Municipal Water District (EVMWD) in accordance with Contract Number 4600001817 dated June 25, 2001. This GWMP provides the framework for the management of groundwater resources in the Elsinore Basin and is the guidance document for future groundwater development activities.

The lead agency for this plan is EVMWD. This plan has been prepared in coordination with local agencies, water purveyors and interested residents through a stakeholder involvement process facilitated by DWR. The GWMP is intended to provide a better understanding of the Elsinore Basin and to recommend various management strategies that result in a reliable water supply for all users of the Elsinore Basin while meeting the increasing water demands.

The following section introduces the GWMP. It includes a description of the study area, the current state of the groundwater supply in the basin, project objectives and a summary of the remainder of the report.

SCOPE OF WORK

This GWMP is prepared with the assistance of Montgomery Watson Harza (MWH) and funded by a grant from the State of California administered by DWR under AB303. The scope of work funded by the State includes the following six technical tasks.

- Data assessment
- Stakeholder involvement
- Preparation of a groundwater monitoring program
- Update of conceptual hydrogeologic model
- Preparation of numerical groundwater model
- Preparation of the GWMP

The work conducted for these tasks is presented in the remainder of this report. References used in the preparation of this report are listed in **Appendix A**. A list of abbreviations is provided in **Appendix B**.

GROUNDWATER MANAGEMENT PLAN REQUIREMENTS

This section summarizes the mandatory, recommended and voluntary components of a GWMP. The requirements for a GWMP are defined in the California Water Code §10753 *et seq*. The

mandatory requirements are specified in §10753.7 and summarized in **Table 1-1**. In addition to these required components, there are several components that DWR recommends be included in a groundwater management plan as presented in Appendix C of DWR's Bulletin 118 (2003) *California's Groundwater*. Section 10753.8 includes several voluntary components that a groundwater management plan may include. These recommended and voluntary requirements are also presented in **Table 1-1**. **Table 1-1** presents the location of these requirements in this report.

Table 1-1
Location of Elsinore Basin GWMP Components

Description		Section(s)
A.	**CWC § 10750 *et seq.*, Required Components[1]**	
1.	Documentation of public involvement statement. §10753.4 (b)	1, App. C
2.	Basin Management Objectives (BMOs). §10753.7(a)(1)	1
3.	Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping. §10753.7(a)(1)	8, App. K
4.	Plan to involve other agencies located within groundwater basin. §10753.7(a)(2)	1 and 8
5.	Map of groundwater basin showing area of agency subject to GWMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118. §10753.7(a)(3)	1, Fig 1-1
6.	Adoption of monitoring protocols to generate information that promotes efficient and effective groundwater management. §10753.7(a)(4)	8, App. K
7.	For agencies not overlying groundwater basins, prepare GWMP using appropriate geologic and hydrogeologic principles. §10753.7(a)(5)	Not Applicable
B.	**DWR's Recommended Components[2]**	
1.	Establish a basin advisory committee.	8
2.	Describe area to be managed under GWMP.	2
3.	Create link between BMOs and goals and actions of GWMP.	5, 8
4.	Describe GWMP monitoring program.	8, App. K
5.	Describe integrated water management planning efforts.	1, 5, 8
6.	Periodic report on implementation of GWMP.	8
7.	Re-evaluate GWMP periodically.	8

Table 1-1 (Continued)
Location of Elsinore Basin GWMP Components

Description		Section(s)
C.	**CWC § 10753.8, Voluntary Components[3]**	
1.	Control of saline water intrusion.	5
2.	Identification and management of wellhead protection areas and recharge areas.	5
3.	Regulation of the migration of contaminated groundwater.	5
4.	Administration of well abandonment and well destruction program.	5
5.	Mitigation of conditions of overdraft.	5
6.	Replenishment of groundwater extracted by water producers.	5
7.	Monitoring of groundwater levels and storage.	5
8.	Facilitating conjunctive use operations.	5
9.	Identification of well construction policies.	5
10.	Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	5
11.	Development of relationships with state and federal regulatory agencies.	5
12.	Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	5

1. CWC § 10750 *et seq.* (seven required components). Amendments to the CWC § 10750 *et seq.* require GWMPs to include several components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects. These amendments to the CWC were included in Senate Bill 1938, effective January 1, 2003.
2. DWR Bulletin 118 (2003) Appendix C components (seven recommended components).
3. CWC § 10750 *et seq.* (12 voluntary components). CWC § 10750 *et seq.* includes 12 specific technical issues that could be addressed in GWMPs to manage the basin optimally and protect against adverse conditions.

STUDY AREA

The study area for this plan is the Elsinore Basin as shown in **Figure 1-1**. The surface drainage area shown on this figure consists of approximately 42 square miles, of which about 25 square miles are located within the basin floor including Lake Elsinore. The remaining portions of the Elsinore Basin include the surrounding highlands and associated streams and canyons. In general, the surface water in the study area drains toward Lake Elsinore. Principal surface water streams and rivers include McVicker Canyon, Leach Canyon and Dickey Canyon along the western margin of Lake Elsinore and the San Jacinto River from the east. During periods of high

Figure 1-1
Study Area

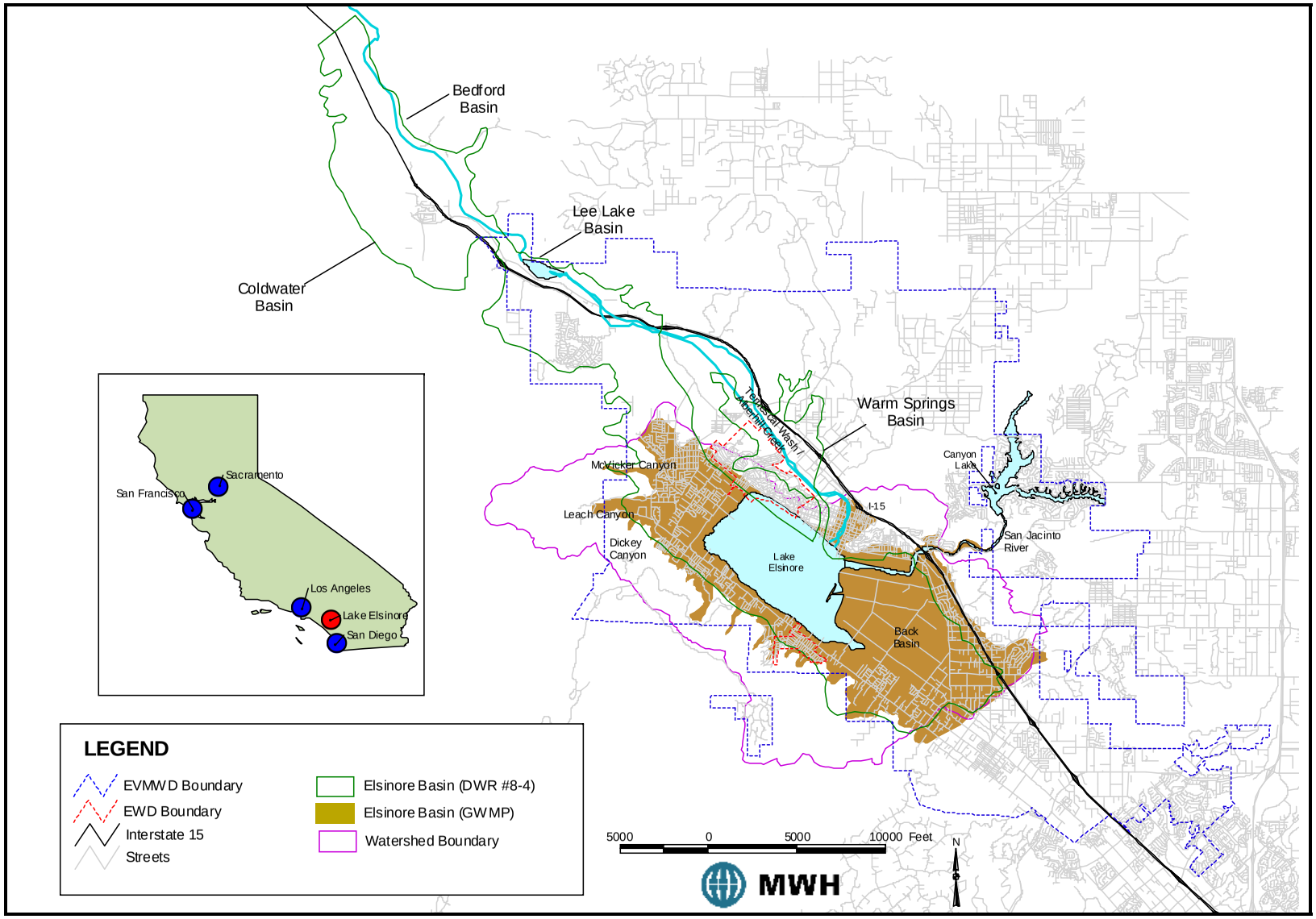
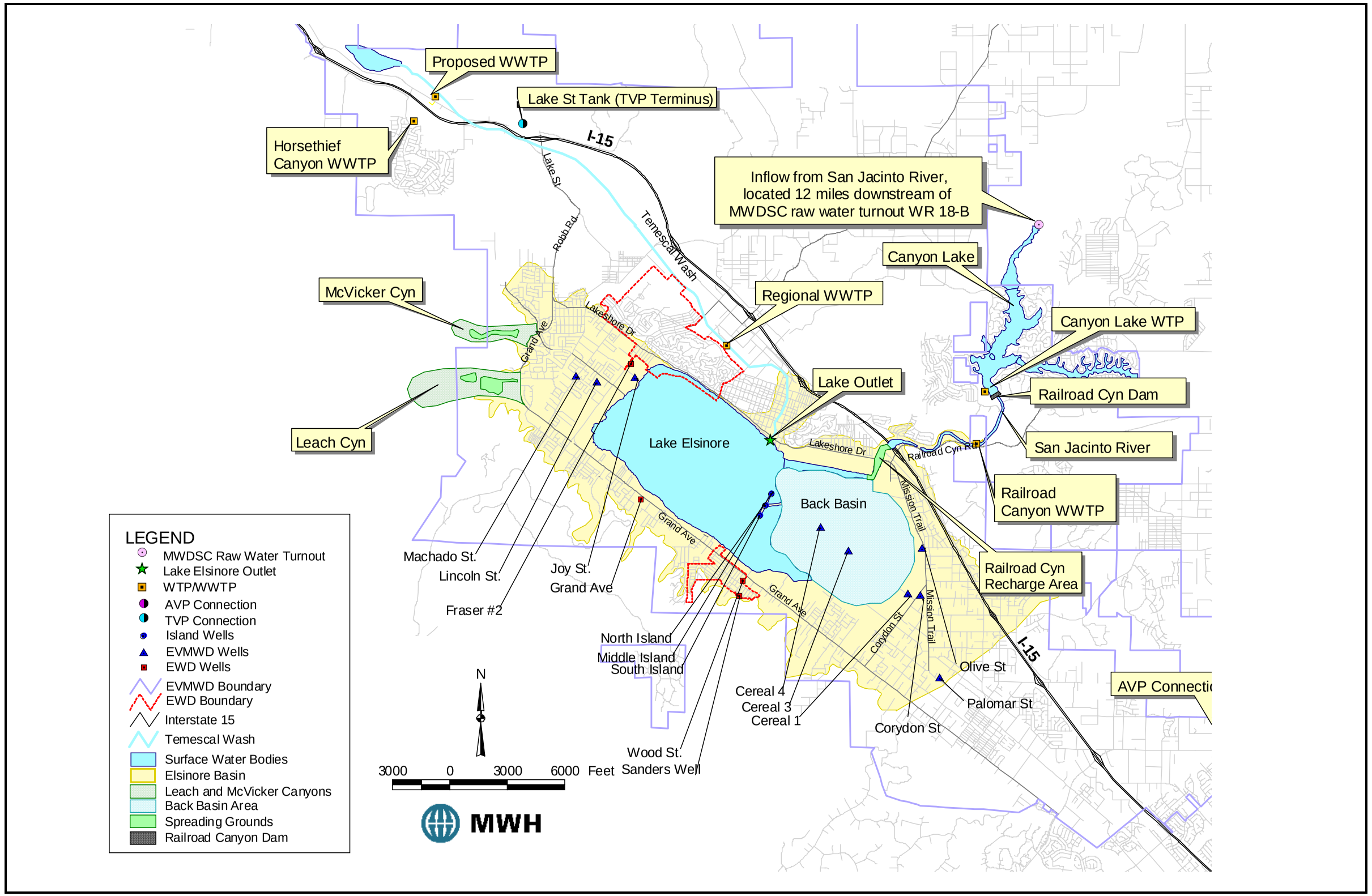


Figure 1-2
Locations of Key Facilities in the Elsinore Basin



lake levels, water in Lake Elsinore flows into the lake outlet channel, which discharges to Temescal Wash, a tributary of the Santa Ana River. The area southeast of the lake, referred to as the Back Basin, is part of the flood plain for Lake Elsinore and the San Jacinto River. The boundary of the groundwater basin is approximately coincident with the surface drainage boundary shown on **Figure 1-1**. **Figure 1-1** also shows the service area boundaries of the EVMWD and the Elsinore Water District (EWD), which provide domestic water service within the basin and are the primary groundwater pumpers in the basin.

As shown on **Figure 1-1,** DWR's Bulletin 118 (2003) indicates the boundary of the Elsinore Basin as encompassing the adjacent Warm Springs, Lee Lake, Coldwater and Bedford groundwater basins. These basins were not included in this groundwater management plan because they are hydrogeologically separated from the Elsinore Basin by the Glen Ivy and Freeway Faults as described in **Section 2**.

PROJECT BACKGROUND

The EVMWD provides water service to a 96 square mile area in western Riverside County. In the Elsinore Basin, the EVMWD currently obtains its water supply from eight groundwater wells, the Canyon Lake Water Treatment Plant (WTP) and the Metropolitan Water District of Southern California (MWDSC) (through Western Municipal Water District) to meet the water demands of its customers. The EVMWD's service area and the location of the water supplies are presented in **Figure 1-2**. EVMWD is the primary groundwater producer in the Elsinore Basin. EVMWD currently pumps approximately 94 percent of the groundwater produced in the Elsinore Basin. Elsinore Water District (EWD), whose service area includes portions north of Lake Elsinore and Lakeland Village south of Lake Elsinore, pumps approximately 5 percent of the groundwater supply. Local pumpers with private wells account for about 1 percent of the pumping in the basin.

Based upon previous studies prepared by the EVMWD, including the Urban Water Management Plan (MWH, 2000), the Water Resources Development Plan (MWH, 1997) and the Distribution System Master Plan (MWH, 2002), rapid growth in the Elsinore area is expected over the next 10 to 20 years. Demands within the Elsinore Basin (including EVMWD's service area and EWD's service area) are projected to more than double by 2020 (from about 23,400 acre-ft/yr in 2000 to as much as 53,100 acre-ft/yr in 2020). EWD's demand is not projected to increase during this time period, as its service area is largely built-out. In the Water Resources Development Plan (MWH, 1997), 26 water supply alternatives were evaluated with various supply sources. This report identified water supplied by the State Water Project (SWP) as the preferred water source. In the Distribution System Master Plan (2002), a supply deficit was projected but future sources were not identified. Because the Distribution System Master Plan contains the most recent water demand projections, these data are used to project supply needs for EVMWD in this GWMP.

To meet the current and future water demands, EVMWD will be increasingly dependent on imported water supplies. For example, in 2000, the groundwater wells accounted for 34 percent of the annual water demand with an additional 10 percent supplied from the Canyon Lake WTP. The remaining 56 percent was imported water supplied by MWDSC through the Auld Valley Pipeline (AVP) connection. Based upon the Distribution System Master Plan, by 2020, imported

water from either the Temescal Valley Pipeline (TVP) or the AVP is projected to supply as much as 80 percent of the demand. Because groundwater is an important part of the future water supply picture, prudent management of the Elsinore Basin is critical.

PLANNING OBJECTIVES

The goal of the GWMP is based upon the assessment of the management issues for the Elsinore Basin and the mission statement of EVMWD. The mission statement of EVMWD is:

> *"To manage the District's natural resources to provide reliable, cost efficient, high quality water and wastewater services for the communities we serve, while promoting conservation, environmental responsibility, education, community interaction, ethical behavior, and recognizing employees as highly valuable assets."*

Based upon discussion with local agencies, water purveyors and residents involved in the stakeholder process, the following statement defines the need and goal for the GWMP:

> *"Because water demand is projected to double in the next 20 years, cooperative groundwater management is required to achieve a sustainable water balance in the Elsinore Basin. The goal of this Groundwater Management Plan is to ensure a reliable, high quality, cost-efficient groundwater supply for the users of the Elsinore Basin in an environmentally responsible manner."*

The purpose of the GWMP is to serve as the guidance document for implementation of groundwater projects required to meet the plan objectives. The following four plan objectives are defined to achieve this goal:

- Enhance water supply reliability
- Manage the basin yield
- Maintain suitable water quality
- Improve understanding of basin hydrogeology

The primary objective of the GWMP is to enhance the water supply reliability through conjunctive use activities in the Elsinore Basin. Conjunctive use is the process of storing water in the groundwater basin during periods in which additional water supplies are available, while extracting the water in periods of reduced imported water supplies typically occurring during droughts. Water can be stored through direct injection, surface spreading or in-lieu storage activities.

The second objective of the GWMP is to manage the basin yield. The GWMP includes a compilation of data needed to estimate the basin yield and define measures required for a sustainable operation of the Elsinore Basin.

The third objective is to maintain suitable water quality in the Elsinore Basin. The quality of water in the Elsinore Basin is generally good. However, there are groundwater quality concerns

in various locations throughout the basin. For example, contamination from septic tanks, the risk of increased concentrations of organic compounds as development progresses in the Elsinore area, and elevated arsenic concentrations are known water quality issues that need to be considered in the recommended management strategies. This GWMP includes water quality management recommendations. These management activities address the current basin conditions as well as the future conditions after implementation of the plan. The water quality evaluation guidelines defined under the AB3030 process will be followed where applicable to the Elsinore Basin.

The fourth objective is to improve the current understanding of the basin hydrogeologic characteristics. A thorough understanding of the basin is critical to the development of future groundwater management projects in the basin. Previous studies have developed a significant understanding of the basin but more work is needed to best manage this important resource.

REGIONAL SETTING OF ELSINORE BASIN

Because many management issues are related to the complex interaction between water bodies and demands within the Elsinore Basin, an understanding of these interactions is important to developing a groundwater management plan that reflects the integrated nature of water resources in the basin. The principal water bodies, demands and discharges are:

- The Elsinore Basin watershed and groundwater basin
- Surface water bodies (Lake Elsinore, Canyon Lake, Temescal Wash, and the San Jacinto River)
- Water supply sources (groundwater, Canyon Lake WTP, imported water, recycled water local runoff)
- Demands (potable, non-potable, evapotranspiration)
- Water disposal (wastewater, outflows to surface water bodies)

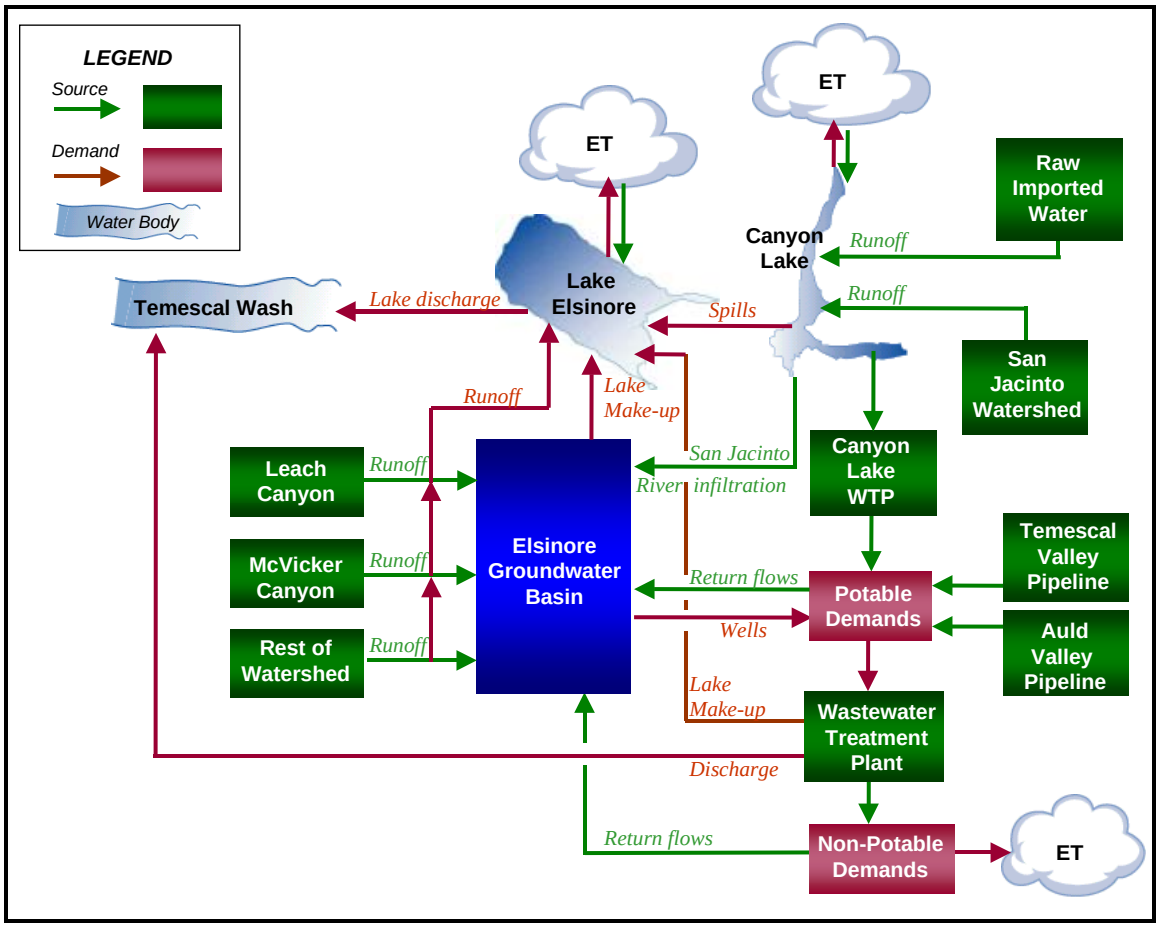
The locations of these features are provided in **Figure 1-2**. The relationships between the water bodies and water users are shown in **Figure 1-3**.

To define management alternatives that achieve a sustainable water balance, the interactions of all the water bodies shown in Figure 1-3 need to be evaluated. Each component is discussed in detail below.

Elsinore Groundwater Basin

The principal source of inflow to the Elsinore groundwater basin is infiltration of local precipitation and runoff from the surrounding watershed (an average of nearly 40 percent of the total inflows). Other inflows to the groundwater basin are water that infiltrates from the San Jacinto River prior to reaching Lake Elsinore and return flows from either irrigation or domestic use. Currently, the only significant outflow from the groundwater basin is the groundwater pumping to meet potable water demand. To maintain the water level in Lake Elsinore above the desired operating level of 1,240 feet above mean sea level (MSL), EVMWD is equipping the three Island wells to pump groundwater into the Lake when the Lake levels are low. In addition, the Elsinore Basin is essentially closed to subsurface inflows and outflows from adjacent

Figure 1-3
Water Flows in the Elsinore Basin



groundwater basins as well as Lake Elsinore. The only exception to this is future pumping of groundwater to maintain lake levels, as discussed below.

Lake Elsinore

Lake Elsinore is a natural lake that, under historical conditions, has varied in size from 6,000 acres in very wet years to a dry playa in drought years. To moderate these swings in lake surface area and to reduce evaporation, a levee was constructed across the lake in 1995, which reduced its surface area from approximately 6,000 to about 3,300 acres. Operational details for Lake Elsinore are provided in **Inflows to** Lake Elsinore include local runoff from the surrounding watershed, precipitation directly onto Lake Elsinore, flows from the San Jacinto River, recycled water from wastewater treatment plants and, in the near future, groundwater from the Island wells. Outflows include overflows to Temescal Wash, which occur when the lake level exceeds 1,255 feet MSL and evaporation. Less than 15 percent of the total runoff from the watershed flows into the lake on an annual average basis. The local runoff that reaches the lake accounts for only about eight percent of the annual lake inflow. This amount varies from year to year, ranging from about 1,500 acre-ft/yr in dry years to more than 5,600 acre-ft/yr during wet years.

Approximately 20 percent of the inflow to Lake Elsinore comes from precipitation directly onto the lake. The remaining 72 percent of the inflows to the lake come from the San Jacinto River.

Table 1-2.

Inflows to Lake Elsinore include local runoff from the surrounding watershed, precipitation directly onto Lake Elsinore, flows from the San Jacinto River, recycled water from wastewater treatment plants and, in the near future, groundwater from the Island wells. Outflows include overflows to Temescal Wash, which occur when the lake level exceeds 1,255 feet MSL and evaporation. Less than 15 percent of the total runoff from the watershed flows into the lake on an annual average basis. The local runoff that reaches the lake accounts for only about eight percent of the annual lake inflow. This amount varies from year to year, ranging from about 1,500 acre-ft/yr in dry years to more than 5,600 acre-ft/yr during wet years. Approximately 20 percent of the inflow to Lake Elsinore comes from precipitation directly onto the lake. The remaining 72 percent of the inflows to the lake come from the San Jacinto River.

Table 1-2
Operational Data for Lake Elsinore

Location	Level
Target lake elevation	1,240 feet MSL
Normal Lake operating range	1,240 – 1,247 feet MSL
Elevation of sill in the outlet channel	1,255 feet MSL
Elevation of emergency outlet to the Back Basin	1,262 feet MSL
Elevation of 100-year floodplain	1,263.3 feet MSL

In addition to the existing inflows from the San Jacinto River and local runoff, Lake Elsinore will soon be replenished with groundwater from the Island wells to maintain a minimum lake level of 1,240 feet MSL. Likewise, as much as 2 mgd of recycled water from the Regional Wastewater Treatment Plant (WWTP) is currently discharged to the lake under a two-year pilot study.

The major water loss from the lake is evaporation that ranges between 13,000 and 15,000 acre-ft/year depending on the lake level and climate conditions. When the lake level exceeds the sill elevation in the outflow channel of 1,255 feet, water is discharged to the Temescal Wash. During major storm events, when the lake level reaches an elevation of 1,262, water will spill to the area south of the dike, also referred to as the Back Basin. Most of the water that is spilled to the Back Basin is lost to evapotranspiration; only a minimal portion will infiltrate into the groundwater basin because of the presence of substantial clay layers near the surface.

Canyon Lake

Canyon Lake receives water from the San Jacinto River watershed and, occasionally, untreated imported water from a connection to MWDSC's Colorado River Aqueduct. Canyon Lake is maintained between 1,372 and 1,382 feet MSL and spills into Railroad Canyon at an elevation above 1,382 feet MSL. Approximately ninety percent of these spills reach the Lake. When

water is available, Canyon Lake water is treated in the Canyon Lake WTP. This plant typically operates between April and October to provide additional water for summer demands. Additional untreated Colorado River water can be purchased from the WR-18B turnout to supplement Canyon Lake flowing down the San Jacinto River.

Imported Water Supplies

EVMWD can purchase imported water at three locations, the TVP connection, the AVP connection and Colorado River Aqueduct turnout WR-18b. Water obtained through the TVP is SWP water that originates from MWDSC's Mills Filtration Plant. Water from this plant is conveyed through the Woodcrest Pipeline up to the Woodcrest Turnout (near I-15) where the TVP connects, which conveys water to the northwestern part of the District's distribution system. Water obtained through the AVP connection is a blend of SWP and Colorado River Aqueduct water that is treated at MWDSC's Skinner Filtration Plant. EVMWD can also obtain untreated imported water from the MWDSC's WR-18B connection to the Colorado River Aqueduct, which discharges into the San Jacinto River 12 miles north of Canyon Lake. The untreated imported water flows down the San Jacinto River until it reaches Canyon Lake.

Wastewater and Recycled Water

In the areas served by sewers, wastewater is collected and treated at one of the three wastewater treatment plants (Regional WWTP, Railroad Canyon WWTP, or Horsethief Canyon WWTP). Wastewater effluent from the Regional WWTP is discharged into the Temescal Wash and is used for lake replenishment as part of a pilot test program. Effluent from the Railroad Canyon and Horsethief Canyon WWTPs is used for local golf course and landscape irrigation.

Potable Demands

Potable water demands are met from four supply sources: imported water from the AVP and the TVP, groundwater, and surface water from the Canyon Lake WTP. After use, a portion of the water is returned to the groundwater basin as irrigation returns, septic tank effluent or wastewater flowing to the Regional WWTP.

Non-Potable Demands

Non-potable demands include lake replenishment for Lake Elsinore. As discussed above, additional water is required to maintain the level of Lake Elsinore above 1240 feet MSL. Current non-potable supplies include up to 7.5 mgd of recycled water from the Regional WWTP (8 mgd capacity less 0.5 mgd for Temescal Wash) and up to 5.2 mgd from the Island wells.

Summary

This conceptual understanding of the Elsinore Basin will be used to develop the groundwater model and the alternatives and to provide the framework for implementation of the GWMP. EVMWD is committed to developing a GWMP that takes into consideration the complex water supply interactions within the Elsinore Basin. The remainder of this report provides documentation of the development process and action items for implementation of the GWMP.

STAKEHOLDER INVOLVEMENT

Collaboration with area stakeholders was an integral part of developing this GWMP. EVMWD, with assistance from DWR and the Center for Collaborative Policy a joint program of California State University Sacramento and the McGeorge School of Law, University of the Pacific, develop a Stakeholder Collaboration Plan that consisted of the following:

- Use of EVMWD web site to present public documents on the groundwater management plan.
- Public information meetings, which allowed more detailed discussion of the Groundwater Management Plan and public input on alternatives development. Public meetings were held on October 3, 2002, February 5, 2003 and August 10, 2004. The first and second public meetings were widely advertised and held in a workshop format to maximize stakeholder participation. The third meeting was focused on private well owners in the basin. Information was presented on the project goals and expectations, alternatives and the preferred plan. All public meetings for the project were held at EVMWD's headquarters in Lake Elsinore.
- A technical review committee consisting of water resources experts from California Department of Water Resources, Eastern Municipal Water District, Orange County Water District, and MWH met three times over the course of plan development to review the technical and scientific aspects of the plan.
- A presentation on the draft plan was made to the staff of the Elsinore Water District on May 11, 2004.
- Presentations on the Groundwater Management Plan were made at four EVMWD Board meetings during the course of plan development: Board Study Session on August 20, 2003. Board meetings on March 3, 2004; June 10, 2004; and March 24, 2005.
- The first public hearing required under the Groundwater Management Planning Act was held on June 10, 2004, which served as a public forum to determine if a Groundwater Management Plan should be prepared.
- A second public hearing was held on March 10, 2005 to receive additional comments on the draft plan and to consider protests by landowners overlying the Elsinore Basin.

Stakeholders include: Regional Water Quality Control Board (Cindy Li), City of Lake Elsinore (Dick Watenpaugh and Pat Kilroy), Santa Ana Watershed Project Authority (Mark Norton), California Department of Health Services (Edward Hitti), Western MWD (Norm Thomas), Elsinore Water District (Sharon Sweesy), City of Canyon Lake (Habib Motlagh), Eastern Municipal Water District (Behrooz Mortazavi), Attorney at Law Master of Dispute Resolution (Dale Schafer), Whitney Drinking Water (Herman Dejone), Farm Mutual Water Company (Robert Wilders), California Department of Water Resources (Carl Hauge), County of Riverside (Wendy Kolk), and MWDSC (Edgar Fandialan). Further information on the stakeholders is presented in **Appendix C**.

Meeting minutes for the stakeholder meetings is presented in **Appendix C**.

GWMP ADOPTION

The procedures for adoption of the Elsinore Basin Groundwater Management Plan (GWMP) are consistent with the provisions of §10753 *et seq.* of the California Water Code. The adoption of the GWMP required that the District perform the following:

- Conduct an initial public hearing on whether to prepare a groundwater management plan. A copy of the notice of public hearing is presented in **Appendix C.** The initial public hearing was held on June 10, 2004.
- Publish the adopted Resolution of Intention. A copy of the resolution of intent and the public notices are presented in **Appendix C**.
- Revise the GWMP based on comments received during the public hearings and any written comments.
- Conduct a second public hearing on whether to adopt the GWMP and to consider protests to the adoption of the plan. The public notice for the second public hearing is presented in **Appendix C**. The second public hearing was held on March 10, 2005. No protests to the adoption of the GWMP were filed at the second public hearing.

The adoption of the GWMP also requires the preparation of the following environmental documents pursuant to the California Environmental Quality Act (CEQA):

- Prepare Initial Environmental Study (IES).
- Perform biological and cultural resources surveys.
- Prepare Mitigated Negative Declaration (MND) and Notices.
- Distribute the MND and Notices. Notices include: Notice of Availability/Notice of Intent (NOA/NOI) to Adopt a Negative Declaration.
- Prepare Mitigation Monitoring and Reporting Plan (MMRP).
- Prepare and filing of a Notice of Determination (NOD).

The CEQA documents and the GWMP were adopted at the March 24, 2005 EVMWD Board meeting. A copy of the resolution of adoption is presented in **Appendix C**.

RECENT PLANNING CHANGES

The technical work performed for this GWMP was conducted in 2002 and in 2003. Since that time, several water-related activities have occurred. Although these activities have some effects on groundwater management, the effects are not significant enough to warrant major revisions to this GWMP. Such revisions will be incorporated in future updates to the GWMP.

The Regional Water Quality Control Board adopted Total Maximum Daily Loads (TMDLs) for nutrients in Canyon Lake and Lake Elsinore in December 2004. The TMDLs specify maximum loading of nitrogen and phosphorus. EVMWD was issued a revised National Pollution Discharge Elimination System (NPDES) permit for discharge to Temescal Wash and Lake

Elsinore in March 2005. This revised permit incorporates the nutrient TMDL requirements. To comply with the TMDLs and the new permit, EVMWD plans to install phosphorus treatment at the Regional Plant and may need to offset excess nitrogen loading of recycled water used for lake replenishment. With the adoption of the TMDLs, the use of Eastern MWD effluent for lake replenishment is not expected to be cost effective due to its cost and high nutrient concentrations. The adoption of the TMDLs was anticipated during the development of this GWMP.

The Lake Elsinore-San Jacinto Watershed Authority (LESJWA) issued a draft program environmental impact report (EIR) for the Lake Elsinore Stabilization and Enhancement Project in March 2005. This EIR included an updated analysis of lake replenishment needs using the 1928-2001 hydrologic period. The results of this analysis differ from those presented in this GWMP due to the different hydrologic periods and criteria for replenishing the lake. For this project, lake replenishment would take place when the lake elevation dropped below 1,247 ft MSL. Although, the results of the LESJWA investigation differs from those of the GWMP, the effect of pumping on the groundwater basin is similar to that evaluated in the GWMP.

EVMWD has installed pumping equipment in two of the three Island Wells. The third well will not be equipped, but instead will be used as a monitoring well. These wells were operated from March 2004 until February 2005 when heavy rainfall raised Lake Elsinore to an elevation of nearly 1,255 feet. Lake replenishment is expected to resume when the lake drops below elevation 1,247 ft. Use of Island well water was anticipated in this plan for lake replenishment.

Revised Basin Plan Objectives for the Elsinore Groundwater Basin were adopted by the Regional Board on January 22, 2004. These revised objectives increased the TDS from 450 to 480 mg/L and decreased the nitrate objective from 4 to 1 mg/L as nitrogen. Specific objectives for hardness, sodium, chloride and sulfate were eliminated. Adoption of these objectives were anticipated in the GWMP but are indicated as proposed in the report.

Wastewater flow projections for EVMWD's Regional WWTP were revised in early 2005 which indicate flows will be about 7.5 mgd in 2020 instead of 18.2 mgd as indicated in the EVMWD Wastewater Master Plan (Kennedy/Jenks Consultants, 2003). This lower projection may prolong the need to use Island Well water for lake replenishment unless an additional source of supplemental water is obtained for the lake.

Construction has been completed for several facilities including a new connection to MWDSC's Lakeview Pipeline and the Eastern MWD's effluent disposal pipeline from Rancho California. The new MWDSC connection (WR-31) allows EVMWD to deliver SWP to Canyon Lake providing a higher quality supply and improved reliability. The Eastern MWD pipeline conveys recycled water from treatment plants in the Rancho California area to Wasson Sill and could provide recycled water for use in the EVMWD service area. Both of these facilities improve water supply reliability and could assist in groundwater management.

REPORT OVERVIEW

The Elsinore Basin GWMP is divided into the following eight sections:

- **Section 1** is the introduction of the GWMP
- **Section 2** includes a description of the hydrogeologic setting of the Elsinore Basin and a description of the conceptual model.
- **Section 3** describes the development of a numerical groundwater model for the Elsinore Basin.
- **Section 4** describes existing and future baseline conditions.
- **Section 5** includes a discussion of management issues.
- **Section 6** describes the management alternatives.
- **Section 7** evaluates each management alternative and recommends the preferred alternative.
- **Section 8** provides an implementation plan for the recommended alternative.

Section 2
Hydrogeologic Setting

The Elsinore Basin is a major source of water supply for EVMWD, EWD and other local groundwater producers. The development of a detailed understanding of the groundwater basin is an important step in the development of the GWMP. The following section discusses the development of the hydrogeologic conceptual model for the Elsinore Basin. This section includes a summary of the following:

- previous work and data collection efforts
- geology and structure
- groundwater flow
- groundwater quality and
- a preliminary groundwater budget

BACKGROUND

Previous Work

In 1994, Geoscience Support Services Inc. (Geoscience) under contract with EVMWD provided a comprehensive review of the hydrogeology of the Elsinore Basin. The Geoscience report compiled historical information from previous reports including: State Water Resources Control Board (1953 and 1959), Harding-Lawson Associates (1978 and 1980) and DWR (DWR, 1981). The purpose of the report was to define the Elsinore Basin in sufficient detail to evaluate the feasibility of surface recharge and injection facilities to augment groundwater supplies. Geoscience prepared a hydrogeologic conceptual model based upon available data at that time, evaluated geophysical data, prepared a numerical groundwater model and evaluated the economic feasibility of recharge in the Elsinore Basin. MWH updated the information compiled in the Geoscience report based upon subsequent efforts and recent information gathered as part of this project.

Neblett and Associates (1998 and 1999) performed a detailed geologic study to evaluate the feasibility of the Liberty Development, a proposed 878-acre residential and golf course development in the Back Basin area. This effort included a fault study and geotechnical study including an extensive field program. The field program included: 21,000 lineal feet of seismic refraction lines, sixty-five cone penetrometer soundings, sixty-one hollow stem auger borings, and forty-six groundwater piezometers to depths of 110 feet. In addition, this report provided an aerial photographic lineament analysis to identify the location of the Glen Ivy fault, a seismic analysis and a liquefaction study to evaluate the feasibility of residential development in this area. The study also defined the surface trace of the Glen Ivy fault. According the Neblett and Associates (1998), the fault zone is “complex and a single main trace was not discernable” and ranges from approximately 100 feet to 500 feet wide.

Data Collection

A variety of additional data has been collected as part of the GWMP effort. A thorough review of the available hydrogeologic data is a prerequisite for the development of the conceptual model. In addition, the data collected under this task served as the input data for the numerical groundwater flow model developed for this groundwater management plan. As part of the GWMP development data has been compiled to evaluate the characteristics of the Elsinore Basin, define the watershed, calculate the water budget and identify potential surface recharge locations. The information types can be categorized as follows:

- Reference reports
- Base maps
- Boundary maps
- Well information
- Water levels
- Production records
- Surface water flows
- Precipitation data
- Water quality data
- Geophysical data

Data Organization

The collected data are organized in a Geographic Information System (GIS) format. A GIS is a combination of a database program and a graphical interface that displays the information on geographic maps. A GIS gives the user the ability to organize and analyze information geographically. By compiling the information in a groundwater GIS, information can be accessed more easily and information can be combined and presented spatially to obtain a better understanding of the groundwater basin. The groundwater GIS for the GWMP is developed using *ArcView 3.2* a product of the Environmental Systems Research Institute (ESRI). The GIS is used for the following purposes in the Elsinore Basin:

- Data collection and organization
- Geographic mapping
- Information analyses
- Calculations
- Provide input data for the numerical model

The groundwater GIS is created in the NAD83, Zone V, California coordinate system. All information added in the future should be in this coordinate system to obtain the same geographic projection of information.

Data Sources

The sources of the information collected are presented by data type in **Table 2-1** along with the file format. The shapefile format is the generic file format for the GIS. Other file formats that

are compatible with ArcView include images (tiff and pdf), AutoCAD drawings (dwg and dxf) and database tables (dbf and xls).

Table 2-1
Data Sources

Data Type	Data Description	Data Source	Data Format
Base maps	Parcels Streets and Freeways Aerial Photography Water Bodies Ground Elevation Contours	EVMWD EVMWD EVMWD EVMWD USGS[1]	Shapefile Shapefile Shapefile Shapefile Shapefile
Boundary maps	EWD – EVMWD Service Areas Groundwater Basins San Jacinto Watershed Townships, Ranges & Sections Elsinore Basin Watershed	EVMWD EVMWD EVMWD EVMWD MWH[1]	Shapefile Shapefile Shapefile Shapefile Shapefile
Well information	Various	Various	Shapefile
Groundwater levels	Monthly Data 1919-2001[3]	EVMWD	Spreadsheet
Production records	Monthly Data 1947-2000[3]	EVMWD, SAWPA, SWRCB[4]	Spreadsheet
Stream gauge data	Daily Data 1916-2001	USGS	Spreadsheet
Precipitation data	Monthly Data 1897-2001	RCFCWCD [5]	Spreadsheet
Water quality data	Monthly Data 1985-2001[3]	Monitoring Wells[2], DHS[6]	Spreadsheet
Geophysical data	Geologic Formations Faults Seismic Lines	MWH[7], CDMG (1969) [8] MWH[7], CDMG (1969) [8] GeoScience (1994), Neblett &Associates (1999	Shapefile Shapefile Shapefile

1 – Drawn and digitized from United States Geological Survey (USGS) contour data
2 – Newly drilled monitoring wells added by MWH
3 – Sporadic data
4 – State Water Resources Control Board
5 – Riverside County Flood Control and Water Conservation District
6 – Department of Health Services
7 – Interpretation of various reports in combination with Back Basin pilot testing results
8 – California Division of Mines and Geology

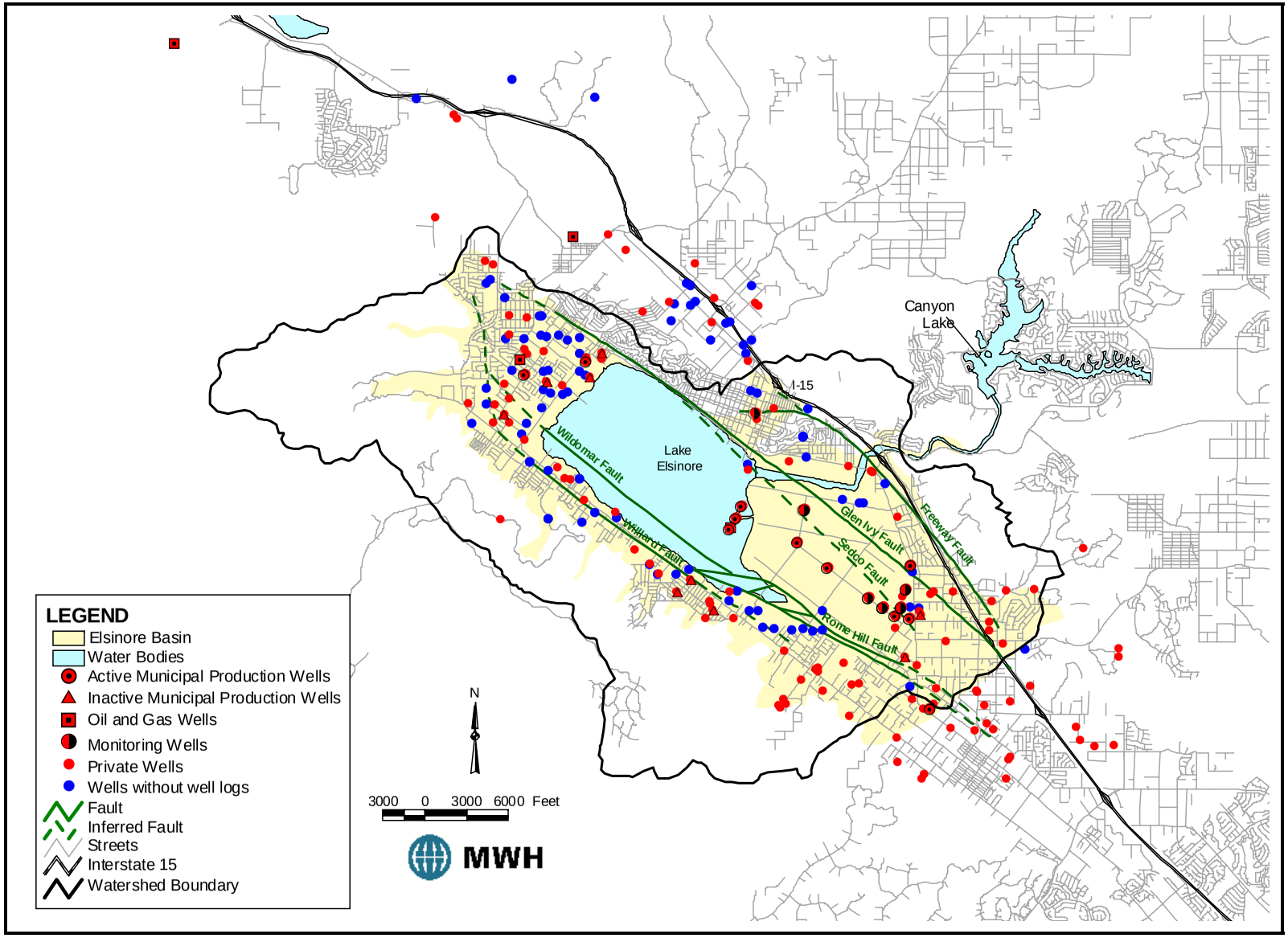
Spreadsheet data including historical water levels, production records and water quality data are not included in the GIS because this format is more flexible for many types of analyses.

Well Information

Lithologic data from wells are critical to the development of the conceptual hydrogeologic model for the Elsinore Basin. **Figure 2-1** presents the location of 239 documented wells within the Elsinore Basin. The location of faults, seismic lines, precipitation stations and stream gauges are also included for reference. The wells are color-coded based on the availability of well logs.

There are 151 wells with well logs (colored red**)**, which provide the most comprehensive descriptions of the lithology in the basin. Well logs are not available for the remaining 88 wells (colored blue). The level of information per well log varies greatly – 23 well logs

Figure 2-1
Wells in the Elsinore Basin



provided limited information and are not used in the subsequent analysis. A total of 124 well logs are scanned and are saved electronically in .pdf format. Based upon the well log data, tops and bottoms of the principal aquifer units are documented and compiled. These data are used to define the structure of the basin as discussed later in this section.

Data Assessment

Based upon a review of the well information and other data, EVMWD has elected not to perform a seismic study to evaluate the geologic structure in the basin as initially envisioned for this project. The seismic studies previously conducted throughout the basin (i.e. Harding Lawson, 1978 and 1980; Neblett & Associates, 1998) provide sufficient seismic data to define the overall structure of the basin. Therefore, EVMWD plans to install additional monitoring wells in lieu of the seismic investigation. The additional monitoring wells provide actual lithologic data that can be used to confirm the conclusions drawn by the seismic work.

GEOLOGY AND STRUCTURE

The geology and structure of the Elsinore Basin are important to the understanding of the basin hydrogeology.

Geologic Setting

Figure 2-2 presents a map of the faults within the Elsinore Basin. The Elsinore Basin was formed within the Elsinore graben, a down-dropped block between the Glen Ivy and Wildomar faults (see **Figure 2-2**), which are associated with the right-lateral strike-slip-dominated Elsinore Fault Zone (EFZ). The EFZ extends approximately 120 miles from Baja California north to the Corona area, where it divides into the Whittier and Chino faults. As the Elsinore Basin was formed by faulting throughout geologic time, it would have likely been occupied by various streams, rivers and lakes similar to the San Jacinto River and Lake Elsinore of today. For example, the San Jacinto River, which currently flows through Railroad Canyon, has probably taken more than one course and may have been in various different locations in its history. As a result, the geology and structure of the Elsinore Basin is complex.

The basement rocks within the Elsinore area generally consist of granodiorite, tonalite and diorite rocks of Jurassic to Cretaceous age (Neblett and Associates, 1998). Metasedimentary rocks (slates and sandstones) of Jurassic age are also encountered. Overlying the basement rocks within the basin, are medium to coarse-grained non-marine sandstones, siltstones and clay of the Pauba Formation (DWR, 1981). The Pauba Formation is overlain by flood plain deposits of late Pleistocene to Holocene age consisting of interfingering sands, silts and clays. Overlying these deposits are relatively unconsolidated Holocene lacustrine sands, silts and clays associated with the ancient San Jacinto River and Lake Elsinore.

Hydrostratigraphy

Figure 2-3 shows the general hydrostratigraphy of the Elsinore Basin. The following descriptions of the hydrostratigraphy are presented from shallowest to deepest. **Figure 2-4** presents a geologic map of the Elsinore Basin**.** The hydrostratigraphic units depicted on

Figure 2-2
Faults of the Elsinore Basin

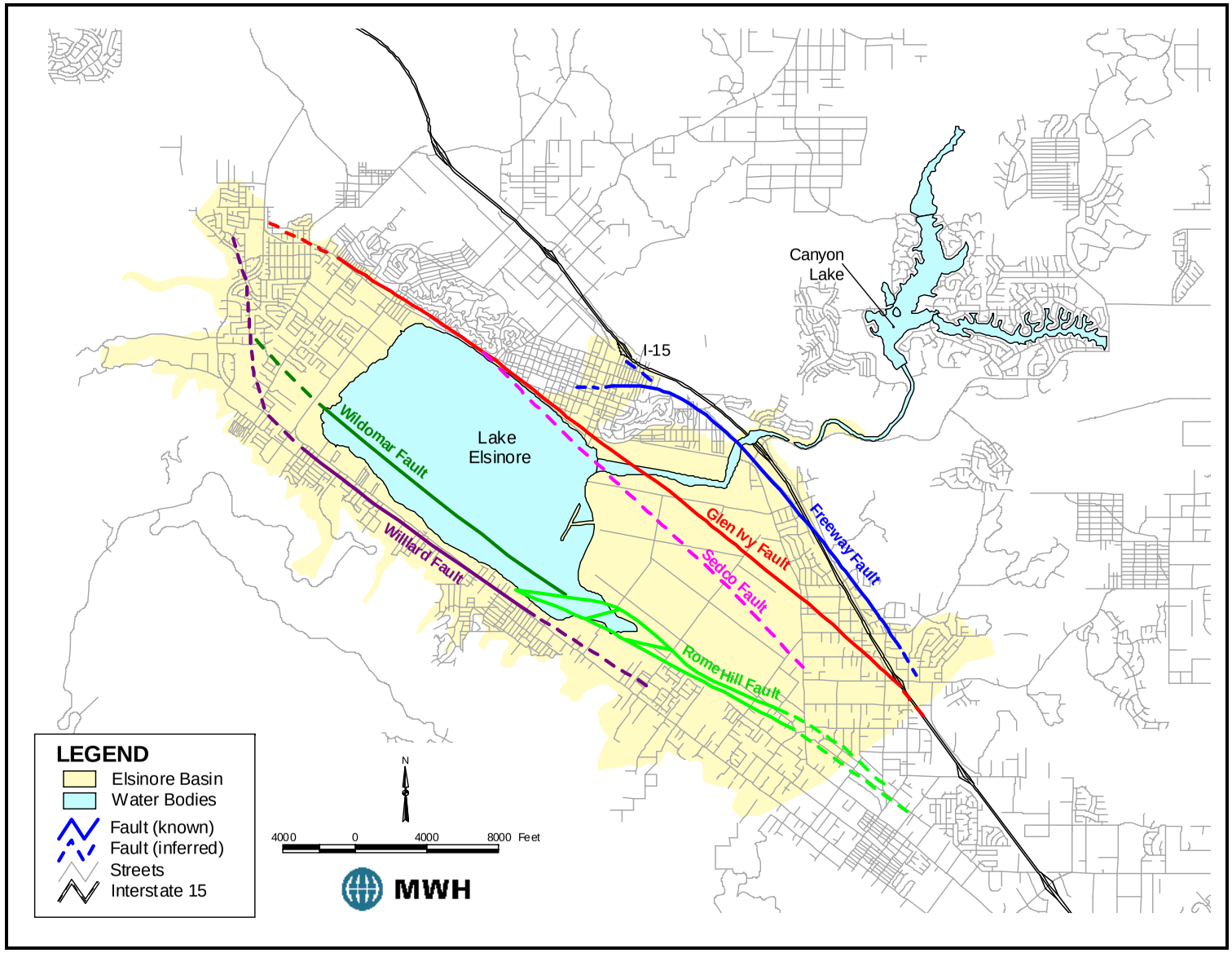


Figure 2-4 include: the Recent alluvium (Qal), the Older alluvium (Qt), the Fernando Group (TQf), the Bedford Canyon Formation (bcb) and undifferentiated basement rocks (bct). Descriptions of these units are described below.

Figure 2-3
Hydrostratigraphy in the Elsinore Basin

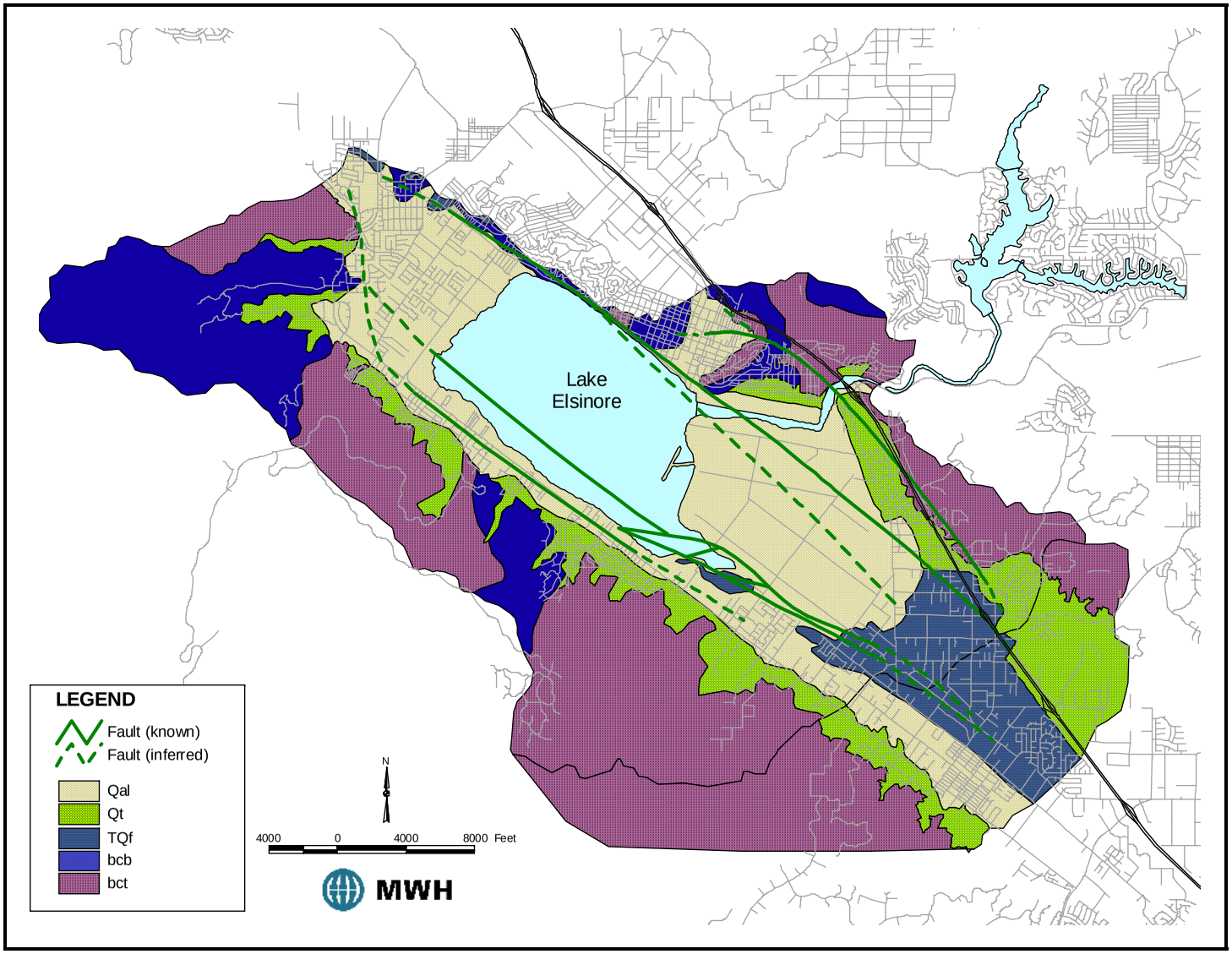
Formation	Symbol	Graphic	Description
Recent Alluvium	Qal		Interfingering sands and clays
			Perched groundwater conditions present
Older Alluvium	Qt		Interfingering sands and clays
			Slightly more consolidated than above
Fernando Group	TQf		Poorly sorted, subangular granitic sands, cobbles, and boulders
			Most produced groundwater comes from this zone
Bedford Canyon Formation	bcb		Blue to black slate and sandstone
			Relatively low groundwater production rates in this zone
Undifferentiated Basement	bct		Granitic basement rocks
			Limited groundwater production except in fractures

Recent Alluvium

The Recent alluvium (Qal) is the youngest of the water-bearing formations in the Elsinore Basin (Geoscience, 1994). It consists of interfingering gravels, sands, silts and clays resulting from streams originating in the surrounding highland areas. Most of these interfingering lenses are laterally discontinuous and do not correlate well across long distances. The Recent alluvium is more than 300 feet thick in some portions of the basin, particularly in the center of the basin.

In many locations, perched groundwater conditions exist within the Recent Alluvium. Perched groundwater can be found within the upper 25 feet, particularly in the Back Basin where as much as 100 feet of impermeable clay occurs at or near the surface, impeding percolation of water to the deeper aquifers.

Figure 2-4
Geology of the Elsinore Basin



Source: Geoscience, 1994 and CDMG, 1969.

Older Alluvium

The Older alluvium (Qt) is similar to the Recent alluvium, consisting of interfingering gravels, sands, silts and clays of stream origin (Geoscience, 1994). The Older alluvium, like the Recent alluvium, is up to 300 feet thick. Because of their similar depositional environments, there does not appear to be a clear and definitive lithologic marker unit between the Recent and Older alluvium that could be determined from well log information. However, the Older alluvium is generally more consolidated and contains more clay than does the Recent alluvium (Geoscience, 1994). Therefore, for the purposes of this report, the Recent and Older alluvium will be referred to simply as alluvium (Qa).

Fernando Group

The Fernando Group (TQf) is characterized by poorly sorted, subangular granitic sands and gravels with laterally discontinuous lenses of silts and clays correlative with the early Pleistocene Pauba Formation, located to the southeast in the Murietta area (Geoscience, 1994). The boundary between the alluvial aquifers and the Fernando Group is marked by a relatively continuous clay aquitard that extends throughout most of the central portion of the basin beneath Lake Elsinore. The Fernando Group is thin or absent along the margins of the basin and is as much as 1,200 feet thick in the center of the basin.

Bedford Canyon Formation

The Bedford Canyon Formation (bcb) is characterized by blue to black slate alternating with layers of fine-grained sandstones of Jurassic age that underlies the Fernando Group throughout the basin (Geoscience, 1994). Lithology identified as Bedford Canyon includes the more consolidated sedimentary section beneath the Fernando Group between the Wildomar fault and the Glen Ivy fault in the deepest part of the basin. Groundwater in the Bedford Canyon formation is limited to the weathered zones at shallow depths and fractures at depth and generally does not produce significant groundwater supplies. The Bedford Canyon Formation is also found in the highland areas of the northern portion of the basin – these areas do not produce significant groundwater supplies (Geoscience, 1994).

Undifferentiated Basement Complex

The basement rocks (bct) in the Elsinore Basin are characterized by igneous granites, tonalites, gabbros and minor basalt of Jurassic to Cretaceous age (Geoscience, 1994). These rocks are found at the surface in the highlands surrounding the basin and generally do not produce significant groundwater except in fractures. In the basin area itself, the depth to bedrock ranges from about 200 feet to as much as 2,800 feet in the Back Basin area.

Structure

As discussed previously, the Elsinore Basin is dominated by the Elsinore graben, a down-dropped block between the Glen Ivy Fault Zone and the Wildomar Fault Zone located to the north and south of Lake Elsinore, respectively. The following section provides a brief discussion of the structure in the Elsinore Basin as it relates to groundwater flow in the basin.

Faults

The Elsinore Basin is dominated by two major fault zones. These are the Glen Ivy Fault Zone, which includes the Glen Ivy fault, the Freeway fault and the Sedco fault, and the Wildomar Fault Zone, which includes the Wildomar fault, the Rome Hill fault and the Willard fault. These faults are shown on **Figure 2-2**. These faults are steeply dipping (nearly vertical) with predominant dip-slip and minor right-lateral strike-slip motion.

Other faults identified by DWR (1981), which subdivided the Elsinore Basin into additional hydrogeologic compartments, appear to be limited to the basement rocks and do not appear to provide barriers to or restrict groundwater flow.

The Freeway fault, which also offsets basement rocks, is located along the I-15 freeway in the northern portion of the basin. This fault does not appear to restrict subsurface flow from the surrounding highlands either.

The Sedco fault, which is located in the Back Basin area, has been extensively studied as part of the Back Basin Pilot Injection Program (BBPIP). Based upon data collected during a pilot injection test, the Sedco fault does not appear to restrict groundwater flow in the Back Basin area. Based upon water level differences and analysis of the sources of groundwater recharge across the fault, the Glen Ivy fault appears to be at least a partial barrier to groundwater flow.

The Rome Hill Fault Zone, which is part of the Wildomar Fault Zone, results in the local surface high called Rome Hill. Because of the extensive faulting and differences in water levels across the fault, this appears to be a barrier to groundwater flow. Therefore, subsurface flow from the surrounding highlands south of the fault, do not appear to provide recharge to the central portion of the basin.

The Willard fault, which extends along Grand Avenue along the southeast and eastern side of the basin, offsets basement rocks in the area and does not appear to be a barrier to flow. Similarly, the parallel Wildomar fault does not appear to be a barrier to groundwater flow.

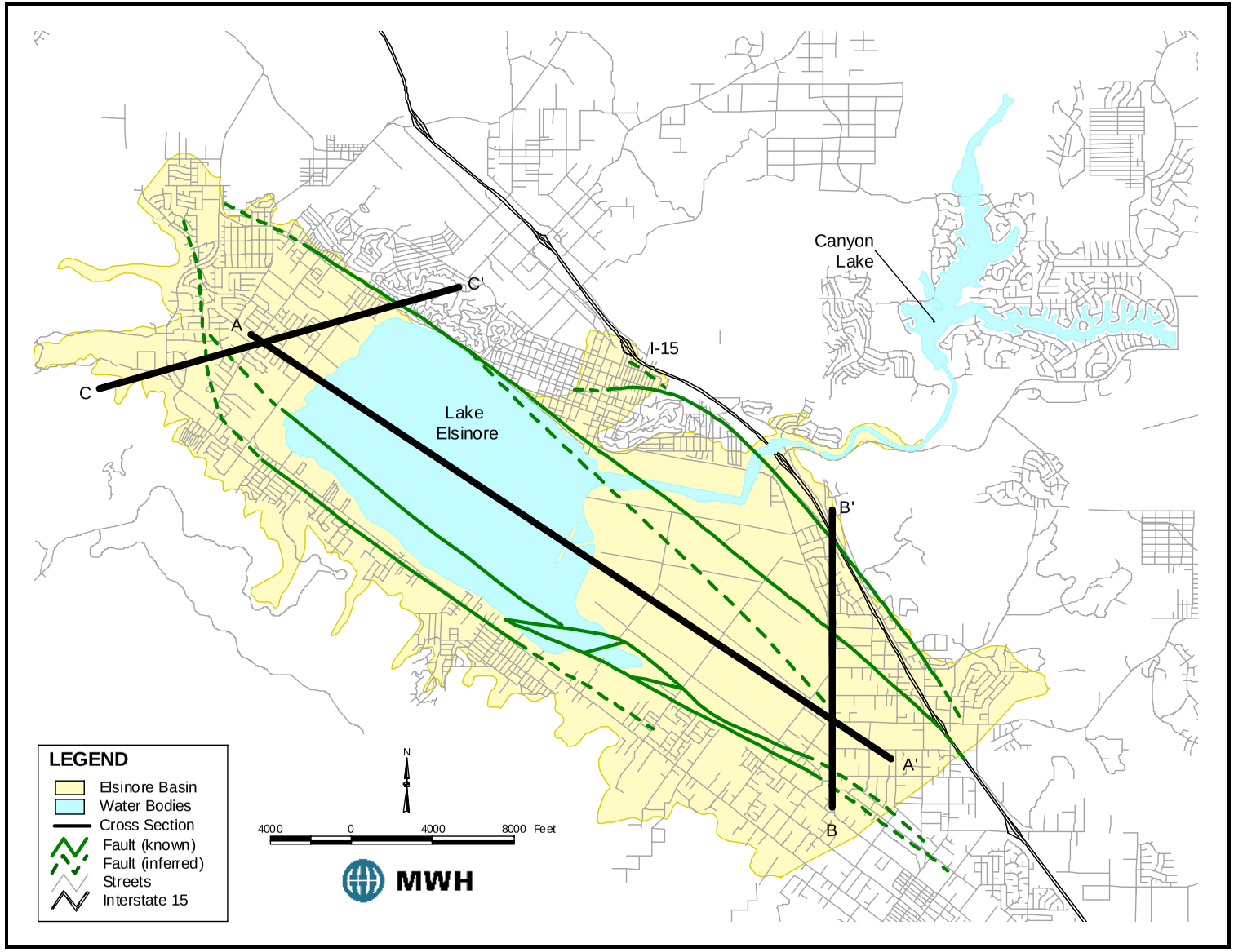
Conceptual Hydrogeologic Sections

To provide a description of the conceptual hydrogeology and overall structure of the Elsinore Basin, three hydrostratigraphic cross sections have been constructed in various locations in the basin. The locations of the cross sections are presented on **Figure 2-5**. The cross sections are presented on **Figure 2-6** through **Figure 2-8.** Information presented on the cross sections is developed from data compiled from driller's logs, geophysical logs, water level data, seismic studies and interpretation developed during the course of this investigation. Structural contour maps depicting the tops and bottoms of key aquifer units are also presented in **Appendix D**.

Cross Section A-A'

This cross section extends approximately 7.5 miles longitudinally across the basin parallel to the long axis of the basin from approximately Grand Avenue on the northwest to Mission Trail on the southeast. The alluvium (shown as Qa on the section) ranges in thickness from about 200 feet in the northwest to more than 450 feet in the southeast part of the section.

Figure 2-5
Location of Cross Sections



The Sedco fault appears to offset the alluvium by about 20 to 40 feet in the Back Basin area based upon geophysical logs from several wells (i.e. Cereal-1, Corydon, MW-1 and MW-2) in the Back Basin area. The clay aquitard, which appears to be relatively continuous throughout the basin, separates the alluvium from the underlying Fernando Group.

The Fernando Group (shown as TQf on the section) is also present throughout the basin underlying the alluvium. In the southeast part of the section, the alluvium is not present and the Fernando Group is actually uplifted to the surface. The Fernando Group extends to a depth of approximately 700 feet overlying the Bedford Canyon Formation in the area north of the lake. In the Back Basin area, the Fernando Group extends to a depth of as much as 1,800 feet below ground surface (fbgs) in the vicinity of the Island wells and is underlain by a more consolidated, less permeable Bedford Canyon Formation. The Fernando Group appears to be offset by as much as 150 feet by the Sedco fault between the Cereal-1 and Corydon Street wells. In the Wildomar area southeast of the Corydon well, the bedrock surface is uplifted to about 900 feet above MSL, creating a barrier to groundwater flow toward the Murietta Basin. This appears to limit the volume of the basin between the Sedco fault and the Glen Ivy fault.

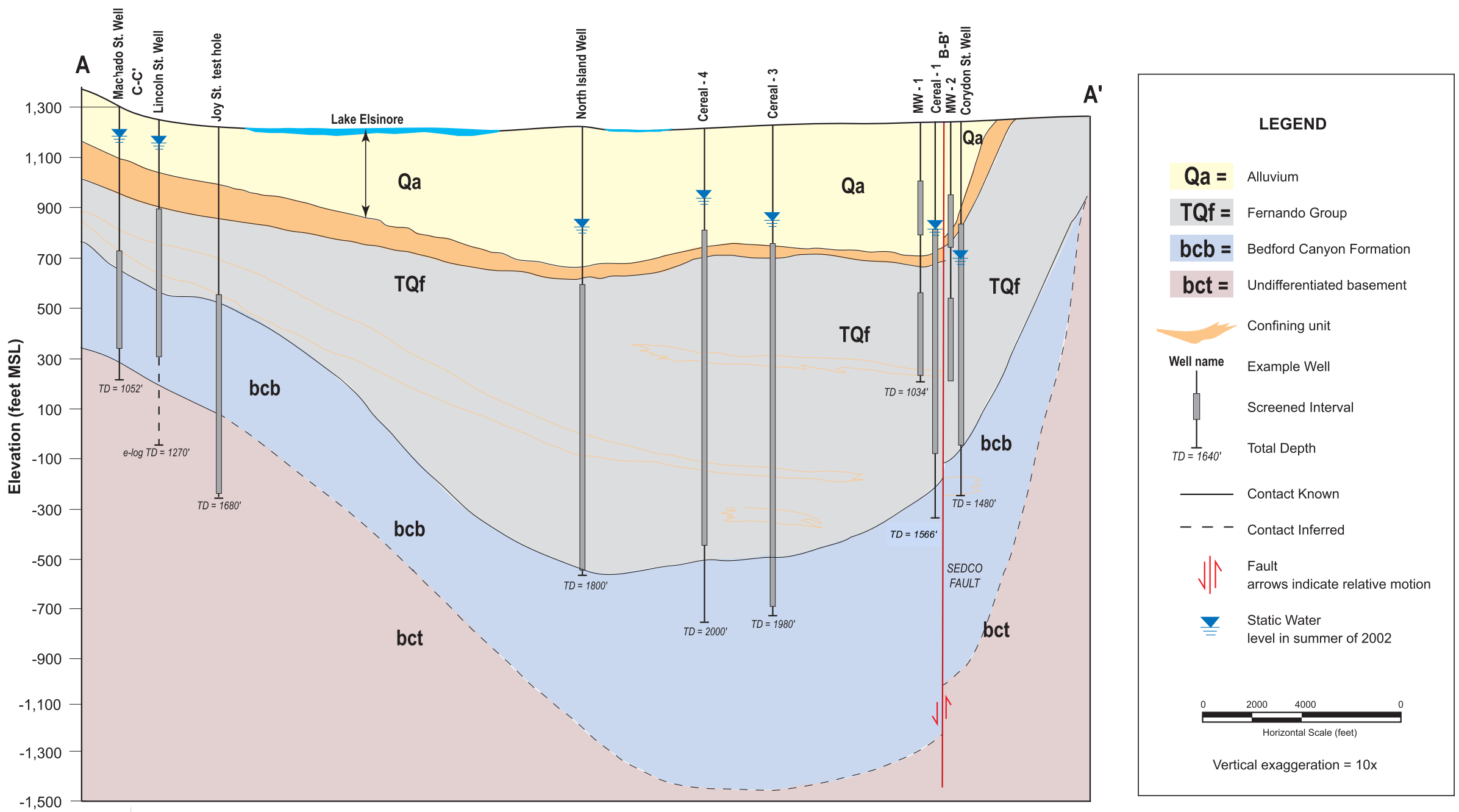
As shown in the section, water levels in wells that are screened in the alluvium are generally higher than water levels in wells that are screened solely within the Fernando Group or the underlying Bedford Canyon Formation, which suggests that there is limited hydrogeologic connection between the alluvium and the Fernando Group. The general groundwater flow direction is from the northwest to the southeast, largely a result of groundwater extraction in the Back Basin. The difference in groundwater levels between the Cereal-1 well, which is screened in both the alluvium and the Fernando Group, and the Corydon Street well, which is screened only in the Fernando Group, appears to be a result of being screened in separate zones.

Cross Section B-B'

Cross Section B-B' extends about 4 miles from south to north through the Back Basin. This section shows the various faults through the Back Basin (from south to north the Wildomar Fault Zone, the Sedco fault, the Glen Ivy fault and the Freeway fault). Depth to bedrock and the resultant alluvial thickness is largely controlled by bedrock faulting in the area. For example, the Fernando Group and the Bedford Canyon Formation generally thicken toward the center of the basin and are not found along the boundaries of the basin (north of Freeway fault and south of Wildomar fault) in this area. This is likely a result of erosional processes caused by downdropping of the bedrock. The thicknesses of these units are also variable across faults. The vertical offset in the bedrock along the Wildomar Fault Zone (which includes the extension of the Wildomar fault and the Rome Hill fault) appears to be as much as 400 feet. Between the Wildomar Fault Zone and the Sedco fault, the bedrock surface undulates from faulting in the bedrock. The vertical offset in the bedrock along the Sedco fault appears to be more than 200 feet. The vertical offset along the Glen Ivy fault is more than 500 feet. The Freeway fault contact is inferred and the offset shown is estimated based upon surface geology.

Cross Section C-C'

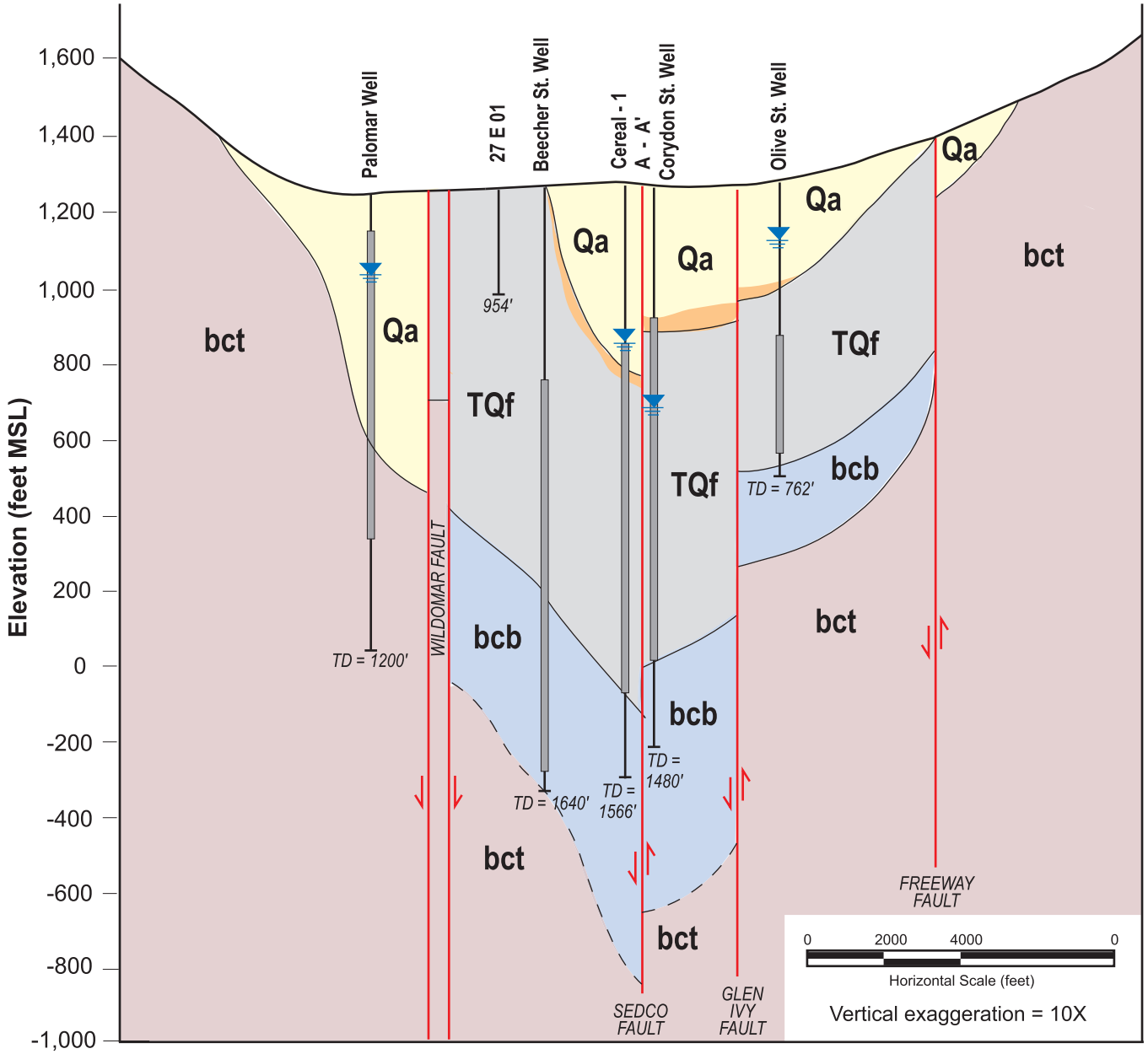
Cross Section C-C' extends about 3 miles east-northeast from Leach Canyon past Lakeshore Drive along the northern side of Lake Elsinore. Like the Back Basin area, the basin geometry is



MWH

Figure 2-6
Cross Section A-A'

Figure 2-7
Cross Section B-B'



LEGEND

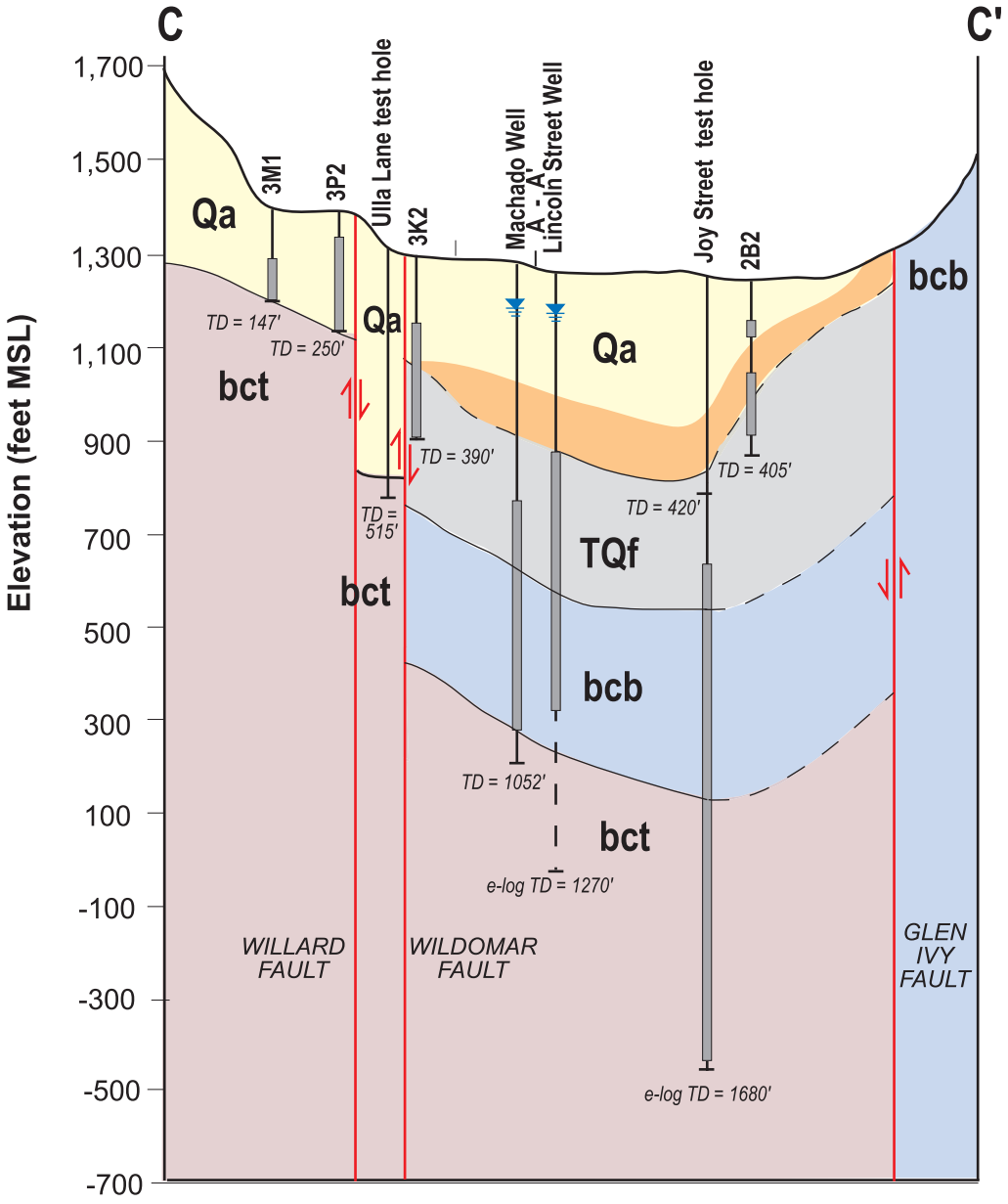
Qa =	Alluvium
TQf =	Fernando Group
bcb =	Bedford Canyon Formation
bct =	Undifferentiated basement

Well name
Example Well
Screened Interval
Total Depth
TD = 1640'

Confining unit
Contact Known
Contact Inferred
Fault
arrows indicate relative motion
Static Water
level in summer of 2002

MWH

Figure 2-8
Cross Section C-C'



LEGEND

Qa =	Alluvium
TQf =	Fernando Group
bcb =	Bedford Canyon Formation
bct =	Undifferentiated basement

Well name
Example Well
Screened Interval
Total Depth
TD = 1640'

Confining unit
Contact Known
Contact Inferred
Fault
arrows indicate relative motion
Static Water
level in summer of 2002

MWH

largely controlled by faulting. This section identifies the locations of the Wildomar, Willard and Glen Ivy faults.

The alluvium in this part of the basin is generally thinner than in the Back Basin area. The depth to bedrock in the area of Leach Canyon ranges from 200 to 250 fbgs near the mouth of the canyon. Depth to bedrock in the center of the basin ranges from 1,000 to 1,200 fbgs. The thickness of the alluvium is about 200 feet in the central portion of the section. In the western portion of the basin, the alluvium is underlain directly by the granite basement complex because the Fernando Group and Bedford Canyon Formation are not present, likely a result of erosional processes. East from the Wildomar fault, the alluvium is underlain by the Fernando Group and the Bedford Canyon Formation. The Fernando Group is approximately 200 feet thick throughout this area.

The Fernando Group is underlain by the Bedford Canyon formation in this part of the basin. As discussed above, the Bedford Canyon Formation is characterized by metamorphosed sedimentary rocks (slates and sandstones) and has limited groundwater production capability. Many of EVMWD's wells including Lincoln Street and Machado Street appear to be screened at least partially within the Bedford Canyon Formation, which may explain their relatively low production rates compared to the wells of the Back Basin.

Aquifer Characteristics

The primary source of data on aquifer characteristics is from pump tests. **Table 2-2** summarizes the aquifer characteristics based upon data compiled from DWR well logs and pumping tests performed throughout the basin.

Based upon aquifer tests performed in the Corydon Street well and the North, Middle and South Island wells, transmissivity values for the Fernando Group in the Back Basin range from about 103,000 to 154,000 gpd/ft, which is consistent with a sand lithology. Aquifer tests for the Cereal-3 and Cereal-4 wells, which are screened in both the Fernando Group and a small portion of the overlying alluvium, suggested transmissivity values ranging from 130,000 to 150,000 gpd/ft (Fox, 1991a and 1991b). The average transmissivity of these screened sections are slightly higher than those screened exclusively in the Fernando Group, which suggests that the alluvium has a higher hydraulic conductivity than the underlying Fernando Group.

Often, direct field measurements of transmissivity and horizontal hydraulic conductivity are not available. To establish a range of transmissivity values for the principal water-bearing units, all available specific capacity data, a related parameter, are compiled. The transmissivity of a confined aquifer can be approximated by multiplying the specific capacity by a constant of approximately 2,000 (Logan, 1964). Sources of specific capacity data included well driller's logs, purveyor's records and published data. Although specific capacity is a relative measure of the transmissivity of the aquifer, each specific capacity measurement is evaluated with caution because specific capacity is often affected by partial penetration of the aquifer, well losses, hydrogeologic boundaries and pumping time. Few of these wells are screened in only one water-bearing zone; therefore, aquifer-specific transmissivity estimates are not available. Furthermore, many wells are also screened across less permeable units, which would result in lower specific capacity values for the aquifer portions of the screened section. Therefore, aquifer-specific

transmissivities that are calculated from specific capacity data should be considered a lower limit.

Table 2-2
Summary of Aquifer Characteristics

Well Name	Aquifer	Saturated Screen Length (b) (ft)	Transmissivity (T) (gpd/ft)	Storativity (s)	Source
North Well	TQf	1,200	138,000 [1]	0.00037	Geoscience, 1990
Middle Well	TQf	1,167	159,000 [1]	0.00660	Geoscience, 1990
South Well	TQf	1,200	104,000 [1]	0.00550	Geoscience, 1990
Cereal-1	Qa and TQf	990	112,000 [1]	0.0035	This study
Cereal-3	Qa and TQf	1,330	130,000-140,000 [1]	NA	Fox, 1991b
Cereal-4	Qa and TQf	1,180	140,000-154,000 [1]	NA	Fox, 1991a
Corydon Street	TQf	920	103,000-123,000 [1]	NA	Fox, 1985
Olive Street	TQf	300	38,000 [2]	NA	Geoscience, 1994
Lincoln Street No. 1	Qa, TQf and bcb	817	16,000 [2]	NA	Geoscience, 1994
Lincoln Street No. 2	TQf and bcb	580	34,000 [2]	NA	Geoscience, 1994
San Jacinto	Qa	300	17,000 [2]	NA	Geoscience, 1994
Beecher Street	TQf and bcb	780	116,000 [2]	NA	Geoscience, 1994
Fraser No. 1	Qa and TQf	220	24,000 [2]	NA	Geoscience, 1994
Machado Street	TQf and bcb	390	19,000 [2]	NA	DWR well log

Notes:
1 Calculated from aquifer test data
2 Calculated from specific capacity data assuming T = specific capacity x 2,000/well efficiency (rounded to nearest 1,000)

No in-situ measurements of horizontal hydraulic conductivity are available so hydraulic conductivity estimates are made from transmissivity. Hydraulic conductivity is defined by the following equation:

$$T/b = k$$

where:
T = transmissivity
b = saturated aquifer thickness and
k = hydraulic conductivity

Based upon the transmissivity estimates provided in **Table 2-2**, horizontal hydraulic conductivity ranges from about 3 ft/day in the area north of the Lake to about 19 ft/day in the Back Basin area. This range in hydraulic conductivity is consistent with a silty to medium sand lithology, which is present throughout the Elsinore Basin.

No direct measurements of vertical hydraulic conductivity are available for of any of the various hydrogeologic units. In most cases, the vertical hydraulic conductivity is expected to be much less (in some cases orders of magnitude) than the horizontal hydraulic conductivity. Even within relatively homogenous sand and gravel aquifers, horizontal hydraulic conductivity will generally exceed vertical hydraulic conductivity by 2 to 20 times (Todd, 1980). If silts and clays are present, this contrast will be even greater. Thin lenses of sediments with low bulk hydraulic conductivity (such as clays common in the study area) typically have an insignificant effect on horizontal conductivity, but they have a significant effect on vertical conductivity.

Storage coefficients derived from aquifer tests range from 0.00037 to 0.0060, consistent with confined or semi-confined aquifers. Based upon preliminary data evaluated as part of the BBPIP, calculated values of transmissivity in the alluvium range from about 80,000 gpd/ft to nearly 312,000 gpd/ft. Calculated values for the storage coefficient in the alluvium range from 1.1×10^{-2} to 8.7×10^{-3}. These coefficients are consistent with an unconfined or semi-confined aquifer system.

GROUNDWATER LEVELS

The following section describes the historical groundwater flow conditions for the Elsinore Basin. A summary of recent groundwater elevations is provided in **Table 2-3**.

General Groundwater Flow

As shown in Cross Section A-A', groundwater currently flows from the northwest to the southeast beneath Lake Elsinore (see **Figure 2-6** and **Figure 2-9**). Based upon the limited groundwater level data available, the average groundwater gradient in the Fernando Group appears to be approximately 0.016 in the central part of the basin. This gradient is very steep and appears to reflect the extensive pumping in the Back Basin area. The groundwater surface elevation within the Fernando Group in the central portion of the basin during the summer of 2002 ranged from 1,196 feet MSL (MSL) in the Machado Street well to 698 feet MSL in the Corydon Street well. Based upon water levels within the Fernando Group from the new monitoring wells MW-1 and MW-2, the gradient appears to steepen toward the Corydon Street well. The groundwater elevation in the Olive Street well, which is on the upthrown side of the Glen Ivy fault (see **Figure 2-7**), is 1,156 feet MSL, more than 400 feet higher than water levels in the Corydon Street well about a mile away. This suggests that the Glen Ivy fault provides at least a partial barrier to groundwater flow. However, observed vertical offsets in the bedrock associated with Glen Ivy fault may also cause fluctuations in water level.

Table 2-3
Summary of Groundwater Elevations – Summer 2002

Well Name	Aquifer	Groundwater Elevation (ft MSL)
Cereal-1	Qa and TQf	843
Cereal-3	Qa and TQf	879
Cereal-4	Qa and TQf	953
Corydon Street	TQf	698
Lincoln Street	TQf and bcb	1168
Machado Street	TQf and bcb	1196
MW-1 Deep	TQf	859
MW-1 Shallow	Qa	1032
MW-2 Deep	TQf	845
MW-2 Shallow	Qa and TQf	955
North Island Well	TQf	877
Olive Street	TQf	1156
Palomar Street	Qa	1074
South Island Well	TQf	900

The groundwater elevations for wells partially or entirely screened within the alluvium are shown on **Figure 2-10**. Because no production wells for which water level data are available are screened entirely in the alluvium, it is not possible to create a contour map for wells within the alluvium. However, the average gradient between the wells Cereal-4 and Cereal-1, which are all screened in both the alluvium and the Fernando Group appears to be approximately 0.012, similar to the gradient within the Fernando Group. Water levels in monitoring wells MW-1 and MW-2, which have piezometers screened exclusively in the alluvium, are about 100 to 150 feet higher than wells that are also screened in the Fernando Group. The Palomar well, located on the south side of the Wildomar Fault Zone, has a water elevation of 1,074 feet MSL. Because no other water level data are available for the area near the Palomar well during 2002, it is not possible to contour water levels in this area for this time period.

Historical Groundwater Levels

An evaluation of historical groundwater levels is important to understanding the behavior of the groundwater basin. Historical groundwater levels in the Elsinore Basin are described below.

Figure 2-9
Groundwater Contour Map
Fernando Group – Summer 2002

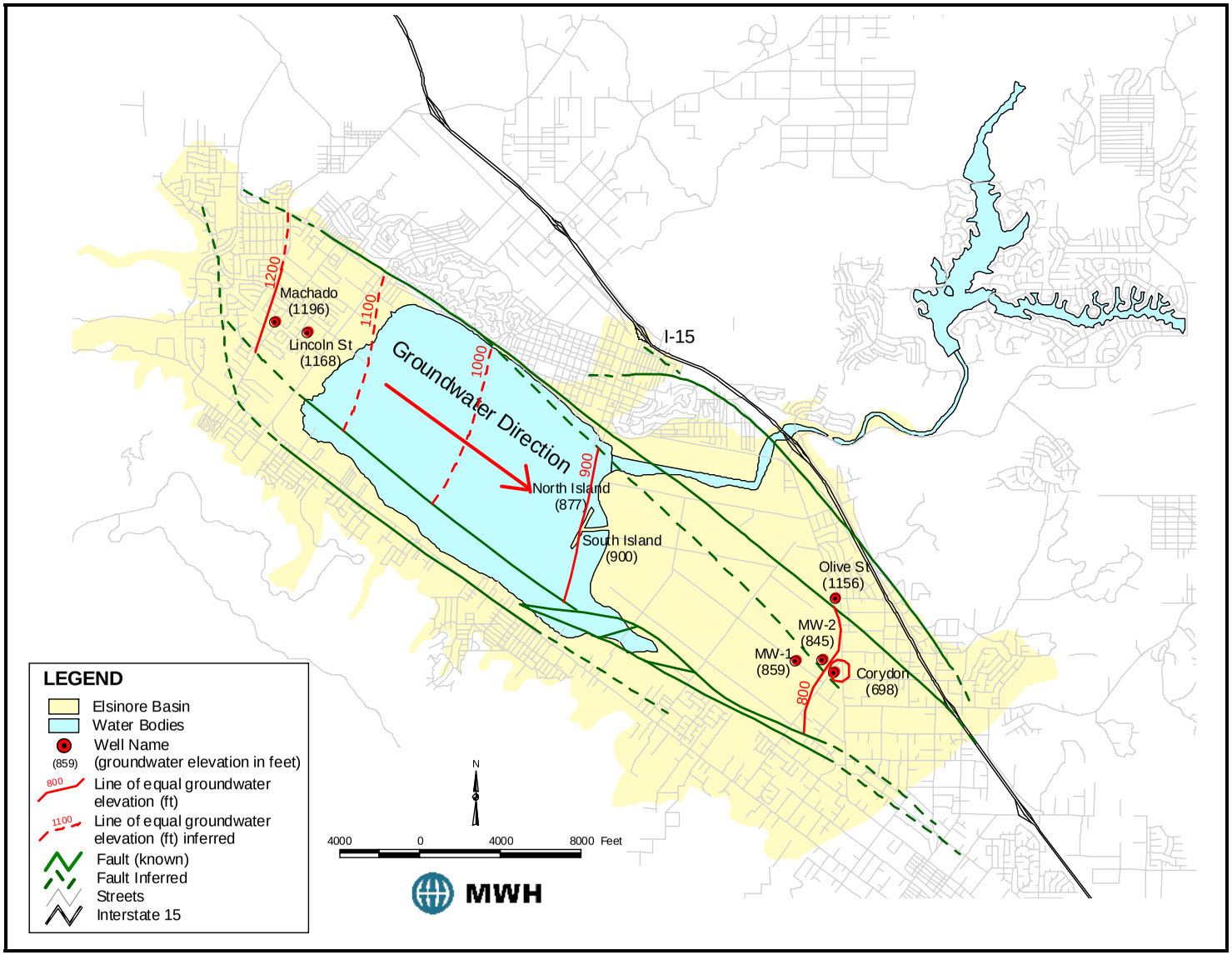
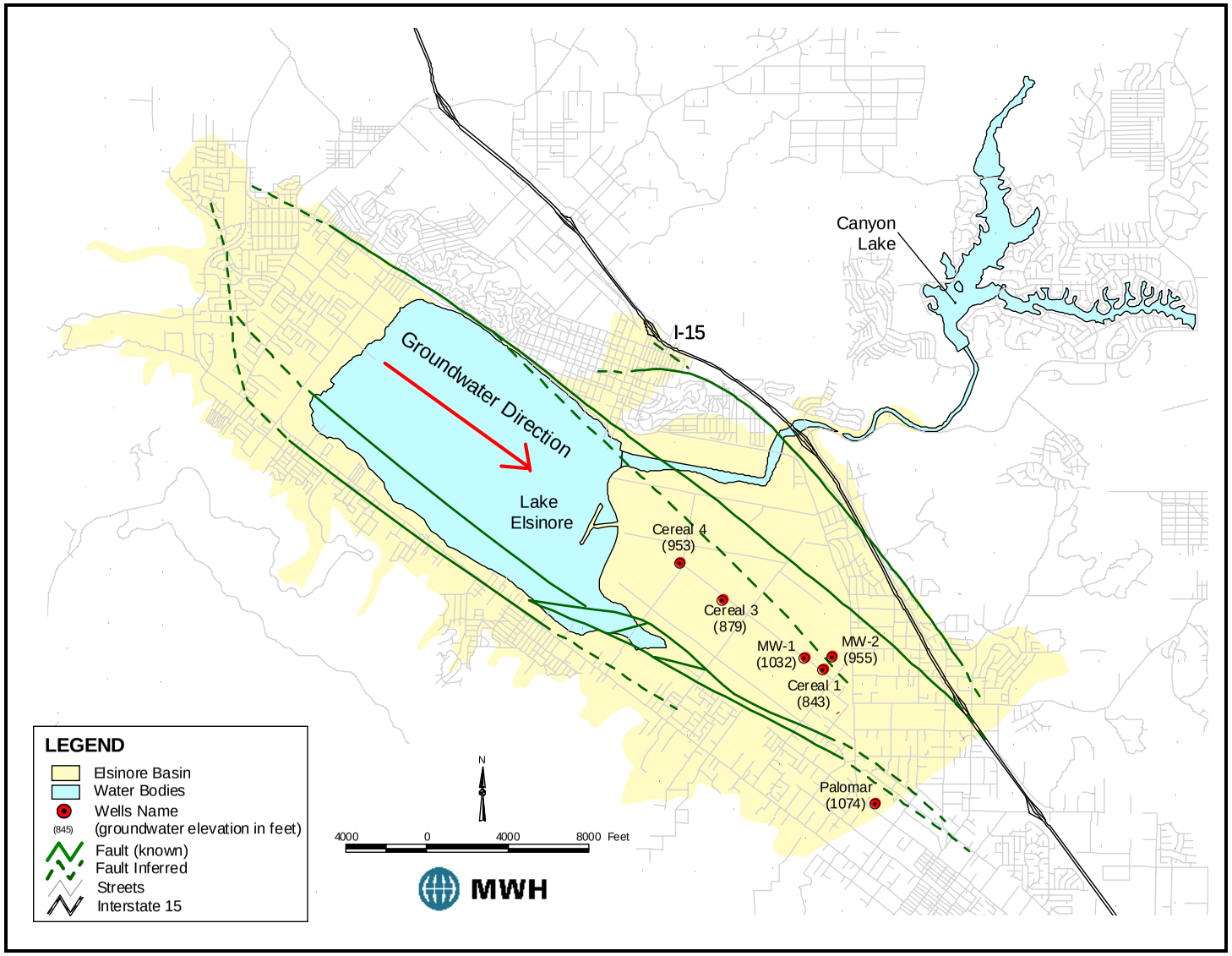


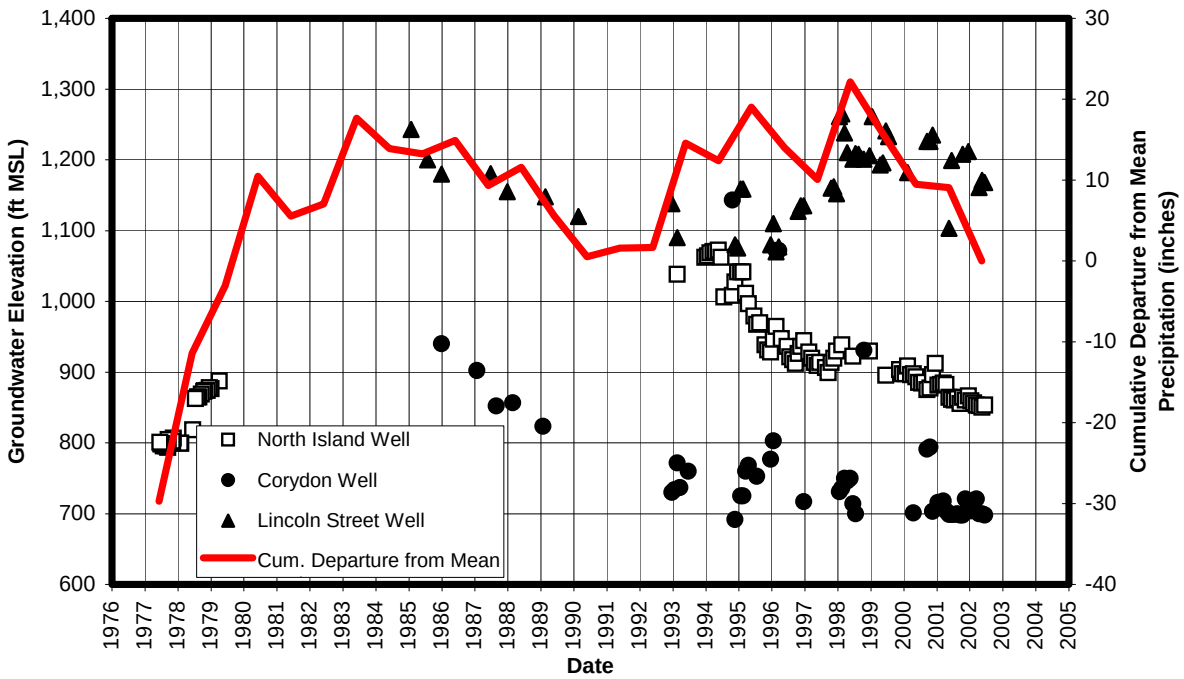
Figure 2-10
Groundwater Level Map
Alluvium and Fernando Group– Summer 2002



Fernando Group

Figure 2-11 shows historical water levels for select wells that are screened within the Fernando Group, but not in the alluvium. The water levels in the Lincoln Street Well, which is located in the area north of the lake, generally follow historical trends in precipitation as indicated by the cumulative departure from mean precipitation curve. The water levels in the Corydon Street and North Island wells are decreasing steadily and have decreased more than 200 feet since the early 1990s. This appears to be consistent with the basin geometry, which suggests that the Back Basin area has limited natural recharge to the Fernando Group and that most of the pumping occurs in this portion of the basin. The area north of the lake appears to have a source of natural recharge to the Fernando Group from surface drainages such as Leach and McVicker Canyons that infiltrate directly through the shallow alluvium into the underlying aquifers.

Figure 2-11
Historical Water Levels in the Fernando Group

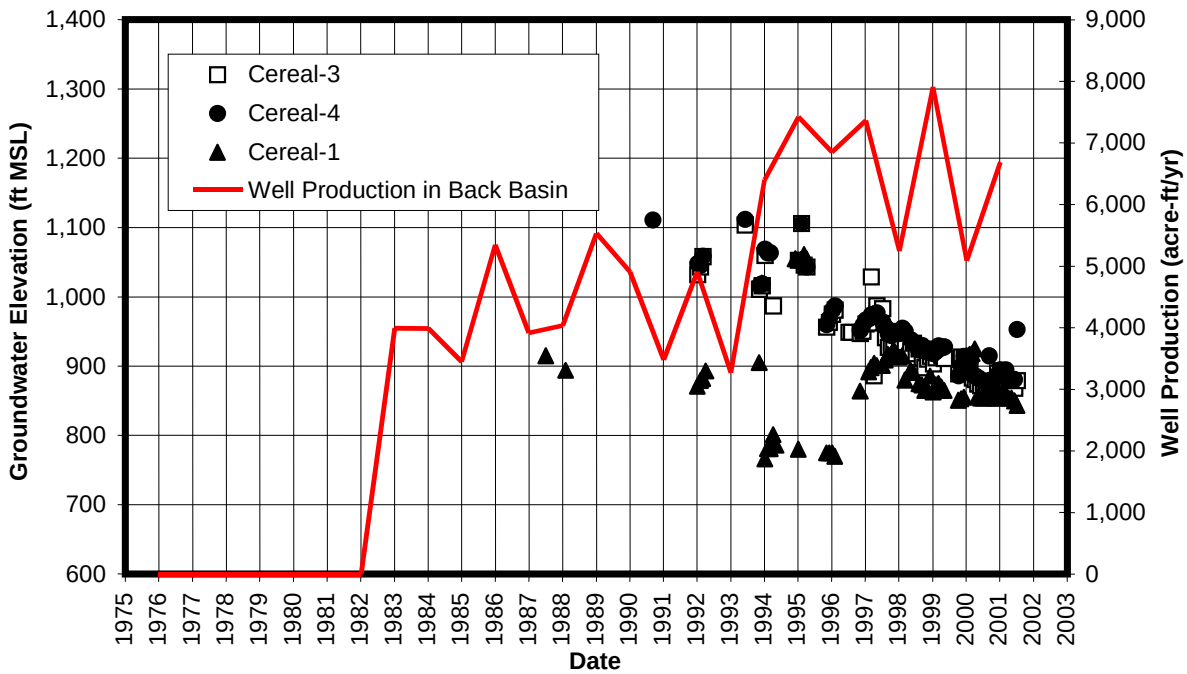


Alluvium and Fernando Group

Figure 2-12 presents historical water levels in select wells screened across both the alluvium (containing both the Upper and Lower alluvium defined previously) and the Fernando Group. In the Back Basin, the water levels in the alluvium are as much as 150 feet higher than in the Fernando Group. Water levels in the Cereal-3 and Cereal-4 wells have declined more than 150 feet since their construction. Water levels in the Cereal-1 well have fluctuated significantly since the well was constructed. The water levels fluctuations appear to be a function of regional pumping patterns in nearby wells (as shown on **Figure 2-12**). During the 1994 to 1996 period, the Cereal-1 well has similar water levels to the Corydon well. This would appear to suggest that

the Sedco fault, which separates the Cereal-1 well and the Corydon Street well is not a barrier to groundwater flow.

Figure 2-12
Historical Water Levels in the Alluvium and the Fernando Group



GROUNDWATER BUDGET

A groundwater budget analysis is the quantification and reconciliation of the inflow and outflow components of the groundwater regime in the study area. The purpose of this analysis is to characterize the major contributions to groundwater flow and evaluate the relative importance of each inflow and outflow component in the hydrologic behavior of the basin. Historical variations in the various components of flow, as well as potential variations of groundwater in storage, can be used to evaluate a representative range of flow conditions in the basin.
Typical components of groundwater inflows and outflows for a groundwater budget analysis are listed below:

Inflows

- Infiltration from direct precipitation
- Surface water infiltration
- Infiltration from deep percolation of applied water
- Infiltration from septic tanks
- Underflow into basin

Outflows

- Groundwater pumping
- Flow to surface water
- Underflow out of basin

Each of these potential components of inflow and outflow as they pertain to the Elsinore Basin are discussed in more detail below.

Inflows

The following are the major inflow components to the Elsinore Groundwater Basin:

- Recharge from precipitation – rainfall directly to the basin
- Surface water infiltration – recharge from infiltration of surface waters such as streams. The San Jacinto River is the major surface water inflow. Inflow from Lake Elsinore is considered negligible.
- Infiltration from land use – direct surface recharge from application of water for irrigation
- Infiltration from septic tanks – infiltration in areas serviced by septic systems in the basin

Precipitation Recharge

Recharge from precipitation is a significant inflow to the Elsinore Basin. The following section quantifies the historical annual average precipitation volume and the amount of this precipitation that infiltrates into the groundwater basin. The following equation calculates the amount of precipitation recharge:

Precipitation Recharge = Total Precipitation –Runoff – Evapotranspiration

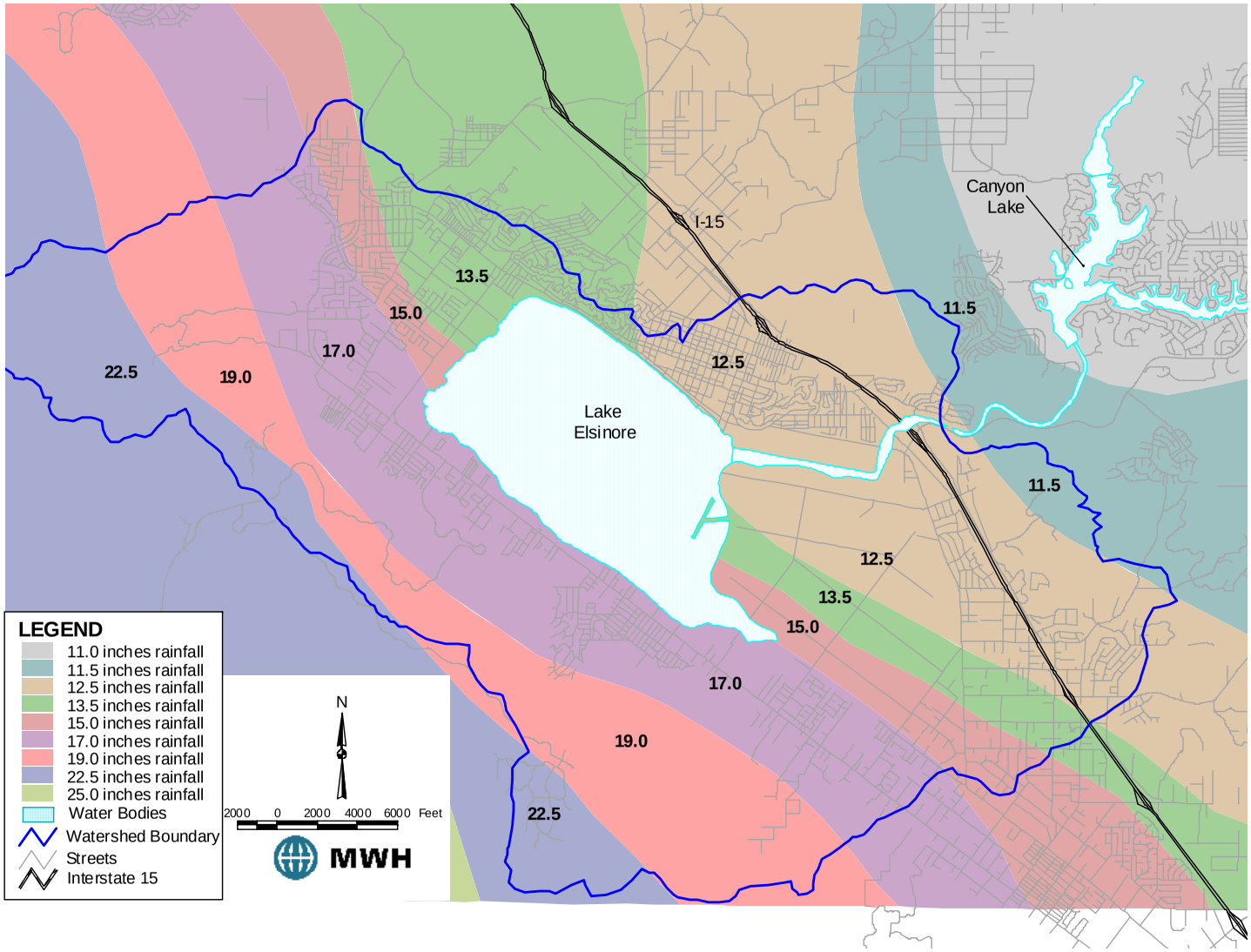
As shown on **Figure 2-13**, precipitation is highly variable across the watershed, ranging from approximately 11.5 inches per year in the northeastern portion of the watershed to as much as 25 inches per year in the southern portion of the watershed.

In the preparation of a groundwater budget, a representative time period over which inflows and outflows are approximately equal that approximates current conditions must be selected. When pumping data and groundwater usage are not stable, precipitation is often used to select the representative time period. **Figure 2-14** shows the annual precipitation and cumulative departure from mean precipitation at Station 67 located north of Lake Elsinore. Average annual precipitation at this rain gauge since 1897 is approximately 12.3 inches.

The cumulative departure from mean precipitation, which represents the cumulative difference between the annual precipitation and the historical average precipitation, is also shown on this figure. The cumulative departure curve shows a general increasing trend in precipitation from 1897 to the early 1940s (i.e. precipitation is generally above average) and a decreasing trend from the early 1940s to the late 1970s (i.e. precipitation is generally below average). Between the late 1970s and the early 1990s and the early 1990s to the present, precipitation patterns exhibit two complete cycles of above-average and below-average precipitation.

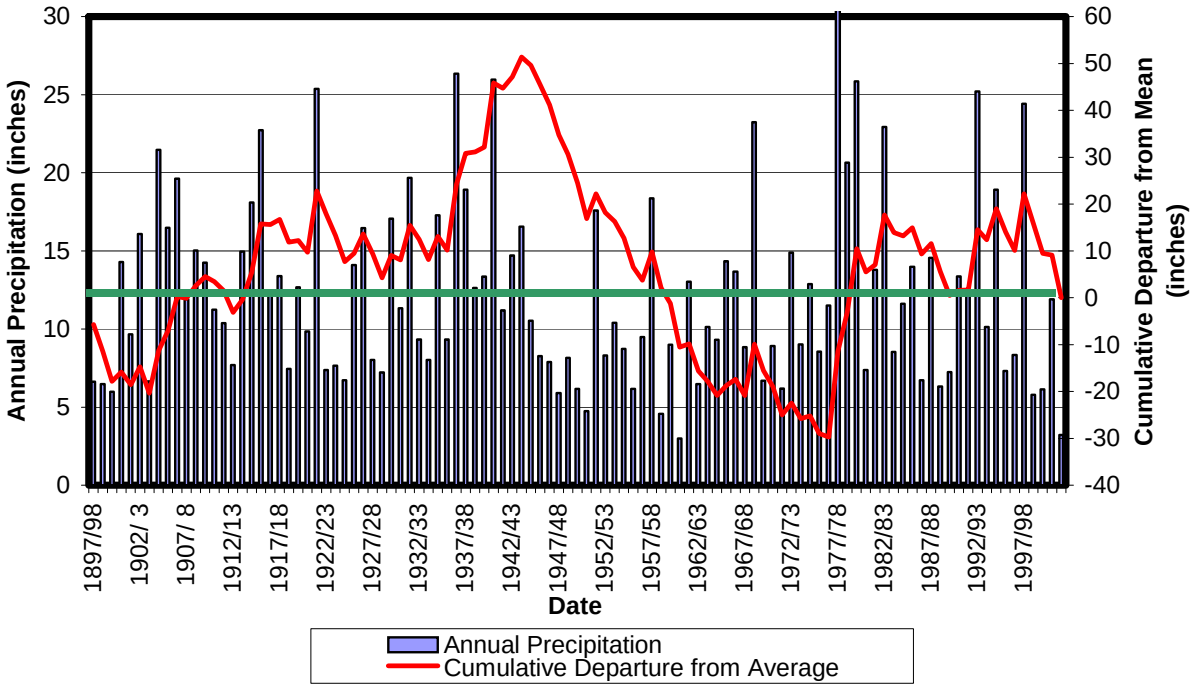
Based upon the data presented on **Figure 2-14**, the base period for the groundwater budget selected for this study is from 1990 to 2000. This 11-year period includes both wet and dry periods and has an average precipitation of approximately 13 inches per year, slightly higher than that for the historical period. Cumulative departure from mean precipitation is

Figure 2-13
Isohyetal Map of Elsinore Watershed



Source: Riverside County Flood Control and Water Conservation District, Isohyetal Map of Average Annual Precipitation.

Figure 2-14
Historical Annual Precipitation
Riverside County Flood Control District – Station 67



approximately equal at each end of this time period, which suggests similar hydrologic conditions at the beginning and the end of the time period.

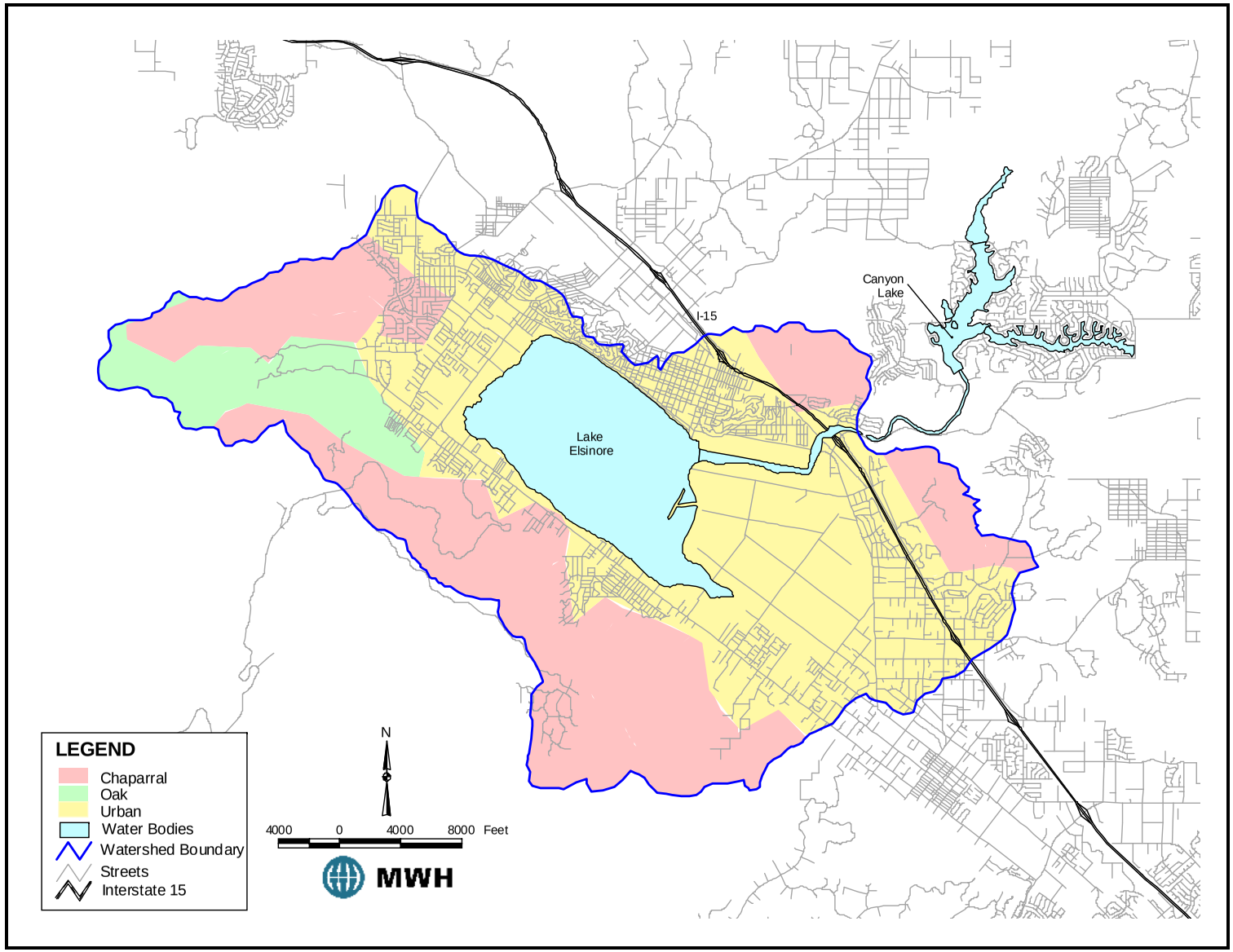
Because the methods for determining the runoff coefficients and associated infiltration rates in the open space areas and the urban areas are different, each component will be discussed separately. Runoff and evapotranspiration estimates for each category are described below.

Recharge from Precipitation in Open Areas

Runoff coefficients based upon various vegetation types, soil types and rainfall intensity are estimated using the methodology described in the Riverside County Flood Control District Hydrology Manual (Riverside County Flood Control District, 1978). As shown on **Figure 2-15**, the vegetation cover in the tributary open areas to the Elsinore Basin is characterized by chaparral and canyon live oak. Chaparral is present throughout most of the watershed area with minor areas of canyon live oak in the northwest portion of the watershed near Leach and Dickey canyons.

Soils are classified by RCFCWCD according to their ability to infiltrate water, ranging from Type A (higher infiltration) to Type D (very low infiltration). Most of the open areas in the watershed have B soil types characterized by moderate infiltration rates (RCFCWCD, 1978). In the northwest portion of the watershed, there are some areas of soil type A characterized by high infiltration rates. Runoff coefficients are estimated for each subwatershed based on the soil types

Figure 2-15
Vegetation Distribution in the Elsinore Basin



Source: Information Center for the Environment, UC Davis

and vegetative cover. An antecedent moisture condition (AMC) value of I is used to determine the runoff coefficients because most storms occur under dry ambient conditions. Runoff coefficients used for this analysis ranged from 0.3 to 0.5.

In general, precipitation that does not become runoff is utilized for soil moisture replenishment before infiltrating through the soil into groundwater. The evapotranspiration within the open space is estimated according to the method described by the DWR (2000). These estimates are provided in **Table 2-4**. With this method, the evapotranspiration is estimated by multiplying the reference evapotranspiration for the area by a landscape coefficient (K_L) for the specific plant community. According to the Riverside County Water Budget Formula (2001), the reference annual evapotranspiration value for Elsinore is 55 inches.

Table 2-4
Evapotranspiration Constants for Elsinore Basin

Plant	Water Needs Category	K_L	Landscape Evapotranspiration (inches)
Chamise Chaparral	Very Low	0.2	11
Canyon Live Oak	Low	0.3	17

During the base period (1990-2000), approximately 2,000 acre-ft/yr entered the groundwater basin in the open areas.

Recharge from Precipitation in Urban Areas

The fate of precipitation on the urban areas in the Elsinore Basin is estimated by creating runoff coefficients for each of the subwatersheds in the basin. Land use data (see **Figure 2-16**) have been used to calculate a weighted average percent imperviousness for each subwatershed. A runoff coefficient is calculated from percent imperviousness. Runoff is calculated by multiplying the precipitation over the subwatershed by the runoff coefficient. Evapotranspiration from the pervious areas of the watershed is subtracted from the non-runoff water and the remainder, if any, is infiltration to groundwater. It is assumed that plants in the urban areas would be irrigated. Therefore, only a portion of the plant evapotranspiration needs are fulfilled through precipitation.

Figure 2-17 presents estimated annual infiltration due to precipitation from 1990 to 2000. The average inflow during this time period is approximately 2,800 acre-ft/yr. It is important to note that significant recharge occurs in the wetter years. During drier periods, there is no significant amount of groundwater recharge from precipitation.

Surface Water Recharge

The principal surface water bodies in the Elsinore Basin are the San Jacinto River and Lake Elsinore. Recharge from these water bodies is derived from infiltration.

Figure 2-16
Land Use in Elsinore Watershed

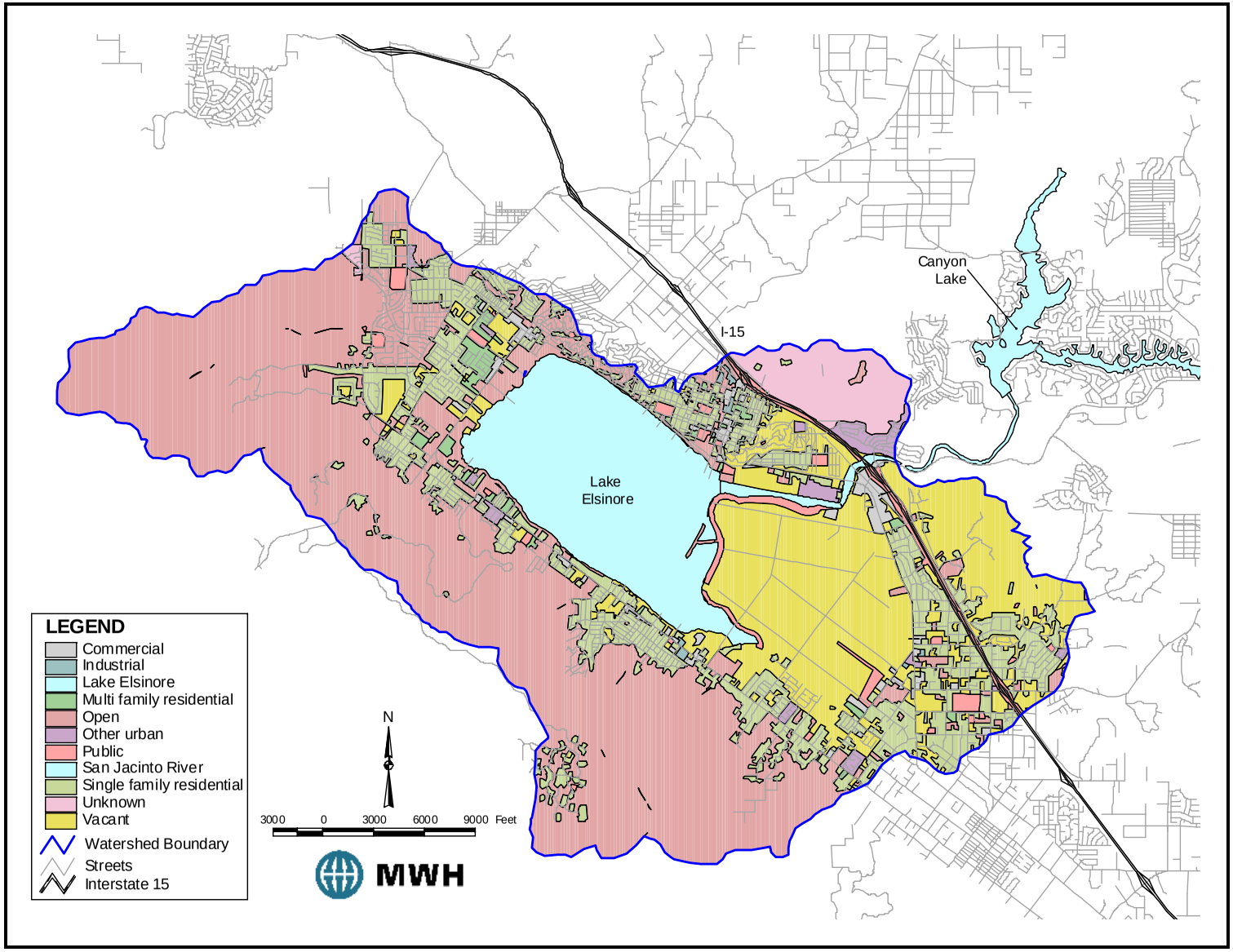
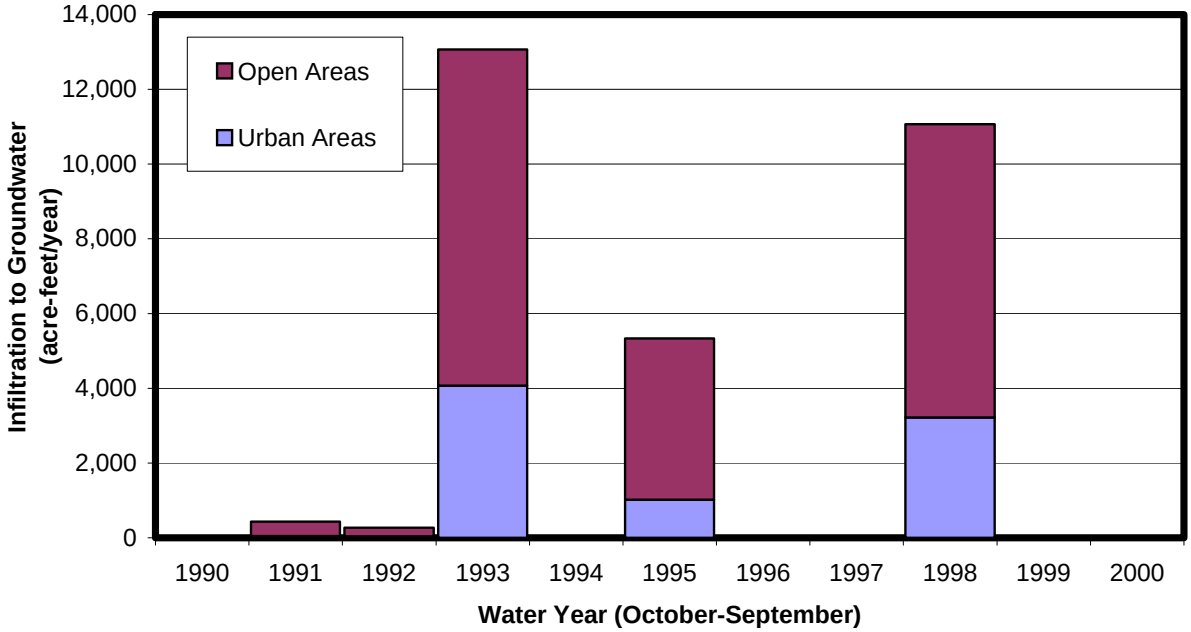


Figure 2-17
Annual Estimated Groundwater Recharge from Precipitation
(1990-2000)



San Jacinto River

The San Jacinto River is the primary source of surface water inflow to the Elsinore Basin. **Figure 2-18** presents historical San Jacinto River stream flows since 1916 in stream gauge 1107050, located north of I-15. Since 1916, the average annual flow at the USGS stream gauge was approximately 19 cfs (13,700 acre-ft/yr). However, since Railroad Canyon Dam was constructed in 1927, substantial flow in this portion of the San Jacinto River only occurs when there are releases or spills from Canyon Lake. The San Jacinto riverbed is characterized by fine to medium sand and encompasses an area of approximately 51 acres (downstream of gauge 1107050). Assuming an infiltration rate of approximately 0.6 feet/day, the average annual inflow to the basin since 1916 has been approximately 1,240 acre-ft/yr or approximately 8 percent of the total flow in the river downstream of Canyon Lake. Based upon field observations and the location of the stream gauge, it is assumed that there is no underflow beneath the stream gauge.

Estimated annual stream recharge to groundwater for the base period (1990 to 2000) is shown on **Figure 2-19**. The average groundwater recharge from the San Jacinto River during this time period is approximately 1,700 acre-ft/yr. As with precipitation, most of the recharge to the basin occurs during wet years.

Figure 2-18
Historical Annual Streamflow at San Jacinto River (1916-2000)

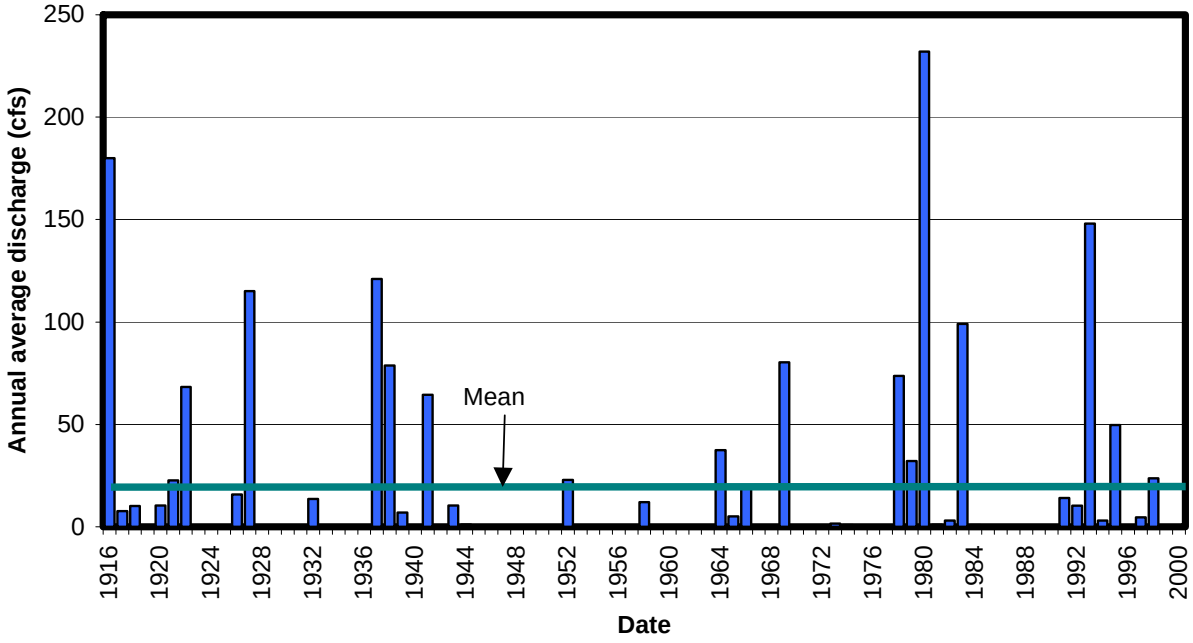
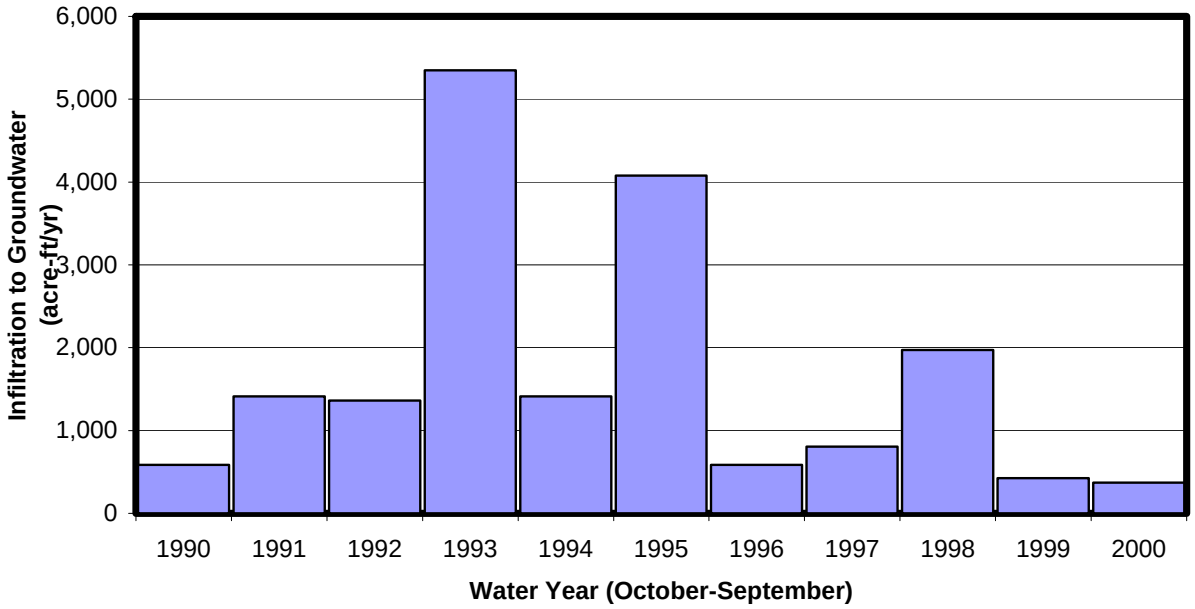


Figure 2-19
Estimated Groundwater Recharge from the San Jacinto River (1990-2000)



Lake Elsinore

Because of the predominance of clay beneath Lake Elsinore, it is assumed that Lake Elsinore itself does not contribute significant recharge to the groundwater basin and the net inflow from the lake is zero.

Recharge through Water Use

Groundwater recharge also occurs from applied water for landscape irrigation and infiltration from septic system leach fields. Each of these components is estimated below.

Applied Water

According to water production and usage data within the Elsinore Basin, approximately 39 percent of the water demand (2,500 acre-ft) in the area is used for outdoor needs, which generally consist of landscaping and irrigation (MWH, 2000). Because of the relatively dry climate and high water demands of most landscaping, the evapotranspiration requirement for landscaping within the Elsinore Basin exceeds 10,000 acre-ft/yr. Therefore, it is assumed that most of the applied water (in addition to most infiltration from direct precipitation) will be utilized by plants as evapotranspiration. Assuming a typical irrigation efficiency of 75 percent, an average of approximately 600 acre-ft/yr enters the groundwater basin from applied water. **Figure 2-20** shows the annual infiltration to groundwater through water use. This figure shows that infiltration of irrigation returns has generally increased since 1990 because of the increase in demands throughout the basin. During wet years (e.g. 1998), less water was used for landscape irrigation so infiltration to the groundwater basin was also lower.

Septic Systems

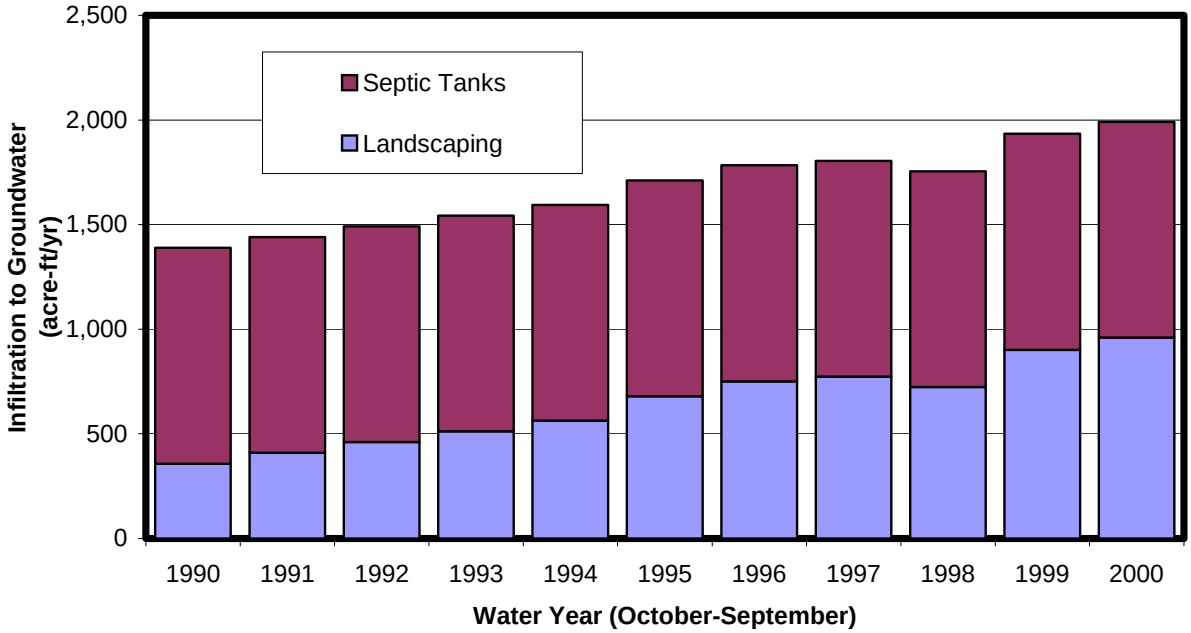
EVMWD GIS data indicate that there are currently approximately 3,900 parcels within the Elsinore Basin that are connected to septic systems. Based upon an annual rate of approximately 0.25 acre-ft per tank, approximately 1,000 acre-ft/yr are added to the groundwater basin from septic systems. This inflow is expected to be relatively constant over the past decade because it is assumed that most new developments obtain connections to the sewer system and do not use septic systems.

In addition, some septic users have converted to the sewer system and some new septic users have been added in areas not serviced by the sewer system. Therefore, during this time period, it is assumed that the number of septic users has remained constant.

Subsurface Inflow

The Elsinore Basin is currently closed to underflow from outside the basin. Therefore, there is no subsurface inflow except as described above.

Figure 2-20
Estimated Groundwater Recharge through Water Use (1990-2000)



Outflows

The following are the major outflow components to the Elsinore Groundwater Basin:

- Evapotranspiration – the loss of groundwater from soil and open water bodies (e.g. Lake Elsinore) and transpiration by plants
- Groundwater pumping – groundwater extraction by wells in the basin
- Flow to surface water – flow from the groundwater basin to surface water bodies such as Lake Elsinore and/or Temescal Wash (i.e. rising groundwater)
- Underflow – subsurface outflow from the basin along the southeastern margin to Murietta

Evapotranspiration by Phreatophytes

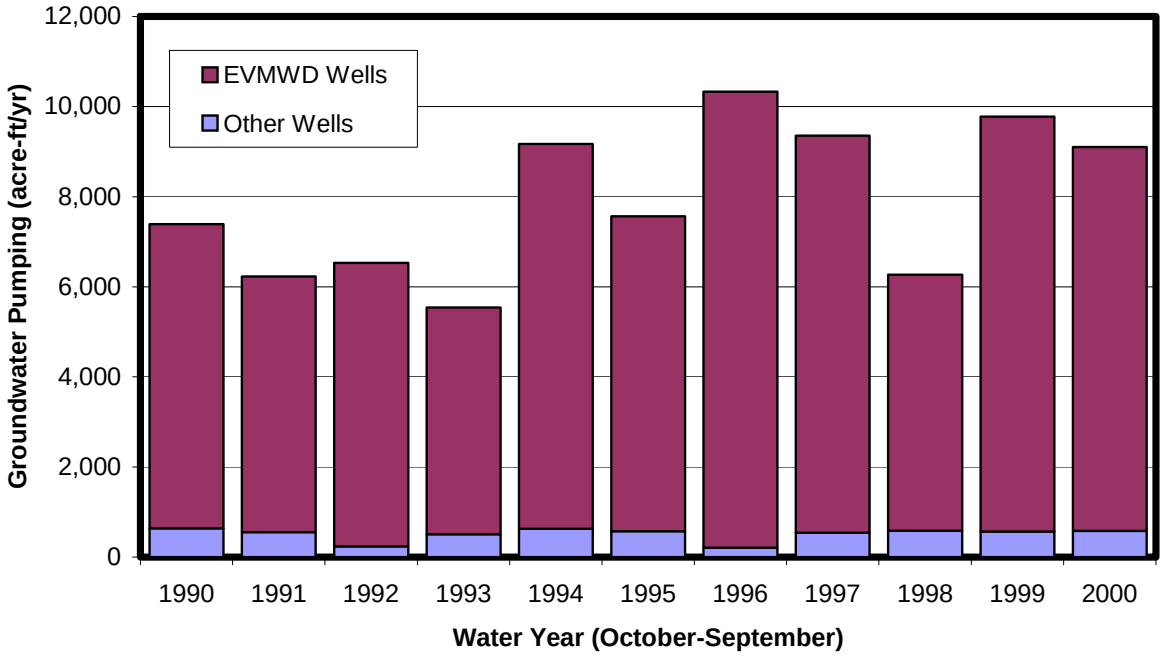
Phreatophytes are plants whose roots extend to the water table and use groundwater directly for their water needs. Because groundwater levels are generally substantially below ground surface, it is unlikely that groundwater is currently lost to plant evapotranspiration. Therefore, this outflow is zero. Evapotranspiration is considered when the infiltration from precipitation on urban and open areas is calculated.

Groundwater Pumping

Historical pumping data are summarized on **Figure 2-21**. These data do not include unmetered pumping from private well owners in the basin, thereby underestimating the actual pumping.

Private pumpers are believed to pump approximately 100 acre-ft/yr (assuming that each well pumps less than 1 acre-ft/yr).

Figure 2-21
Historical Groundwater Pumping in the Elsinore Basin



Surface Outflows

Because static groundwater levels are more than 100 feet below the level of Lake Elsinore, it is unlikely that significant groundwater is lost to the Lake. However, in some locations in the Back Basin, there is perched groundwater at levels as high 10 feet below ground surface. It is possible that this water could migrate toward Lake Elsinore. However, this water is limited in extent and would not produce significant outflows.

Subsurface Outflows

As discussed previously, the general groundwater flow direction is from the northwest to the southeast within the Elsinore Basin. Therefore, there is a potential for flow from the Elsinore Basin into the Murietta groundwater basin toward the southeast. As discussed previously, the bedrock surface rises up in the southeast to an elevation above current water levels, thereby preventing groundwater from leaving the basin. It is possible for water to be exchanged between the two basins if the water table rises to above an elevation of approximately 1,100 feet. However, if this situation were to occur, the potential flow is estimated to be less than 100 acre-ft/yr and is considered negligible.

Water Budget Summary

Table 2-5 presents the average groundwater budget for the base period from 1990 to 2000.

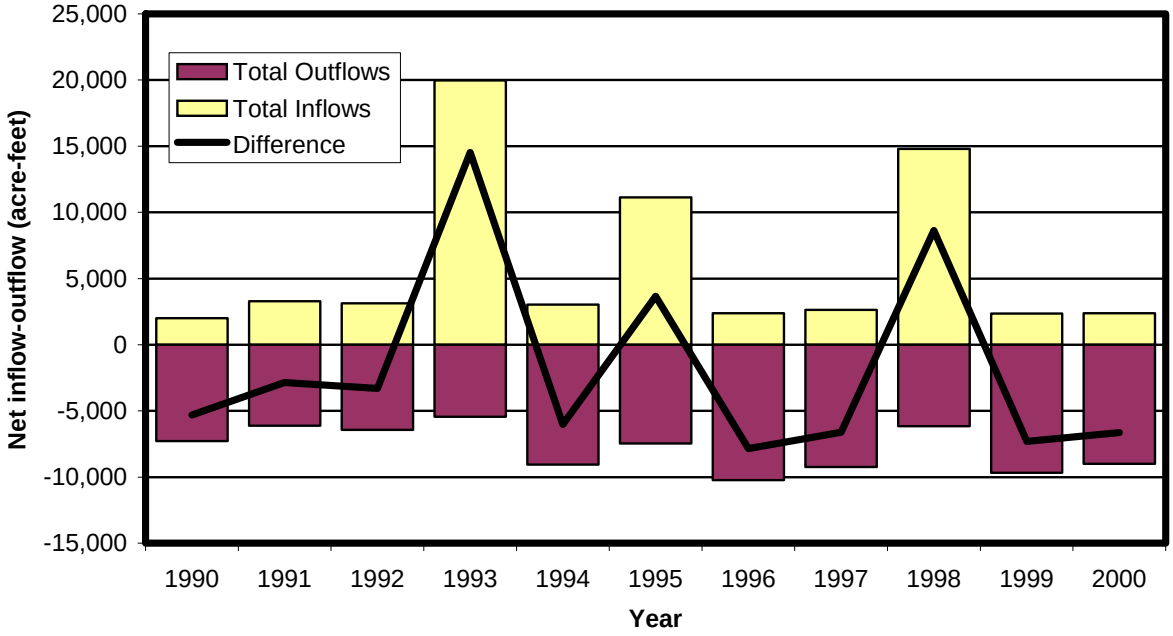
Table 2-5
Summary of Estimated Groundwater Basin Budget for 1990-2000

Component	Average (1990-2000)
Inflows	
Infiltration of Precipitation	
Rural Areas	2,000
Urban Areas	800
Recharge from Surface Water	
Recharge from San Jacinto River	1,700
Recharge from Lake Elsinore	0
Return Flows	
Applied Water	600
Septic Systems	1,000
Subsurface Inflow	0
Total Inflows	**6,100**
Outflows	
Groundwater Pumping	7,900
Surface Outflow	0
Subsurface Outflow	0
Total Outflows	**7,900**
NET SURPLUS/DEFICIT	**-1,800**

Based upon this period, the difference between inflows and outflows suggests an average annual groundwater deficit of approximately 1,800 acre-ft/yr over the 11-year period of review. **Figure 2-22** shows estimated annual inflows and outflows over the period. It is important to note that, during the period 1990 to 2000, the Elsinore Basin experienced a groundwater deficit in eight of the 11 years reviewed. The three years of positive balance were 1992-3, 1994-5 and 1997-8, which were very wet years. The estimated cumulative groundwater deficit in the Elsinore Basin between 1990 and 2000 was approximately 19,000 acre-ft.

These data are used to calibrate a groundwater flow model for the Elsinore Basin. Details on the model creation and calibration are provided in Section 3.

Figure 2-22
Total Estimated Inflows and Outflows to Groundwater Basin



GROUNDWATER QUALITY

The following section provides a description of the groundwater quality within the basin as it relates to the hydrogeologic conceptual model.

Piper diagrams are often used to observe differences in general water quality from various sources. A Piper diagram plots various cation and anion concentrations on the same graph as a relative percentage, which allows for identification of water quality similarities and differences among various water sources that may not be detected simply by comparing bulk concentrations. A Piper diagram for the Elsinore Basin is provided on **Figure 2-23**. These data suggest various water quality signatures throughout the basin. For example, the Cereal-1 well, which is screened across the alluvium and the Fernando Group, has an intermediate quality between the Corydon Well (which is screened only in the Fernando Group) and the monitoring wells that are screened in the alluvium. Similarly, the Lincoln Street Well and the Machado Well, which are screened in the Fernando Group and the Bedford Canyon Formation, appear to have similar water quality.

Time-series plots for total dissolved solids (TDS), nitrate and sulfate in select wells are presented on **Figure 2-24** through **Figure 2-26**. These constituents are often used to identify changes in water quality. General observations made from these data include:

- TDS (caused by higher nitrate and sulfate) is generally higher in the area north of the lake and along basin margins than in the Back Basin

- Highest concentrations of TDS, sulfate and nitrate are found at the Lincoln Street Well
- Lowest concentrations of TDS and sulfate are found in the Olive Street Well
- Nitrate (as nitrate) concentrations in the Palomar Well appear to be increasing
- Concentrations of arsenic are below the current standard of 50 µg/L, however, they have exceeded the new (effective 2006) maximum contaminant level of 10 µg/L in the Back Basin wells (Cereal-1, Cereal-3, Cereal-4 and Corydon Street)
- Highest concentrations of arsenic are found in deeper wells such as Cereal-1, Cereal-3 and Cereal-4

Figure 2-23
Piper Diagram in the Elsinore Basin

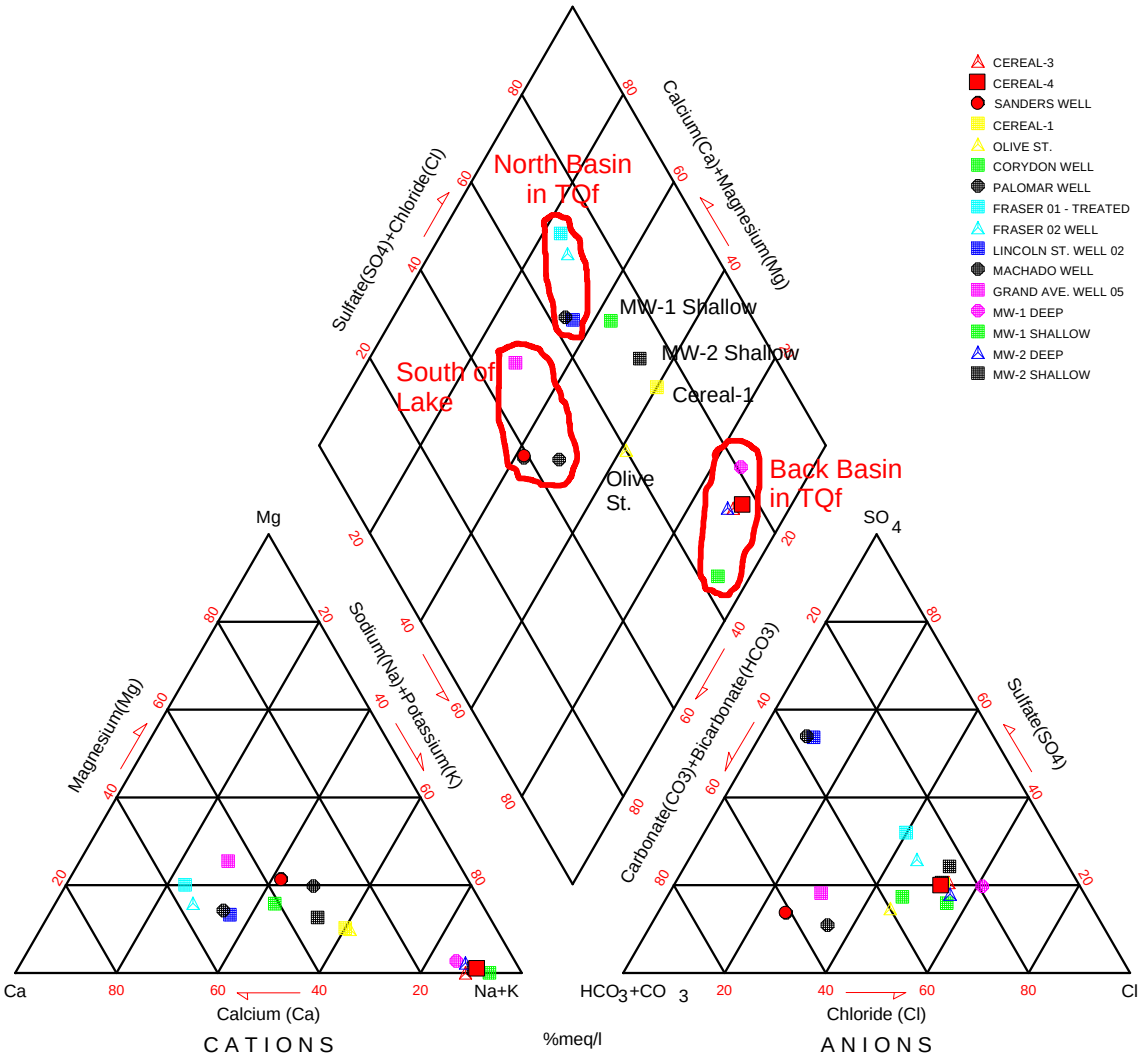


Figure 2-24
Historical Total Dissolved Solids Concentrations in Elsinore Basin Wells

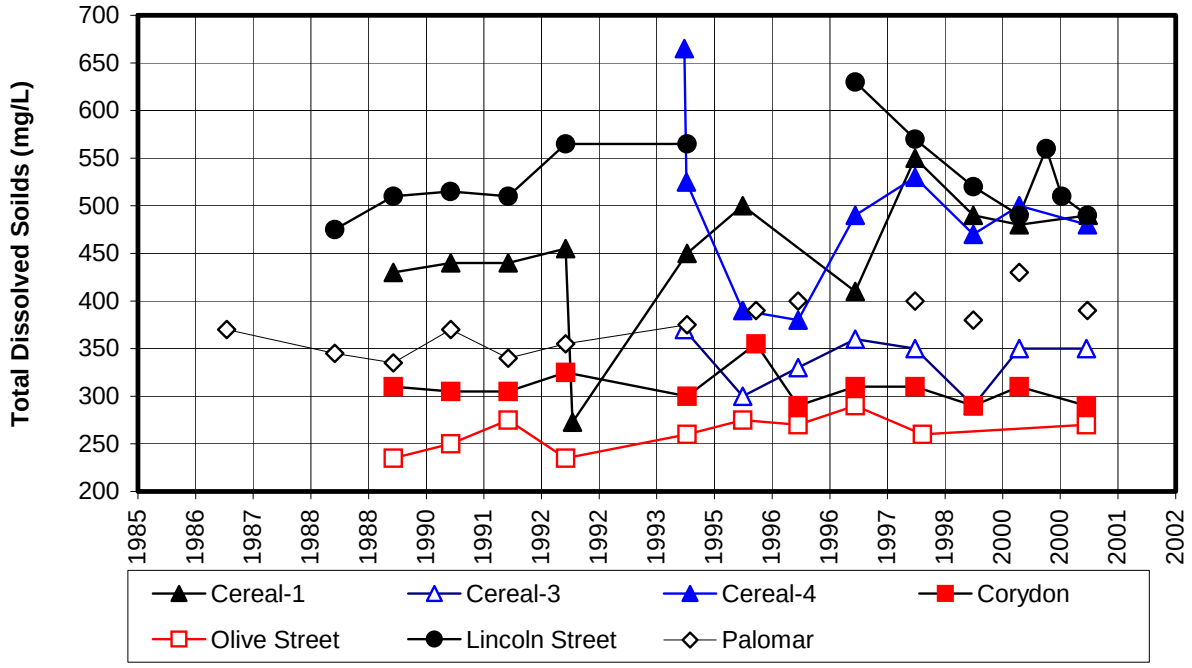


Figure 2-25
Historical Sulfate Concentrations in Wells in the Elsinore Basin

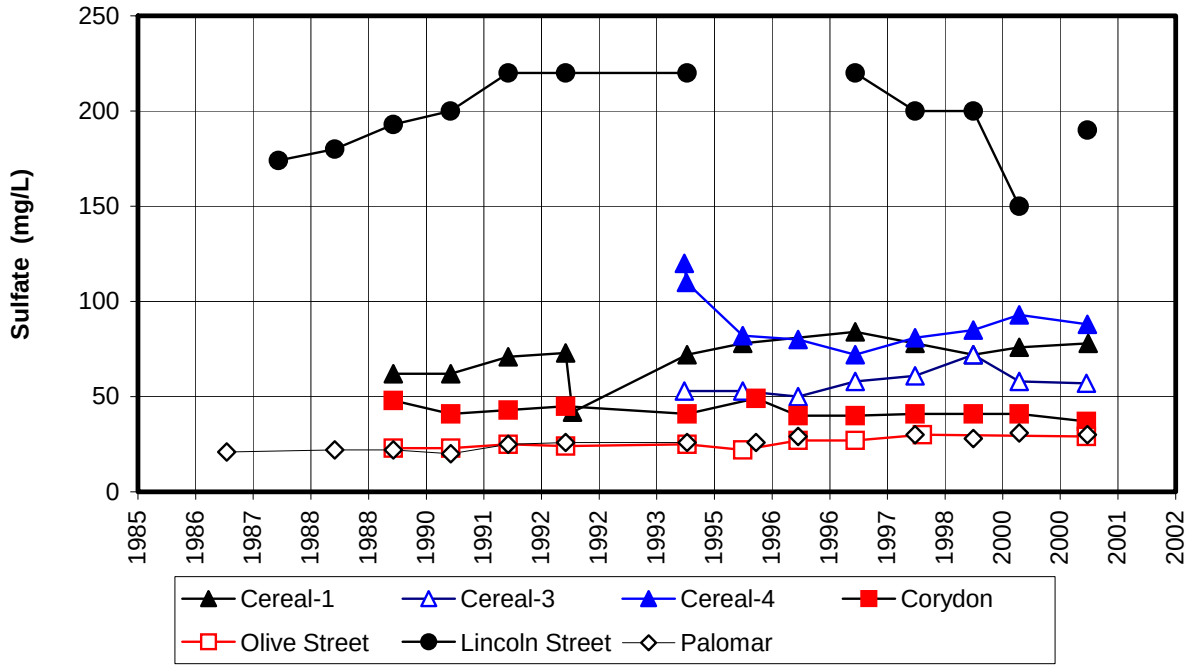


Figure 2-26
Historical Nitrate Concentrations in Wells in the Elsinore Basin

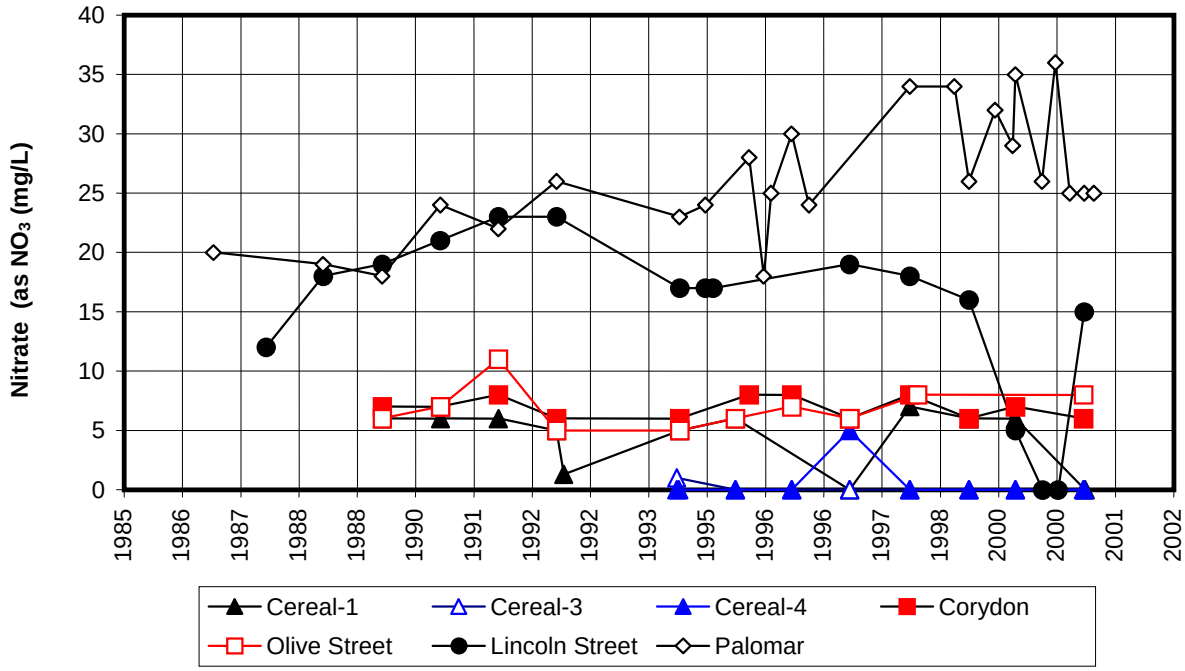
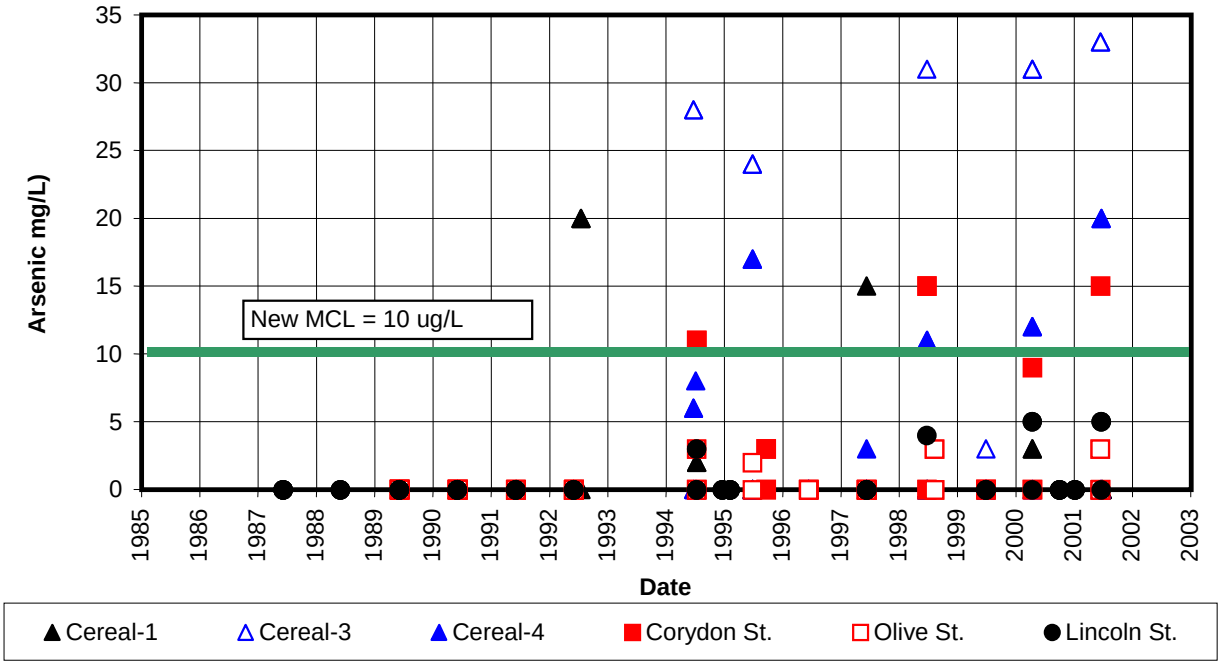


Figure 2-27
Historical Arsenic Concentrations in Elsinore Basin Wells



The higher concentrations of various constituents in the area north of the lake could be a result of historical land use practices in this area. Much of the area north of the lake historically has been an agricultural area. In addition, much of this area was on septic systems, which can result in higher nitrate concentrations in the groundwater. Wells such as Lincoln Street and Machado Street have higher nitrate and sulfate concentrations, which may be related to the prior land use in this area. Shallow wells in the area have also had historically higher sulfate and nitrate concentrations.

SUMMARY

Based upon the data compiled as part of this study, the conceptual understanding of the Elsinore Basin structure has been developed. The alluvium appears to be separated from the Fernando Group by a confining to semi-confining aquitard throughout much of the basin, which restricts downward migration of groundwater into the Fernando Group. Recharge to the alluvium occurs along the margins of the basin through Leach, McVicker and Dickey Canyons and the San Jacinto River. Surface recharge to the Fernando Group is generally limited to the north end of the basin. Faults within the basin, except for the Glen Ivy fault and the Rome Hill fault do not appear to restrict groundwater flow, which allows recharge to occur within the basin.

Based upon vertical and lateral variations in water level throughout the basin, the following observations are made:

- Water levels are generally declining in the Back Basin in both the alluvium and the Fernando Group
- Water levels are generally stable in the area north of the lake
- Water levels in the alluvium are generally higher than in the Fernando Group, which suggests the presence of a confining or semi-confining unit between the Fernando Group and the overlying alluvium.
- Groundwater flow is generally from the area north of the lake to the Back Basin

Lateral and vertical variations in water quality are also observed. General observations made from these data include:

- TDS (caused by higher nitrate and sulfate) is generally higher in the area north of the lake and along basin margins than in the Back Basin
- Highest concentrations of TDS, sulfate and nitrate are found at the Lincoln Street Well
- Lowest concentrations of TDS and sulfate are found in the Olive Street Well
- Highest concentrations of nitrate are found in the Palomar Well and these concentrations appear to be increasing.

The average groundwater deficit between 1990 and 2000 was approximately 1,800 acre-ft/yr. This estimate is generally consistent with the observed decline in groundwater levels during this time period in the Back Basin area.

These data are used as inputs to the numerical groundwater model, which is discussed in **Section 3**.

Section 3
Groundwater Model

This section describes the development of the groundwater model for the Elsinore Basin. This report includes:

- Model layer definition, including thickness and horizontal extent
- Geologic fault definition
- Aquifer parameters, including vertical and horizontal conductivity and storativity
- Results of model calibration.

The purpose of the groundwater model is for use as a groundwater resource planning tool. The model is able to quantitatively evaluate aquifer responses to induced stresses and proposed groundwater use scenarios.

MODEL CONSTRUCTION

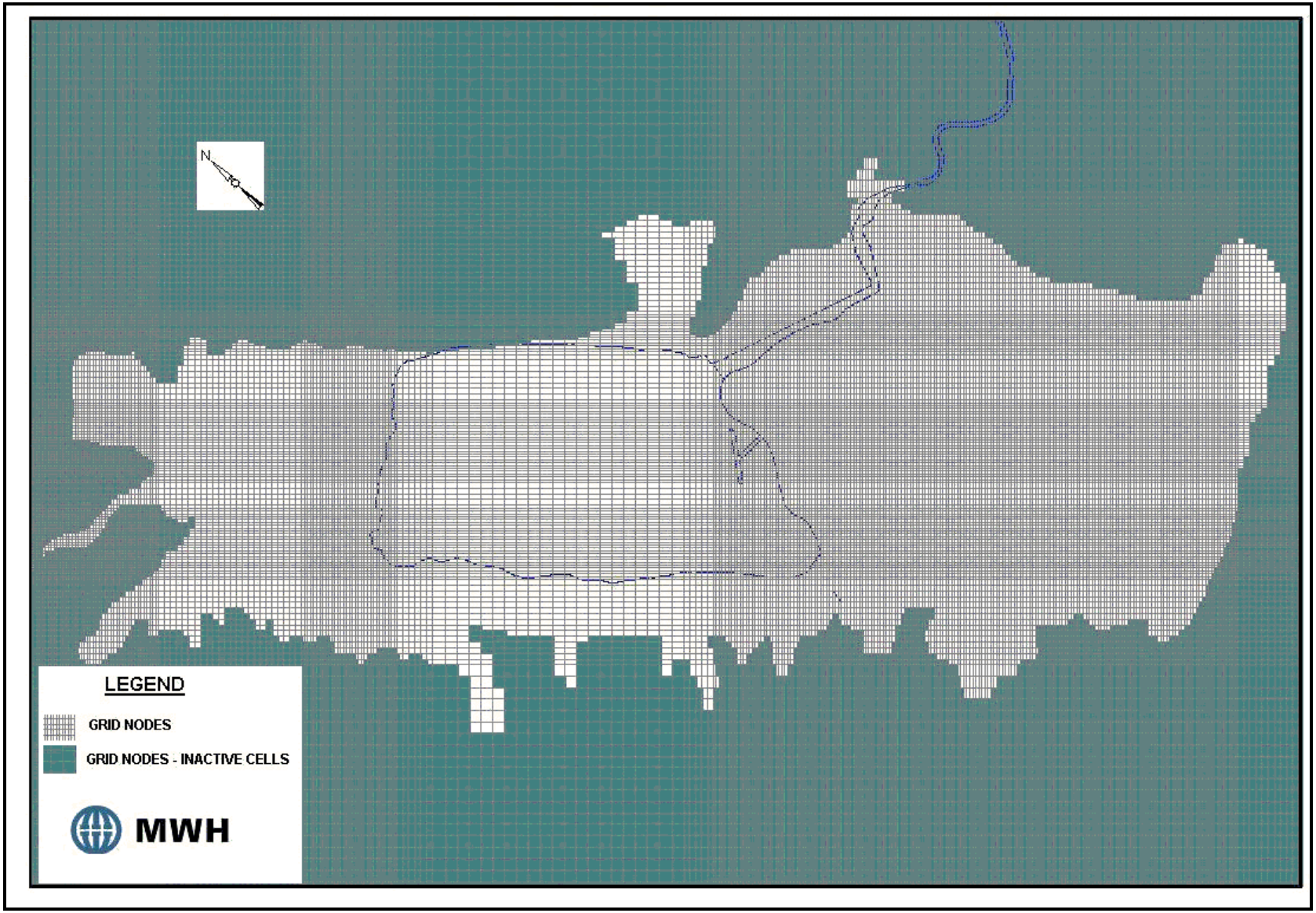
In general, a numerical model approximates groundwater flow conditions for a groundwater system based upon conceptual model aquifer parameters, groundwater flow conditions and proximal groundwater quality. Flow model construction and calibration simulations are undertaken using Visual MODFLOW Pro 3.0 (Waterloo Hydrogeologic, 2002), a graphical interface to MODFLOW. Visual MODFLOW Pro is a commercially available, three-dimensional, block-centered, finite difference simulator of groundwater flow and contaminant transport. MODFLOW is an industry standard, numerical groundwater model developed by the United States Geological Survey (USGS). The model created for use in the Elsinore Basin does not include a water quality assessment. However, future updates of the model may include water quality assessments. This section describes the model domain, model layer discretization, aquifer parameters, boundary conditions and hydrologic stresses.

Model Domain

The model domain, shown on **Figure 3-1**, is an area of approximately 80 square miles, of which approximately 25 square miles (white area) centered on Lake Elsinore are comprised of active cells located within the groundwater basin. Cells in the remaining area lie outside the groundwater basin boundary, and these are assigned inactive status during creation of the model.

The horizontal model domain is comprised of a grid of rectangular computational cells oriented with its principal axes coincident to the predominant direction of groundwater flow (northwest to southeast) within the basin. The dimensions of the domain are 36,880 feet perpendicular to the predominant groundwater flow and 60,340 feet parallel to the predominant groundwater flow direction. As mentioned previously, appropriate computational cells within the model domain are made inactive in areas outside the active groundwater flow system.

Figure 3-1
Model Domain and Grid Discretization



The active model domain is 26,320 feet perpendicular to predominant groundwater flow and 51,740 feet parallel to the predominant groundwater flow direction. The rectangular grid spacing varies, with areas of enhanced numerical interest (near pumping wells, faults, etc.) having grid dimensions of approximately 115 by 120 feet. Coarser grid spacing is present away from those regions, with maximum grid spacing approximately 480 by 460 feet. Overall, the active model grid is comprised of 98 rows and 311 columns.

The model is discretized vertically into four layers. However, all five hydrostratigraphic units present in the basin are represented in the model, as explained below.

Model Layer Discretization

Vertical discretization of the model layers reflects the conceptual model of the basin, which is discussed in detail in **Section 2**. The flow model of the groundwater basin is comprised of four model layers (see **Figure 3-2**), with hydraulic characteristics generally as follows:

- Layer 1 - shallow aquifer composed of alluvium (Qal) and Older Alluvium (Qt)
- Layer 2 – localized clay aquitard underlying the shallow aquifer (Aqt)
- Layer 3 – Fernando Group (TQf)
- Layer 4 – Bedford Canyon Formation (bcb)

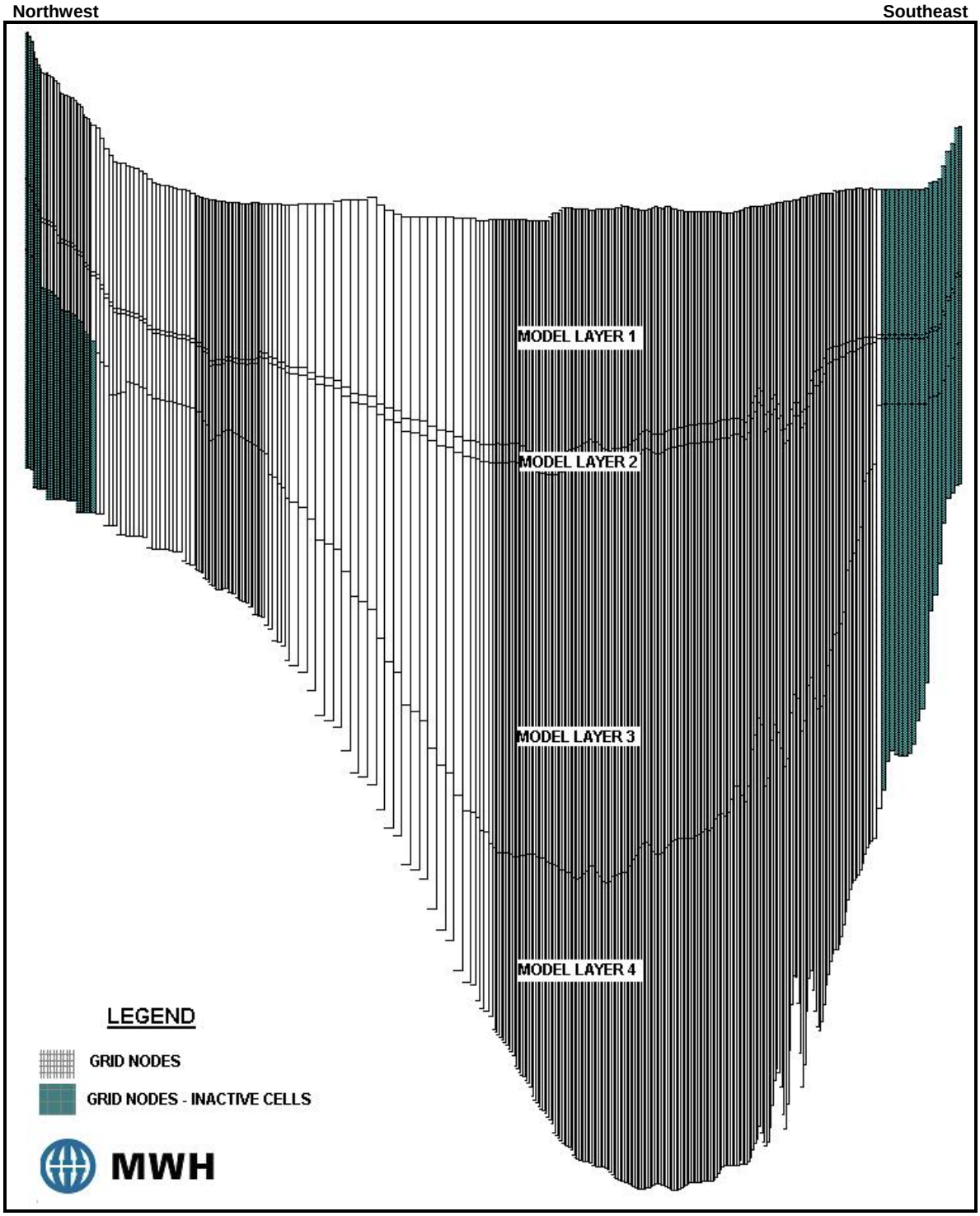
Figure 3-2 shows a longitudinal cross section through the model domain to illustrate the model layers. Model Layer 1, the shallow alluvial aquifer, is generally laterally continuous in the active model domain, except in the Back Basin area where the Fernando Group is exposed at the ground surface due to faulting. With similar hydraulic properties, the Qal and Qt map units (**Section 2**) are combined into undifferentiated alluvium (Qa) for modeling purposes. Comprised of interfingering sands and clays, the alluvium is second to the Fernando Group in importance as a source of groundwater supply in the basin. The thickness of this unit exceeds 300 feet in parts of the basin.

Model Layer 2, the clay aquitard, appears to be laterally continuous in the graben area defined by the Glen Ivy and Wildomar faults. However, outside the graben, the aquitard is typically not present. The aquitard thickness approaches 100 feet or more in the western part of the basin. Where the Fernando Group is found at the ground surface, the aquitard is locally absent. Water level data suggest that the aquitard, where present, is a confining unit to the underlying Fernando Group.

Model Layer 3, the Fernando Group (TQf), is composed of poorly sorted granitic sands, cobbles and boulders. With a saturated thickness approaching 1,200 feet in places, the Fernando Group is the most important source of groundwater in the basin. Due to the complex geologic structure and depositional history of the basin, including numerous faults and periods of erosion and/or non-deposition, the Fernando Group is not laterally continuous in the basin. In general, the lateral extent, as ascertained from borehole data, is defined by the graben area between the Glen Ivy and Wildomar faults referred to previously.

Figure 3-2
Longitudinal Cross Section Through Flow Model

(vertical exaggeration 25X)



Consequently, where the Fernando Group is present at the ground surface (due to faulting in the Back Basin area for example), its hydraulic properties are assigned to Layer 1 in that area even though Layer 1 is assigned hydraulic properties of the undifferentiated alluvium elsewhere. Likewise, in areas of the basin where the aquitard is thin or not present, such that alluvium directly overlies the Fernando Group, Layer 2 is assigned hydraulic properties pertaining to the Fernando Group even though in the remainder of the model Layer 2 is assigned hydraulic properties of the aquitard. This technique is also used as necessary to assign hydraulic properties of the undifferentiated granitic basement rocks to Layers 2, 3 and 4 outside the graben area.

Model Layer 4, the Bedford Canyon Formation (bcb), is described as interbedded slate and sandstone. It does not yield significant quantities of groundwater to wells. Like the Fernando Group, its presence appears to be largely fault-controlled. Therefore, in the model, the Bedford Canyon Formation is predominately found within the graben area between the two major fault systems (Rome Hill and Wildomar), except in the structurally complex Back Basin area (e.g. Rome Hill fault area). The base of the flow model is the base of Layer 4. Depending on the location within the model, Layer 4 is assigned hydraulic characteristics of either the Bedford Canyon or the undifferentiated basement rocks described below.

The base of the flow model in the area generally between the Wildomar and Glen Ivy faults is considered to be the top of the undifferentiated granitic basement rocks. Elsewhere the zone of hydraulic conductivity representing the basement rocks may be present in Model Layers 2, 3 or 4 where faulting or nondeposition of overlying units has juxtaposed alluvium with underlying basement rocks. While the hydraulic conductivity of the basement rocks is considered to be several orders of magnitude less than that of the overlying formations, the unit does yield small amounts of groundwater to wells where fractures or weathered zones are present.

The elevations of the bottom of model layers are based on cross sections A-A', B-B', and C-C' found in **Section 2** (**Figures 2-6 through 2-8**), as well as borehole data compiled by MWH. In addition, structure contour maps showing approximate elevations of the base of the four hydrostratigraphic units are generated using available borehole data (**Appendix D**).

Naturally, fault-induced displacements of up to hundreds of feet can create challenges for any contouring algorithm that is used to generate layer bottom elevations as input to a model. For that reason, layer bottom elevations in the model should only be considered as rough approximations in areas where the geologic structure is complex, i.e. near the faults.

Based on Cross Section A-A' in **Section 2** (**Figure 2-6**), the Fernando Group and Bedford Canyon Formation exhibit the greatest saturated thickness in the Back Basin area, specifically in the vicinity of the Cereal-3 and Cereal-4 wells. A representative longitudinal cross section showing the four layers of the model is shown in **Figure 3-2**. A four-layer model allows stresses to be simulated in a specific layer, as appropriate, given the completion depths of the extraction wells within the model domain.

Aquifer Parameters

Aquifer parameters are based upon data compiled as part of this investigation as described in **Section 2**. **Figure 3-3** shows the lateral distribution of hydraulic conductivity assigned to Model

Layer 1 (top of figure) and Model Layer 3 (bottom of figure), which are the primary waterbearing formations in the basin. The color-coded zones correspond to different values of hydraulic conductivity (K) and storativity.

The white and green zones represent regions consisting predominately of alluvium; green, purple, and blue represent the Fernando Group; red indicates the Bedford Canyon Formation; and teal represents the undifferentiated basement rocks. Because the colors indicate similar hydrogeologic properties, colors in different zones may be the same. The spatial distribution in all layers, as well as the model input values, reflect data gathered from borehole logs, aquifer pumping tests, well specific capacity information, and values estimated from the literature.

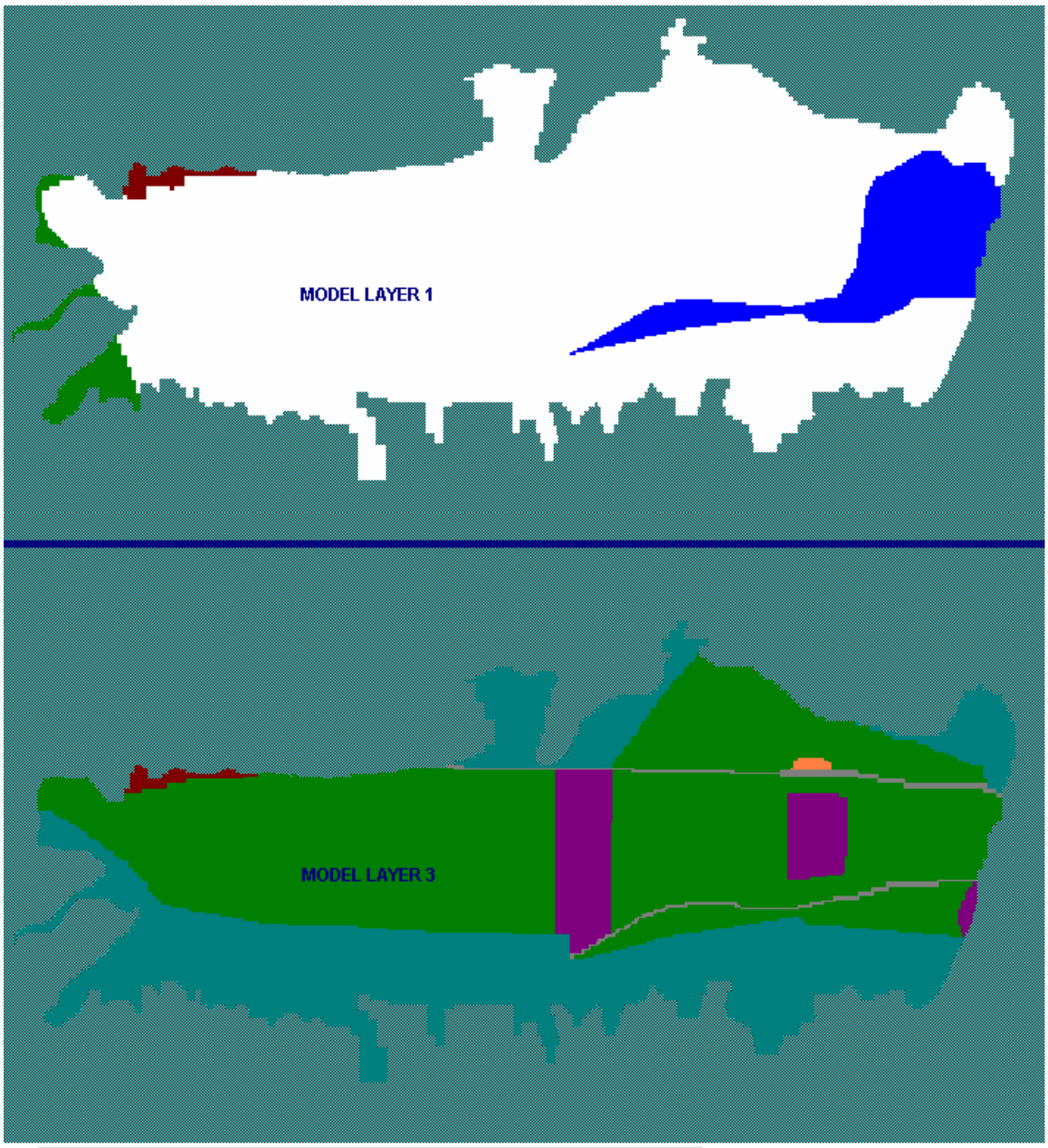
Other hydraulic characteristics that are assigned to the color-coded zones are explained below and are summarized in **Table 3-1.**

- Model Layer 1 is assigned a horizontal to vertical hydraulic conductivity (K_H:K_V) anisotropy ratio varying from 3:1 to 100:1. Isotropic horizontal hydraulic conductivity values are assumed.
- A horizontal to vertical hydraulic conductivity anisotropy ratio of 100:1 is used for Model Layer 2, reflecting the higher proportion of clays in the aquitard. Isotropic horizontal hydraulic conductivity is also assumed for this model layer.
- A horizontal to vertical hydraulic conductivity anisotropy ratio varying from 3:1 to 100:1 is used for Model Layer 3.
- Specific storage values ranging from 10^{-6} to 10^{-3} ft^{-1} are assigned to the various zones. For specific yield, values ranging from 0.05 to 0.20 are used, depending on the layer and formation represented.

Table 3-1
Aquifer Property Model Input Parameters

Hydrostratigraphic Unit	Model Hydraulic Conductivity			Model Specific Storage (1/ft)	Model Specific Yield	Model Effective Porosity
	Kx (ft/day)	Ky (ft/day)	Kz (ft/day)			
Alluvium	20 3.0	20 3.0	2.0 1.0	10^{-5} 10^{-5}	0.15 0.15	0.20 0.20
Clay aquitard	0.01 0.01	0.01 0.01	0.001 10^{-5}	10^{-6} 10^{-6}	0.05 0.05	0.05 0.05
Fernando Group	3.0 3.0 5.0	3.0 3.0 5.0	1.0 0.03 1.0	10^{-4} 10^{-3} 10^{-5}	0.1 0.1 0.2	0.10 0.10 0.2
Bedford Canyon Formation	0.5	0.5	0.1	10^{-6}	0.10	0.10
Undifferentiated Basement	0.001	0.001	10^{-5}	10^{-6}	0.10	0.10
Rome Hill and Willard Faults	0.001	0.001	10^{-4}	10^{-6}	0.10	0.10

Figure 3-3
Hydraulic Conductivity Distribution, Model Layers 1 and 3



Hydraulic Conductivity (feet/day)				
Color	Horizontal	Vertical	Geologic Formation Model Layer 1	Geologic Formation Model Layer 3
	20	2	Alluvium	N/A
	3	0.03	Fernado Group	N/A
	3	1	Alluvium	Fernando Group
	0.5	0.1	Bedford Canyon	Bedford Canyon
	0.5	0.1	N/A	Fernando Group
	5	1	N/A	Fernando Group
	0.001	0.00001	N/A	Basement
	0.001	0.0001	N/A	Faults
	N/A	N/A	N/A	Inactive Zone

MWH

Historical water level data suggest that the aquitard forms an effective hydraulic barrier between the alluvium and underlying Fernando Group. Hydraulic heads are typically higher in the alluvium. Many of the wells in the basin are completed into more than one aquifer, which masks the actual formation-specific head elevation at those locations.

Boundary Conditions

As summarized in the water budget discussion in **Section 2**, subsurface inflows and outflows of groundwater to/from the basin are insignificant due to physical boundaries present at the basin perimeter. As a result of the geologic structure, the basin is surrounded and underlain by essentially impermeable rocks. Therefore, except for occasional inflows from the San Jacinto River, the Elsinore Basin can be considered a closed groundwater basin. In the model, inactive cells are placed in the domain outside the groundwater basin boundary to simulate the physical barriers to groundwater flow. The basin boundary, therefore, is considered a no-flow boundary. In addition, a no-flow boundary is present at the bottom of Model Layer 4. No constant-head boundaries are used in the model.

Basin recharge (net of evapotranspiration) in the form of infiltration from precipitation, irrigation return flows, and septic system effluent are applied at variable rates in sixteen discrete zones over the entire active domain of the model (as described in **Section 2**). Each polygon is assigned its own set of monthly net recharge values. These sources of recharge are applied according to rates obtained from groundwater balance over a period of approximately 11 years (water year 1990 through water year 2000 as defined in **Section 2**). Inflows to the basin from the San Jacinto River are applied over the same time period in a discrete area of the riverbed within the model domain. San Jacinto River inflow is modeled using the recharge boundary condition within Visual MODFLOW. Lake Elsinore is not considered a significant source of recharge to the groundwater system.

Hydrologic Stresses

Groundwater is pumped primarily from the alluvium and Fernando Group at several locations within the groundwater basin. Groundwater extraction occurs primarily from municipal wells operated by the EVMWD and EWD, as indicated in **Table 3-2** and on **Figure 3-4.** Total extraction volumes average approximately 7,900 acre-ft/yr between 1990 and 2000. Historical monthly extraction rates from the EVMWD wells are highly variable. Pumping rates in the Back Basin have slowly declined during 1990 to 2000 due to a decline in the potentiometric surface in the Back Basin. Regional groundwater flow inside the basin is toward the southeast (toward the Back Basin area) where several water district wells are clustered.

Table 3-2
Summary of Wells in Flow Model

Well Identification	Water Bearing Formation	Type of Well	Used in Calibration?
Cereal 1	Alluvium and Fernando Group	Pumping	Yes
Cereal 3	Alluvium and Fernando Group	Pumping	Yes
Cereal 4	Alluvium and Fernando Group	Pumping	Yes
Corydon	Fernando Group	Pumping	Yes
Lincoln #2	Fernando Group and Bedford Canyon	Pumping	Yes
Olive St	Fernando Group, Bedford Canyon and Basement rocks	Pumping	Yes
Palomar	Fernando Group	Pumping	Yes
Fraser #2	Fernando Group	Pumping	No
Grand Well	Not available	Pumping	No
Sanders Well	Basement rocks	Pumping	No
Showboat	Alluvium	Pumping	No
Wood Street #2	Alluvium and Basement rocks	Pumping	No
Wood Well	Alluvium and Basement rocks	Pumping	No
North Island	Fernando Group	Non-pumping	Yes
South Island	Fernando Group	Non-pumping	Yes

MODEL CALIBRATION

Within Visual MODFLOW, the user has a choice of five mathematical solvers that can be used to calculate the series of equations developed during solution of the groundwater model flow simulation. For groundwater flow simulations performed during model calibration, the Waterloo Hydrogeologic Software (WHS) numerical solver is used to calculate simulation results. The WHS Solver is an iterative, bi-conjugate gradient routine that solves the large system of equations using both inner and outer iteration levels. Overall, the WHS solver is found to be stable and accurate in its solution of the sets of equations to be solved by the problem posed.

Because of the complexity of the basin and interactions of the faults and uncertainty in the data, the model is considered calibrated if calculated heads are within 100 feet of the actual heads for key wells and matched the overall water level trends over the calibration period.

Figure 3-4
Calibration and Pumping Well Location Map

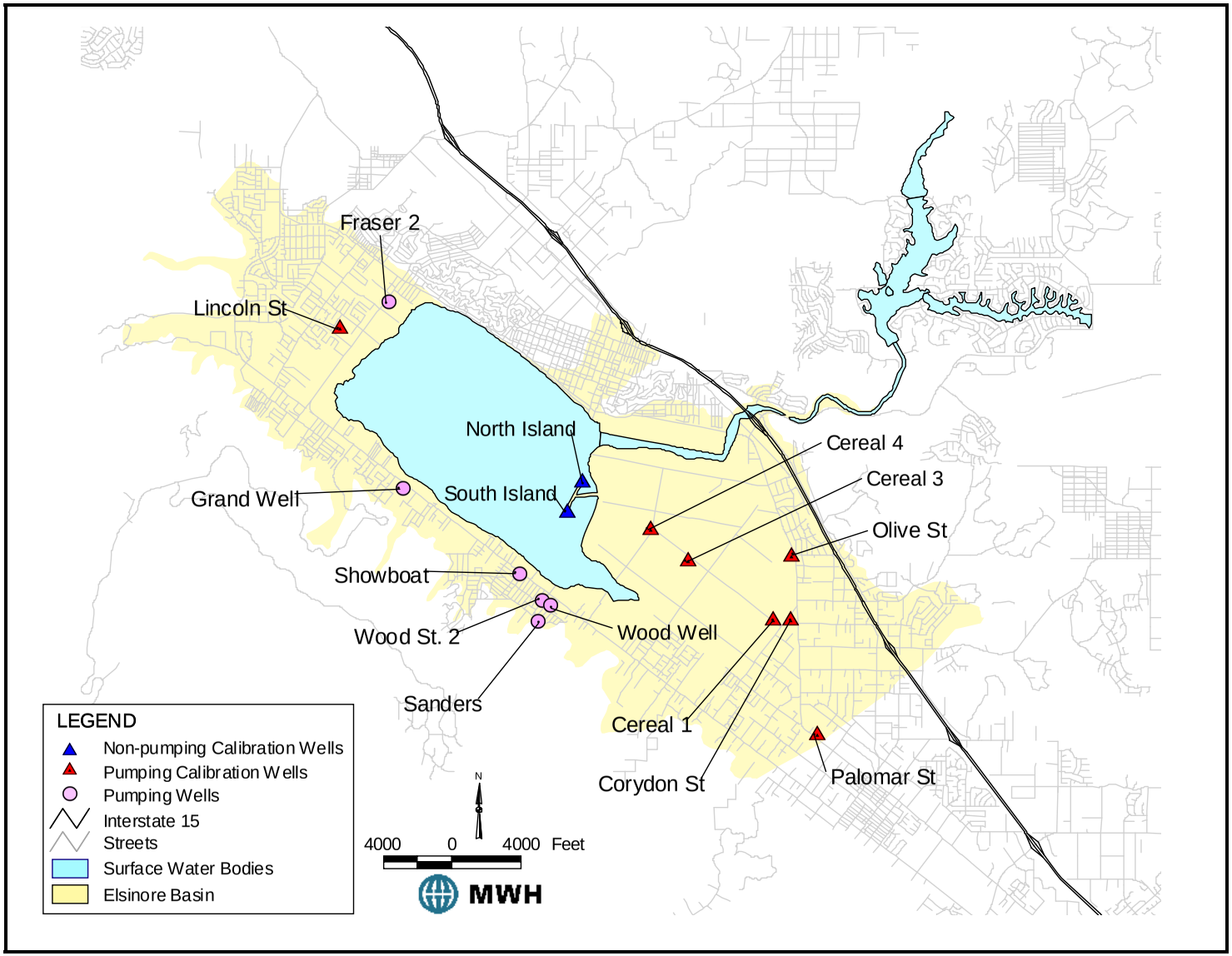
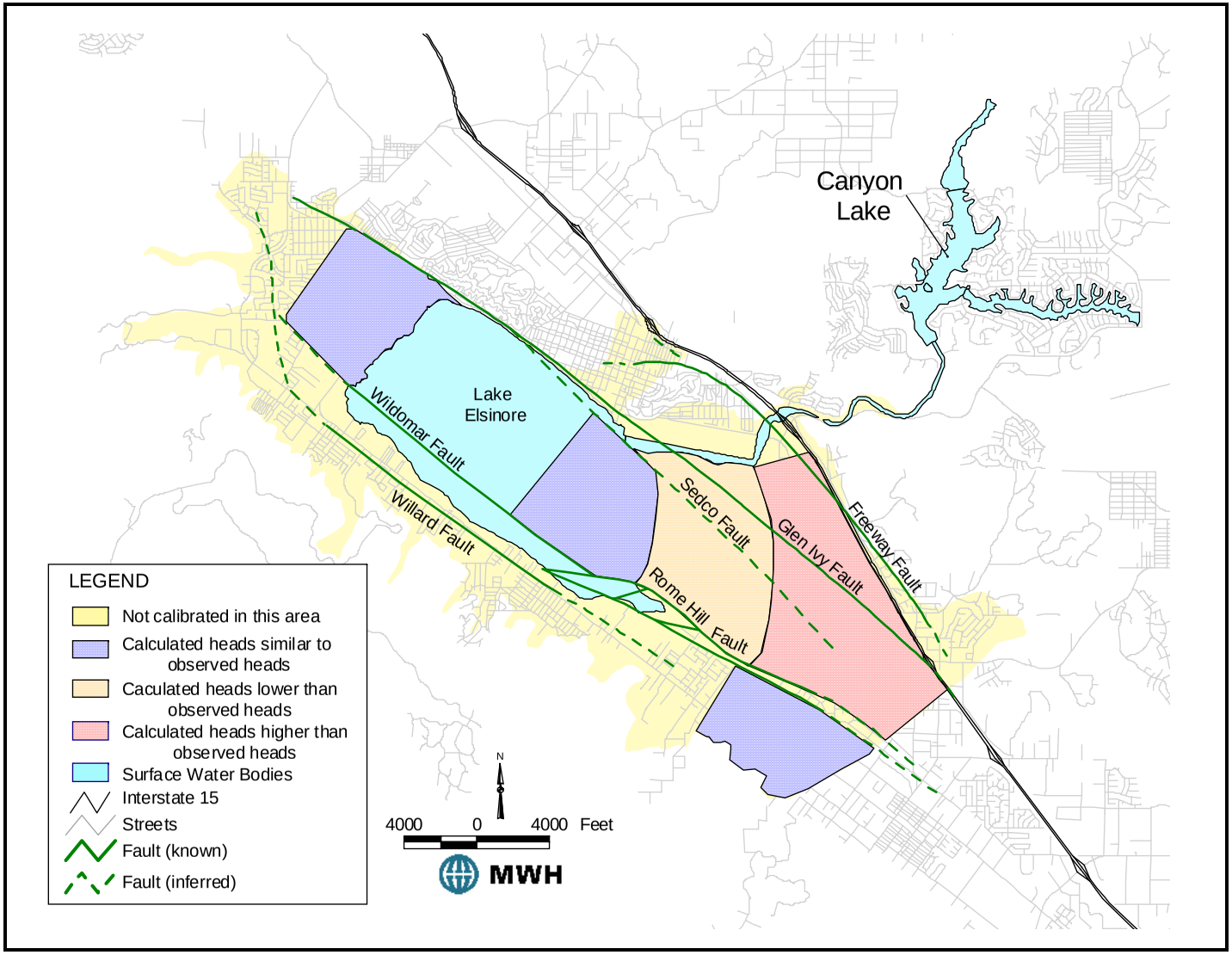


Figure 3-5
Relative Goodness of Fit for Groundwater Model



Calibration Wells

The seven EVMWD municipal wells listed in **Table 3-2** are used as calibration wells in the model. Measured water levels under pumping and static conditions comprised the calibration target values. In addition, the North Island and South Island wells are used as calibration wells in the model. The locations of wells utilized for model calibration as well as other pumping wells in the basin are shown on **Figure 3-4**.

Results

Calibration results for the calibration wells in Layer 3 are provided in **Appendix E**. The use of pumping wells for calibration purposes complicates calibration evaluation because of error induced by numerical limitations. In Visual MODFLOW, the extracted volume of groundwater is spread over the entire horizontal computational cell, thereby damping the numerical response of the model to changes in pumping rates. For example, measured pumping heads may decrease faster than calculated heads when increasing the extraction rate of a well. Conversely, measured pumping heads may increase faster than calculated heads when decreasing the extraction rate of a well. During model simulations, extraction rates are varied instantaneously on a monthly basis. Because of these numerical limitations, calibration plots at the non-pumping North and South Island wells are closely monitored as the best approximation of model calibration.

Appendix E also presents model calibration plots of calculated versus observed head (static and pumping) data for 1990 through 2000 and for individual years 1991 through 2000. The figures show that calibration improves with the later years, likely corresponding with an improvement in observed data quality. To verify that the groundwater model is predicting the same groundwater deficit as is presented in the conceptual model, a mass balance is calculated and evaluated for the entire model domain. The overall mass balance for the calibration period is shown in **Appendix E**. Overall, the water mass balance calculated by the model closely matches with the water budget presented in the conceptual model (**Section 2**).

Calibration plots are presented for wells going from northwest to southeast. A brief summary of calibration results for each well follows.

Lincoln Street Well

Calculated head levels are shown to change with variation in pumping rate and recharge. However, because the actual static levels increase with time and the pumping levels decrease with time, it is difficult to ascertain the actual trend in this area of the basin based upon the trend of Lincoln Street. In addition, reliable data are not available for this well prior to 1992. Based upon data from other wells near the Lincoln Street well (e.g. Machado Street well, Fraser 2 and Wisconsin well), the water levels appear to be relatively stable in this area. Therefore, the trend in water levels predicted for the Lincoln Street Well appears to be consistent with observed data.

North Island Well

Calculated head levels closely match observed static head data. The North Island well is a non-pumping well and provides more reliable calibration data for the basin. Data are not available

for this well from early 1990 through 1992. Calculated heads for this well do not match observed trends particularly well during the El Niño event of 1992-93. This may be due to a variety of factors including: construction of the lake levee in 1995 that changed the hydrology of the basin or underestimating the amount of groundwater recharge based on averaging the El Niño rainfall event over the six month stress periods in 1993/94. However, the calculated data match well with the observed data post-1995. Therefore, the model appears to be well calibrated in this area of the basin.

South Island Well

Calculated head levels closely match observed static head data. The South Island well is a non-pumping well and, like the North Island well provides reliable calibration data for the basin. Data are not available for this well from early 1990 through 1992. Like the North Island well, calculated heads for this well do not match observed trends particularly well during the El Niño event of 1992-93. The calculated data match well with the observed data post-1995, however. Therefore, the model appears to be well calibrated in this area of the basin.

Cereal 4 Well

The trend of the calculated heads closely matches the trend of the observed data. Calculated head values generally deviate less than 20 feet from observed pumping head data. This well was constructed in 1991 so limited data are available prior to 1992. Since 1995, calculated trends track well with observed trends.

Cereal 3 Well

The trend of the calculated heads closely matches the trend of the observed data. Calculated head values generally deviate less than 30 feet from observed pumping head data. This well was constructed in 1991, so limited data are available prior to 1992. Since 1995, calculated trends track well with observed trends, although calculated water levels are generally lower than the observed water levels.

Cereal 1 Well

Calculated heads match the observed trend and are generally lower than static levels and higher than pumping head levels. The trend in this well is difficult to match because this well is used as a standby well and does not operate continuously during the month. For modeling purposes, an average monthly pumping rate is assumed, which results in higher head levels than observed. However, the trend is matched more closely after 1997 when this well was used more frequently and the average monthly pumping is more representative of the pumping from this well. Therefore, although the calculated heads do not match exactly with the observed heads, it appears to match well with the overall trend in the basin.

Corydon Well

The calculated heads for the Corydon well are generally higher than the observed heads by more than the 100-foot criterion. Repeated attempts to match data at the Corydon well have been unsuccessful. It is unclear if this is because of unknown geologic heterogeneity or if the

measured data are suspect. Because the Corydon well is close to a fault boundary (Sedco fault) and the southern edge of the groundwater basin, it is difficult to determine if there may boundary effects that may impact the ability to calibrate to this well. In addition, the difference between observed static and pumping levels is relatively low and is not consistent with pump test data for this area. This suggests that the well may not be completely recovered when static water levels are taken and that the water levels recorded are largely dependent upon when the water levels are taken. This uncertainty makes calibration in this area difficult.

Olive Street Well

The measured pumping and static head data for the Olive Street well vary considerably, often by 200 feet or more during singular gauging events. Calculated variations between pumping and static data match this trend. Because the Olive Street well has been off-line for bacterial problems, it is used on an infrequent basis, which results in the large variations in water levels. Because of this, it is difficult to calibrate to absolute water levels for this well. Rather, trends in the data and fluctuations between on and off cycles are used to determine suitability of fit. Overall, the calculated head values generally match this fluctuation. However, like the Corydon Street well, this calculated heads are generally higher than the actual pumping heads.

Palomar Well

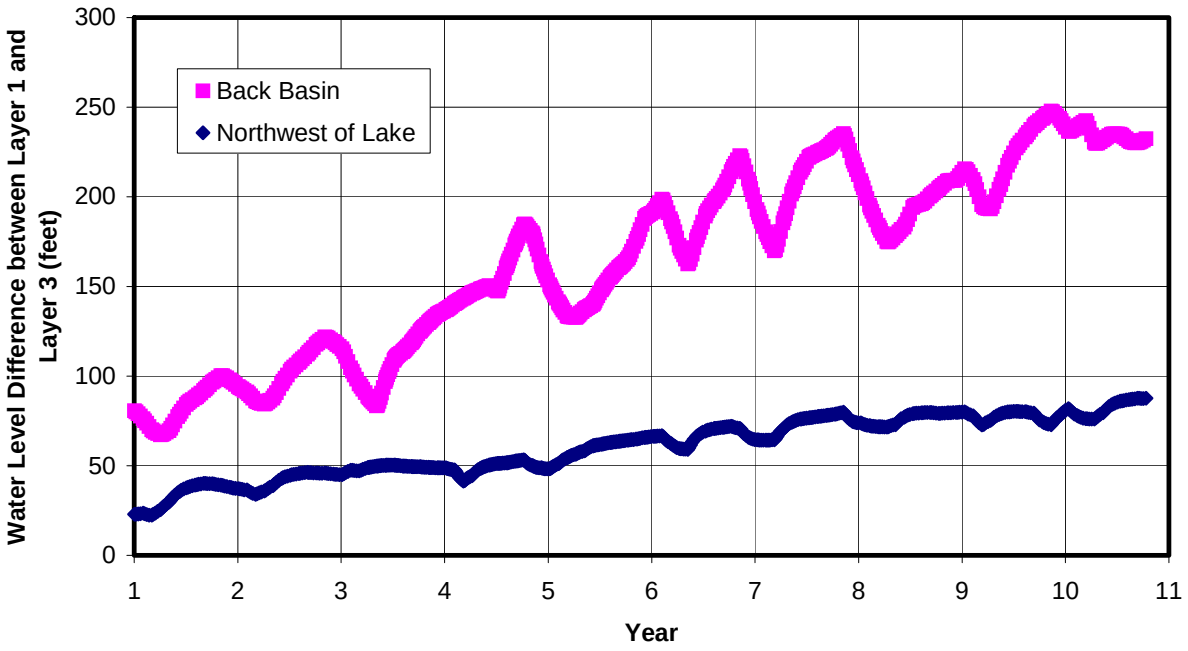
Calculated heads generally match the decreasing trend and values of the observed data. This area is generally well calibrated.

Calibration Analysis

A summary of the goodness of fit for the model area is provided on **Figure 3-5**. This figure shows the relative calibration error in qualitative terms. Where limited calibration data are available such as the margins of the basin, south of and beneath Lake Elsinore (areas shown in yellow), caution should be exercised in interpreting modeling results. In general, the model performs relatively well in the northwest portion of the basin, near the Island wells, and in the southeast portion of the basin near the Palomar well and differences in the calculated heads and the observed heads are generally much less than the 100-foot criterion. In the area between Cereal-4 and Cereal-3 in the Back Basin, calculated heads are generally lower than the observed heads. On the other hands, calculated heads are higher in the area east of Cereal-1. This area will need to be evaluated further.

Because of a lack of data available in the alluvium (Layer 1) for comparison over the calibration period, it is difficult to discern the accuracy of the groundwater flow model in the alluvium. As discussed in **Section 2**, the difference in head between the alluvium (Layer 1) and the Fernando Group (Layer 3) is on the order of 200 feet in the Back Basin area. In the northwest part of the basin, this difference is less. As shown in the contour map provided in **Appendix E** and the head summary shown on **Figure 3-6**, the calculated head in Layer 1 is generally consistent with these observations.

Figure 3-6
Modeled Difference in Water Level Between Layer 1 and Layer 3



Additional monitoring well data in the alluvium will be needed to calibrate the head changes in Layer 1.

Sensitivity Analysis

During model calibration, the sensitivity of the model results to variations in key parameters (e.g. definition of faults, aquifer parameters, pumping rate, and recharge rates) is evaluated.

In the Back Basin area, the model is very sensitive to whether the Glen Ivy and Rome Hill faults are simulated to restrict groundwater flow. At one extreme, simulating these faults as not restricting flow results in inaccurate calculated head levels at the following wells: Olive Street, Corydon, and Cereal 1. Calculated heads at Corydon Street and Cereal 1 are on the order of 100 to 200 feet higher if the faults are not modeled as barriers than if they are modeled as barriers to flow.

Water levels in the Back Basin area are less sensitive to other parameters such as hydraulic conductivity or storativity. Calibration simulations in other portions of the basin show that the model is moderately sensitive to the magnitude of storage parameter specified. As is the case with many transient models, storage parameters are obtained from the literature for each specific soil/rock type and are adjusted during calibration runs.

Because most of the available calibration data is obtained from pumping wells, model calibration is extremely sensitive to assigned extraction or injection rates. During model calibration, pumping rates are averaged and assigned as monthly values. This averaging introduces error

into calculated head values because the instantaneous pumping rate is not used. Due to the use of the pumping wells as calibration points, any deviation in modeled pumping rate from the actual instantaneous rate would result in a difference in calculated head and measured head data. Even for a properly calibrated model with minimal geologic uncertainty, the use of pumping wells to evaluate model calibration is fraught with difficulties.

Except along the margins of the basin, the model is minimally sensitive to net recharge. Recharge input is "averaged" both temporally and spatially over a 6-month period, which attenuates peaks and valleys in net recharge that enters the groundwater flow domain. Spatial averaging occurs by the use of rainfall, runoff and septic data on a subregional basis. The overall effect is that net recharge input is "smoothed." Therefore, peaks in data would not be captured but the overall trend would be observed. In this regard, the model would only be minimally affected. Future data input that includes recharge specification on a more refined temporal and spatial basis would likely result in improved model response.

Summary

Overall, model calibration is strongly impacted by sparse hydraulic head data of questionable quality and the use of pumping wells as calibration points. Because of the aforementioned limitations, this model should be considered a qualitative predictive tool, useful in the evaluation of aquifer trends in response to aquifer stresses. In order to use the model as a quantitative predictor of absolute aquifer head values, more site hydraulic head data should be collected and used to perform a post-audit of model accuracy.

MODEL LIMITATIONS

The availability and accuracy of site physical data limit computer models. Some limitations of the model are presented as follows:

- The model strives to simulate discontinuous water-bearing formations with widely varying hydrogeologic properties. Due to the complex geology and extensive faulting present in the basin, it is impractical for the model to capture all geologic heterogeneity. Limited site data available during model development does not allow for incorporation of all such possible features.

- With the exception of the Fernando Group, sparse aquifer pumping test data (for determination of hydraulic properties) are available for the hydrostratigraphic units. Consequently, model input hydraulic characteristics for the alluvium, aquitard, Bedford Canyon Formation and basement rocks are estimated using appropriate values, which are then adjusted during model calibration.

- The limited number of calibration wells (nine) within the 25 square mile groundwater basin limits the evaluation of model calibration. Sufficient data over the calibration period is not available for the alluvium formations.

- Some wells have screens across multiple water-bearing formations. This complicates model calibration because it is difficult to determine how much of the flow comes from each formation prior to calibration.

Although the groundwater flow model has inherent limitations, it can be effectively used to predict general trends in aquifer reaction to pumping stresses. Site data is limited; however, data is sufficient in number and accuracy to calibrate the model for use as a predictive tool of aquifer general trends for basin-wide alternatives analysis. Among other uses, the model can be expected to be a good predictive tool to evaluate general trends for proposed groundwater recharge scenarios. However, it should not be used to evaluate site-specific water level variations or be used to evaluate absolute water levels.

The model can be used effectively to evaluate different groundwater recharge scenarios in fulfillment of development of this GWMP. The groundwater model presented herein is a good predictive tool for analysis of aquifer response to induced stresses in the groundwater basin and proposed groundwater use scenarios.

Future updates may be necessary based upon information collected through implementation of the GWMP. In particular, additional groundwater information that is gathered from monitoring wells in the alluvium and the Fernando Group should be included to verify model calibration. The model should be reviewed periodically to verify that it still provides valid information.

SUMMARY AND RECOMMENDATIONS

This section details the composition of a four-layer, finite-difference groundwater flow model. Software utilized for modeling is Visual MODFLOW Pro 3.0. Overall, calculated head values at observation points match observed trends. The model water mass balance sufficiently matches the water budget presented in the conceptual model in **Section 2**. Also, calculated groundwater flow directions match those presented in **Section 2**.

Data and numerical limitations enact restrictions on the evaluation of model. Data are spatially sparse which limits the extent of the model calibration. Numerically, the use of pumping wells for calibration purposes complicates calibration evaluation because of error induced by numerical limitations and potential errors during the collection of the pumping data (i.e. well was not completely recovered). In Visual MODFLOW, the extracted volume of groundwater is virtually spread over the entire horizontal computational cell, thereby damping the numerical response of the model to changes in pumping rates in that cell. Even with these complications, the groundwater model is useful as a groundwater resource planning tool. The model is able to quantitatively evaluate aquifer responses to induced stresses and proposed groundwater use scenarios. However, caution should be exercised is using the groundwater model to evaluate site-specific or absolute water levels. Rather, it provides a measure of relative performance of various groundwater management options.

Section 4
Baseline Conditions

The review of historical water conditions in **Section 2** indicates that the Elsinore Basin in a state of groundwater deficit today. However, to determine whether these problems will continue, a reasonable estimate of future water conditions is necessary. These conditions include future water demands and the supplies required to meet those demands. They also provide a baseline for developing and comparing the effectiveness of the alternative management plans that are developed in **Section 5**. This section presents a discussion of future supplies and demands anticipated for the Elsinore Basin, the projected water balance and the expected impacts if no management plan were implemented. The section concludes with a discussion of the need for a management plan.

INTRODUCTION

As discussed in **Section 1**, potable water demands are projected to more than double by 2020. **Table 4-1** presents an accounting of the supplies and demands for the Elsinore Basin for existing conditions. Year 2000 data are used throughout this report to reflect current conditions to remain consistent with the estimates provided in the Water Distribution System Master Plan (MWH, 2002). The data presented herein include groundwater pumping from EVMWD, EWD and private pumpers. Total pumping in the Elsinore Basin during 2000 was approximately 8,200 acre-ft. Total water demands were approximately 23,400 acre-ft.

Table 4-1
Potable Water Demands in the Elsinore Basin – Year 2000

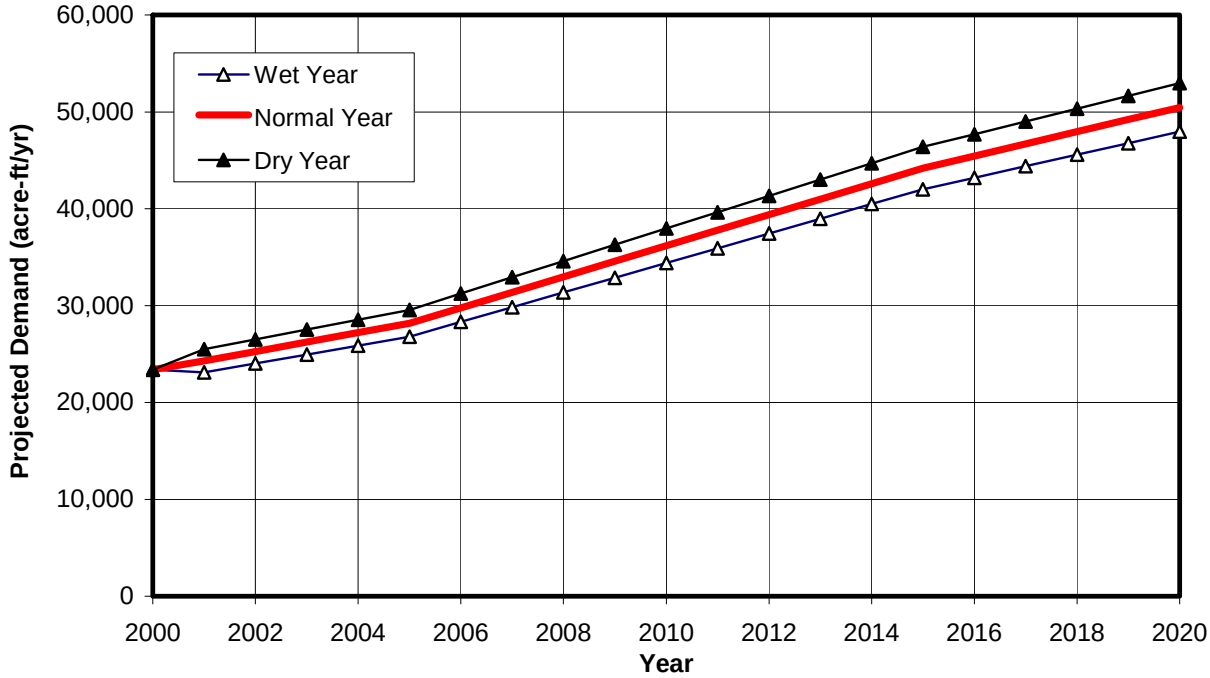
Description		Year 2000
Demand	Average Day Demand	23,400
Supplies	Existing Wells [1]	8,200
	Canyon Lake WTP	2,300
	Imported water from MWDSC (Auld Valley)	12,900
	Imported water from MWDSC (Temescal Valley)	0
	Total	23,400
Supply Shortfall		0

1 – Includes EVMWD, EWD and private wells.

Figure 4-1 presents a summary of the projected water demands for the Elsinore Basin through 2020. These projections are based upon the monthly potable demand projections presented in the Distribution System Master Plan (MWH, 2002). The potable demand projections are based

upon SCAG population projections through 2025 and the amount of projected development through 2080 as described in the Distribution System Master Plan (MWH, 2002). Based upon discussions with EWD, it is assumed that EWD's demand will remain fixed in the future because its service area is essentially built-out. In addition, the demand for private pumpers is projected to remain constant, as new developments will likely be supplied by EVMWD. This figure shows a range in demand assuming the average annual demand increases approximately 5 percent in dry years and decreases approximately 5 percent in wet years. As such, the potable demand is projected to range from 48,000 acre-ft/yr to 53,100 acre-ft/yr by 2020.

Figure 4-1
Summary of Projected Potable Water Demands through 2020



These projections do not include water demands for non-potable supplies such as recycled water or groundwater not suitable for potable use. As discussed in **Section 1**, recycled water is currently being used in to replenish Lake Elsinore on a pilot basis. Because the feasibility of a basin-wide recycled water system has not been determined at this time, additional studies may be necessary. Based upon a review of the local hydrology, for purposes of this report, wet years occur about 3 out of 10 years, dry years every 2 out of 10 and 5 out of 10 are considered normal years.

The remainder of this section discusses the future baseline conditions in the basin.

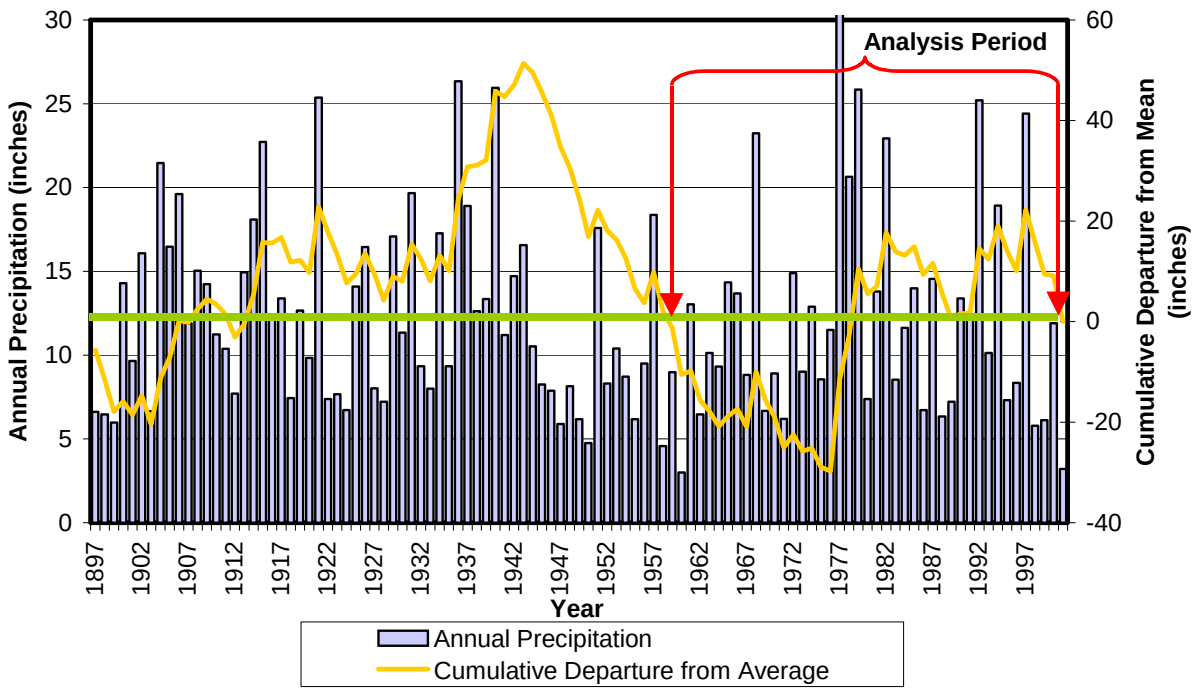
BASELINE CONDITIONS

Projections of future conditions are by their nature approximations and, as such, are frequently based on historical trends or on estimates made by others. In the development of future water demands and supplies, a number of assumptions have been made, as described below. The

planning period for the GWMP is the year 2020. However, because the water balance analysis presented in **Section 2** for the historical period 1990 to 2000 suggests that inflows to the basin are currently less than the outflows, it is important to evaluate the groundwater impacts of this situation continuing in the future. Therefore, two future baseline conditions have been developed for this GWMP.

Baseline A simulates current (year 2000) groundwater pumping patterns in the basin. Baseline B simulates expected pumping conditions in the basin in year 2020 without the implementation of any groundwater management activities. To evaluate the potential range in groundwater conditions in the basin, the hydrologic conditions for the period October 1960 through September 2001 are used. This 41-year period represents a period of precipitation that closely approximates the long-term average rainfall and includes a wide range of wet, normal and dry years as shown on **Figure 4-2**. The baseline conditions and the groundwater levels predicted with the groundwater model are described below.

Figure 4-2
Annual Precipitation at Lake Elsinore



This approach of modeling the basin is used to evaluate the baseline conditions and the alternatives because it provides the ability to define the potential range of conditions based upon hydrology given a fixed set of groundwater pumping conditions.

Baseline A – Current Basin Conditions

Baseline A is based on year 2000 conditions for water demands, operating groundwater wells, and the degree of urbanization of the basin area. The purpose of Baseline A is to compare the

current pumping conditions with the basin conditions in year 2020 due to increased water demands, increased urbanization (reduced infiltration) and increased groundwater production from additional planned groundwater wells.

Planning Assumptions

The following is a description of the planning assumptions for Baseline A. According to MWDSC, their imported water supply is sufficient to meet projected demands for the next 20 years (MWDSC, 2003). Therefore, supply projections are made assuming that the TVP and the AVP can be used to full capacity when necessary.

Water Demands

The water demands used in Baseline A are the combined year 2000 demands of EVMWD, EWD and the private pumpers. As discussed above, the demand in 2000 was 23,400 acre-ft. If these demands are projected into the future, taking into consideration wet and dry year cycles, current demands would range from 22,300 acre-ft/yr in wet years to 24,600 acre-ft/yr in dry years as shown in **Table 4-2**.

Table 4-2
Potable Water Demands in the Elsinore Basin – Baseline A

Description		Actual 2000 (acre-ft/yr)	Normal Year 2000 (acre-ft/yr)	Dry Year 2000 (acre-ft/yr)	Wet Year 2000 (acre-ft/yr)
Demand	Average Annual Demand	23,400	23,400	24,600	22,300
Supplies	Existing Wells	8,200	9,900	9,900	9,900
	Canyon Lake WTP	2,300	3,000	700	6,600
	MWDSC (AVP)	12,900	6,600	6,600	4,500
	MWDSC (TVP)	0	3,900	7,400	1,300
	Total	23,400	23,400	24,600	22,300
Supply Deficit		0	0	0	0

Water Supplies

To meet the potable demand, the water supplies included in Baseline A are:

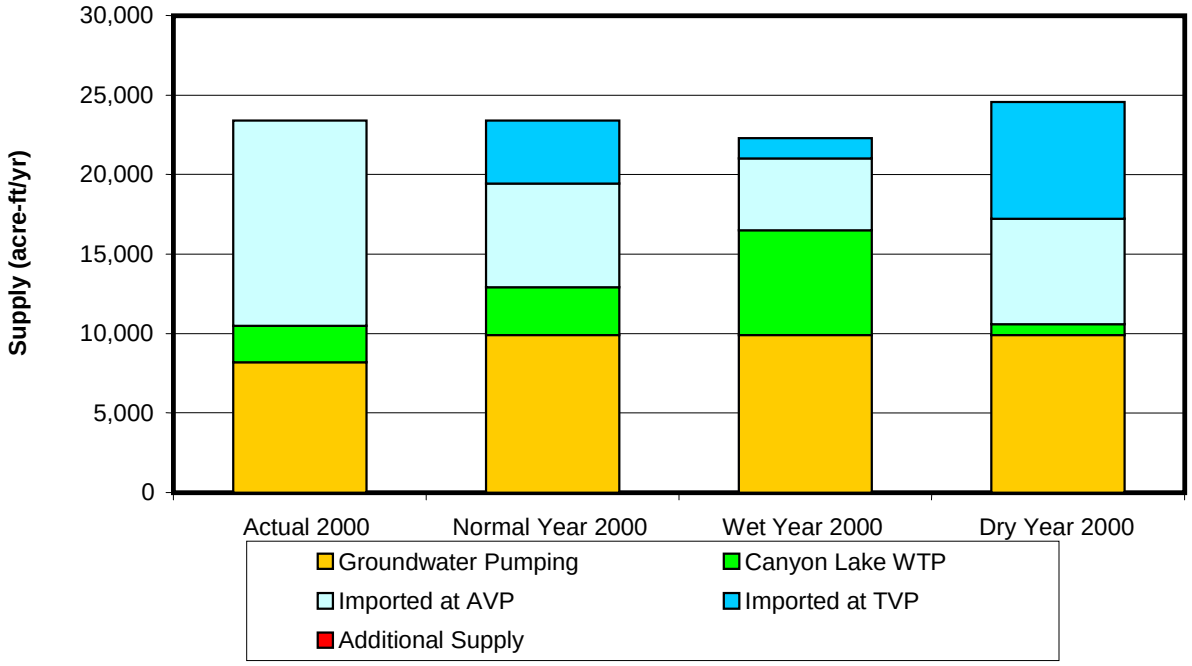
- Eight existing groundwater wells of EVMWD with a total capacity of 11,600 gallons per minute (gpm).
- Four existing groundwater wells of EWD with a total capacity of 3,400 gpm.
- Unknown number and capacity of private wells.
- Imported water from AVP with a capacity of 14,000 gpm (22,600 acre-ft/yr).

- Imported water from TVP with a capacity of 15,300 gpm (24,700 acre-ft/yr).
- Canyon Lake WTP with a capacity of 6,250 gpm with annual flows ranging from 700 to 6,600 acre-ft/yr when operating.

Groundwater production estimates are made based upon actual production data from 1997 to 2001 and reflect the average production from each well in the basin over this 5-year period and includes the new EVMWD Machado Street well because it was on-line during 2001. Therefore, the estimated production for Baseline A conditions (9,900 acre-ft/yr) is slightly higher than the actual conditions in 2000. In addition, the groundwater pumping is kept constant during wet and dry years to evaluate the affects of varying hydrology on the groundwater basin. The proposed EVMWD Joy Street and Terra Cotta wells are not included in Baseline A because these wells were not online in 2000 or 2001.

Similarly, imported water from the TVP was not available to EVMWD in 2000. Projections for Baseline A include the use of imported water from the TVP. Neither the TVP nor the AVP reach capacity under Baseline A. A summary of the projected supplies to meet the demands is provided on **Figure 4-3**. No additional supplies are required to meet current demands under this scenario. However, the ability of the groundwater basin to sustain this level of pumping through a wide range of hydrologic conditions must be evaluated.

Figure 4-3
Summary of Supplies to Meet Projected Demands – Baseline A



Note: The amount of groundwater pumping presented on this figure does not allow sustainable basin conditions.

Land Use

In Baseline A, the land use for year 2000 is used to calculate the amount of infiltration from precipitation in the local watershed and the amount of return flows from irrigation.

Septic Tanks

It is estimated that approximately 3,900 septic tanks are located within the groundwater basin. These septic tanks contribute to about 1,000 acre-ft of infiltration per year. Baseline A assumes that none of these septic tanks will be connected to the sewer system.

Lake Replenishment

No lake replenishment using groundwater or reclaimed water is included in Baseline A because lake replenishment was not performed prior to 2002.

Groundwater Balance

The estimated groundwater balance based upon 1961 to 2001 hydrology for Baseline A is summarized in **Table 4-3**. Note that this groundwater balance reflects projected future conditions with historical inflows and is therefore, not directly related to the actual conditions presented in **Section 2**. If groundwater pumping conditions for 2000 continued for a repeat of the 41-year hydrologic analysis period, an average deficit of approximately 4,400 acre-ft/yr would occur. The annual basin balance is projected to range from a deficit of 8,200 acre-ft/yr in dry years similar to water year 1960-61 to a surplus of as much as 10,800 acre-ft/yr in wet years similar to water year 1980-81.

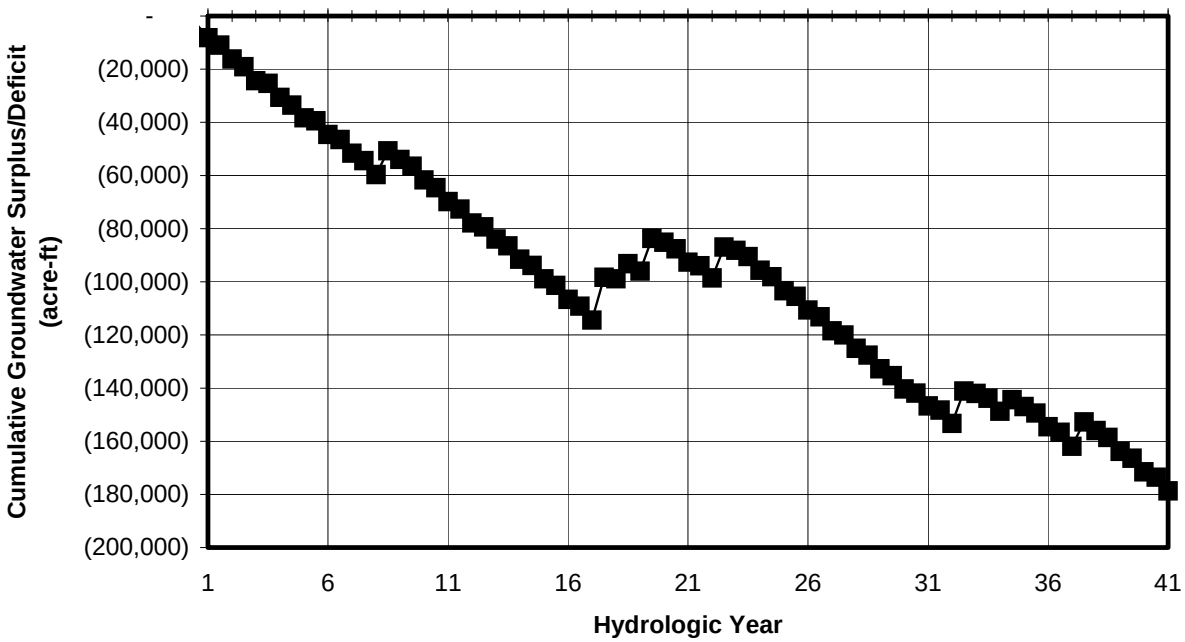
Table 4-3
Summary of Groundwater Balance – Baseline A

Parameter	Average (acre-ft/yr)	Wet Year (acre-ft/yr)	Dry Year (acre-ft/yr)
INFLOWS			
Infiltration of Precipitation			
Rural Areas	1,700	9,500	0
Urban Areas	900	5,500	0
Recharge from Surface Water			
San Jacinto River	1,200	4,000	0
Lake Elsinore	0	0	0
Return Flows			
Septic Systems	1,000	1,000	1,000
Applied Water	700	700	700
Subsurface Inflows		-	-
Total Inflows	**5,500**	**20,700**	**1,700**
OUTFLOWS			
Groundwater Pumpage	(9,900)	(9,900)	(9,900)
Surface Outflow	0	0	0
Subsurface Outflow	0	0	0
Total Outflows	**(9,900)**	**(9,900)**	**(9,900)**
Net Surplus/(Deficit)	**(4,400)**	**10,800**	**(8,200)**

Base period = 1961 to 2001

Figure 4-4 presents the projected cumulative groundwater balance for the Elsinore Basin under Baseline A for the 41-year simulation. This figure shows that the basin would lose approximately 176,000 acre-ft of storage (about 12 percent of the basin storage) after 41 years if pumping were kept constant at the Baseline A rate. Because the natural inflows and outflows are approximately equal during this period, a deficit would indicate that the basin is not currently in balance and the existing condition is not sustainable.

Figure 4-4
Projected Cumulative Groundwater Balance - Baseline A

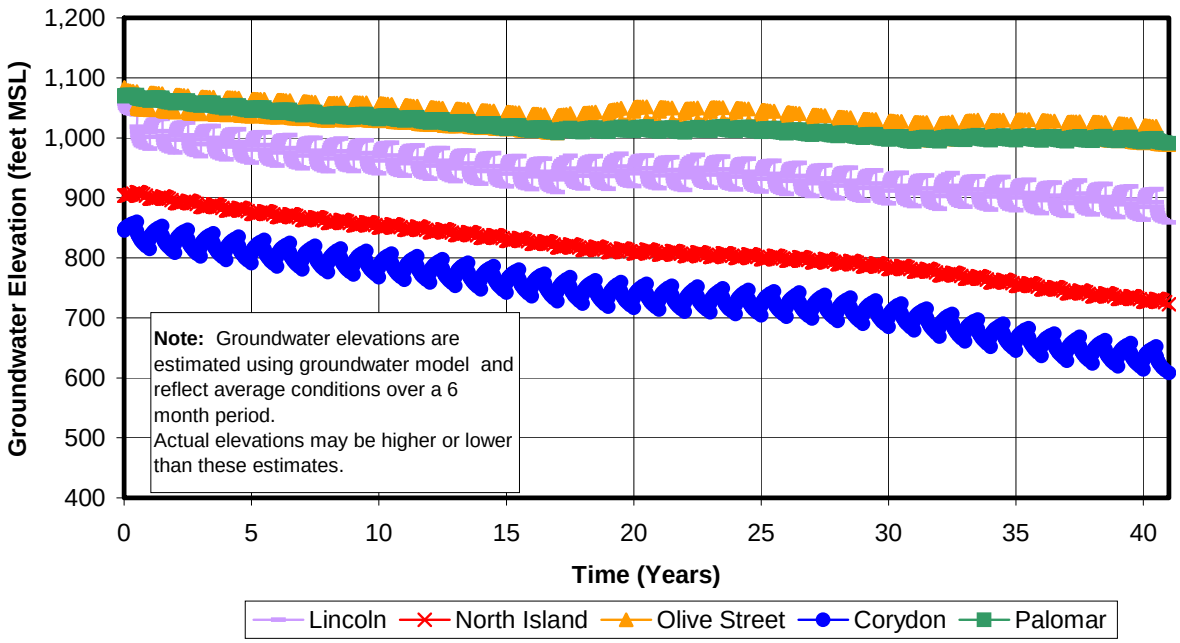


Water Levels

The predicted water levels in the Elsinore Basin for Baseline A conditions are presented on **Figure 4-5**. This figure shows that the water levels are declining throughout the groundwater basin. Water levels in the Corydon well, for example, are projected to decline as much as 250 feet over 41 years. Water levels in wells near the edge of the basin (e.g. Olive Street and Palomar) are projected to decline on the order of 80 to 90 feet. Other wells are projected to decline as much 200 feet. As discussed above, this condition is not sustainable. Impacts of this condition include:

- Water quality degradation as poor quality water migrates from other portions of the basin
- Increased risk of land subsidence that may result in damage to infrastructure
- Aquifer subsidence that may result in permanently reduced yield and storage capacities
- Reduced well pumping capacities due to shorter wetted screen intervals
- Mitigation costs to private users relying on this groundwater basin
- Reduced supply reliability in prolonged drought periods or emergencies such as earthquakes.
- Loss of habitat in wetlands and reduction of recreation industry if water for lake replenishment is not available.

Figure 4-5
Projected Water Levels of Baseline A – Existing Conditions



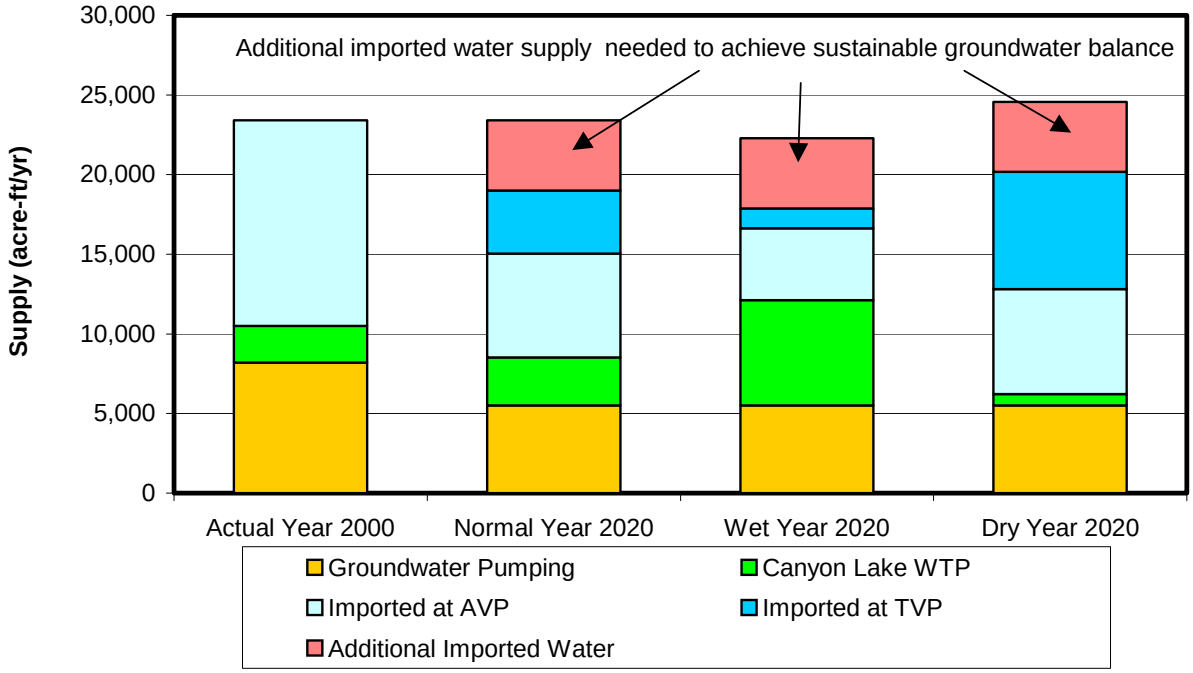
Under current pumping conditions, the average long-term groundwater deficit is about 4,400 acre-ft/yr. Therefore, without a groundwater management strategy, 9,900 acre-ft/yr could not be pumped from the basin over the long-term without significant detrimental impacts, which results in additional supply deficit. To obtain a sustainable balance in the basin, an additional 4,400 acre-ft/yr of imported water supplies would need to be purchased to reduce groundwater pumping to the current sustainable yield (5,500 acre-ft/yr) as shown on **Figure 4-6**. The supply picture presented here is significantly different from the data presented on **Figure 4-3** and may not be feasible for future demands. Therefore, Baseline B addresses future conditions in the Elsinore Basin.

Baseline B – Year 2020 Basin Conditions

Baseline B is based on the anticipated future conditions in year 2020 with respect to water demands, operating groundwater wells and the degree of urbanization of the basin area. Baseline B has a dual purpose:

- Baseline B is used to compare the basin conditions in year 2020 with the current (year 2000) basin conditions to quantify the effects of increased pumping and decreased infiltration due to projected development.
- Baseline B provides a basis for evaluation of management alternatives, which represent the year 2020 conditions as well.

Figure 4-6
Supply Mix to Meet the Projected Year 2020 Demands with Sustainable Groundwater Balance– Baseline A



Planning Assumptions

The following discusses the planning assumptions for Baseline B.

Water Demands

The water demands of EVMWD are projected to increase to 50,000 acre-ft in year 2020 (MWH, May 2002), while the water demands of EWD and private pumpers are assumed to remain constant at 500 acre-ft/yr. Under normal hydrologic conditions, the total demand is 50,500 acre-ft/yr. In a dry year, the demand is assumed to increase by five percent to 53,100 acre-ft/yr. In a wet year, the demand is assumed to decrease by five percent to 48,000 acre-ft/yr. A summary of the potable demands and supplies is presented in **Table 4-4**.

Water Supplies to Meet Demands

The water supplies included in Baseline B are the same as Baseline A plus the Joy Street Well, which is drilled, and ready to be equipped. The Joy Street Well has an estimated capacity of 1,000 gpm, which increases the groundwater production to 11,300 acre-ft/yr. To meet the maximum day demands (MDD) in year 2020, 14 additional wells are required to provide peaking capacity, assuming each well has a capacity of 1,000 gpm, or another peaking source is needed. According to MWDSC, their imported water supply is sufficient to meet projected demands for the next 20 years (MWDSC, 2003). Therefore, supply projections are made assuming the TVP and the AVP can be used at capacity if necessary. The groundwater supplies accounted for here

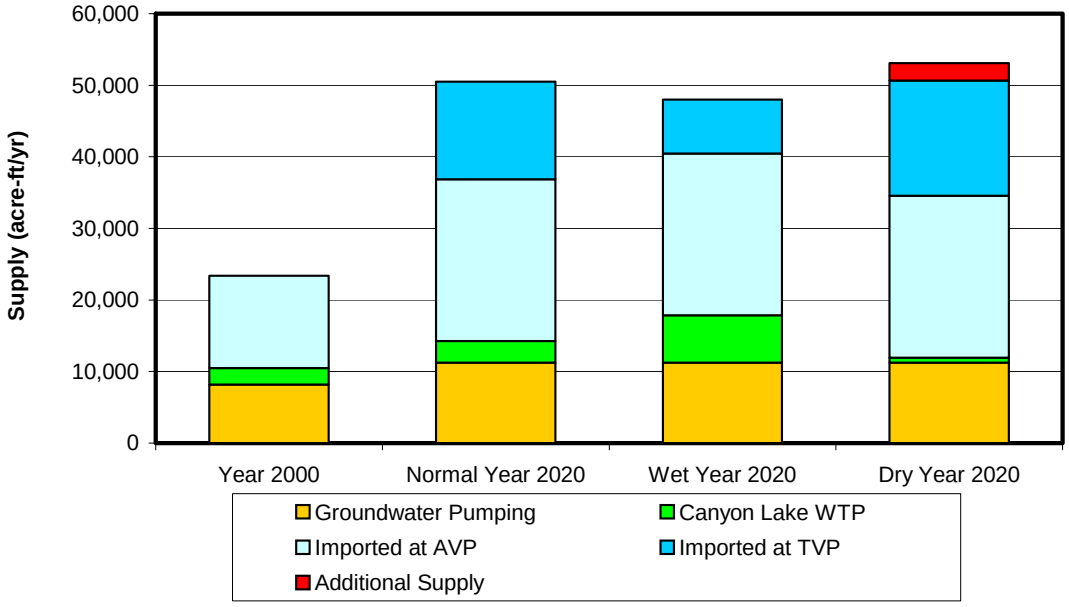
include only those supplies used to meet potable demands. The use of recycled water and non-potable groundwater supplies for lake replenishment is discussed later.

Table 4-4
Potable Water Demands in the Elsinore Basin – Baseline B

Description		Year 2000 (acre-ft/yr)	Normal Year 2020 (acre-ft/yr)	Dry Year 2020 (acre-ft/yr)	Wet Year 2020 (acre-f/yr)
Demand	Average Annual Demand	23,400	50,500	53,100	48,000
Supplies	Existing Wells	8,200	11,300	11,300	11,300
Supplies	Canyon Lake WTP	2,300	3,000	700	6,600
	MWDSC (AVP)	12,900	22,600	22,600	21,600
	MWDSC (TVP)	0	13,600	16,100	8,500
	Total	23,400	50,500	50,700	48,000
Supply Shortfall		0	0	2,400	0

Figure 4-7 presents a graph of the projected supplies and demands under Baseline B. This figure implies that there are sufficient supplies in existing facilities to meet the potable demand in normal and wet years, while only dry years have a supply shortfall of approximately 2,400 acre-ft/yr. However, Baseline B results in groundwater pumping in excess of the perennial yield. Therefore, a supply deficit actually occurs in all years.

Figure 4-7
Supply Mix to Meet the Projected Year 2020 Demands – Baseline B



Note: The amount of groundwater pumping presented on this figure does not allow sustainable basin conditions.

Land Use

In Baseline B, the projected land use from the General Plans of the City of Lake Elsinore (City of Lake Elsinore, 1990) and Riverside County (Riverside County, 1994) for year 2020 is used to calculate the amount of runoff and the amount of return flows from irrigation.

Septic Tanks

The amount of infiltration from septic tanks in Baseline B is approximately 1,000 acre-ft per year, which is the same as in Baseline A. This is based on the assumption that septic tanks installed for new developments in the basin, will offset the number of existing septic tanks that are connected to the EVMWD sewer system by year 2020.

Lake Replenishment

Lake Elsinore replenishment is assumed to be accomplished with a combination of recycled water and groundwater when the lake level drops below elevation 1,240 ft MSL. Recycled water from the Regional WWTP would be used as the primary source of replenishment water up to 7.5 mgd (the current capacity of the plant less 0.5 mgd to Temescal Wash). The three Island wells would be used as the secondary source when the reclaimed water supply is not adequate to maintain the lake level at elevation 1,240 ft MSL. A summary of the lake replenishment requirements for Lake Elsinore is provided on **Figure 4-8** and in **Table 4-5**.

Figure 4-8
Summary of Lake Replenishment Requirements for Baseline B

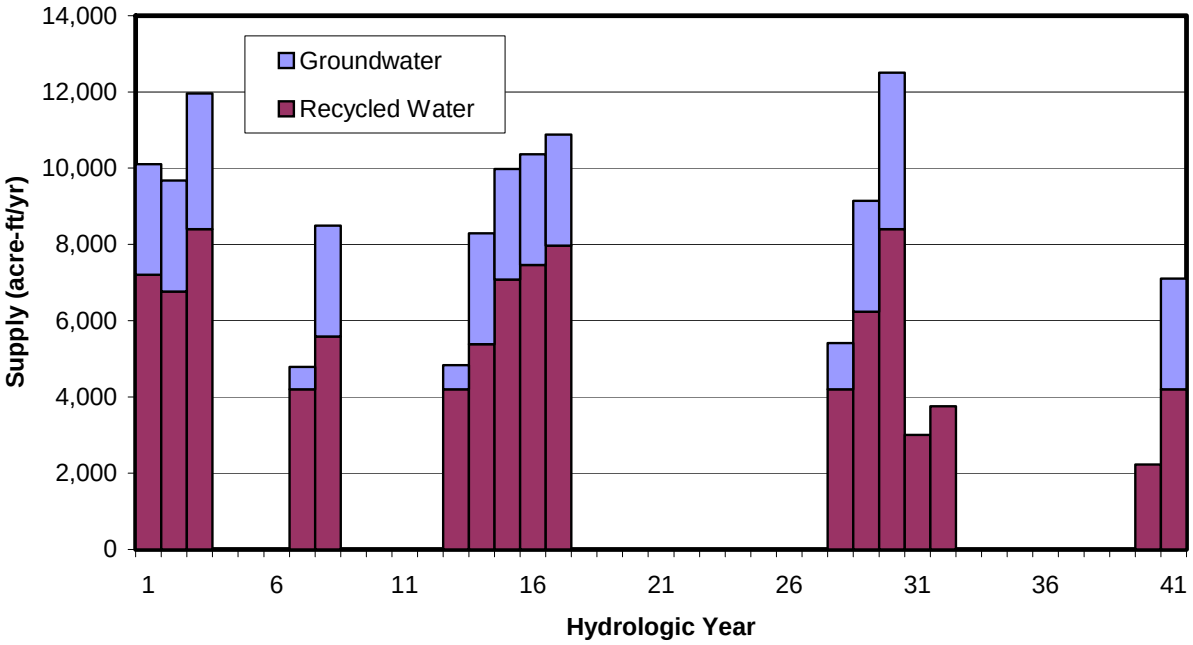


Table 4-5
Range of Lake Replenishment Requirements – Baseline B

Parameter	Year 2000 (acre-ft/yr)	Normal Year 2020 (acre-ft/yr)	Wet Year 2020 (acre-ft/yr)	Dry Year 2020 (acre-ft/yr)
Recycled Water from Regional WWTP				
Capacity (8 mgd)	9,000	9,000	9,000	9,000
Used for Lake Makeup	0	2,300	0	8,400
Groundwater	0	900 [1]	0 [2]	4,100 [3]
Total Used for Lake Makeup	0	3,200	0	12,500

1 – Normal year based upon average over 41 years
2 – Wet year based upon hydrologic year 1981
3 – Dry year based upon hydrologic year 1990, which had the highest lake demand.

As shown in **Table 4-5**, an average of about 3,200 acre-ft/yr is necessary to maintain Lake Elsinore at an elevation of 1240 feet MSL. As shown on **Figure 4-8**, lake makeup water is needed about 40 percent of the time. When required, about 70 percent of the makeup water is projected to come from recycled water from the Regional WWTP. No lake makeup water is necessary during wet years as local runoff is sufficient to maintain the lake level. Up to 12,500 acre-ft/yr of lake makeup would be required if conditions during water year 1990 were repeated. Because the highest lake demand (water year 1990) presented in **Table 4-5** is not coincident with the driest single year in the Elsinore Basin (water year 1961) presented in **Table 4-6**, the groundwater pumping in these tables differs.

A similar study performed by the LESJWA using the 1928 to 2000 hydrological period, with two years of very high runoff into the lake, estimated the make-up water needed to maintain the lake elevation at 1,240 ft was 13,800 acre-ft/yr (equal to evaporation at a 1,247 ft lake level less 1,400 acre-ft/yr of local runoff) in dry years. The study assumed that up to 7.5 mgd of recycled water from the Regional Plant and 5,000 acre-ft/yr of groundwater from the Island Wells were available for lake make-up on a long-term basis, with the remainder coming from Eastern MWD. This evaluation computed an average make-up water need of 6,911 acre-ft/yr and then adjusted that average to 8,000 acre-ft/yr, presumably based on the findings of the 1997 MWH study. Further discussion on these reports is presented in **Appendix F**.

Groundwater Balance

A summary of the groundwater balance under Baseline B is provided in **Table 4-6**. If groundwater conditions of Baseline B continued for the next 41 years, an average deficit of approximately 6,500 acre-ft/yr would occur. The annual basin balance is projected to range from a deficit of more than 12,100 acre-ft/yr in dry years similar to 1960-1 (which was the driest single year over the 41-year simulation) to a surplus of as much as 8,300 acre-ft/yr in wet years similar to 1980-1.

Table 4-6
Summary of Groundwater Balance – Baseline B

Parameter	Average (acre-ft/yr)	Wet Year [1] (acre-ft/yr)	Dry Year [1] (acre-ft/yr)
INFLOWS			
Infiltration of Precipitation			
Rural Areas	1,700	9,500	0
Urban Areas	700	4,000	0
Recharge from Surface Water			
San Jacinto River	1,200	4,000	0
Lake Elsinore	0	0	0
Return Flows			
Septic Systems	1,000	1,000	1,000
Applied Water	1,100	1,100	1,100
Subsurface Inflows	0	0	0
Total Inflows	**5,700**	**19,600**	**2,100**
OUTFLOWS			
Groundwater Pumpage	(11,300)	(11,300)	(11,300)
Pumping for Lake Replenishment	(900)	0 [1]	(2,900) [2]
Subsurface Outflow	0	0	0
Total Outflows	**(12,200)**	**(11,300)**	**(14,200)**
Net Surplus/(Deficit)	**(6,500)**	**8,300**	**(12,100)**

1 – Wet year is based upon hydrologic year 1981
2 – Dry year based upon hydrologic year 1961. This year differs from hydrologic period shown in Table 4-5. Therefore, data presented are different. See text for further discussion.

Figure 4-9 presents the projected cumulative groundwater balance for the Elsinore Basin under Baseline B for the 41-year simulation. This figure shows that the basin is projected to lose approximately 264,000 acre-ft of storage after 41 years (nearly 20 percent of the basin storage). Because inflows during this period are approximately equal to the long-term average for the basin, a deficit would indicate that the basin is not currently in balance and the projected 2020 conditions are not sustainable.

Water Levels

The predicted water levels in the Elsinore Basin for the conditions of Baseline B are presented on **Figure 4-10**. This figure shows that the water levels are declining throughout the basin. The decrease in water levels under Baseline B conditions is also greater than the decrease in water levels under Baseline A conditions. For example, water levels in the Corydon Street well are projected to drop more than 400 feet over the simulation period. Water levels in the north end of the lake near Lincoln Street well are projected to drop more than 200 feet. Declining water levels can lead to other detrimental effects such as land subsidence, increased pumping costs, loss of production capacity and water quality degradation.

Figure 4-9
Projected Cumulative Groundwater Balance - Baselines A and B

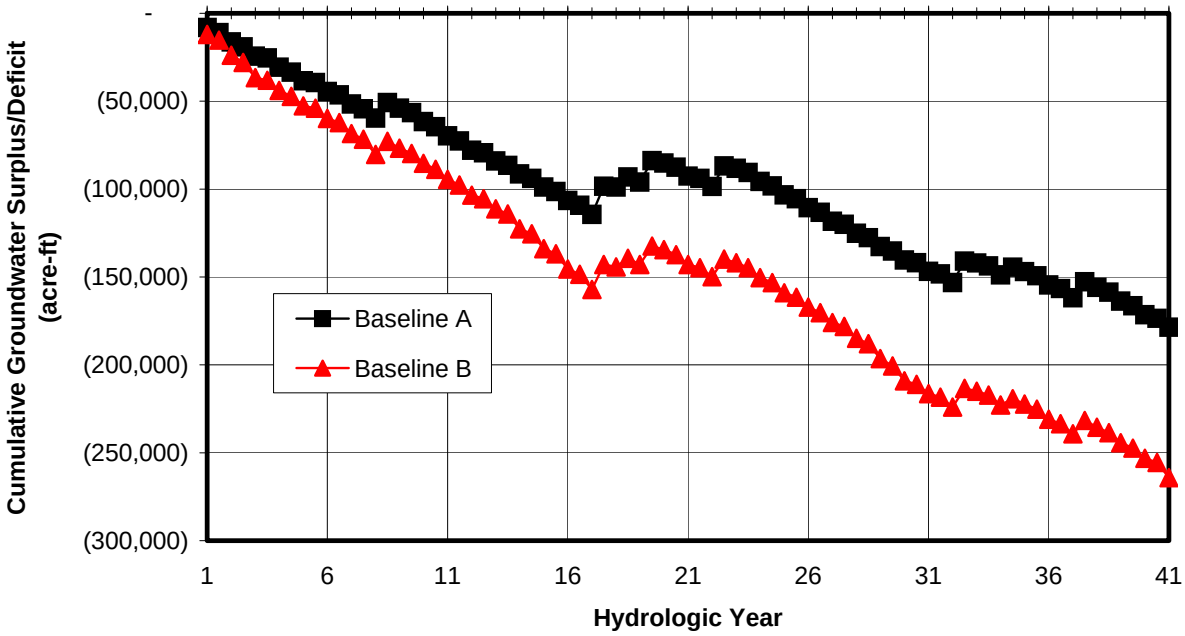
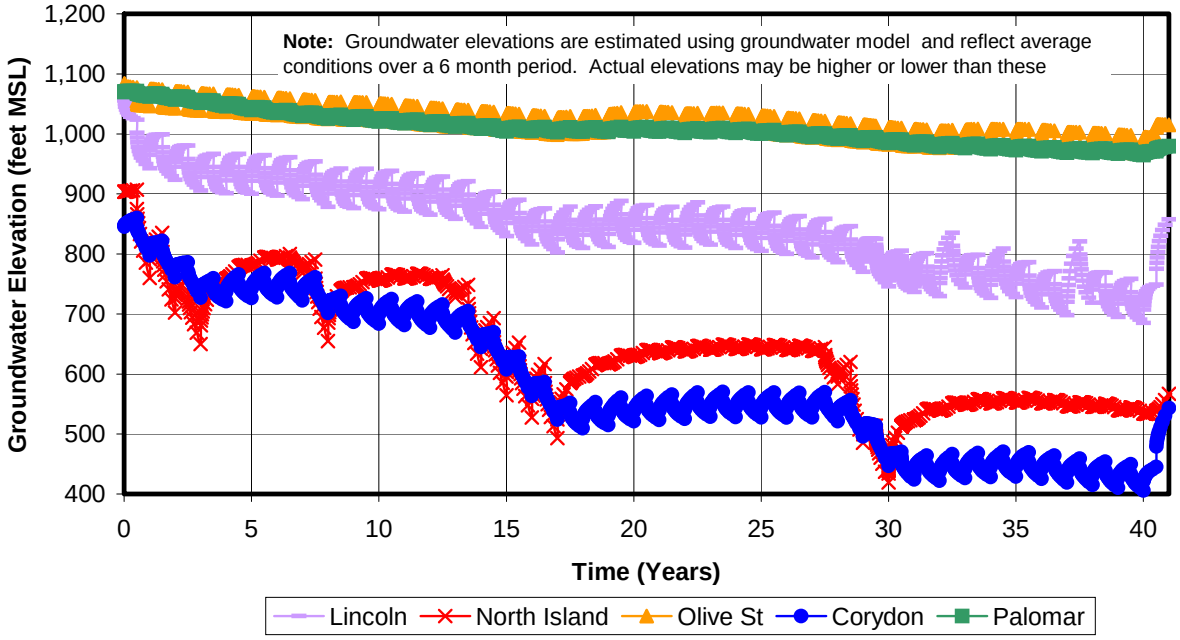


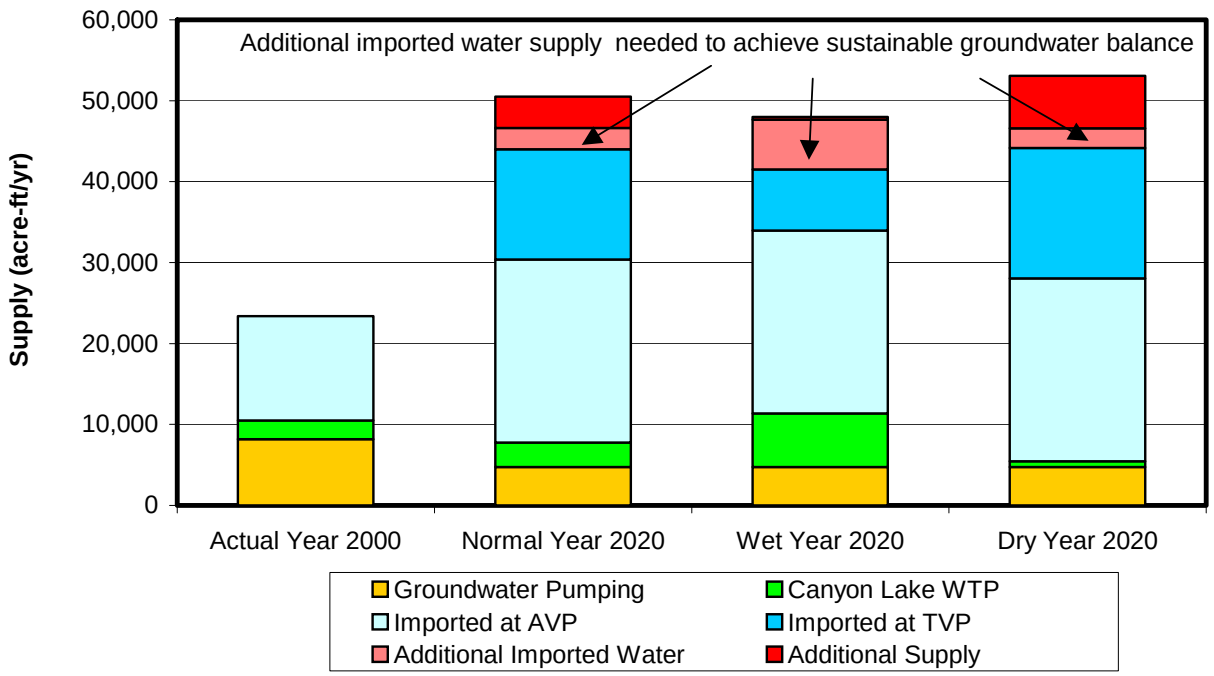
Figure 4-10
Projected Water Levels of Baseline B – Future Conditions



As discussed above, the projected average long-term deficit in the basin is approximately 6,500 acre-ft/yr, assuming the groundwater pumping continues at the current rate as well as the planned addition of Joy Street Well. The future sustainable yield of the basin is projected to be about 5,700 acre-ft/yr (slightly higher than under current conditions because of increased applied water returns). To maintain a sustainable yield, groundwater pumping needs to be reduced by 6,500 acre-ft/yr, which would need to be replaced with additional imported water or other water supply.

This situation is presented graphically on **Figure 4-11**. This figure shows that to maintain a sustainable balance, additional supplies will be needed in the summer months in all years to maintain a sustainable yield assuming that groundwater pumping is reduced evenly throughout the year by 42 percent. This figure shows that from 300 acre-ft/yr to 6,500 acre-ft/yr of new supply (shown in red) would be required to meet the projected year 2020 demands.

Figure 4-11
Supply Mix to Meet Year 2020 Demands
with Sustainable Groundwater Balance– Baseline B



NEED FOR MANAGEMENT PLAN

As illustrated with the water balance in **Section 2** and the projected water levels of Baseline A, the conditions of the Elsinore Basin indicate that the groundwater basin may be in a state of overdraft. A continuation of the current conditions to year 2020 will result in an increased overdraft as illustrated with the decreasing water levels in Baseline B. Water quality degradation and increased risk of land subsidence are two of the related adverse impacts of these declining water levels. Estimates of total volume of water in storage range from 1.45 million acre-ft (Fox,

1999) to 1.8 million acre-ft (DWR, 1981). Without the project in 2020 (Baseline B), the basin would lose nearly 20 percent of its storage on a long-term basis. The impacts of this lost storage include:

- Water quality degradation as poor quality water migrates downward throughout the basin
- Increased risk of land subsidence that may result in damage of infrastructure
- Aquifer subsidence that may result in permanent reduced yield and storage capacities
- Reduced well pumping capacities due to shorter wetted screen intervals
- Increased cost of potable water for EVMWD's customers
- Reduced supply reliability in prolonged drought periods or emergencies such as earthquakes.
- Loss of habitat in wetlands and reduction of recreation industry if water for lake replenishment is not available.

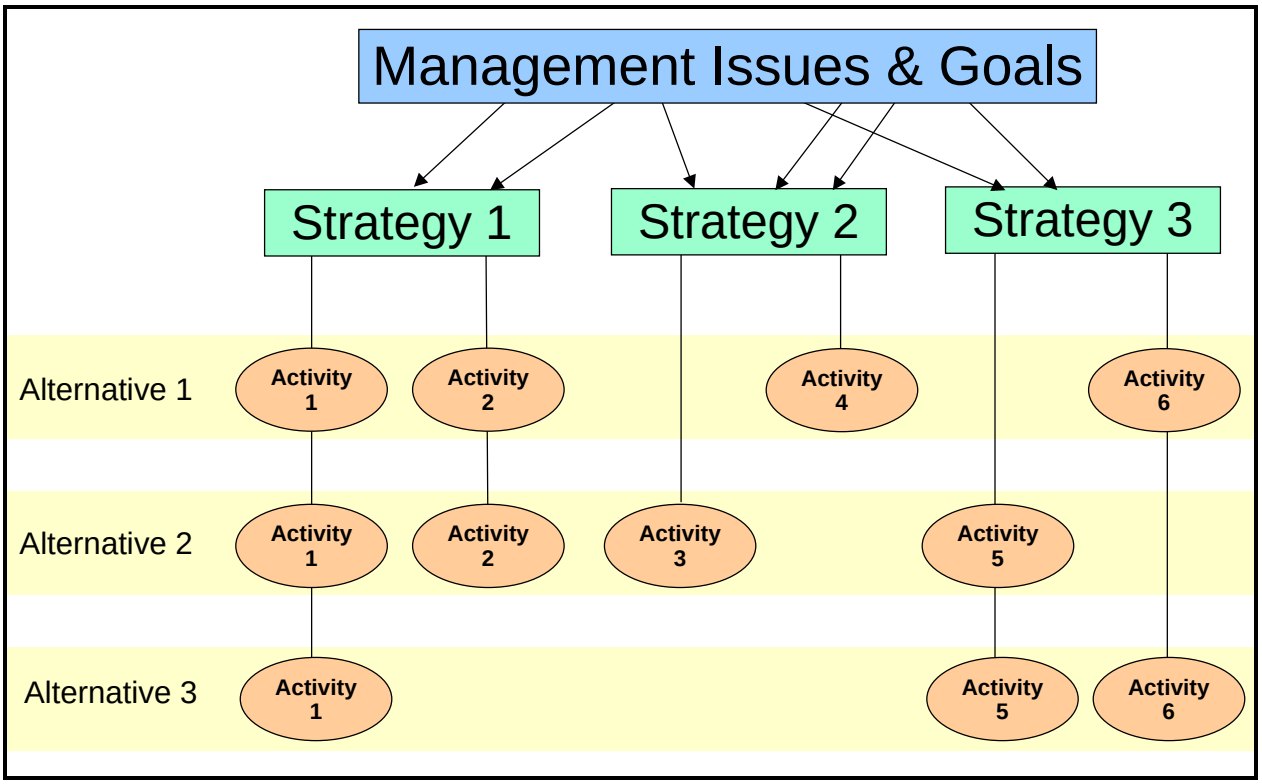
As a result, it is imperative that the District develop a GWMP that will resolve the overdraft problem and protect the groundwater supply for use by future generations. To develop a comprehensive groundwater management plan that incorporates all the management issues of the Elsinore Basin, a complete inventory of management issues is needed. The inventory of management issues is discussed in the following section.

Section 5
Management Issues and Strategies

INTRODUCTION

This section describes the development of groundwater management alternatives that will be evaluated in the GWMP. To define the management alternatives, a three-step process is followed as presented on **Figure 5-1**.

Figure 5-1
Process to Define Management Alternatives



First, an inventory of the groundwater basin management issues is prepared, which are then translated into management goals. To address these management issues, various general management strategies are defined (e.g. surface spreading or water conservation). For each management strategy, one or more specific activities are defined that can be implemented in the Elsinore Basin. For example, for the strategy "Surface Spreading," activities may include spreading basins in Leach Canyon or McVicker Canyon. Finally, a total of four management alternatives are defined by creating unique combinations of multiple activities. The description of these alternatives is presented in Section 6.

GROUNDWATER MANAGEMENT ISSUES

The Groundwater Management Act (California Water Code, Part 2.75, §10753), also known as AB 3030 (1992) and amended by SB 1938 (2002), provides the authority to prepare groundwater management plans. Section 10753.8 identifies twelve specific components or issues that may be included in a groundwater management plan. Groundwater management plans developed with these components permit local agencies to adopt programs to manage groundwater and serve as guidelines for this groundwater management plan.

An AB 3030 groundwater management plan may include the following:

- Control of saline water intrusion
- Identification and management of wellhead protection areas and recharge areas
- Regulation of the migration of contaminated groundwater
- Identification of well construction policies
- Administration of a well abandonment and well destruction program
- Construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling and extraction projects
- Review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination
- Mitigation of conditions of overdraft
- Replenishment of groundwater extracted by water producers
- Monitoring of groundwater levels and storage
- Facilitating conjunctive use operations
- Development of relationships with state and federal regulatory agencies

In addition to the twelve components defined under AB 3030, the conditions of the Elsinore Basin and EVMWD's water supply are evaluated to identify other specific management issues for both existing and anticipated future conditions. Additional management issues that are related to the existing basin conditions include:

- Meeting current and future drinking water quality regulations for EVMWD's potable wells
- The increased dependence on imported water supplies due to the doubling of water demands in the next 20 years
- The increased use of groundwater for groundwater and Lake replenishment requirements
- The potential impact of groundwater management activities on hot spring wells
- Risk of liquefaction and subsidence

A detailed description and the assessment of the issues listed in the AB 3030 requirements, and the existing and future potential issues (17 in total) are given below. A summary table is also provided in **Appendix G**.

AB 3030 Issues and Components

The following section describes the issues and components identified under §10753.8 of the Water Code that may be included in a groundwater management plan. The format for this discussion follows the potential management issues described in **Table 5-1**.

1. Saline Water Intrusion

One of the components identified by AB 3030 is the control of saline water intrusion. Saline water intrusion includes the following:

- Increase in salt content dissolved from earth materials
- Lateral or upward migration of saline water
- Downward seepage of sewage, agricultural, or industrial waste
- Downward seepage of mineralized surface water
- Interzonal or inter-aquifer migration of saline water
- Sea water intrusion

Although Lake Elsinore water has a higher salt concentration than the underlying groundwater, the lake is not considered as a potential source of downward seepage of saline water because the lake bottom sediments and underlying clay layers prevent migration of the lake water into the groundwater system. Three wells (known as the Island wells) were installed in the 1960s in the southern region of the lake to pump groundwater to the lake to maintain the water levels in the lake during times of low natural inflow. The Middle Island well has a leak in the well casing, which may have allowed higher TDS water to migrate from the alluvium into the underlying Fernando Group. EVMWD is currently repairing this well to prevent future contamination.

The Elsinore Basin is located more than 50 miles from the ocean. Therefore, seawater intrusion is not considered a threat. Based upon recent groundwater quality data, the remainder of the basin is not characterized by saline water and therefore, saline water intrusion is not a significant issue for the Elsinore Basin. Other water quality issues are discussed below.

2. Wellhead Protection

The identification and management of wellhead protection areas and recharge areas is another component that is recommended to be evaluated under the AB 3030 requirements. On behalf of EVMWD, Kennedy/Jenks Consultants prepared a Drinking Water Source Assessment and Protection Plan in March 2002. The plan included an evaluation of EVMWD's eight groundwater wells and possible contamination activities located within 2-, 5-, and 10-year fixed radii from these wells. For example, a 10-year radius is the distance from a well that groundwater travels in a 10-year period.

Table 5-1
List of Potential Management Issues

Issue Number	AB 3030 & SB 1938	Description	Applicability to Elsinore Basin
AB 3030/SB 1938 Issues			
1	Yes	Control of saline water intrusion	Not Significant
2	Yes	Identification and management of wellhead protection areas and recharge areas	Existing
3	Yes	Regulation of the migration of contaminated groundwater	Existing
4	Yes	Identification of well construction policies	Existing
5	Yes	The administration of a well abandonment and well destruction program	Existing
6	Yes	Construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling and extraction projects	Existing
7	Yes	Review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination	Existing
8	Yes	Mitigation of conditions of overdraft (water balance, water levels, and land subsidence)	Existing
9	Yes	Replenishment of groundwater extracted by water producers	Existing
10	Yes	Monitoring of groundwater production, levels, storage and water quality	Existing
11	Yes	Facilitating conjunctive use operations	Existing

Table 5-1 (continued)
List of Potential Management Issues

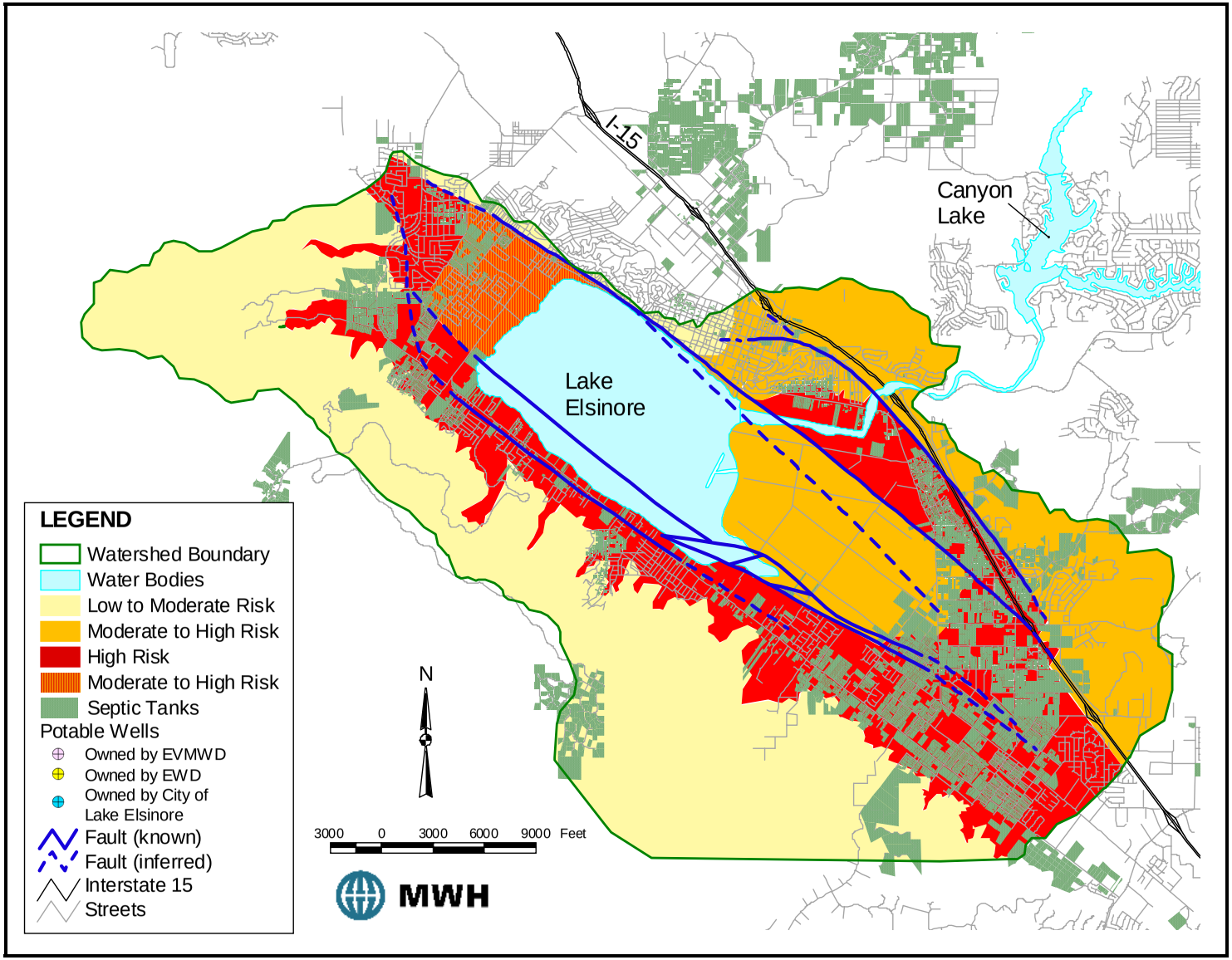
Issue Number	AB 3030 & SB 1938	Description	Applicability to Elsinore Basin
12	Yes	Development of relationships with state and federal regulatory agencies	Existing
Other Management Issues			
1	No	Compliance with drinking water quality regulations and Basin Plan Objectives	Existing
2	No	The increased dependence on imported water supplies due to the doubling of water demands in the next 20 years	Existing
3	No	The increased need for groundwater due to lake replenishment requirements	Existing
4	No	The potential impact of groundwater management activities on hot spring wells	Not Significant
5	No	Risk of liquefaction	Future

3. Migration of Contaminated Groundwater

The downward seepage of sewage, agricultural, or industrial waste is a potential source of groundwater contamination. The EVMWD service area includes residential and industrial land uses. Agricultural land use has greatly diminished in the last ten years and is currently limited to residential parcels. However, in some areas (e.g. the north end of the lake) where historical agricultural land use was present, there is a potential for downward migration of high TDS and sulfate groundwater. In areas with close proximity to septic tanks, downward migration of nitrate occurs.

In addition, approximately 3,900 parcels in the City of Lake Elsinore and surrounding areas have septic systems that are still in use (see **Figure 5-2).** Risk zones associated with septic tank locations relative to groundwater supply are presented below.

Figure 5-2
Septic Tank Risk Zones



Generally, the level of risk is related to existing or potential future groundwater supply development and recharge potential. The categories and the basis for their selection are as follows:

- **Areas of Low to Moderate Risk:** These areas generally consist of bedrock. There is little or no potential for the development of groundwater supply projects in these areas.
- **Areas of Moderate to High Risk:** These are areas where there are existing groundwater supply facilities or the potential for the development of future groundwater supply. However, the clay content is higher in the shallow sediments, which provides limited separation between septic tank effluent and the deeper water supply aquifers.
- **Areas of High Risk:** These are areas where there are existing groundwater supply facilities or the potential for future groundwater supply development. Based on the location relative to the basin boundaries, and the lack of fine-grained sediments in the shallow sediments, these areas are where most of the aquifer recharge occurs and are the most vulnerable to contamination.

One of the eight EVMWD wells (Palomar) and two of EWD's wells (Wood and Sanders) are currently located in high risk zones. As discussed in Section 2, the Palomar well has experienced an increase in nitrate concentrations (an indicator parameter for contamination from septic tanks or previous agricultural use) over the past 15 years. If nitrate concentrations in this well continue to increase, it is possible that it could exceed the MCL of 45 mg/L in the near future. Sufficient data are not available to evaluate the nitrate concentrations in the Wood and Sanders wells. Although concentrations are currently below the nitrate MCL of 45 mg/L in these wells, nitrate presents an issue for groundwater quality in portions of the basin.

An additional concern for contamination is from leaky underground storage tanks (LUSTs) discharging petroleum products, solvents or other organic constituents. In particular, the gasoline oxygenate MTBE (methyl tertiary-butyl ether) has become a major problem throughout California. Thirty-five cases of LUSTs have been reported to the RWQCB (RWQCB, 2003). Cleanups are currently underway or completed for these locations. According to the RWQCB, MTBE has been detected in the groundwater as a result of LUSTs in four locations throughout the Elsinore Basin since 1998. Based upon recent groundwater production well quality data, no District or EWD well has had detections of MTBE or other organic compounds attributed to these LUSTs.

4. Well Construction Policies

Because improperly constructed wells can impact water quality, proactive policies to ensure proper construction are an important aspect of the GWMP. Well construction policies are addressed later in this document under Groundwater Management Strategies and Activities.

5. Well Abandonment and Destruction

Improperly abandoned or uncapped wells can provide a vertical conduit for surface contaminants into the groundwater. Therefore, proactive involvement by EVMWD is necessary to help promote groundwater protection practices. Well abandonment policies are addressed later in this document under Groundwater Management Strategies and Activities.

6. Construction of Groundwater Projects

One of the AB 3030 requirements is to evaluate the impact of the construction and operation of various projects on the groundwater basin water quality and quantity. Projects mentioned include:

- Groundwater contamination cleanup projects (discussed above)
- Groundwater storage projects
- Groundwater recharge projects
- Groundwater extraction projects
- Water conservation projects
- Water recycling projects

Groundwater Storage Projects

One of the main objectives of the GWMP is to evaluate the possibilities of groundwater storage to provide additional water supplies in dry periods and thereby improving water supply reliability. Groundwater storage and recovery may result in greater fluctuations of water levels and a potential change in water quality in the aquifers used for storage. Water level changes may lead to a risk of subsidence or liquefaction.

Groundwater Recharge and Extraction Projects

For groundwater recharge, surface recharge, direct injection and in-lieu recharge are considered and evaluated in this GWMP. To identify potential surface recharge locations, EVMWD is conducted a study to evaluate the feasibility of surface recharge in the Elsinore Basin. In addition, EVMWD completed the BBIPP to assess the benefits of injecting imported water in the underlying aquifers in the Back Basin area. Both projects provided EVMWD with additional information on potential technical and management issues with regards to these activities.

Water Conservation Projects

Water conservation is an approach to reduce potable water demands, and thereby providing part of the solution for the projected water supply deficit. Many water conservation methods such as low flow toilets, water saving clothes washers and low flow showerheads, do not significantly impact the groundwater basin because water conservation will reduce the demand for imported water, while pumping will remain essentially constant. However, conservation focused on a reduction of irrigation water use may result in reduced infiltration that replenishes the groundwater basin. Therefore, a portion of the conserved water may not return to the basin and must be considered when evaluating water conservation programs.

Water Recycling Projects

EVMWD conducted a pilot study that evaluates the effect of discharging recycled water to Lake Elsinore on water quality with the ultimate intent of obtaining a National Pollutant Discharge Elimination System (NPDES) permit. This pilot study was completed in February 2004. The use of recycled water to maintain the lake level was approved by the Regional Board in March

2005. Increased recycled water use will reduce the amount of groundwater that will need to be pumped from the groundwater basin into the lake. The amount of wastewater effluent available for lake augmentation depends on the waste discharge requirements, the required minimum discharge to Temescal Wash, future demand for non-potable water and availability of recycled water from EMWD. In addition, recycled water may also be used for landscape irrigation, which may increase the salt concentration within the groundwater basin. The current regional treatment capacity is 8 mgd, which is planned to be expanded 20 mgd by year 2020.

7. Impact of Land Use Plans on Groundwater Contamination

Land use plans were obtained during the preparation stages of the Distribution System Master Plan (MWH, 2002). EVMWD will continue to interact with planning agencies, including the City of Lake Elsinore and Riverside County to obtain land use plans, track future developments and identify potential water quality impacts on the groundwater basin, as well as determine future utility service needs.

8. Mitigation of Overdraft Conditions

The contemporary definition of *overdraft* incorporates an evaluation of the consequences of extracting more groundwater from a basin than is returned. The *perennial yield* of a groundwater basin defines the rate at which water can be withdrawn perennially under specific operating conditions without producing an undesired result (e.g., water quality degradation, land subsidence, or declining water levels). Any production in excess of perennial yield is regarded as overdraft. The existence of overdraft implies that continuation of current water management practices will result in significant adverse impacts on environmental, social or economic conditions (Todd, 1980; American Society of Civil Engineers, 1987).

Groundwater Balance and Water Levels

A groundwater balance, which accounts for the inflows and outflows in the basin, illustrates the extent of groundwater overdraft. From 1990 through 2000, the average annual groundwater storage decreased by about 1,800 acre-ft/yr (as discussed in Section 2). It should be noted that this period was wetter than the historical average and, as such, may underestimate the actual deficit in the basin. In addition, water levels in some wells in the south portion of the basin declined more than 200 feet from 1990 to 2000. Groundwater levels remained fairly constant in the northern part of the basin where most of the recharge occurs.

As discussed in Section 4, the projected future groundwater balance indicates continued decline in water levels and continued overdraft conditions in the basin if current groundwater activities are continued. The average groundwater deficit is projected to be about 4,400 acre-ft/yr if existing conditions (Baseline A) continue and more than 6,500 acre-ft/yr with projected increases in groundwater use (Baseline B). Because of the negative groundwater balance and declining water levels, the sustainability of this condition is a significant issue for this GWMP.

Risk for Land Subsidence

Land subsidence is the lowering of the ground surface due to groundwater withdrawal or seismic activity. Seismic-induced movements may cause subsidence on the depressed side of a fault, or relatively small-scale subsidence can also occur when dry soils are saturated with water due to seismic activity. Groundwater withdrawal is the most likely mechanism or cause for land subsidence in the Elsinore Basin. Groundwater withdrawal causes the sediments of the aquifer to consolidate. The amount of consolidation depends upon the thickness and hydrogeologic character of the aquifer, as well as the rate and amount of decrease in the water level. Fine-grained sediments (clays), such as those composing the aquitard that separates the alluvium and the Fernando Group, are more susceptible to consolidation and subsidence than coarse-grained sediments (sands and gravels) when groundwater is removed from them. However, the low permeability and high specific storage of fine-grained sediments cause consolidation to occur slowly, over a period of several years, rather than as an instantaneous response to water level decline. Therefore, a short-term impact might be difficult to detect and subsidence may occur years after the water level had declined. However, once the consolidation occurs, consolidation of fine-grained sediments is permanent, due to a permanent rearrangement of soil particles. This results in a permanent loss of groundwater storage capacity and causes permanent land subsidence.

Uneven depression of the land surface is the major indication of vertical consolidation due to surface subsidence. Land subsidence due to vertical consolidation usually is not uniform, possibly due to differences in the underlying sediments. The resulting damage can include:

- Visible cracks, fissures, or surface depressions
- Damage to structures, such as canals, utilities, roads, and buildings
- Damage and loss in effectiveness of the subsurface agricultural drainage system
- Disruption of surface drainage and irrigation systems
- Loss of vertical elevation

In addition to vertical consolidation, regional and local horizontal ground movements can occur due to large amounts of localized groundwater extraction. The horizontal movements can ultimately result in inelastic failures at the ground surface that appear as surface fissures. Surface fissures can damage structures, interrupt irrigation of agriculture, capture runoff and can become direct conduits for poor quality water to enter the aquifer. The risk of subsidence is a potential issue for EVMWD as water levels have been decreasing over the past ten years and the use of groundwater is projected to increase in the future.

9. Replenishment of Extracted Groundwater

As discussed in the water budget of Section 4, average annual inflow to the Elsinore Basin totals approximately 5,700 acre-ft/yr based upon a repeat of the 1961-2001 hydrology under 2020 demand conditions. In the northwest portion of the basin, the inflow over the past ten years has been in approximate balance with the outflows. However, the water levels in the southern part of the basin have been declining, which suggests that the replenishment has been lower than the

groundwater extraction. Maintaining water levels within an acceptable range is an objective of the GWMP and is incorporated in the groundwater management strategies.

Infiltrating precipitation in open and urban areas contributes approximately 2,400 acre-ft/yr, which is about 40 percent of the total inflow to the basin. Urbanization results in a loss permeable land surface, which leads to more runoff and less infiltration. It is estimated that the increased urbanization around the lake will diminish groundwater recharge due to infiltration of runoff from 900 to 700 acre-ft/yr between the present and year 2020. Due to this relatively small amount, the effect of reduced recharge is not considered a significant issue for the GWMP.

10. Monitoring of Groundwater Production, Levels, Storage, and Water Quality

EVMWD and EWD currently record the production and water levels from their existing wells monthly. In addition, water quality samples are collected on an annual basis. The basin contains more than 200 wells, most of which are operated by private well owners. Groundwater pumpers extracting more than 25 acre-ft on an annual basis are required to file their production with the SWRCB per California Water Code §4999 *et seq*. However, this reporting is not comprehensive and, for most producers, occurs on an irregular basis. Additional information is necessary to better identify areas of potential concern. Data currently available are discussed in more detail in Section 2.

An understanding of the water quality throughout the basin is also an important aspect of groundwater management. Water quality information is required to evaluate the existing basin conditions and the compatibility with imported water supplies, as well as to monitor the changes in water quality as a result of the proposed groundwater management activities such as surface infiltration and direct injection of imported water. The Groundwater Monitoring Plan (MWH, 2003) has specified the recommended parameters, locations and frequency for water quality and water level monitoring.

11. Facilitating Conjunctive Use Operations

Conjunctive use is the practice of storing surface water in a groundwater basin in wet periods and withdrawing it from the basin in dry periods. The goal of conjunctive use is to improve water supply reliability. Conjunctive use will be part of all management strategies, and is discussed in more detail in Section 6.

12. Develop Relationships with Regulatory Agencies

Early participation of agencies and stakeholders will provide the opportunity to include their concerns in the GWMP and is important to avoid any unanticipated issues and ease the implementation process. Stakeholders and regulatory agencies have been invited to participate in the GWMP development process via the formal stakeholder meetings. Continued involvement will be necessary.

Other Management Issues

In addition to those issues addressed in AB 3030, there are other groundwater management issues or components that are considered in this GWMP.

1. Compliance with Drinking Water Quality Regulations and Basin Plan Objectives

Existing areas of concern relative to drinking water quality regulations and the Basin Plan Objectives in the Elsinore Basin include:

- Concentrations of TDS have exceeded the DHS-recommended secondary standard of 500 mg/L in the Lincoln Street Well and Cereal 4 Well.
- Concentrations of nitrate and sulfate, although higher in some locations, have not exceeded applicable standards in any EVMWD well.
- Concentrations of arsenic are below the current MCL of 50 μg/L, however, they have exceeded the new (effective 2006) arsenic MCL of 10 μg/L in the Back Basin wells (Cereal 1, Cereal 3, Cereal 4 and Corydon Street).
- Highest concentrations of arsenic are found in deeper wells such as Cereal 1, Cereal 3 and Cereal 4.

According to EVMWD staff, the Olive Street well is not currently in production because of elevated bacterial levels. These elevated levels may be caused by a variety of environmental conditions including the influence of septic tanks and surface water and/or operating conditions such as vegetable oil leakage within the pump. Because the elevated bacteria levels are not associated with a corresponding increase in nitrate concentrations or other nutrients, it is unlikely to be caused by septic tanks alone. Further investigation will be required to address this issue.

Future use of EVMWD wells will depend upon the active management of water quality with respect to TDS, nitrate, arsenic and bacteria. Blending options may need to be addressed. As discussed previously, the future risk of contamination from septic tanks and LUSTs should also be considered.

Table 5-2 summarizes the specific water quality objectives set for the Elsinore Basin by the RWQCB (1995). The water quality objectives of the Basin Plan are more stringent that the Title 22 drinking water regulations. It should be noted that Regional Board recently revised the Basin Plan objectives. The revised limits the Basin Plan objectives to two parameters, TDS and nitrate (as N) with maximum concentration of 480 mg/L and 1 mg/L, respectively. These revisions were adopted in December 2004. Future groundwater management activities will need to be consistent with these revised objectives and regulations. With current TDS concentrations of about 550 mg/L in the upper aquifer, this parameter is a groundwater management concern, as TDS concentrations tend to increase over time due to continuous addition of salt through natural recharge, septic tank infiltration, injection of imported water, or surface spreading of imported water.

Table 5-2
Specific Water Quality Objectives for Elsinore Basin

Constituent	Units	Basin Objective	Drinking Water Standards
Elsinore Basin			
Total Dissolved Solids	mg/L	450[1], 480[2]	500[3]
Hardness	mg/L	260[1]	NS
Sodium	mg/L	50[1]	NS
Chloride	mg/L	60[1]	250[3]
Sulfate	mg/L	60[1]	250[3]
Nitrate (as N)	mg/L	4[1],1[2]	10
San Jacinto River – Reach 1			
Total Dissolved Solids	mg/L	450	500[3]
Hardness	mg/L	260	NS
Sodium	mg/L	50	NS
Chloride	mg/L	65	250[3]
Sulfate	mg/L	60	250[3]
Total Inorganic Nitrogen	mg/L	3	NS
COD	mg/L	15	NS
Lake Elsinore			
Total Dissolved Solids	mg/L	2,000	500[3]
Total Inorganic Nitrogen	mg/L	1.5	NS
Canyon Lake			
Total Dissolved Solids	mg/L	700	500[3]
Hardness	mg/L	325	NS
Sodium	mg/L	100	NS
Chloride	mg/L	90	250[3]
Total Inorganic Nitrogen	mg/L	8	NS
Sulfate	mg/L	290	250[3]

Source: Regional Board, 1995 and 2004
1 – Previous Basin Plan Objective for Elsinore Basin (RWQCB, 1995) revised or eliminated in 2004.
2 – Revised Basin Plan Objective for Elsinore Basin (RWQCB, 2004)
3 – Recommended Secondary Maximum Contaminant Level (MCL) of California
NS = No standard

2. Doubling of Water Demand in the Next 20 Years

As discussed in Section 1, water demands in the Elsinore Basin are projected to more than double by 2020. The increasing water demands in EVMWD's water service area result in the need for additional water supplies by 2020. This issue is one of the driving forces behind the GWMP.

With the potable water demands doubling over the next 20 years and limited groundwater resources, the reliance on imported water will increase. Based on the water source allocation of the Distribution System Master Plan (MWH, 2002), imported water will be 80 percent of the water supply in year 2020. As the need for imported water increases throughout Southern California, the reliability of this source is critical for EVMWD's water supply.

3. Lake Replenishment Requirements

As discussed previously, the target minimum level for Lake Elsinore is 1,240 feet MSL. To maintain this level, the volume of additional water required from either groundwater or required for lake augmentation varies from zero to more than 12,500 acre-ft/yr in dry years. A more detailed analysis is included in **Appendix F**.

Replenishment water can be obtained from groundwater, recycled water or untreated imported water. EVMWD conducted a pilot study to evaluate the effect of discharging recycled water on the lake's water quality. Untreated imported water is costly, but may be more economical than groundwater. When groundwater is used for lake augmentation, groundwater overdraft increases. To prevent the overdraft impacts, additional imported water is necessary for groundwater replenishment or to meet demands. Therefore, the use of groundwater for lake replenishment results in the purchase of more treated imported water to meet potable water demands and may be less cost-effective than using other sources of water for lake replenishment.

4. Impact of Future Basin Operations on Hot Springs

Through discussions with stakeholders in the basin, the impact of the GWMP on local hot springs is identified as a potential issue in the basin. Within the EVMWD service area, wells with hot water are located along the outflow channel from Lake Elsinore to Silver Street. The heated water associated with the faulting in the area rises to shallow depths near downtown Lake Elsinore north of the Glen Ivy fault. Because the Glen Ivy fault appears to be a barrier to flow at this location, activities in the Elsinore Basin are not anticipated to influence the hot spring operations.

5. Risk of Liquefaction

Liquefaction is a process by which sediments below the water table temporarily lose strength and behave as a liquid rather than a solid. In the liquefied condition, soil may deform enough to cause damage to buildings and other structures. Seismic shaking is the most common cause of liquefaction. Liquefaction occurs in sands and silts in areas with high groundwater levels. Liquefaction has been most abundant in areas where groundwater occurs within 30 feet of the ground surface; few instances of liquefaction have occurred in areas with groundwater deeper

than 60 feet (EERI, 1999). Dense soils, including well-compacted fills, have low susceptibility to liquefaction (EERI, 1999).

The risk for liquefaction in the Elsinore Basin is the highest in areas where groundwater levels in the alluvium are shallow. This primarily occurs in the Back Basin area but may also occur in other locations if water levels were to rise to within 30 feet of the ground surface. Storing groundwater in the basin that results in higher groundwater levels may increase the risk of liquefaction. The GWMP needs to establish the maximum water levels to minimize the risk of liquefaction.

GROUNDWATER MANAGEMENT STRATEGIES AND ACTIVITIES

A groundwater management strategy is a general approach that addresses one or more of the management issues. The strategies identified are:

- Store imported water by using dual purpose wells
- Increase local supplies by using spreading basins
- Store imported water by using spreading basins
- Save groundwater for dry years by using in-lieu recharge
- Develop new sources of supply
- Reduce supply needs through water conservation
- Measure progress through basin monitoring
- Stakeholder involvement
- Protect groundwater quality by developing programs and policies

The management activities are presented per strategy in **Table 5-3**, which also includes the source(s) of water considered for each activity. These strategies and corresponding activities are explained below.

Dual Purpose Wells

Dual purpose wells are wells that can both inject water into and extract water from the aquifer. Depending on the difference between the distribution system and the aquifer pressures, water can either flow by gravity into the aquifer or needs to be pumped during injection cycles. Wells can be used to inject water in periods when imported water may be available in large amounts or at lower cost. During dry periods, when less imported water may be available or the cost of imported water is high, the wells can be used to extract the stored water from the aquifer.

The design of injection wells is similar to that of a water supply well. Because water is injected directly into the aquifer, this method bypasses the unsaturated zone and any intervening low permeability layers and eliminates evaporation losses. Therefore, injection wells are advantageous in regions where shallow clay layers are present that prevent good infiltration. However, because water is injected directly into a drinking water aquifer, water used for injection needs to meet drinking water regulations prior to injection as specified under CFR 144.12a (EPA, 1999). Therefore, the only water sources available for injection are treated imported water from MWDSC and water from the Canyon Lake WTP.

Possible Locations

Locations considered for dual purpose wells, which are provided on **Figure 5-3,** include:

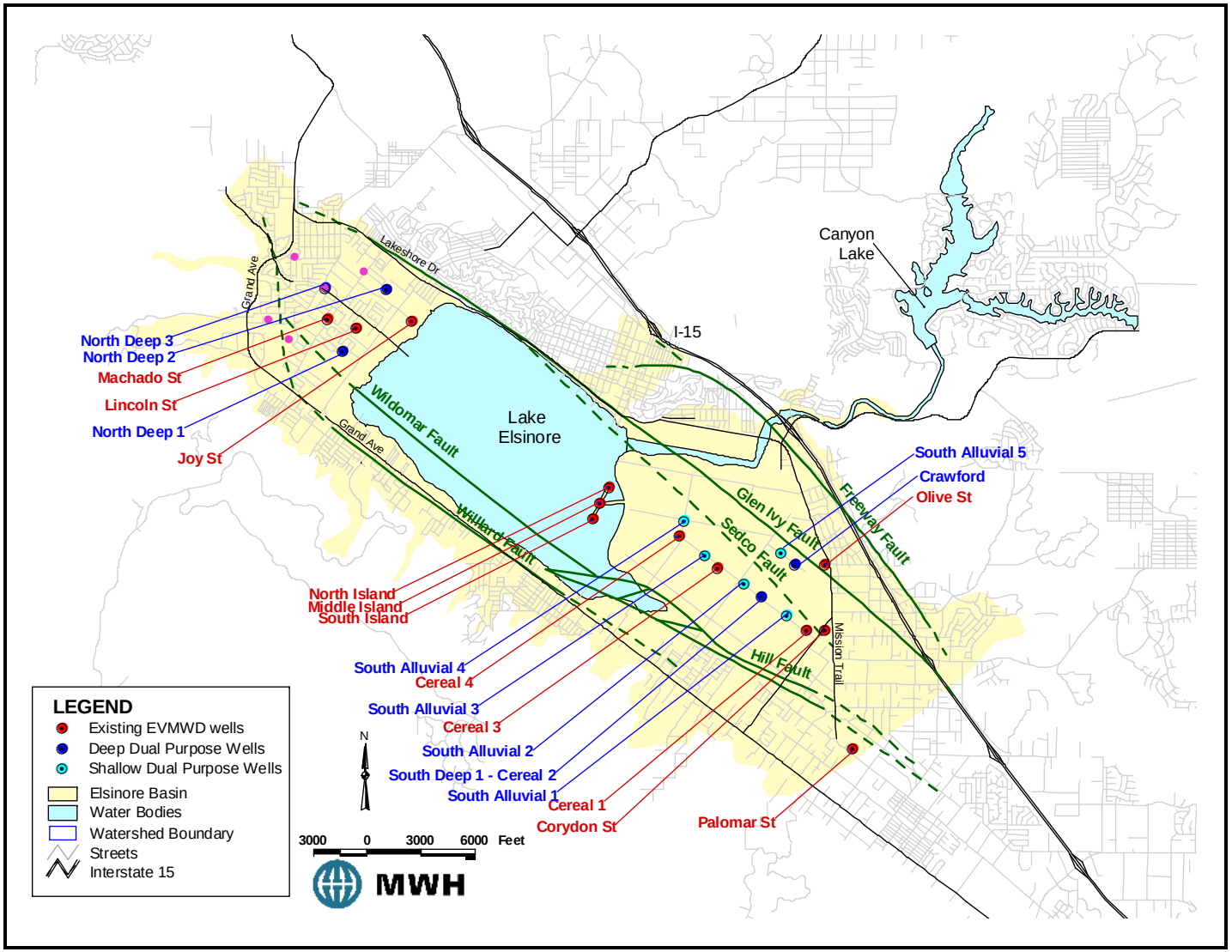
- North of the lake between Lakeshore Drive and Grand Avenue and
- South of the lake within the Back Basin

Table 5-3
Management Activities and Water Sources Considered

Strategy	Activity	Existing Sources			New Sources		
		Imported Water from TVP[1]	Imported Water from AVP[2]	Canyon Lake WTP[3]	Recycled water from RWWTP[4] or EMWD[5]	Imported Water from SJRT[6]	Sewering of Septic Tanks
Store imported water by using dual purpose wells	Dual purpose wells north of the Lake	X	X	X	-	-	-
	Dual purpose wells south of the Lake	X	X	X	-	-	-
Increase local supplies and store imported water by using surface spreading basins	Spreading basins in McVicker Canyon	X	X	-	X	X	X
	Spreading basins in Leach Canyon	X	X	-	X	X	X
	Surface recharge in Railroad Canyon	-	-	-	-	X	-
Save groundwater for dry years by using in-lieu recharge	In-lieu recharge with imported water	X	X	-	-	-	-
	In-lieu recharge with Canyon Lake WTP water	-	-	X	-	-	-
Other Strategies • Develop new sources of supply • Reduce supply needs through water conservation • Measure progress through basin monitoring • Stakeholder involvement • Protect groundwater quality by developing programs and policies							

1 - Temescal Valley Pipeline, 2 - Auld Valley Pipeline, 3 - Water Treatment Plant, 4 - Regional Wastewater Treatment Plant,
5 - Eastern Municipal Water District, 6 - San Jacinto Untreated Water Turnout, "X" means considered and "-" means not considered.

Figure 5-3
Location of Dual Purpose Wells



Recharge Potential

Three dual-purpose wells are considered in the area north of the lake. Details are as follows:

- Three deep dual-purpose wells (up to 1,000 feet)
- Extraction capacity of deep wells would be 1,000 gpm per well
- Injection capacity of deep wells would be 750 gpm per well

Eleven dual-purpose wells are being considered within the Back Basin area. Details are as follows:

- Six deep (up to 1,000 feet) and five shallow (less than 500 feet) dual purpose wells.
- Four existing deep wells (Cereal 1, Cereal 3, Cereal 4 and Corydon) would be converted to dual purposed wells. The remaining two deep wells would be new wells.
- Extraction capacity of deep wells would range from 1,000 gpm to 1,750 gpm
- Injection capacity of deep wells would range from 750 gpm to 1,400 gpm per well
- Extraction capacity of shallow wells would be 700 gpm per well
- Injection capacity of shallow wells would be 350 gpm per well

These capacities are based upon preliminary results of the BBIPP. Details of these wells are summarized in **Table 5-4**. When available, up to about 11,750 acre-ft/year of imported water could be injected using dual-purpose wells. These wells could extract up to about 13,100 acre-ft/yr.

Table 5-4
Summary of Recharge Potential with Dual Purpose Wells

Area	Number of Wells	Maximum Injection Capacity (gpm)	Maximum Extraction Capacity (gpm)	Annual Injection Potential[1] (acre-ft/yr)	Annual Extraction Potential[1] (acre-ft/yr)
North of Lake					
Deep Wells	3	750	1,000	600 per well	810 per well
Back Basin					
Shallow Wells	5	350	700	280 per well	560 per well
Deep Wells	5	1,400	1,750	1,130 per well	1,410 per well
Deep Wells	1	750	1,000	600 per well	810 per well
Total	**14**	**11,750**	**16,250**	**11,750**	**13,100**

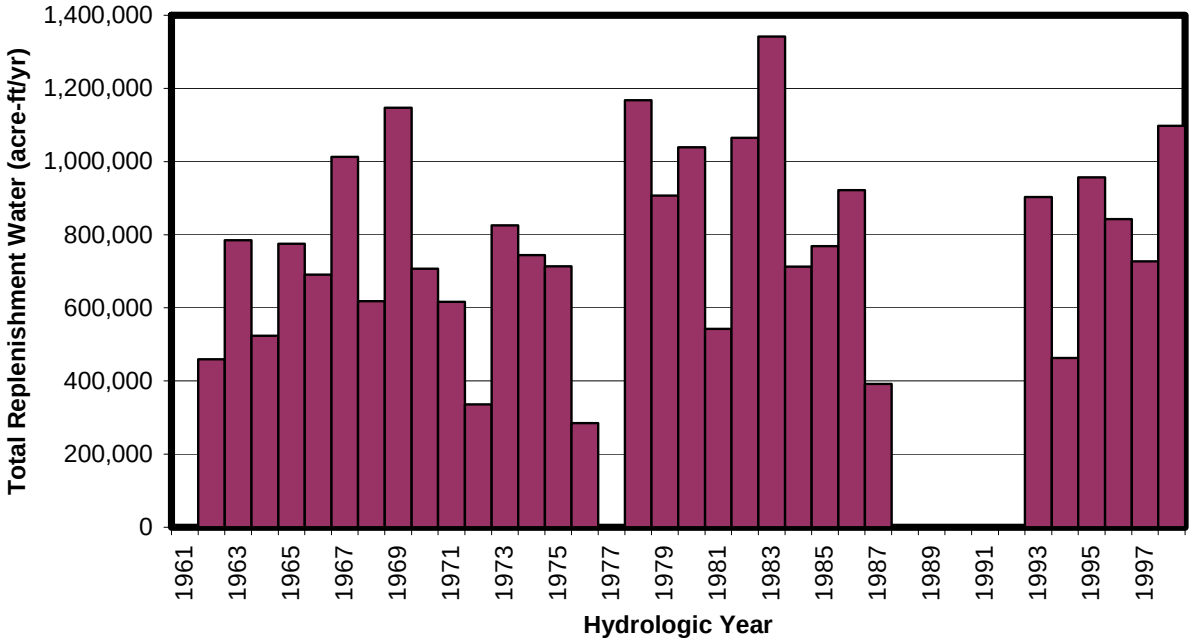
1 – Calculations assume continuous extraction/injection during six months per year.

Operation

Dual-purpose wells are operated in cycles of injection and extraction. Water that could be used for injection is treated water from Canyon Lake WTP and treated imported water from MWDSC. Because the connection with the TVP is closer to the area north of the lake than the AVP connection, the injected water would primarily originate from the TVP for wells north of the Lake. For wells in the Back Basin, injected water may come from either the TVP or the AVP. Injection would take place in low demand periods (typically October through March) when lower cost replenishment water is available and the water distribution system can accommodate the extra water demand for the injection wells without resulting in low system pressures.

Based on information provided by MWDSC, replenishment water is expected to be available for injection in approximately eight out of ten years. **Figure 5-4** shows the projected amount of replenishment water available in year 2020 based on hydrologic conditions from 1961 through 1998.

Figure 5-4
Total Replenishment Supplies Available from MWDSC (1961-1998)



Injection is assumed to take place during six months from October through March. It should be noted that injection may be possible year around during wet years if excess replenishment water is available. The extraction periods depend on the need for stored groundwater. In years that the summer demand can be met with the existing groundwater wells and imported water, the dual-purpose wells would not extract any long term stored water. However, in dry years when existing supplies cannot meet the summer demand peak, the dual-purpose wells would be used to

extract stored water from the groundwater basin. To exercise all the wells regularly, cycling the use of dual-purpose wells for extraction along with the regular production wells is recommended.

The operation of dual-purpose wells south of the lake would be the same as the dual purpose wells in the north part of the basin. Injection in the area south of the lake is would be with water from the AVP connection due to the closer proximity.

Implementation

Implementation of dual-purpose wells north of the lake would include the design and construction of three wells. Environmental documents have been prepared and permits (such as waste discharge requirements or waivers) would need to be prepared prior to construction. One well with injection capabilities should be constructed and tested before designing, constructing or converting a second well.

The implementation of dual-purpose wells south of the lake would require the design and construction of seven wells. Environmental documents and permits would need to be prepared prior to construction.

Surface Spreading

Surface spreading is the process of infiltrating water into the groundwater aquifer using ponds or ditches. These spreading facilities are open areas with highly permeable soil to allow rapid infiltration by gravity. Infiltration rates vary based on the soil type and the depth of the water in the spreading basin, but typically range from less than one to six feet per day in areas suitable for surface recharge. Surface spreading can be used for surface runoff, recycled water, or other sources such as imported water.

Many different types and sizes of spreading facilities exist. The size is dependent upon the available land and the amount of water that needs to be captured. A spreading facility is typically divided into multiple ponds or basins that are separated with earthen berms. The ponds are often interconnected and are terraced to allow water to flow from one basin to the next. The number of available basins further limits the effective spreading area because regular maintenance is required to sustain high infiltration rates. The water level in the spreading basins should not exceed more than five feet because the weight of the water compacts the soil, which limits the infiltration rate. Low water levels at the other hand result in lower infiltration rates due to lower water pressures.

Spreading basins are the most common method of groundwater recharge because they are relatively inexpensive if adequate land is available. However, this method is not suitable in areas where surface clay is present because these clays limit downward infiltration. In the Elsinore Basin, surface spreading is most suitable along the margins of the Elsinore Basin where substantial clay is absent. In addition, the San Jacinto River, where the groundwater aquifer is naturally recharged, is also a suitable location for surface recharge. At these locations, the infiltration of local runoff can be maximized, reducing the amount of imported water required for recharge.

McVicker Canyon

One site for proposed surface spreading is located within City of Lake Elsinore, near the intersection of Grand Avenue and Lincoln Street. The site encompasses the eastern portion of the McVicker Canyon bottom, and includes a portion of the existing flood control basin and drainage facilities maintained by Riverside County Flood Control and Water Conservation District (RCFCWCD). The flood control basin includes an earthen dam situated across the upper mouth of the McVicker Canyon. Along the southwestern margin of the site, an apparently natural seep flows in and drains into the basin area. The McVicker Canyon site and the Leach Canyon site are shown on **Figure 5-5**.

Recharge Potential

The recharge potential for McVicker Canyon is summarized in **Table 5-5.**

Based upon available land area near McVicker Canyon, as much as 800 acre-ft/yr could be infiltrated (assuming an infiltration rate of approximately 1 foot per day) with minor modification of the existing debris basins in an area of approximately 9 acres. If additional recharge were required, the basins could be expanded to infiltrate as much as 2,000 acre-ft/yr.

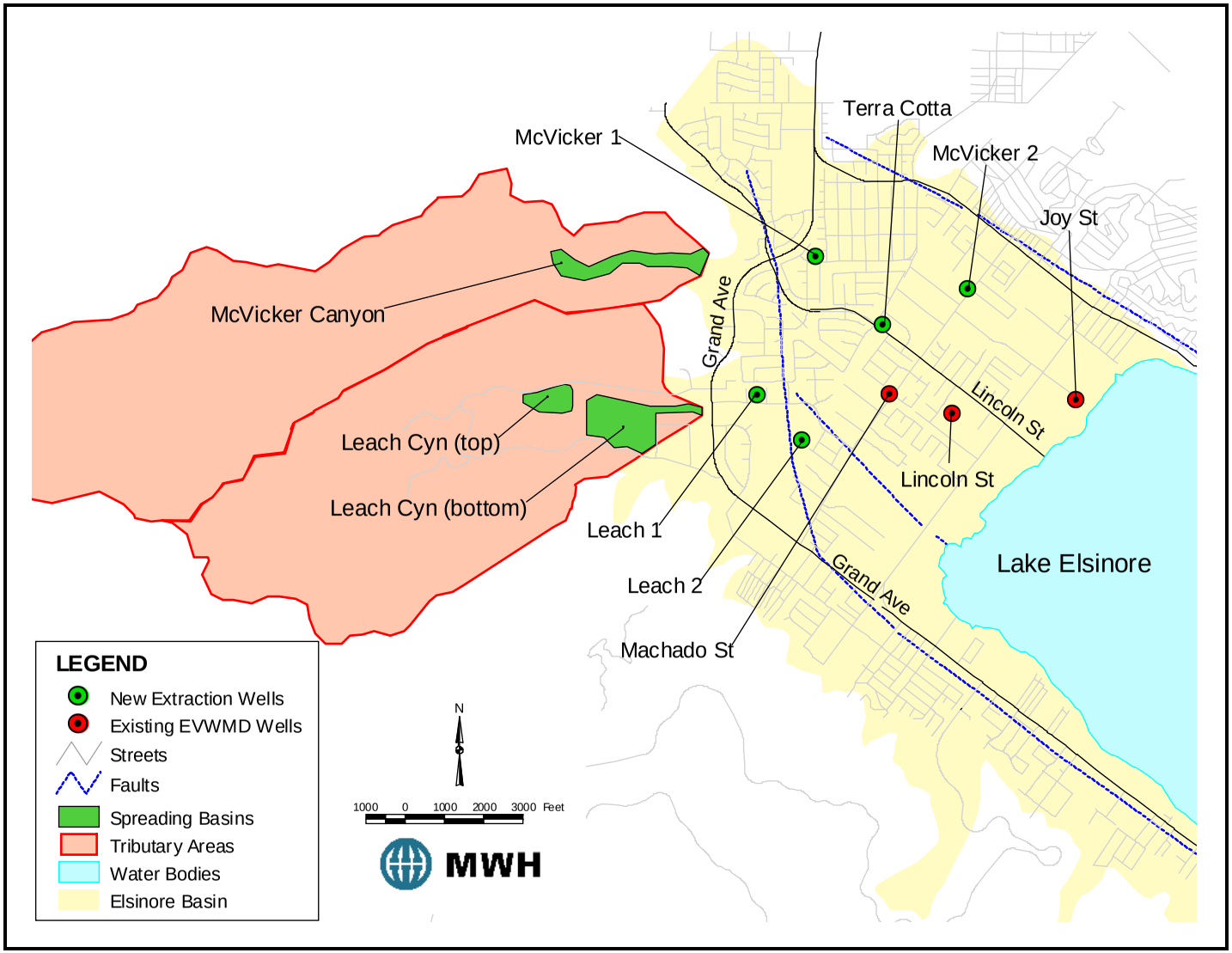
Table 5-5
McVicker Canyon Surface Spreading Potential

Parameter	Minimum Size	Expanded Size
Total Site Area (acres)	9	22
Wetted Area (acres)	6	15
Annual Infiltration from Runoff (acre-ft/yr)	200	400
Infiltration from Imported Source (acre-ft/6 months)	600	1,600
Total Annual Infiltration Volume (acre-ft)	800	2,000
Availability of Imported Water	6 months; October through March 67 percent use factor	6 months; October through March 67 percent use factor

Implementation

Implementing surface spreading at McVicker Canyon would require grading of the entire site to provide infiltration surfaces and berms to separate the individual ponds. Pipelines from either the intersection of Broadway Avenue and Grand Avenue or Railroad Canyon Dam would need to be constructed as well as a booster station if water from Canyon Lake is used for surface spreading. Specific details of the spreading operations and actual amounts infiltrated under each alternative will be discussed later in the description of each alternative.

Figure 5-5
Potential Recharge Locations



For the design of the spreading facilities, it is important to have a good understanding of the recharge characteristics of the soils. Although a good understanding of the Elsinore Basin geology has been obtained, more understanding is on the following topics is desired before spreading facilities can be designed:

- The infiltration rate and basin geometry along the San Jacinto River between Canyon Lake and Lake Elsinore
- The infiltration rate and transport characteristics and depth to bedrock in the vicinity of Leach and McVicker Canyons

More data should be collected from pilot tests of surface spreading for the canyon(s) selected as part of the preferred management alternative to obtain information required for a detailed design.

Leach Canyon

Leach Canyon is located within the unincorporated part of Riverside County within the City of Lake Elsinore's sphere of influence. The site consists of two portions. The top portion includes the lower part of the flood control basin located within Leach Canyon, and is bordered to the east by the debris dam at the mouth of the canyon. The location of this site is depicted on **Figure 5-5**. The north boundary of the site is Leach Canyon Road, which becomes Amorose Street at the intersection point with the dam. The bottom portion consists of a narrow strip of land south of single-family residential properties along Amorose Street, abutting Grand Avenue to the east and the dam to the west. This portion contains an earthen channel that drains from the flood control basin behind the debris dam to Grand Avenue, where it joins another drainage channel.

Recharge Potential

The recharge potential for Leach Canyon is summarized in **Table 5-6**. Based upon available land area near Leach Canyon, as much as 1,800 acre-ft/yr could be infiltrated (assuming an infiltration rate of approximately 1 foot per day) with minor modification of the existing debris basins. If additional recharge were required, the basins could be expanded to recharge as much as 3,300 acre-ft/yr. Specific details of the spreading operations and actual amounts infiltrated under each alternative will be discussed later in the description of each alternative.

Table 5-6
Leach Canyon Surface Spreading Potential

Parameter	Minimum Size	Expanded Size
Total Site Area (acres)	21	38
Wetted Area (acres)	14	25
Annual Infiltration from Runoff (acre-ft/yr)	300	500
Infiltration from Imported Source (acre-ft/6 months)	1,500	2,800
Total Annual Infiltration Volume (acre-ft)	1,800	3,300
Availability of Imported Water	6 months; October through March 67 percent use factor	6 months; October through March 67 percent use factor

Three sources of water may be used for surface spreading: treated imported water from the TVP, untreated imported water or recycled water from the Regional WWTP. Specific details on the required transmission pipelines and pumping stations to deliver water from these sources to the spreading basins is discussed under Alternative 2.

Operation

Imported water would be available six months per year for supplementing rainfall to provide groundwater recharge. Water could be imported from the TVP, the San Jacinto River or potentially the Regional WWTP. The ponds would be available for infiltration of imported water approximately 67 percent of dry weather days to allow for wetting and drying cycles. Volume would be reserved to provide detention of runoff in the event of a storm. During rain events, they would be fully functional. The ponds would be available for maintenance during periods of inactivity. Based on preliminary calculations, it appears that the anticipated annual infiltration volumes of water at Leach Canyon would not cause excessive groundwater mounding. Pilot testing is needed to verify this assumption.

Implementation

Implementing surface spreading at Leach Canyon would require grading of the entire site to provide level infiltration surfaces and berms to separate the individual ponds. The pipelines from either the intersection of Broadway Avenue and Grand Avenue or Railroad Canyon Dam would need to be constructed as well as a booster station if water from Canyon Lake is used for surface spreading. Prior to implementation, pilot tests should be performed to determine the long-term infiltration rates of the soils in the Canyon. The objectives of the pilot test are mentioned under the implementation of McVicker Canyon.

Railroad Canyon

The site for proposed surface recharge in Railroad Canyon is located within the City of Lake Elsinore, near the intersection of Interstate 15 (I-15) and Railroad Canyon Road. The site resides within the San Jacinto River channel along Railroad Canyon road, and includes the riparian/flood plain area, and is approximately bounded by Railroad Canyon Road to the south, I-15 to the west, and Newport Road to the north. The river passes beneath the Summerhill Road bridge at the junction of the two portions.

Recharge Potential

The infiltration site consists of 51 acres of existing riverbed, located just downstream of USGS stream gauge 11070500. Modification of the existing riverbed to create a spreading facility has environmental constraints that would need to be mitigated when constructed. Without modification, a maximum of 30 acre-ft per day could be infiltrated, assuming an infiltration rate of 0.6 feet per day. Due to the finer grained soils present, the infiltration rate here is believed to be lower than in the canyon sites.

Operation

The proposed infiltration site is the existing riverbed. Preliminary calculations indicate that river flows less than ten acre-ft per day (5 cfs) delivered to the spreading site will not reach Lake Elsinore; thus up to this amount could be infiltrated for groundwater recharge. Once the infiltration capacity of the riverbed is reached, water flows into Lake Elsinore. The source of water for spreading would be Canyon Lake, which feeds the San Jacinto River below Canyon Lake in wet weather, when water is released from the Railroad Canyon Dam or when the lake spills. The lake level could be maintained at the spillway elevation to achieve continuous recharge by purchasing untreated imported water. It should be noted that some losses of water will occur while the water flows through the 12-mile stretch of the San Jacinto River north of Canyon Lake. These losses are estimated to range between 6 and 16 percent (MWH, 1997). Other losses would be the increased evaporation from Canyon Lake due to an increase lake surface area when the lake is full.

Implementation

The existing riverbed would not require modification to implement the surface recharge concept.

In-Lieu Recharge

The concept of in-lieu recharge involves the replacement of groundwater pumping with imported water supplies. With an in-lieu operation, water users that currently pump groundwater would maximize the use of imported water during wet periods (either seasonally or annually) when more imported water may be available. Groundwater pumping would be limited during these periods. During dry periods, the users would pump groundwater using existing facilities. Groundwater recharge occurs during the wet periods as groundwater accumulates instead of being pumped out of the basin. The amount of in-lieu recharge that can be implemented in the Elsinore Basin is dependent upon the demand and the capacity of existing facilities.

EVMWD is the principal groundwater producer in the Elsinore Basin, EVMWD is responsible for approximately 95 percent of the total groundwater pumping in the basin. Implementation of in-lieu recharge by EVMWD would not require any major facilities as the water distribution system has two imported water connections. However, some groundwater pumping will be required to provide peaking capacity. If individual pumpers or the Elsinore Water District (EWD) are included in in-lieu operations, imported water can be supplied to these users through the EVMWD distribution system.

New Sources of Supply

The strategy of developing new supply sources involves expanding the mix of available water to make EVMWD's water supply more flexible and reliable. The following new supply sources were identified in discussions with District Staff and the stakeholders:

- Untreated imported water from MWDSC's San Jacinto Raw Water Turnout (WR-18B)
- Runoff from the local watershed
- Recycled water from the Regional WWTP

- Recycled water from Eastern Municipal Water District (EMWD)
- Recycled water produced by connecting existing septic users to sewer

San Jacinto Raw Water Turnout

The San Jacinto Raw Water Turnout (SJRWT) is located north of Avenue B and 10th Street in the City of Lakeview near Lake Perris. This 50-cfs MWDSC connection (WR-18B) can deliver untreated Colorado River water into the San Jacinto River. From the turnout point, water travels approximately 12 miles downstream to Canyon Lake. Before the AVP was built, this connection was used to deliver water into Canyon Lake that fed the Canyon Lake WTP. Because EVMWD can purchase treated imported water at the AVP connection, this connection has not been used regularly to feed the Canyon Lake WTP. Currently, the Canyon Lake WTP only treats natural runoff from the San Jacinto River watershed. Untreated imported water from the SJRWT can be used as a supply source for surface spreading or for lake replenishment. A new imported water connection (WR-31) provides access to untreated SWP water.

Surface Spreading

Untreated imported water from the SJRWT can be used for either surface recharge in the San Jacinto River or surface spreading in local canyons. As discussed previously, McVicker and Leach Canyons have the best recharge potential. However, spreading imported water at these locations would require construction of an untreated water pipeline from the dam to the spreading basins. Another option is a pipeline from the outlet of the San Jacinto River into Lake Elsinore

Lake Replenishment or Augmentation

Untreated water from the SJRWT can also be used for lake replenishment reducing the amount of groundwater that needs to be utilized for lake augmentation. Although the cost of untreated imported water is higher than the cost of groundwater, the use of untreated water for lake replenishment may be more cost effective than the use of groundwater when the total costs of water supply are considered. When high quality groundwater is pumped into the lake, this water is no longer available for potable water supply. To keep the basin in balance, potable groundwater pumping would need to be reduced, resulting in the need for more treated water from MWDSC at a higher cost than the untreated imported water. The use of groundwater for lake augmentation will eventually be paid for as treated water. A secondary advantage of using untreated water for lake augmentation is the increased natural recharge in the San Jacinto riverbed. The most cost-effective source for lake augmentation is likely to be recycled water, assuming that no additional treatment is required beyond existing processes.

Local Runoff

The capture of local runoff can be increased by the construction of surface spreading basins in the canyons and by enhanced infiltration in the San Jacinto River.

Regional WWTP

Based upon current construction and the Sewer Master Plan (Kennedy/Jenks, 2003), the Regional WWTP has a current capacity of 8 mgd and which is planned to be expanded to 20 mgd by the year 2020. This projection does not include conversion of all septic tanks to sewer system connections within the basin, hence the total available wastewater flow from the Regional WTP may be higher than anticipated. The GWMP recommends that policies be developed to regulate the installation of septic tanks for new developments as well as the conversion of existing septic tanks that are in close proximity of sewer trunk mains and sewer transmission pipes. Reducing the amount of septic tanks is the basin is beneficial for groundwater quality, possibly lake water quality, and provides additional recycled water. Recycled water can be used for irrigation, lake augmentation and possibly surface spreading.

Wastewater from EMWD

At this time, the availability of recycled water from EMWD for EVMWD's use is unknown. EMWD delivers recycled water primarily for irrigation within their service area. However, during periods of low recycled water demand, EMWD stores recycled water in reservoirs and may discharge excess recycled water through a pipeline to Temescal Wash. This excess recycled water could potentially be used for irrigation, surface spreading or lake augmentation. Additional recycled water from EMWD's Temecula plant may also be available for EVMWD use in the future. EMWD recently constructed a pipeline to convey effluent from its Temecula Valley Plant to Temescal Wash. The availability of this source of supply and the cost of this water should be further investigated. EVMWD is currently evaluating the use of this supply as part of the Wildomar Recycled Water Master Plan.

Water Conservation

The water demand projections used in this GWMP are based on the Water Distribution Master Plan (MWH, 2002), which does not include any water conservation measures. Water conservation could be used to reduce water consumption and decrease the need for new water supplies. Specific strategies for water conservation included in this management plan are:

- Low water use landscaping
- Increased awareness and financial incentives

These strategies are currently in place in many communities throughout California, the Pacific Northwest and the southwestern states. They have been very successful. Agencies such as the U.S. Bureau of Reclamation and MWDSC also offer funding opportunities and other resources to agencies that want to implement water conservation programs in their communities. In December 2002, EVMWD became a signatory to the Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California defining best management practices (BMP) for demand management.

Low Water Use Landscaping

Low water use landscaping utilizes plants that have lower water needs relative to traditional turf. Low water use landscaping has been found to use approximately 42 percent less water than traditional turf (East Bay Municipal Utility District, 1992) and provide significant financial savings on labor, energy usage, fertilizer and herbicides. It should be noted that a reduction in irrigation in the groundwater basin also would lead to reduced return flows that contribute to groundwater recharge. However, the net effect is lower water supply needs. Therefore, it would be beneficial to EVMWD if low water use landscaping is implemented throughout EVMWD service area to decrease potable water needs. Key principles of low water use landscaping can be found in **Appendix H**.

Water Savings Potential

Table 5-7 shows the projected irrigation demands for EVMWD's service area, inside and outside the groundwater basin in year 2020 and the potential water savings that could be generated from implementation of a low water use landscaping program. These calculations assume:

- 39 percent of total demand is for outdoor use, or irrigation (Urban Water Management Plan, 2000).
- Low water use landscaping is implemented in 20 percent of the parcels that are projected to be developed by year 2020.
- The water reduction achieved with low water use landscaping is 42 percent (East Bay MUD, 1992).

These policies could reduce the water demand by as much as 1,630 acre-ft/yr within EVMWD's service area, which is about three percent of the total project water demand in year 2020.

Table 5-7
Estimated Irrigation Savings with Low Water Use Landscaping

Description	Inside the GW Basin (acre-ft/yr)	Outside the GW Basin (acre-ft/yr)	Total Service Area (acre-ft/yr)
Water Demand Year 2020[1]	18,560	31,390	49,950
Irrigation Demand without low water use landscaping[2]	7,240	12,240	19,480
Irrigation Demand with low water use landscaping[3]	6,630	11,220	17,850
Projected Water Savings[3]	610	1,020	1,630

1 – Based on demand projections (MWH, 2002)
2 – Based on 39 percent outdoor use
3 – Based on a participate rate of 20 percent and 42 percent water savings for participating parcels

Implementation

The conversion of traditional landscaping to low water use landscaping needs to be implemented over time and would be easiest accomplished for new developments. The use of low water use landscaping could be encouraged through public outreach, education and financial incentives. EVMWD could play an important role in stimulating low water use landscaping practices by providing water rate discounts. EVMWD should evaluate what other agencies have accomplished with applications of this principle.

Increase Awareness and Financial Incentives

Water conservation may be implemented at residences as well as businesses. Because all new developments (which contribute up to 50 percent of the future water demand) will have water saving devices installed, most conservation in EVMWD will be from retrofits of existing toilets, showerheads, washing machines and other equipment in residential and commercial areas.

Water Savings Potential

The estimated water conservation potential is based on the following assumptions:

- Low flow toilets in residential properties resulting in a ten percent water reduction.
- Water savings due to low flow toilets in non-residential properties is ten percent.
- Low flow showerheads and plumbing in residential properties resulting in a five percent water reduction.
- High efficiency clothes washers in residential properties result in a ten percent water reduction.
- Sensitive sprinkler systems in residential properties resulting in a five percent water reduction.
- Water savings in non-residential properties is ten percent.
- 20 percent of existing customers will install low flow toilets, water saving showerheads, adjust plumbing, use high-efficiency clothes washers, and install sensitive irrigation systems by year 2020.
- 100 percent of the future customers will have low flow toilets and water saving showerheads.
- 80 percent of future customers will use high-efficiency clothes washers and install sensitive irrigation systems by year 2020.
- The overall water savings for residential customers is assumed to be 20 percent in addition to irrigation savings, taking into consideration that customers may not implement all possible water savings devices.
- The overall water saving for non-residential customers is assumed to be 10 percent.

The assumptions used are based on water conservation studies conducted throughout the United States (Ayres, 1993-1995; EBMUD, 2002; GDS, 2000). As shown in **Table 5-8**, the estimated water savings potential is approximately 5,000 acre-ft per year or about ten percent of the projected water demands for year 2020. These saving do not include the three percent saving due to low water use landscaping as discussed previously.

Water conservation achieved through the increasing public awareness will primarily offset the need for additional imported water supplies.

Implementation

Education and financial incentives are the main strategies to achieve water conservation in residential and business environments. In addition, changes in building codes effect water conservation by requiring devices such as low flow toilets. Education of customers can be accomplished though brochures at public parks and libraries, websites, school programs, community activities and television and radio commercials. Financial incentives are an effective strategy to increase water conservation because it provides benefits for people to change their behavior, rather than requesting an effort without rewards.

Table 5-8
Estimated Water Savings with Awareness and Financial Incentives

Water Demand		Residential[1] (acre-ft/yr)	Non-Residential[2] (acre-ft/yr)	Total (acre-ft/yr)
Without Conservation	Existing Customers	20,545	2,283	22,828
	Future Customers	24,414	2,713	27,127
	Total	**44,960**	**4,996**	**49,955**
With Conservation	Existing Customers	19,723 [3,5]	2,237 [3,6]	21,961
	Future Customers	20,508 [4,5]	2,496 [4,6]	23,004
	Total	**40,231**	**4,733**	**44,964**
Water Savings	Existing Customers	822	46	867
	Future Customers	3,906	217	4,123
	Total	**4,728**	**263**	**4,991**

1 – Residential demands is 90 % of the total demand
2 – Non-residential demand is 10% of the total demand
3 – Based on 20 % participation
4 – Based on 80 % participation
5 – Based 20% water savings for participating customers
6 – Based 10% water savings for participating customers

Financial incentives could be formulated in many ways, the most common are:

- Providing discounts for customers who reduce their water consumption by a predetermined percentage.
- Providing partial rebates for customers who purchase and install water conservation technologies, such as water efficient washing machines, toilets and showerheads.
- Tiered water rate structures.

EVMWD has already implemented a rebate program for ultra low-flow toilets and for water conserving washing machines. Rebates of up to $60 are given to customers who replace a toilet

that uses 3.5 to 5 gallons per flush with one that uses 1.6 gallons per flush. These toilets result in approximate water saving of ten percent for residential customers. Through June 30, 2003, EVMWD is offering a $35 rebate to customers who replace older, high volume washers with more efficient models. These washers save approximately 20 gallons of water per load, which is approximately ten percent of residential water use. In addition, these washers reduce energy use by up to 60 percent. These incentives could be expanded to increase the participation rates in these programs. Examples of other rebate programs and implementation details are included in **Appendix H**.

Basin Monitoring

A basin monitoring program is important to better understand the groundwater basin and to measure the effects of the strategies that are implemented. In addition, basin monitoring provides a basis for effective adaptive management. Basin parameters that should be monitored can be divided into the following categories:

- Water quality (groundwater and surface water)
- Groundwater levels
- Groundwater production
- Surface water levels
- Surface flows
- Precipitation

A preliminary monitoring program is presented in the Groundwater Monitoring Plan (MWH, 2003), and includes the monitoring of the parameters listed above. The monitoring program also includes the installation of new monitoring wells, aquifer testing and land subsidence monitoring.

The information collected will ultimately lead to more efficient implementation of management strategies, as it would provide guidance for adjusting management parameters according to the results over time. The collection of background data will also provide a baseline that can be used to evaluate the success of future programs.

Stakeholder Involvement

Stakeholder involvement is an important component of a successful management plan. The management of the Elsinore Basin involves many regulatory and institutional agencies as well as the general public. Involvement of the community and local agencies early in the process is important to establish a sense of ownership of the program. Examples of agency involvement that can be part of the basin management are:

- Registration of well status and production records with the SWRCB
- Coordination and enforcement of well construction and abandonment with Riverside County and DWR
- Implementation of the basin monitoring program (described above) with EWD and the City of Lake Elsinore

- Definition and implementation of septic tank policies with the City of Lake Elsinore, Riverside County and the RWQCB
- Coordination with RCFCD to maintain dual purpose flood control-surface recharge facilities in local canyons
- Formation of a basin advisory committee that will provide oversight on basin management

Groundwater Quality Protection Programs and Policies

The following is a list of activities that should be implemented as part of each GWMP alternative to protect the groundwater quality in the Elsinore Basin:

- Develop a wellhead protection program
- Develop a well construction and abandonment program
- Develop septic tank conversion policies
- Collect and evaluate land development plans

Wellhead Protection Program

The GWMP recommends that EVMWD implement a protection plan to monitor and protect existing water sources. The recharge areas to the groundwater basin have been formed naturally and are generally located around the periphery of the basin in the undeveloped regions of the basin. These areas tend to be less visited by the public, but are not protected from public access.

This GWMP recommends that EVMWD contact the RWQCB regularly to verify that no new contaminants have been accidentally released into the groundwater basin. If a leak or spill is identified, effective control and clean-up of contaminated groundwater would be conducted by the appropriate parties. This would include a coordinated effort between the appropriate regulatory agencies involved, source control, understanding of the hydrogeology, and delineation of the contamination. The regulatory agencies may include any combination of the following: RWQCB, Department of Toxic Substances Control, U.S. Environmental Protection Agency (EPA), and EVMWD. The degree to which they participate depends on the nature and magnitude of the problem.

Well Construction and Abandonment Program

Improperly constructed wells can result in poor yields and contaminated groundwater by establishing a pathway for pollutants to enter a well from the surface, allowing communication between aquifers of varying quality or the unauthorized disposal of waste into the well. In cooperation with Riverside County (Environmental Health Department), EVMWD should ensure that all wells drilled in the groundwater basin follow the California Water Code §13700 through §13806. The well drilling contractors shall be in possession of an active C-57 Contractor's license and shall obtain a County permit for the drilling, deepening, modification, or repair of any well in accordance with Riverside County Ordinance 682.3. Minimum standards for the construction of wells are specified in DWR Bulletins 74-81 and 74-90.

The GWMP recommends that EVMWD implement a well abandonment program in cooperation with Riverside County (Environmental Health Department). The program would include the

identification of abandoned or improperly destroyed wells within the Elsinore Basin and a well abandonment or capping procedure. A well canvass is recommended for the identification and registration of these wells. Wells would be evaluated and destroyed as necessary. This program would include the property owners and appropriate regulatory agencies. The property owners are responsible to assure that the wells are properly destroyed, if no future use is anticipated, or capped and maintained, if future use is anticipated as outlined in Riverside County Ordinance 682.3. Proper destruction procedures are also specified in the DWR Bulletins 74-81 and 74-90.

Septic Tank Conversion Policies

The GWMP recommends that policies be developed to regulate the installation of septic tanks for new developments as well as the conversion of existing septic tanks that are in close proximity of sewer trunk mains and sewer transmission pipes. Reducing the amount of septic tanks in the basin is beneficial for groundwater quality, possibly lake water quality, and provides a new water source.

Land Development Plans

The GWMP recommends that EVMWD implement a program to regularly collect land development plans that include areas within the groundwater basin, for example every six months. EVMWD can request that the planning agencies contact EVMWD when any permit is applied for to construct the following types of facilities: unsewered residential properties, industrial buildings, production wells, and commercial structures. The use of shallow drainage wells to dispose run-off water should not be approved for construction within the groundwater basin because of the potential for surface contaminants entering the groundwater from these types of facilities.

Activities Not Considered

One activity identified during the stakeholder involvement process that is not considered in this GWMP is to increase the Lake Elsinore's spillway elevation. This activity is excluded from further discussions because of the increased risk for flooding. As discussed previously, Lake Elsinore can discharge to Temescal Wash. The flow rate can be substantial in periods of heavy rain when the runoff from the local and San Jacinto watersheds raises the lake level above the sill elevation in the outflow channel (1,255 feet MSL). This outflow could be reduced if the sill elevation is raised. A higher sill elevation would create more storage capacity in the lake. However, in a severe storm, less water would be discharged to Temescal Wash, hence increasing the 100-year flood elevation. The 100-year flood elevation has been set at 1263.3 feet MSL. It is not possible to increase the flood elevation due to developments around the lake, and therefore an increase of the spillway elevation would reduce the size of storm that could be captured in the existing flood plain. Because the 100-year flood elevation is fixed, the increase of the spillway is not considered as a valid activity for this management plan.

Section 6
Description of Alternatives

This section describes the groundwater management alternatives developed to meet the goals of the GWMP. The alternatives evaluate water management from different conceptual viewpoints, each with the intent of achieving the goals of the GWMP in a timely, cost-effective, and environmentally responsible manner.

Four alternatives are identified to meet the current and future demands of EVMWD, while achieving a sustainable water balance in the Elsinore Basin. Due to the programmatic nature of the GWMP, the alternatives and their associated facilities and programs are conceptual and, other than those programs identified as ongoing projects, may differ in their ultimate configuration. The four different alternatives are:

- Alternative 1 – Dual Purpose Wells
- Alternative 2 – Surface Spreading
- Alternative 3 – In-lieu Recharge and Water Conservation
- Alternative 4 – Combination

The purpose of Alternatives 1, 2 and 3 is to attempt to manage the basin using different strategies to identify those strategies that perform better. Alternative 4 is developed based upon evaluation of the first three alternatives and includes a combination of the best strategies. Each alternative is compared with the baselines discussed in Section 4. For the comparison of alternatives and to evaluate the impact of the different activities on the groundwater levels in the basin, a numerical groundwater model is used to simulate the groundwater response to a repeat of the hydrologic conditions for the period 1961 through 2001. This allows evaluation of basin response over a wide range of wet, normal and dry years. The projected water demands for 2020 are met with Alternatives 1, 3, and 4 using different sources of supply. There is a 3,800 acre-ft/yr deficit under Alternative 2. A detailed summary of the components included in the two baselines and the four alternatives is presented in **Table 6-1.**

MODELING ASSUMPTIONS

Assumptions used in the groundwater modeling and hydraulic modeling of the alternatives are discussed below. The evaluation of the alternatives and the results are discussed in detail in **Section 7**.

Groundwater Model

For each alternative, separate model input files are prepared to represent the conditions of each alternative. Numerical groundwater model input consist of the following:

Table 6-1
Summary of Alternatives

Item	Baseline A	Baseline B	Alternative 1 Dual Purpose Wells	Alternative 2 Surface Spreading	Alternative 3 In-Lieu Recharge and Water Conservation	Alternative 4 Combination
Water Demand	Year 2000	Year 2020	Same as Baseline B	Same as Baseline B	Year 2020 with 10% water conservation	Same as Baseline B with 5% water conservation
Water Supplies	Current Supplies: • 8 Existing EVMWD Wells • 4 Existing EWD Wells • Canyon Lake WTP • AVP Connection • TVP Connection	• Same as in Baseline A • Joy Street Well • 11 wells for peaking	• Same as in Baseline A • Joy Street Well • Conversion of 4 existing wells to dual purpose wells • 10 new dual purpose wells • 4 wells for peaking	• Same as in Baseline A • Joy Street Well • 5 new extraction wells • 11 wells for peaking	• Same as in Baseline A • Joy Street Well • 8 wells for peaking	• Same as in Baseline A • Equipping Joy Street Well as dual purpose • Conversion of 6 existing wells to dual purpose wells • 7 new dual purpose wells • 4 wells for peaking
Land Use	Year 2000	Year 2020	Same as Baseline B	Same as Baseline B	Same as Baseline B	Same as Baseline B
Lake Replenishment	None	• 7.5 mgd of Recycled Water • 3 Island Wells	Same as Baseline B	Same as Baseline B	Same as Baseline B	• 17.7 mgd of Recycled Water • 1 Island Wells
Septic Tanks	Existing Septic Tanks	Existing Septic Tanks	Conversion of all Septic Tanks in at least the High-Risk Zone	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Special Projects (in addition to the peaking wells)	None	• 17.9 miles of 36-inch to 12-inch diameter pipeline to bring in new source water[2] from the Woodcrest Turnout to Lake St. Tank.	Dual Purpose Wells with imported water: • 3 deep wells north of the lake • 6 deep wells south of the lake[1] • 5 shallow wells south of the lake Other Facilities: • 30-inch diameter pipeline (4,000 ft) • 800 HP pumping station between Cal Oaks and the Back Basin	Surface Spreading with imported water: • 25-acre spreading basin in Leach Canyon • 15-acre spreading basin in McVicker Canyon • 5 extraction wells north of Lake • Pipelines and PS to convey add'l water source to spreading basins	• 8 peaking wells	Dual Purpose Wells with imported water: • 3 deep wells n/o the lake[3] • 6 deep wells s/o of the lake[1] • 5 shallow wells south of the lake Other Facilities: • 30-inch diam. pipeline (4,000 ft) • 800 HP pumping station betw. Cal Oaks and the Back Basin
Basin Monitoring	• Water Quality • Groundwater levels • Groundwater production • Lake levels • Surface flow rates • Rainfall	Same as Baseline A	• Expanded monitoring network for parameters of Baseline A and B • Subsidence	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Stakeholder Involvement	None	None	• Formation of a basin advisory committee	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Wellhead Protection	Existing EVMWD Wells	Same as Baseline A	• Expansion to all active wells in the basin	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Well Construction and Abandonment Program	None	None	• Identification of location/status of wells through a well canvass • Development of a Well Construction and Abandonment Program that includes the coordinates of these activities with Riverside County Department of Environmental Health. • Implementation of policies and regulations	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Land Development Plans	None	None	• Coordination with local and regional planning agencies	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

1 – Four are existing wells (Cereal 1, Cereal 3, Cereal 4, and Corydon), 2 – New source water could also come from a different location, this project was chosen allocate cost for the supply shortfall, 3 – This includes Joy Street Well.

- recharge due to infiltrating precipitation.
- recharge due to infiltration from the San Jacinto River, irrigation water and septic tanks effluent.
- groundwater pumping of potable wells for potable water demand.
- groundwater pumping of Island wells for lake maintenance.
- direct injection recharge (Alternatives 1 and 4)
- surface spreading recharge (Alternative 2 only)

The amounts are calculated for the hydrologic period from 1961 to 2001 with six-month stress periods. The calculations are based on providing sufficient water supply to meet the year 2020 water demands, balancing the groundwater basin when possible and maintaining the water level of Lake Elsinore at 1,240 feet MSL. A summary of the model input and resulting groundwater balance is presented in **Table 6-2.**

Table 6-2
Summary of Average Groundwater Balance for 2020

	Baseline A	Baseline B	ALT1	ALT2	ALT3	ALT4
Parameter	**acre-ft/yr**	**acre-ft/yr**	**acre-ft/yr**	**acre-ft/yr**	**acre-ft/yr**	**acre-ft/yr**
INFLOWS						
Infiltration of Precipitation						
Rural Areas	1,700	1,700	1,700	1,700	1,700	1,700
Urban Areas	900	700	700	700	700	700
Recharge from Surface Water						
San Jacinto River	1,200	1,200	1,200	1,200	1,200	1,200
Lake Elsinore	0	0	0	0	0	0
Return Flows						
Septic Systems	1,000	1,000	200	200	200	200
Applied Water	700	1,100	1,100	1,100	1,100	1,100
Subsurface Inflows	0	0	0	0	0	0
Groundwater Recharge						
Injection	0	0	6,700	0	0	5,900
Spreading	0	0	0	4,800	0	0
Total Inflows	**5,500**	**5,700**	**11,600**	**9,700**	**4,900**	**10,800**
OUTFLOWS						
Groundwater Pumpage						
Potable Use	(9,900)	(11,300)	(9,400)	(11,300)	(4,100)	(7,900)
Lake Replenishment	0	(900)	(900)	(900)	(900)	0
Dual Purpose Wells	0	0	(1,300)	0	0	(2,800)
Wells for Surface Spreading	0	0	0	(1,300)	0	0
Subsurface Outflow	0	0	0	0	0	0
Total Outflows	**(9,900)**	**(12,200)**	**(11,600)**	**(13,500)**	**(5,000)**	**(10,700)**
Net Surplus/(Deficit)	**(4,400)**	**(6,500)**	**0**	**(3,800)**	**(100)**	**100**

Note: Values shown are averages over the anticipated range of demands and hydrology.

Hydraulic Model

The hydraulic model developed for the Distribution System Master Plan (MWH, 2002) is used to size pipelines and booster stations and to evaluate system pressures and reservoir response in each of the four alternatives. The maximum injection and extraction capacities as summarized in **Table 6-3.**

Table 6-3
Maximum Injection and Extraction Capacities

Well Name	Extraction Rate (gpm)	Injection Rate (gpm)
Cereal Wells 1, 3, and 4	1,750	1,400
Corydon Well	1,000	750
Olive Street Well	350	None
Palomar Well	300	None
Lincoln Well	935	750
Machado Well	1,250	750
Joy Street Well	1,000	750
Proposed deep dual purpose wells in the Back Basin (Cereal 2 and Crawford)	1,750	1,400
Proposed shallow dual purpose wells in the Back Basin	700	350
Proposed deep dual purpose wells north of Lake Elsinore	1,000	750
Proposed wells north of Lake Elsinore for Extraction of Surface Spreading in Canyons (McVicker 1 and 2, Leach 1 and 2, Terra Cotta)	600	None

For the hydraulic simulations, the following assumptions are made:

- The demands in the hydraulic model include the water demands of EVMWD only. Demands of private pumpers and EWD are not taken into consideration as they are not served from the EVMWD system.
- For the simulation of injection scenarios, the ADD of year 2020 is used, as injection will only occur during winter months.

- For the simulation of extraction scenarios, the MDD of year 2020 is used. Because extraction occurs during summer months, including the maximum day. MDD corresponds with a peaking factor of 2.0. Some scenarios are modeled at lower demands without the additional proposed peaking wells.
- Injection and extraction do not occur at the same time.
- Injection and extraction do not necessarily occur at maximum rates.
- The maximum capacity of Canyon Lake WTP is 9.0 mgd (6,250 gpm).
- The maximum connection capacity of the AVP is 24.2 mgd (16,805 gpm). The existing pumps are capable of pumping more than the rated connection, but flows are limited to the capacity of the connection.
- The maximum capacity of the TVP is 26.5 mgd (18,403 gpm), with the proposed pump station.
- The Island wells are not included in hydraulic model runs.

A comparison of the supplies and demands for each alternative is provided in **Table 6-4**. Details of supplies and demands presented in this table are discussed under each alternative. **Table 6-5** presents a Lake Elsinore balance for each alternative.

ALTERNATIVE 1 – DUAL PURPOSE WELLS

The purpose of Alternative 1 is to achieve a balanced groundwater basin through a conjunctive use program using dual-purpose injection-extraction wells. Treated water would be injected during periods when replenishment water is available. The new dual-purpose wells would be used to extract stored groundwater when additional supplies are required to meet the year 2020 demands.

Water Demands

Alternative 1 includes the same water demands and land use as Baseline B.

Water Supplies

Alternative 1 requires the equipping of 14 dual-purpose wells. These dual-purpose wells would increase the groundwater extraction capacity for potable use from 13,350 gpm (Baseline B) to 21,300 gpm. The 14 dual-purpose wells include:

- Four existing wells (Corydon, Cereal 1, Cereal 3, and Cereal 4) would be converted to dual purpose wells
- Two new deep dual purpose wells in the Back Basin area (Cereal 2 and Crawford-5)
- Five new shallow dual purpose wells in the Back Basin area (South Alluvial 1 through 5)
- Three deep dual purpose wells in the area north of Lake Elsinore (North Deep 1 through 3)

Injection would take place between October and March in years when replenishment water is available, which depends on the hydrologic conditions of the sources that contribute to MWDSC's overall supply. The dual-purpose wells would be used for extraction in the summer months of dry years when the demands increase and the available imported supply from MWDSC is reduced.

To meet the MDD in year 2020, three additional wells are required to provide peaking capacity, assuming that each well has a capacity of 1,000 gpm.

Table 6-4
Projected Average Supplies and Demands for 2020

	Baseline A acre-ft/yr	Baseline B acre-ft/yr	ALT1 acre-ft/yr	ALT2 acre-ft/yr	ALT3 acre-ft/yr	ALT4 acre-ft/yr
Demands						
Potable Demands	23,400	50,500	50,500	50,500	45,500	48,000
Water Conservation	0	0	0	0	5,000	2,500
Total Demands	**23,400**	**50,500**	**50,500**	**50,500**	**50,500**	**50,500**
Supplies to Meet Demand						
Groundwater						
Existing or Planned Wells	9,900	11,300	9,400	11,300	4,100	7,900
Additional Wells	0	0	1,300	1,300	0	2,800
Imported Water						
AVP	6,600	22,600	22,600	22,300	22,600	18,100
TVP	3,900	13,600	14,200	12,600	15,800	16,200
Canyon Lake WTP	3,000	3,000	3,000	3,000	3,000	3,000
Total Supplies	**23,400**	**50,500**	**50,500**	**50,500**	**45,500**	**48,000**
Lake Replenishment						
Groundwater	0	900	900	900	900	0
Recycled Water	0	2,300	2,300	2,400	2,300	3,400
Total Lake Replenishment	**0**	**3,200**	**3,200**	**3,300**	**3,200**	**3,400**
Groundwater Recharge						
Injection Wells	0	0	6,700	0	0	5,900
Surface Spreading	0	0	0	3,800	0	0
Capture of Add'l Runoff	0	0	0	1,000	0	0
Net In-Lieu Recharge	0	0	600	0	7,200	600
Total GW Recharge	**0**	**0**	**7,300**	**4,800**	**7,200**	**6,500**
Imported Supplies						
Direct Use						
Normal Deliveries	10,500	36,200	35,900	34,900	34,500	33,700
In-lieu Deliveries [1]	0	0	900	0	3,900	1,100
Injection Wells	0	0	6,700	0	0	5,900
Surface Spreading	0	0	0	3,800	0	0
Total Imported Supplies	**10,500**	**36,200**	**43,500**	**38,700**	**38,400**	**40,200**

Note: Values shown are averages over the anticipated range of demands and hydrology.
1 In-lieu deliveries are the volume of water delivered to offset groundwater pumping remaining in storage for at least one year.

Table 6-5
Summary of Projected Lake Elsinore Balance for 2020

Item	Baseline A	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
INFLOWS						
Groundwater Pumping	0	900	900	900	900	0
Precipitation on Lake	3,800	3,800	3,800	3,800	3,800	3,800
Local Runoff	1,500	1,500	1,500	1,300	1,500	1,500
San Jacinto River	13,800	13,800	13,800	13,800	13,800	13,800
Recycled Water	0	2,300	2,300	2,400	2,300	3,400
Total Inflow	**19,000**	**22,300**	**22,300**	**22,200**	**22,300**	**22,500**
OUTFLOWS						
Evaporation Losses	15,600	15,600	15,600	15,600	15,600	15,600
Spills	6,000	6,700	6,700	6,600	6,700	6,700
Total Outflow	**21,600**	**22,300**	**22,300**	**22,200**	**22,300**	**22,500**
Lake Balance	**(2,600)**	**0**	**0**	**0**	**0**	**0**

Note: Values shown are averages over the anticipated range of demands and hydrology.

The injection and extraction cycles of Alternative 1 as a function of the hydrologic conditions of 1960 through 2001 are shown on **Figure 6-1**. During the 41-year hydrologic cycle, about 274,000 acre-ft of imported water would be injected, and 54,000 acre-ft of additional water would be extracted. With these operations, the groundwater basin remains in a long-term balance.

Figure 6-1 shows that injection would take place in 33 of the 41 years. Over the 41-year period, an average of 6,700 acre-ft/yr would be injected. Extraction would take place during 22 out of the 41 years. Dual-purpose wells would be used in combination with existing wells to meet demands during these periods when surplus water is not available. In addition, because dual-purpose wells would not be pumping at the same time as injection, imported water would be purchased for in-lieu recharge. With Alternative 1, pumping in the winter months is reduced an average of 1,900 acre-ft and increased an average of 1,300 acre-ft during the summer months. The net long-term in-lieu recharge is approximately 600 acre-ft/yr over the 41-year period of record. However, because an average of 900 acre-ft/yr of the in-lieu water stored remains in storage for more than one year, this amount can be purchased at the long-term storage rate. Details of the long-term storage rate program are provided in Section 7.

The water supply distribution for 2020 demands in average, wet and dry years is shown in **Figure 6-2**. As shown in this figure, extraction from dual purpose wells is only required in dry years, while the increased water production at Canyon Lake WTP plant is available to meet the

Figure 6-1
Injection and Extraction Cycles of Alternative 1

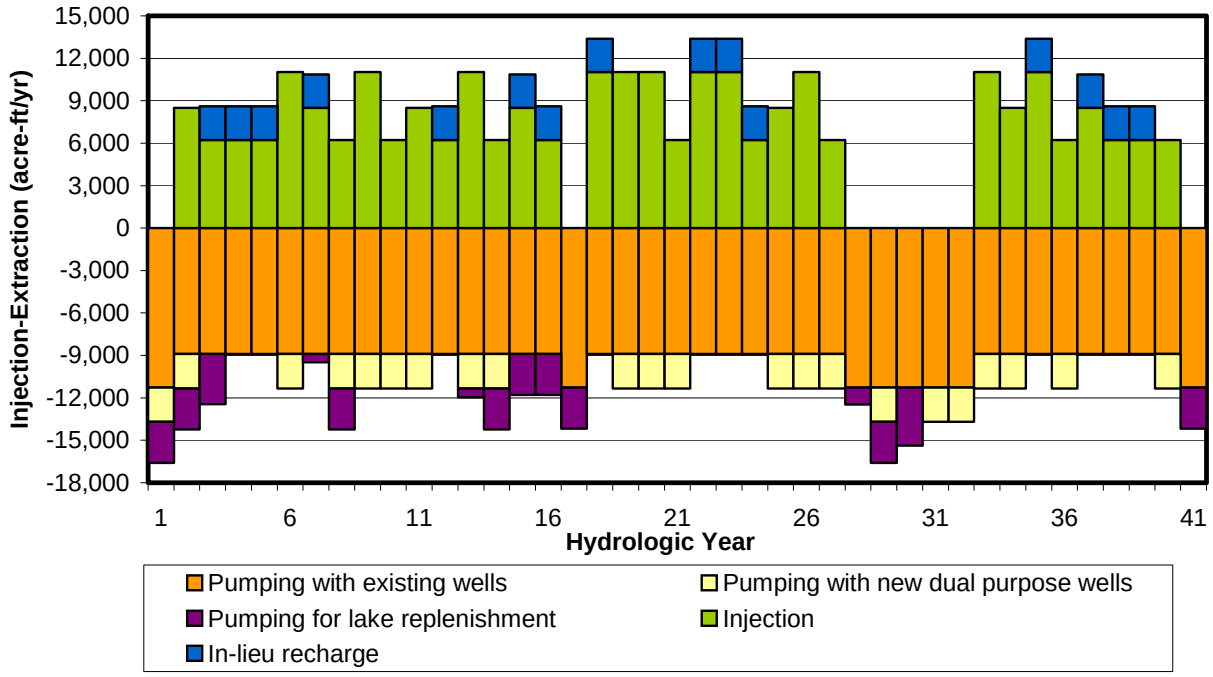
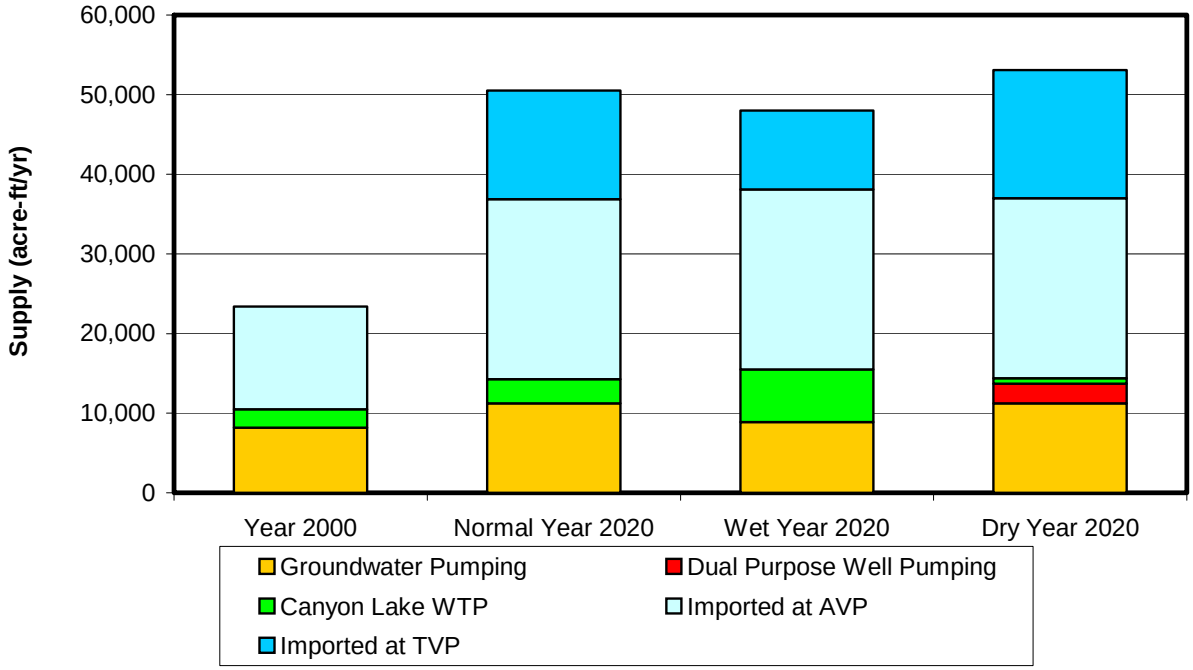


Figure 6-2
Year 2020 Potable Supplies with Alternative 1



water demands in average and wet years. On an average annual basis, about 73 percent of the demand are supplied from imported water, 21 percent from groundwater pumping and 6 percent from Canyon Lake WTP. It should be noted that these supply distributions are based on six-month average demands, and that dual purpose wells and peaking wells would need to be available to provide peaking capacity.

Analyses with a hydraulic distribution system model are performed to size any additional facilities to maintain sufficient system pressures during extraction and injection cycles. For extraction, a 30-inch diameter pipeline of about 4,000 lineal feet is required along Corydon Street from Palomar Street to Cereal Street. For injection, it is most cost-effective to build an 800 HP inline booster station near the I-15 and Clinton Keith Rd to lift the water imported from the AVP connection. For water imported through the TVP connection, it is assumed that the inline booster station at Grand Avenue can be used (reserving the direction) to lift water flowing from TVP to the Back Basin.

Septic Tanks

Alternative 1 assumes that all septic tanks in at least the high-risk zone (see Section 5) would be connected to the sewer system by 2020. Approximately 2,900 septic tanks, or 80 percent of all the septic tanks in the basin, are located within the high-risk zone of the basin. The conversion of these septic tanks to the sewer system reduces the amount of infiltration from approximately 1,000 acre-ft/yr to about 200 acre-ft/yr. Although not included in this GWMP, it is recommended that all septic tanks within the Elsinore groundwater basin be converted to sewer.

Lake Replenishment

Lake replenishment activities would be the same as Baseline B.

ALTERNATIVE 2 – SURFACE SPREADING

The purpose of Alternative 2 is to achieve a long-term groundwater balance using spreading basins in the Leach and McVicker Canyons to maximize the capture of local runoff water and other available water sources. Imported water from MWDSC or recycled water from the Regional WWTP would be infiltrated in the spreading basins to supplement local runoff, in order to permit conjunctive use operation of the basin. New wells would be required in the area north of the lake to extract water that is recharged in the spreading basins. By spreading more water than is extracted, a more sustainable water balance is anticipated. For this alternative, the maximum amount of recharge at Leach and McVicker Canyon is applied assuming that the maximum size recharge facility described in **Section 5** could be constructed. Based upon recent investigations, recharge in these areas may not feasible and may limit the ability of this alternative to achieve a sustainable yield. In addition, the San Jacinto River recharge project described in Section 5 is not included because the groundwater impacts of recharge at this location are unknown given current understanding of the basin.

Water Demands

Alternative 2 includes the same water demands, land use, and lake replenishment assumptions as Baseline B, and the same septic tank assumptions as described under Alternative 1.

Water Supplies

In addition to the supplies listed in Baseline B, Alternative 2 contains five additional extraction wells to extract water that is recharged in the spreading basins. These five wells have a combined capacity of 3.5 mgd (2,400 gpm). In addition, 11 extra wells with a combined capacity of 16.5 mgd (12,000 gpm) are required to provide peaking capacity to meet the MDD in year 2020, assuming that these peaking wells have an capacity of 1,000 gpm each.

The two surface spreading grounds and the extraction wells are sized as follows:

- One surface spreading facility would be located in McVicker Canyon with 15 wetted acres and an infiltration capacity of about 1,900 acre-ft in six months.
- One surface spreading facility would be located in Leach Canyon with 25 wetted acres. This spreading basin is divided into two areas, the upper area (6 acres) and the lower area (19 acres).
- Five new extraction wells would be located north of the lake with a total extraction capacity of 2,400 gpm.

More details on the sizing of the spreading facilities are presented in **Section 5**. The ponds would be available for infiltration of imported water approximately 67 percent of dry weather days in the six-month operation period to allow for wetting and drying cycles. Volume would be reserved to provide retention of runoff. During rain events, the basins would be fully functional. The pond maintenance would occur during periods of inactivity. The spreading of local runoff can be supplemented with four different supply sources: treated imported water, untreated imported water and recycled water from the Regional WWTP or recycled water from EMWD. The required facilities are determined using the hydraulic distribution system model and are described below. The most cost-effective source will be determined in the alternative evaluation. For calculations in this report, the use of treated imported water is assumed.

Option 1 – Treated Imported Water

To deliver 11.8 mgd of treated imported water from the TVP, a 36-inch diameter pipeline of approximately 6,000 lineal feet would need to be constructed from the intersection of Lake Street and Mountain Street to the inlet locations of Leach Canyon and McVicker Park. A 30-inch diameter pipeline of approximately 7,400 lineal feet would need to be constructed from McVicker Park to the inlet location of Leach Canyon and a 24-inch diameter pipeline of approximately 5,000 lineal feet would need to be constructed from McVicker Park to the inlet location of McVicker Canyon. These inlet locations will be at the upper part of the spreading basins, where water can flow into the spreading facility by gravity. This recommendation also uses the existing 21-inch pipeline in the 1601 pressure zone along Lake Street and assumes that the Alberhill pump station as recommended in the Distribution System Master Plan is implemented (210 HP pump station from the 1434 pressure zone to the 1601 pressure zone). To pump the water from the 1601 pressure zone to the top of the spreading basins (1820 feet MSL), an 800 HP pumping station expansion at Rice Canyon Pump Station needs to be constructed. The assumptions used for the availability of treated imported water are the same as in Alternative 1.

Option 2 – Untreated Imported Water

To deliver 11.8 mgd of untreated imported water, a 36-inch diameter pipeline of approximately 48,000 lineal feet needs to be constructed from the Canyon Lake outlet at the Railroad Canyon Dam to McVicker Park. A 30-inch diameter pipeline of approximately 7,400 lineal feet would need to be constructed from McVicker Park to the inlet location of Leach Canyon and a 24-inch diameter pipeline of approximately 5,000 lineal feet would need to be constructed from McVicker Park to the inlet location of McVicker Canyon. In addition, a 2,000 HP booster station would be required to pump the water to the spreading basins, as the water level in Canyon Lake level varies between 1,372 and 1,382 feet MSL and the inlet point at both canyons is at about 1,820 feet MSL.

Option 3 – Recycled Water from the Regional WWTP

To deliver 5.9 mgd of recycled water from the Regional WWTP, a 24-inch diameter pipeline of approximately 22,000 lineal feet needs to be constructed to convey water to McVicker Park. A 20-inch diameter pipeline of approximately 7,400 lineal feet would need to be constructed from McVicker Park to the inlet location of Leach Canyon and a 16-inch diameter pipeline of approximately 5,000 lineal feet would need to be constructed from McVicker Park to the inlet location of McVicker Canyon. In addition, a 1,200 HP pumping station would need to be constructed from the plant to the inlet locations of the spreading basins, as the discharge outlet of the Regional WWTP is approximately 1,253 ft MSL and the inlet point at both canyons is about 1,820 ft MSL. It is assumed that not more than 50 percent of water infiltrated in the spreading basins can consist of recycled water in accordance with DHS regulations for recharge with recycled water. Therefore, recycled water can only be used in combination with local runoff and imported water. It should be noted that this source is only available when recycled water is not used for lake replenishment.

Option 4 – Recycled Water from EMWD

In periods when EMWD pumps recycled water to Temescal Wash for discharge, this water can be captured and pumped to the spreading basins. Assuming that up to 5.9 mgd of recycled water would be available from EMWD (likely only in wet years), a 36-inch diameter pipeline of approximately 25,000 lineal feet needs to be constructed to convey water to McVicker Park from the EMWD outlet point. A 30-inch diameter pipeline of approximately 7,400 lineal feet would need to be constructed from McVicker Park to the inlet location of Leach Canyon and a 24-inch diameter pipeline of approximately 5,000 lineal feet would need to be constructed from McVicker Park to the inlet location of McVicker Canyon. In addition, a 2,400 HP booster station would be required to pump the water to the spreading basins, as the elevation at the EMWD outlet point is 1,255 ft MSL and the inlet point at both canyons is about 1,820 feet MSL.

Cost Comparison of Various Sources

The cost of using recycled water for surface spreading versus treated and untreated imported water is estimated to determine which source is the most cost-effective. The results of this comparison are shown in **Table 6-6**, while details on the items included in each option are presented in **Appendix I**.

Table 6-6
Cost Comparison Surface Spreading Water Sources

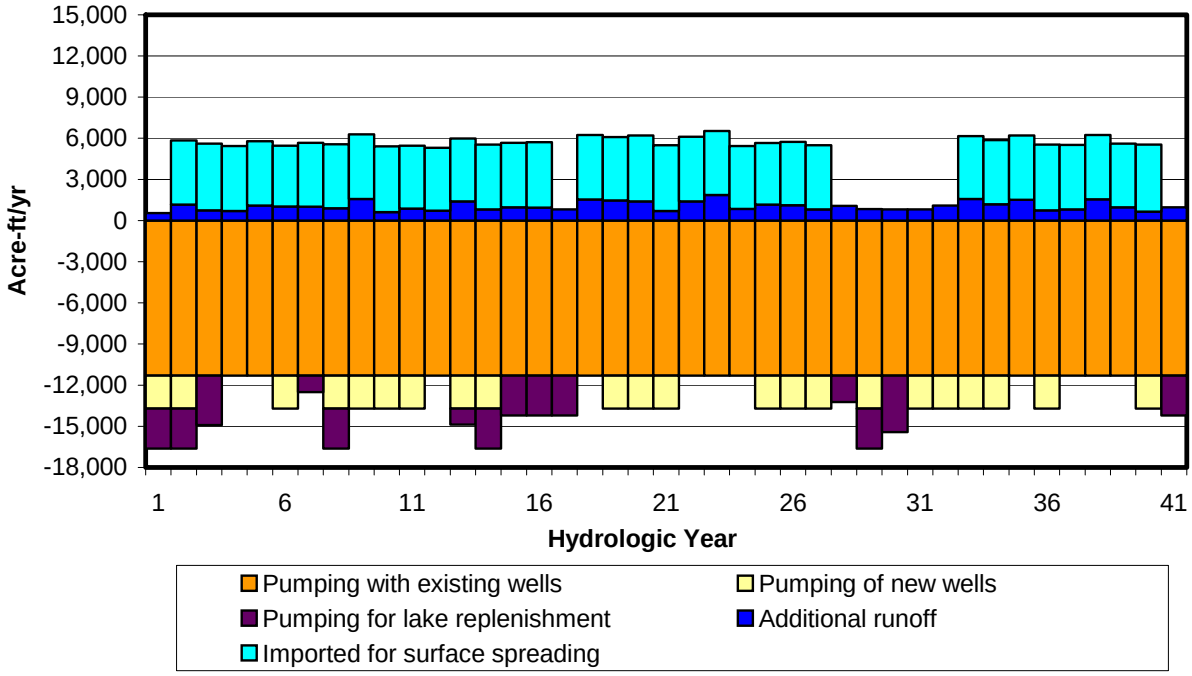
Item	Option 1 Treated, Imported Water	Option 2 Untreated Imported Water	Option 3 Recycled Water from Reg. WWTP	Option 4 Recycled Water from EMWD
Capital Cost	$ 8,400,000	$ 28,400,000	$ 15,200,000	$ 16,400,000
Annual Capital Cost	337,000	1,053,000	605,000	641,000
Annual Power Cost	232,000	580,000	464,000	638,000
Annual Supply Cost	1,260,000	978,600	630,000	976,000
Total Annual Cost	$ 1,829,000	$ 2,611,600	$ 1,699,000	$ 2,255,500
Total Supply (acre-ft/6 months)	**4,200**	**4,200**	**2,100**	**2,100**
Unit Cost per acre-ft	**$435**	**$622**	**$809**	**$1,074**

Based on the cost estimates of the four options, it can be concluded that the use of treated imported water is the least expensive, and the other three sources are about 1.5 to 2.0 times more expensive. The higher costs for the options with recycled water are caused by the draft DHS regulation that not more than 50 percent of the water spread can be recycled water. This requirement result in double infrastructure improvements to convey and pump both treated imported water and recycled water to the spreading basins. It should be noted that the cost per acre-foot is likely to be lower, when the same recycled water pipeline is used to serve irrigation demands along the route of the pipeline including McVicker Park. Although the investigation of the extend of this potential recycled water demand is beyond the scope of this project, it is not expected that this will reduce the cost of Option 3 and 4 below $435 per acre-foot. As shown in **Table 6-6**, the capital cost increases with distance. As the untreated MWDSC water is the furthest away from the spreading basin locations, high capital investments are required for a pipeline and pumping station from Canyon Lake to the spreading basin. The Regional WWTP is closer to the basins than the connection with EMWD near the sill in the Lake outlet channel, which results in slightly lower capital cost. The cost of using treated imported water is the lowest because of a combination of 1) the shorter distance to the spreading basins, 2) lower pumping cost, and 3) because the existing distribution system can partially be used to convey treated imported water. A detailed cost summary is included in **Appendix I**.

The amounts of surface spreading with local runoff and imported water/recycled supplies, and the associated extraction with the four new extraction wells to meet the year 2020 demands are shown on **Figure 6-3** as a function of the hydrologic conditions from October 1960 through September 2001. As shown in this figure, the amount of water spread would always be greater than zero, even in years that imported or recycled replenishment water is not available, as local runoff will contribute some amount of recharge.

During the 41-year hydrologic cycle, about 197,000 acre-ft of water is recharged in the spreading basins, 22 percent from local runoff and 78 percent from imported or other source water. During the 41-year period, about 42,000 acre-ft would be extracted. Replenishment would take place

Figure 6-3
Surface Spreading and Extraction Cycles Alternative 2



every year, ranging from 540 to 6,540 acre-ft in six months. Extraction would take place during 22 years of the 41-year period and ranges from 0 to 1,930 acre-ft in six months. With these operations, the groundwater basin has an average deficit of 3,800 acre-ft/yr compared to 6,400 acre-ft/yr in Baseline B. Availability of suitable land limits the surface spreading capacity, hence a sustainable groundwater balance is not achieved in this alternative. No in-lieu recharge would occur with Alternative 2 because wells would not be turned off during the recharge operations.

The water supply distribution for the year 2020 demands in average, wet and dry years is shown on **Figure 6-4**. As shown in this figure, groundwater pumping with the four new wells that extract the water recharged in the canyons is only required in dry years. It should be noted that this supply distribution does result in a groundwater deficit of approximately 3,800 acre-ft/yr as presented in **Table 6-2**. When this amount is subtracted from the groundwater pumping amounts and replaced by additional imported water supplies, a sustainable groundwater balance is achieved. This situation is presented graphically on **Figure 6-5**. It should be noted that these supply distributions are based on six-month average demands, and that peaking wells would need to be available to provide peaking capacity.

Figure 6-4
Year 2020 Potable Supplies for Alternative 2

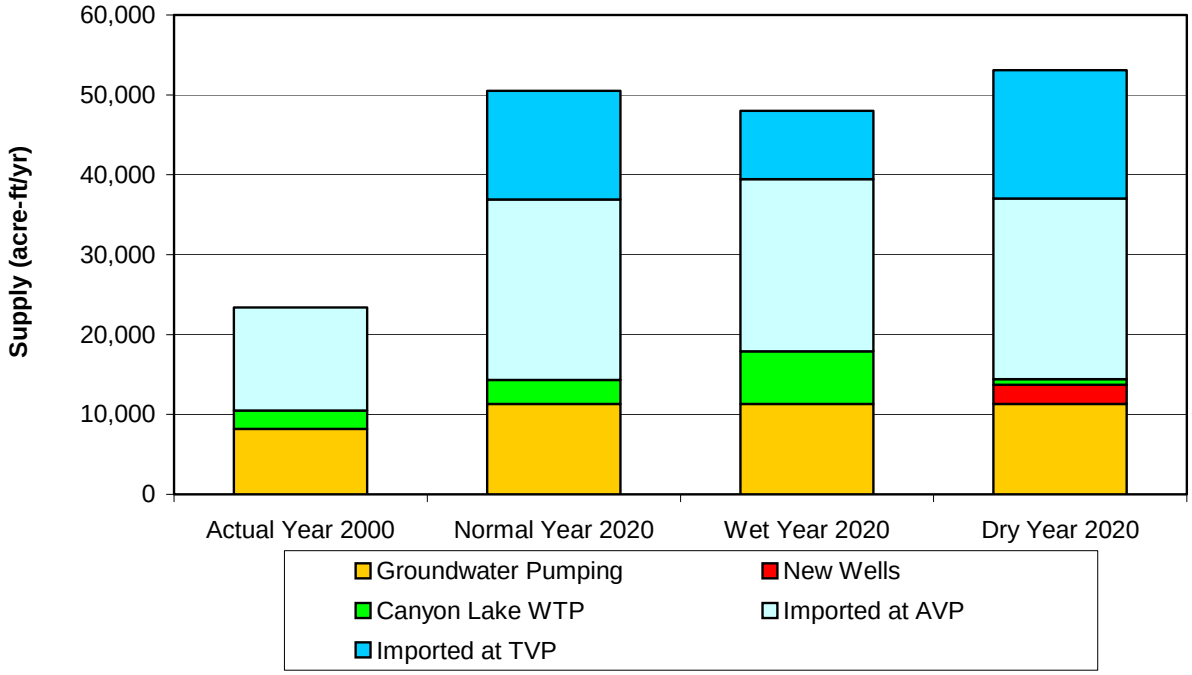
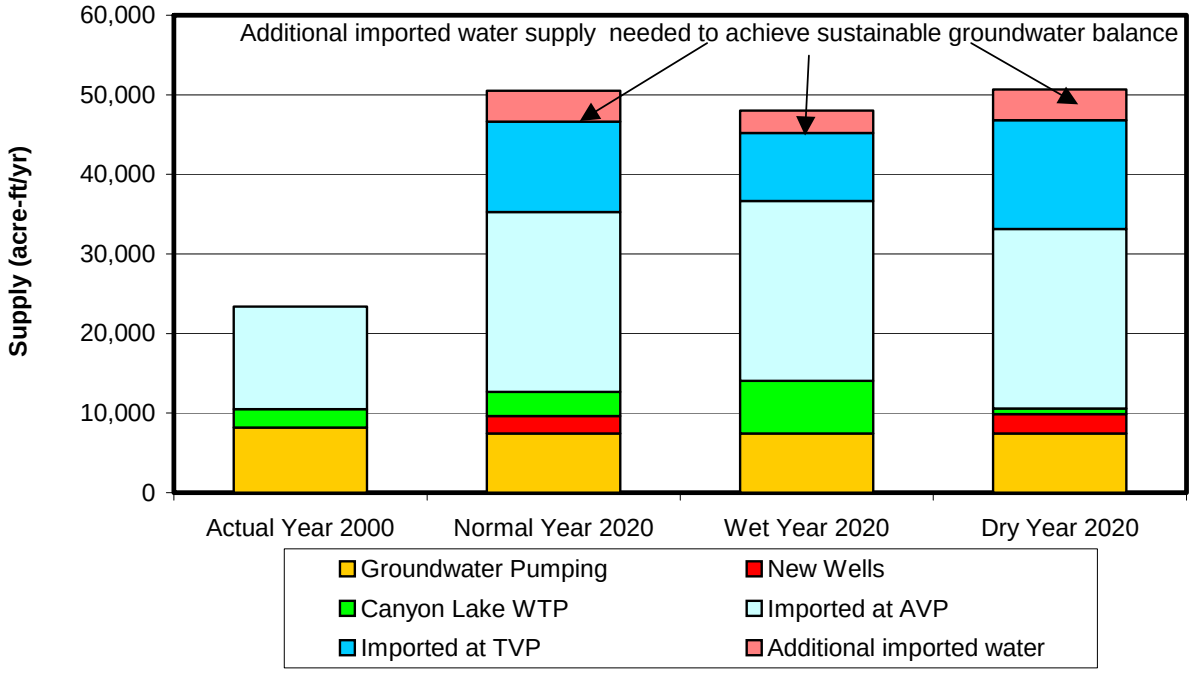


Figure 6-5
Supply Mix to Meet Year 2020 Demands
with Sustainable Groundwater Balance– Alternative 2



ALTERNATIVE 3 – IN-LIEU RECHARGE

The purpose of Alternative 3 is to achieve a long-term groundwater balance using a combination of in-lieu recharge and water conservation. With in-lieu recharge, the amount of imported water used would be maximized to reduce groundwater pumping, hence increasing the basin storage as natural inflows continue. For in-lieu recharge, construction of new facilities is not required, with the exception of the eight new wells are needed to provide peaking capacity to meet MDD in year 2020 assuming that these peaking wells have a capacity of 1,000 gpm each.

Alternative 3 includes the same water supply, land use and lake replenishment assumptions as Baseline B and the same septic tank assumptions as described under Alternative 1. Differentiating components and activities are described below.

Water Demands

The water demands in Alternative 3 would be reduced as discussed in the water conservation portion of Section 5. The average annual water demand in normal demand years is assumed to decrease from 50,500 acre-ft/yr to 45,500 acre-ft/yr, a reduction of ten percent. Annual water demands are assumed to vary plus or minus five percent between hot, dry years and cool, wet years compared to normal year conditions.

Water Supply

The amounts of groundwater pumping, imported water for in-lieu recharge as a function of the hydrologic conditions from October 1960 through September 2001 are shown on **Figure 6-6**. About 50 percent of the groundwater pumping of Baseline B is replaced with imported water in Alternative 3. With this alternative, pumping is reduced approximately 3,900 acre-ft during the winter months and 3,300 acre-ft during the summer months. This pumping is replaced with imported water creating in-lieu recharge. The winter recharge could be purchased at long-term storage rates.

The water supply distribution for the year 2020 demands in average, wet and dry years is shown on **Figure 6-7**. As shown in this figure, the groundwater pumping in wet years is almost zero and primarily offset by the increased production of Canyon Lake WTP. The reduced water demands due to conservation measures can be met with imported water when in-lieu replenishment takes place. These assumptions are based on calculations that balance the groundwater basin over the 41-year period while meeting year 2020 demands. Alternative 3 achieves a balanced groundwater basin, meaning that the amount extracted is equal to the amount replenished over the 41-year period. In this alternative, 85 percent of the average water demands are supplied from imported water, nine percent from groundwater and six percent from the Canyon Lake WTP.

It should be noted that these supply distributions are based on a six-month average demands, and that peaking wells would need to be available to provide peaking capacity.

Figure 6-6
Groundwater Pumping and In-Lieu Recharge – Alternative 3

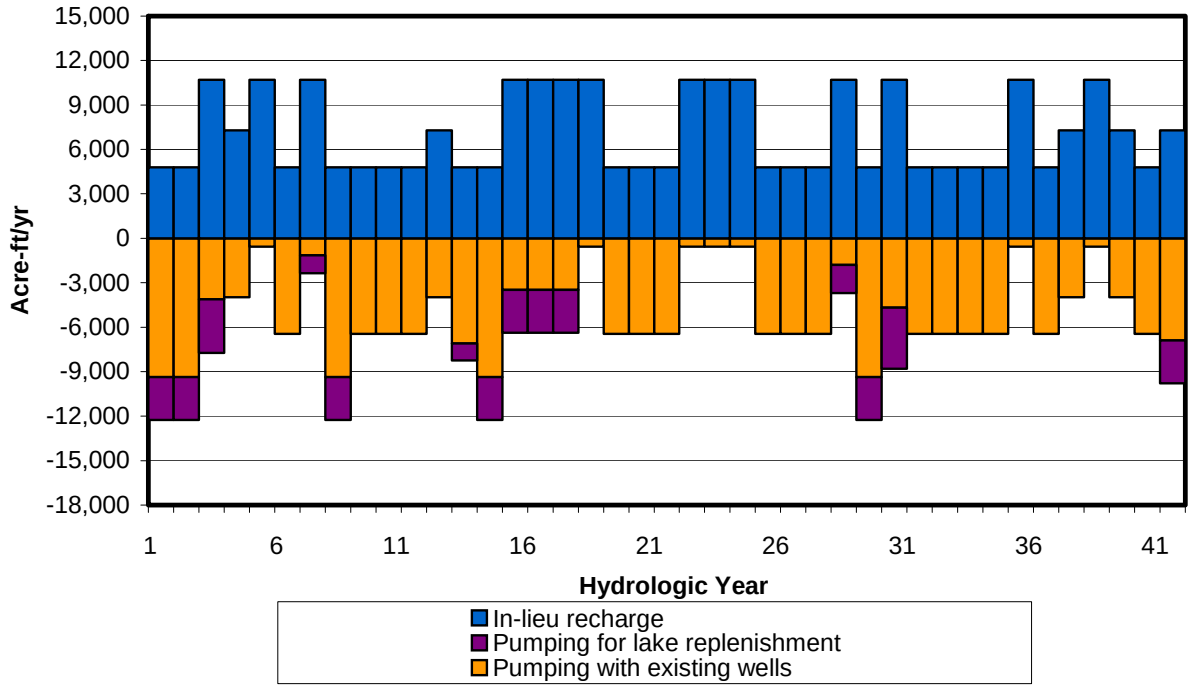
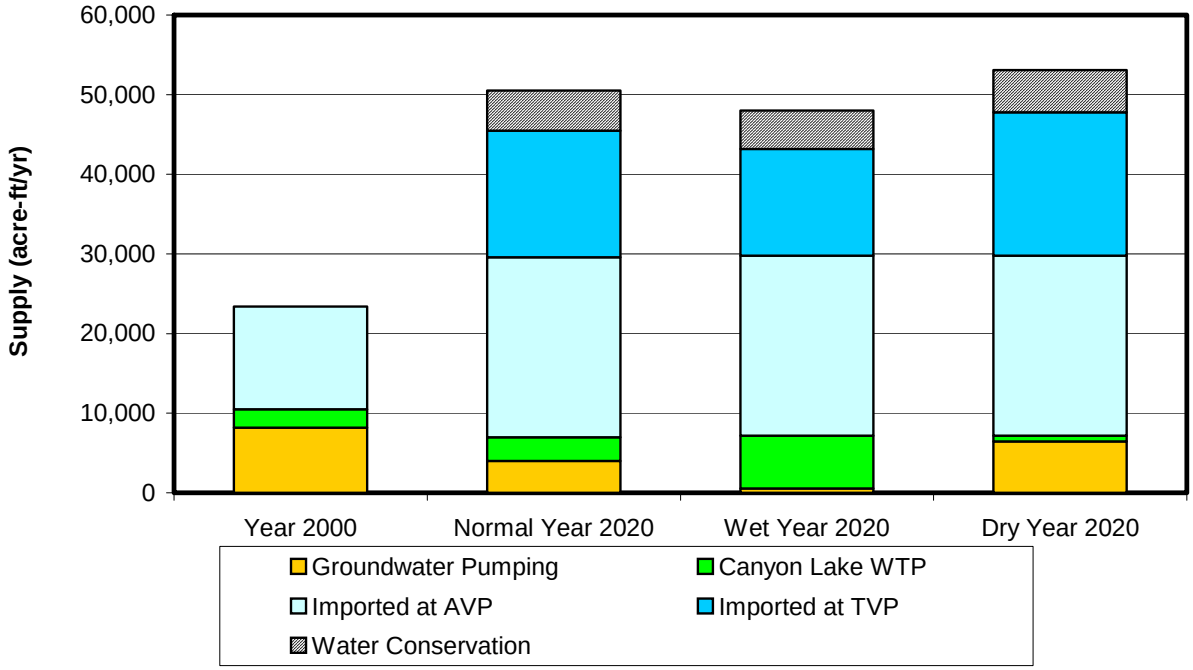


Figure 6-7
Year 2020 Potable Supplies for Alternative 3



ALTERNATIVE 4 – COMBINATION ALTERNATIVE

The purpose of Alternative 4 is to achieve a long-term groundwater balance using a combination of dual-purpose wells, in-lieu recharge, and water conservation. Dual-purpose wells would be installed in the Back Basin area as well as in the area north of Lake Elsinore. Similar to Alternatives 1 through 3, injection of treated imported water is only possible in periods when MWDSC makes replenishment water available.

As discussed above, spreading basins in McVicker Canyon and the upper portion of Leach Canyon may not be feasible. In addition, as is discussed in more detail in Section 7, Alternative 1 performed better than Alternative 2 in the northwest portion of the basin in terms of water level response and cost. Due to the high cost of pipelines and booster stations to convey the relatively small amount of supplemental water and the small amount of local runoff captured from these facilities, surface spreading is not included in Alternative 4.

For this alternative, construction of new dual-purpose wells, pipelines and booster stations is required. Alternative 4 includes the same land use assumptions as Baseline B and the same septic tank assumptions as described under Alternative 1. Differentiating components and activities are described below.

Water Demands

The water demands in Alternative 4 would be reduced with five percent compared to ten percent in Alternative 3. It is anticipated that this degree of water conservation is feasible without many financial incentives, as the projected demands of the Distribution Master Plan did not include any water conservation while current building codes require the installation of water saving devices. The average annual water demand in a normal year would decrease from 50,500 acre-ft/yr to 48,000 acre-ft/yr. Annual water demands are assumed to increase five percent in dry years and decrease five percent in wet years compared to normal year conditions.

Water Supplies

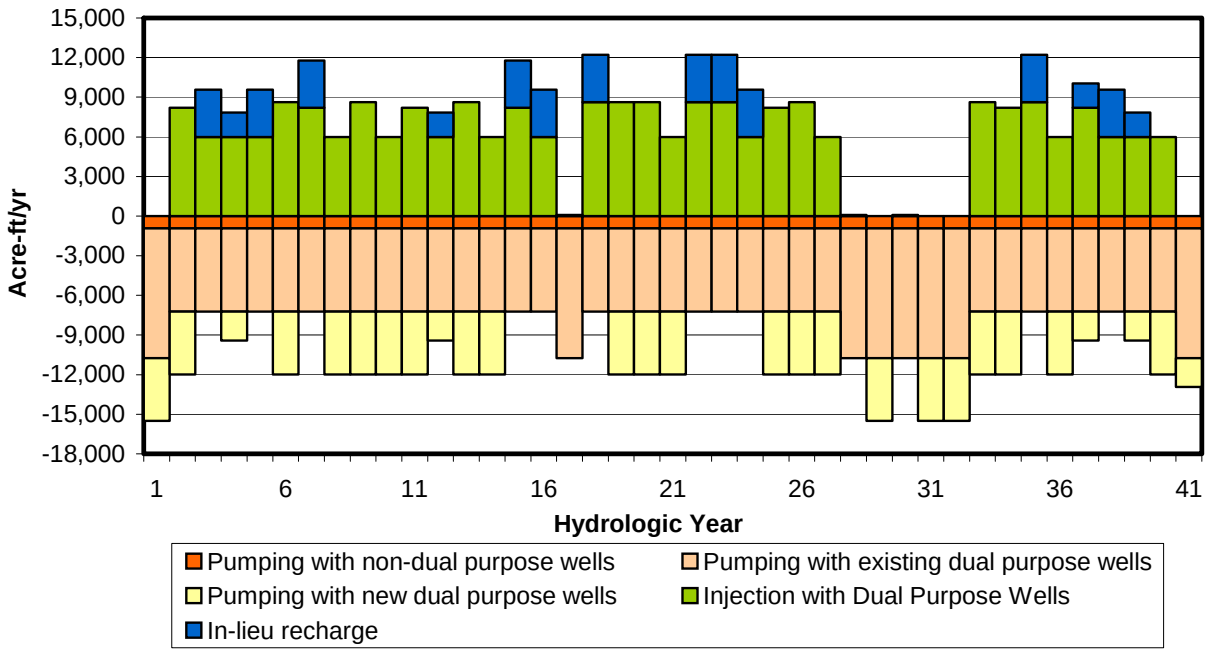
In addition to the supplies listed in Baseline B, Alternative 4 has 14 dual-purpose wells. Injection would take place between October and March in years when replenishment water is available, which depends on the hydrologic conditions of the sources that contribute to MWDSC's overall supply. The dual-purpose wells would be used for extraction in the summer months of dry years when the demands increase and the available imported supply from MWDSC is reduced. These dual-purpose wells are:

- Existing wells in the Back Basin area (Corydon, Cereal 1, Cereal 3, and Cereal 4) would be converted to dual purpose wells
- Two new deep dual purpose wells in the Back Basin area (Crawford-5 and Cereal 2)
- Five new shallow dual purpose wells in the Back Basin Area (South Alluvial 1 through 5)
- Joy Street well would be equipped as a dual purpose well
- Two new deep dual purpose wells in the area north of Lake Elsinore

In addition, four additional wells with a capacity of 1,000 gpm each are needed to provide peaking capacity to meet MDD.

Figure 6-8 shows the injection and extraction cycles of Alternative 4 as a function of the hydrologic conditions of 1960 through 2001. During the 41-year hydrologic cycle, about 240,000 acre-ft of imported water would be injected. With these operations, the groundwater basin remains in a long-term balance, meaning that the amount extracted is equal to the amount replenished over the 41-year period. As shown in this figure, lake replenishment from groundwater (because lake replenishment is provided by recycled water as discussed below) is insignificant, hence, less injection of imported water is required to maintain a sustainable groundwater balance. As a result, potable groundwater pumping is reduced by an average of 3,100 acre-ft during the winter. Pumping is increased by about 2,500 acre-ft during the summer, which results in a net in-lieu recharge of about 600 acre-ft/yr. However, approximately 1,100 acre-ft of the in-lieu water stored during the winter months remains in storage for more than one year, which allows EVMWD to take advantage of long-term storage water rates. More details on this issue are provided in **Section 7**.

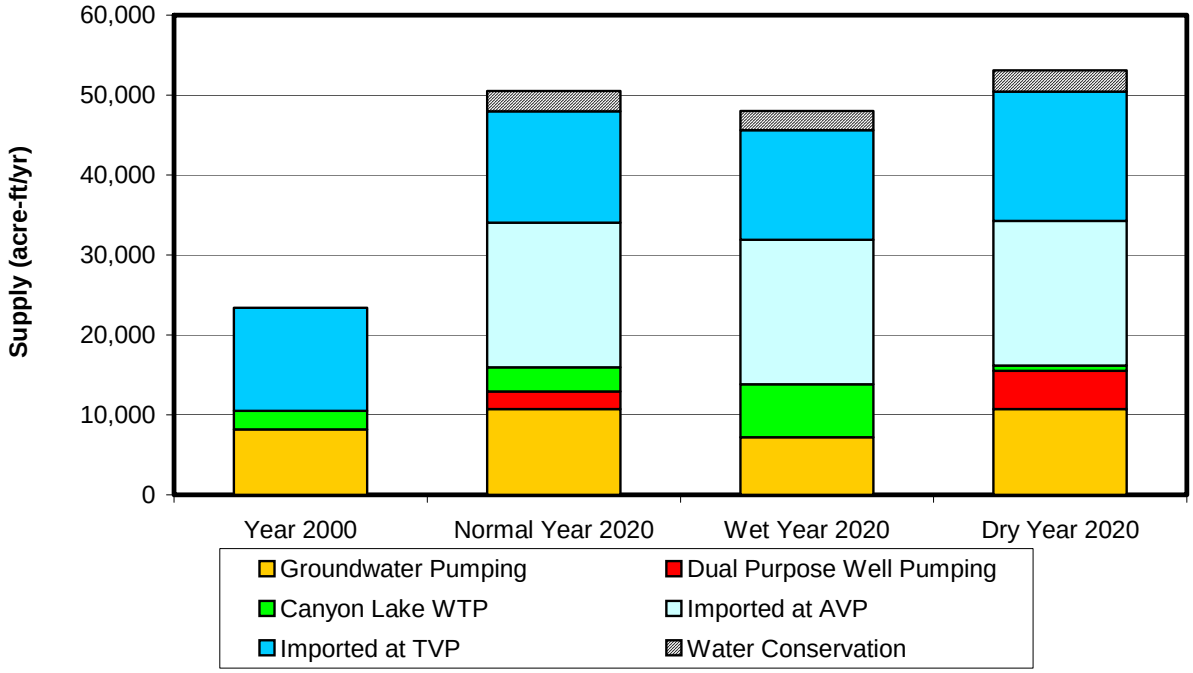
Figure 6-8
Groundwater Pumping and Injection – Alternative 4



The water supply distribution for the year 2020 demands in average, wet and dry years is shown on **Figure 6-9**. As shown in this figure, the dual purpose well are only required in dry years, when demands increase and the production of Canyon Lake WTP is almost zero. Alternative 4 achieves a balanced groundwater basin, In this alternative, 71 percent of the average potable water demands are supplied from imported water (not including water used for replenishment), 23 percent from groundwater and six percent from the Canyon Lake WTP. It should be noted

that these supply distributions are based on a six-month average demands, and that dual purpose wells and peaking wells would need to be available to provide peaking capacity.

Figure 6-9
Supply of Year 2020 Demand with Alternative 4



Lake Replenishment

Lake replenishment is assumed to be accomplished with recycled water and groundwater when the lake level drops below elevation 1,240 feet MSL. Recycled water would be used as the primary source of replenishment water up to 17.7 mgd. This is the projected capacity of the Regional WWTP in year 2020 minus 0.5 mgd for environmental discharge to Temescal Wash. One of the three Island wells would be used as the secondary source when the recycled water supply is not adequate to maintain the Lake level at elevation 1,240 MSL. Based on lake balance calculations, replenishment with groundwater occurred twice in 41 years. In addition, recycled water from EMWD could be used if necessary.

Note that since the technical analyses in this report were completed, The Lake Elsinore-San Jacinto Watershed Authority (LESJWA) issued a draft program environmental impact report (EIR) for the Lake Elsinore Stabilization and Enhancement Project in March 2005. This EIR included an updated analysis of lake replenishment needs using the 1928-2001 hydrologic period. The results of this analysis differ from those presented in this GWMP due to the different hydrologic periods and criteria for replenishing the lake. For this project, lake replenishment would take place when the lake elevation dropped below 1,247 ft MSL. Although, the results of the LESJWA investigation differs from those of the GWMP, the effect of pumping on the groundwater basin is similar to that evaluated in the GWMP.

In addition, The Regional Water Quality Control Board adopted Total Maximum Daily Loads (TMDLs) for nutrients in Canyon Lake and Lake Elsinore in December 2004. With the adoption of the TMDLs, the use of Eastern MWD effluent for lake replenishment is not expected to be cost-effective due to its cost and high nutrient concentrations.

The remaining sections of this report will evaluate the alternatives presented herein and recommend an implementation strategy for the preferred alternative.

Section 7
Evaluation of Alternatives

INTRODUCTION

The selection of a preferred alternative involves evaluating each alternative against a set of evaluation criteria and the conditions of Baseline B as discussed in **Section 4**. The alternative which best meets the evaluation criteria is selected as the preferred alternative. This section described the assumptions used in groundwater modeling, hydraulic modeling and cost calculations, followed by a discussion of the evaluation criteria, the evaluation results, and the selection of the preferred alternative.

EVALUATION CRITERIA

The process of evaluating the effectiveness of each alternative in meeting the GWMP's goal involves technical analyses coupled with professional judgment and experience. Each management alternative is evaluated using the following set of criteria:

- Ability to reduce overdraft
- Expected cost
- Environmental impacts
- Risk
- Legal and regulatory implementation
- Public acceptability
- Funding
- Reliability
- Water Quality
- Flexibility
- Ease of implementation

Alternatives are rated on a scale of 1 to 5, with 5 being excellent and 1 being a very poor score. In addition, each criterion has a weighting factor ranging from 1 to 3, with 3 used for the most important criteria and 1 for the least important criteria. The total ranking of the alternatives compared to Baseline B is presented with and without the weighting to illustrate the impact of the assigned weighting to the final ranking of alternatives. Where possible, quantifiable measures are defined to rate the alternatives for each of the criteria, however the majority of criteria are rated based on qualitative considerations. The basis for the numerical rating of the alternatives for each criterion is presented in **Table 7-1**. The definitions of the criteria are described in more detail below.

Table 7-1
Evaluation Criteria

Evaluation Criteria	Very Poor Score (1)	Poor Score (2)	Fair Score (3)	Good Score (4)	Excellent Score (5)
Ability to Reduce Overdraft	Steep declining water levels, Storage deficit > 4,000 AF/yr.	Declining water levels, Storage deficit 1,000-4,000 AF/yr.	Some declining water levels, Storage deficit < 1,000 AF/yr.	Stable water levels, Storage surplus 0-1,000 AF/yr.	Increasing water levels, Storage surplus > 1,000 AF/yr.
Expected Costs	>$600/AF	$501-600/AF	$401-500/AF	$300-400/AF	<$300/AF
Environmental Impacts	Significant negative environmental impact and controversy.	Negative impact that can only be partially mitigated.	Some negative impact, but can be satisfactorily mitigated.	Min. negative impact, some beneficial environmental impact.	No negative impact, beneficial environmental impact.
Risk	Not technically feasible based on current information.	High risk due to use of new technologies or technically difficult components.	Moderate risk.	Low risk due to the use of demonstrated technologies at some locations.	No risk due to use of proven technologies.
Legal and Regulatory Issues	Very significant.	Significant.	Moderate.	Minimal.	None.
Public Acceptability	Public is expected to vigorously oppose.	Public is expected to oppose to some components.	Public is not expected to oppose the alternative.	Public is expected to support most components	Public is expected to support the whole alternative
Funding	Capital cost >$40 M, uneven distribution of investment.	Capital cost $31-40 M, uneven distribution of investments.	Capital cost $21-30 M, fairly even distribution of investments.	Capital cost $10-20 M and even distribution of investments.	Capital cost < $10 M and even distribution of investments.
Reliability	Reliance on imported supply in consecutive drought years >90%	Reliance on imported supply in consecutive drought years 80-89%	Reliance on imported supply in consecutive drought years 70-79 %	Reliance on imported supply in consecutive drought years 60-69%	Reliance on imported supply in consecutive drought years <60 %
Water Quality	Significant increase in TDS concentration (over 100 percent)	Moderate increase in TDS concentration (over 50 percent(	Minor increase in TDS concentration (over 20 percent)	No increase in TDS concentration (plus or minus 10 percent)	Decrease in TDS concentration (more than 10 percent decrease)
Flexibility	Not flexible.	Some degree of flexibility.	Fairly Flexible.	Very Flexible.	Extremely Flexible.
Ease of Implementation	Very high degree of technical difficulty.	High degree of technical difficulty.	Some technical difficulties anticipated.	Minimal technical difficulties anticipated.	No technical difficulties anticipated.

Ability to Reduce Overdraft

The ability to maintain a sustainable water balance over long-term hydrologic conditions is one of the primary goals of the GWMP; hence, the weighting factor of this criterion is 3. Overdraft can be quantified with the two indicators: 1) the reduction in groundwater storage when outflows exceed the inflows over a long-term period and 2) by the adverse impact associated with overdraft such as declining water levels, land subsidence and water quality degradation. An increase in groundwater storage must occur to eliminate overdraft and the associated adverse impacts. Increasing groundwater inflows, reducing groundwater outflows or a combination of both can achieve a reduction of overdraft.

As described in the **Section 5**, the storage deficit under Baseline B conditions is approximately 6,500 acre-ft/yr. This deficit results in declining water levels up to 400 feet. To achieve a balanced groundwater basin, the additional recharge and/or reduction of groundwater pumping needs to be 6,500 acre-ft/yr on a long-term average basis. Alternatives that achieve this are rated as 5, while alternatives with an average storage deficit of greater than 4,000 acre-ft/yr are rated as 1. Intermediate ratings are listed in **Table 7-1**.

Expected Cost

Alternatives are compared based on the unit cost of water per acre-ft, which is calculated by dividing the total annual cost by the total water supply, which is the average water demand plus water conservation amount when applicable. Because one of the GWMP goals is to provide a cost-effective water supply, the maximum weighting factor of 3 is assigned to this criterion.

The following capital costs are converted to annual cost in current dollars per alternative:

- Capital cost of new peaking wells.
- Capital cost of well rehabilitation and electrical upgrades
- Capital cost of new dual purpose wells
- Capital cost of conversions of existing wells to dual purpose.
- Capital cost of spreading basins
- Capital cost of pipelines and booster stations to convey treated imported water to dual purpose wells or spreading basins

The total annual costs used to calculate the unit cost per acre-ft include:

- Annual capital cost
- O&M cost for groundwater pumping of potable wells and island wells
- O&M cost for operating Canyon Lake WTP
- O&M of spreading ponds
- Annual cost of purchasing imported water at Tier 1, Tier 2 or replenishment rate.
- Energy cost of new booster stations included in an alternative
- Annual cost of water conservation

Alternatives with a unit cost between $401 and $500 per acre-ft are rated as fair (3) because the cost of Tier 1 and Tier 2 water is within this range. Alternatives with unit cost below $300 per acre-ft are rated as excellent, while alternatives with a unit cost of greater than $600 per acre-ft are rated as very poor. The ranges for each rating category are presented in **Table 7-1**. The assumptions used for the development of cost estimates are discussed below.

Cost Assumptions

Capital cost assumptions are developed based on data obtained from industry manufacturers, MWH's experience on similar planning projects and data provided by the District. Pipeline costs have been calculated using recent cost data for work completed by MWH. All estimates have been adjusted to an Engineering News Record (ENR) Construction Cost Index (CCI) of 7,572 (Los Angeles, March, 2003) and are consistent with the American Association of Cost Engineers guidelines for developing reconnaissance-level estimates which should range between 50 percent above and 30 percent below actual capital expenditures. A 30 percent contingency is included in the cost estimates. The engineering, administration, and legal costs are estimated to be 25 percent of construction costs. The engineering, administration, and legal costs also include typical services such as inspection, materials testing and construction management. All costs are presented in current dollars.

The alternatives are compared based upon the total annual cost, which includes the annual capital cost and the operational and maintenance (O&M) cost. For the conversion of capital cost to annual cost a discount rate (interest minus inflation) of four percent is used based on direction from the District. Pipelines are depreciated over 40 years, electrical and mechanical equipment and pump stations over 20 years, wells over 75 years, and spreading basins over 20 years.

The energy cost of groundwater pumping is calculated per well using the modeled flow rates, the water levels calculated with the groundwater model, and a unit energy cost of $0.12 per kWh. The average pumping cost over the 41-year simulation period are determined for four categories, wells in the Back Basin area, wells in the area north of the Lake, the EWD wells, and the Island Wells. As the water levels vary between alternatives, different pumping rates are calculated for each alternative. For the total groundwater pumping cost, a surcharge of $25 per acre-ft is added to the energy cost to account for treatment and well maintenance costs. This amount was assumed based upon the difference in total pumping cost provided by the district and the calculated energy cost based on model results. The total groundwater pumping cost and the unit cost per supply source that are used in the cost calculations are summarized in **Table 7-2**. This table includes $150 per acre-foot of recycled water that is used for lake replenishment to account for the potential lost profit. This amount is a rough estimate and is used in the cost calculations to indicate that (a portion) of the lake make-up amount can be sold to future recycled water customers if a recycled water system is developed within the District's service area.

The cost of water conservation is based on estimates prepared in the Urban Water Management Plan (MWH, 2000). This plan estimated to achieve three percent water conservation by implementing a two-phase program. The annual cost of phase 1 (years 0-3) was estimated to be $108,000 and phase two (years 7-10) was estimated to cost $127,000 per year in 2003 dollars. This equals to about $122,000 per year on an annual basis. The cost includes water surveys, residential plumbing retrofits, large scale landscaping conservation and incentives, high-

efficiency appliances promotion, public information, development of a water waste prohibition program, and ultra-flow toilet rebates.

Table 7-2
Summary of Water Supply Cost

Water Supply Source	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Groundwater Wells north of Lake Elsinore	$ 124	$ 99	$ 106	$ 83	$ 78
Groundwater Wells in the Back Basin Area	$ 139	$ 86	$ 136	$ 95	$ 84
Groundwater Wells EWD	$ 95	$ 91	$ 105	$ 83	$ 81
Island Wells	$ 154	$ 109	$ 150	$ 114	$ 93
Canyon Lake WTP	$ 230				
Treated Imported Water Tier 1	$ 418				
Treated Imported Water Tier 2	$ 499				
Replenishment Water	$ 300				
Additional Source Water	$ 499				
Untreated Imported Water[1]	$ 233				
Recycled water from EMWD	$ 165				
Lost revenue from recycled water used for Lake replenishment	$ 150				

1 – Untreated water obtained through turnout WR-18B

The cost of water conservation is based on the cost estimates prepared for the conservation program presented in the UWMP. These estimates include costs for EVMWD only, and do not include the costs assigned to the naturally occurring conservation as a result of plumbing codes, cost incurred by the public, or MWDSC rebates. For the purpose of this GWMP, a unit water conservation cost of $260 per acre-foot is used.

The cost of spreading basins is estimated based on the amount of earthwork using a unit cost of $12 per cubic yard. This includes cutting, spreading to create berms, and hauling. The earthwork amounts are based on three-dimensional modeling of the sites. These amounts and the estimated capital costs are summarized in **Appendix I**.

The cost of septic tank conversions is not included in the cost estimates presented in this report. The development of the septic tank conversion policies is on going. As part of this effort and economic analysis will be conducted that evaluates the cost of septic tank conversion and the benefits of the avoided cost of well treatment and septic tank replacement cost.

The cost of converting an existing well to dual-purpose use is estimated to cost $100,000 per well which includes a small building to place equipment. This estimate is not location specific and is used for all well conversions.

Environmental Impacts

The environmental impacts included in the alternative evaluation include changes in groundwater storage, land subsidence, use of land with biological resources, and impacts on habitat, water quality degradation, and public health and safety. In addition, the best use of water resources and the level of environmental responsibility are evaluated. Because one of the GWMP goals is to provide a water supply in an environmentally responsible manner, the maximum weighting factor of 3 is assigned to this criterion. Alternatives with some adverse environmental impact, that can be satisfactorily mitigated, are rated as fair score (3). Alternatives with no adverse environmental impacts and/or beneficial environmental impacts are rated as excellent (5), while alternatives with significant adverse environmental impacts that may cause controversy are rated as very poor (1). The definitions for each rating category are presented in **Table 7-1**.

Risk

Risk is defined as the chance that specific investments will not produce the desired results due to use of new technologies or other risks. Other risks may include a reduction in pumping capacity of wells due to declining water levels, the availability of new water supply sources, or unknown basin characteristics. As some degree of risk is expected in new planning strategies, alternatives with a moderate risk are rated as fair (3). Alternatives that contain components that are not technically feasible based on current information are rated as very poor (1), while alternatives without any risks due to the use of proven technologies only are rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Because risk is not part of the GWMP goal, but does relate to the potential for losses if investments do not produce the desired results, this criterion is assigned a weighting factor of 2.

Legal and Regulatory Issues

For the rating of the alternative, the legal and regulatory issues criterion is defined as the degree of difficulty for achieving compliance with existing regulations or to obtain legal approvals to implement the alternative. Legal and regulatory constraints may include, but are not limited to, the settlement agreement with EWD (monitoring mitigation plan), agreement with the City of Lake Elsinore regarding the lake levels, NPDES permit for discharge of recycled water in Lake Elsinore, and compliance with the Basin Plan objectives.

As the implementation of new project is likely to result in some legal and/or regulatory constraints, alternatives with moderate issues are rated as fair (3). Alternatives that contain components that have very significant legal and regulatory constraints are rated as very poor (1), while alternatives without any constraints are rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Although legal and regulatory constraints are not part of the GWMP goal, these issues can result in fatal flaw situations. Hence, this criterion is assigned a weighting factor of 2.

Public Acceptability

The public acceptability criterion is defined as the anticipated degree of public approval or opposition to the alternative. A stakeholder process is used in the development of this GWMP to gather information from the public on their concerns about the management of the Elsinore Basin and to incorporate ideas in the management alternatives. Public acceptability is a function of the negative or positive impact that the implementation of an alternative has on the public including, but is not limited to, the financial impact, environmental impact, temporary inconveniences due to construction work, and the degree of participation in water conservation programs. If the public is not expected to oppose or support to an alternative, this alternative is rated as fair (3). Alternatives that contain components that are expected be vigorously opposed by the public are rated as very poor (1), while alternatives that are expected to be supported completely are rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Public acceptability is not part of GWMP goal, however, the support of the public is important for the implementation of the alternatives; hence, this criterion is assigned a weighting factor of 2.

Funding

One of the components of implementation is the acquisition of funds to construct the required wells, pipelines, pumping stations, and/or spreading basins. Not only the amount of required funds, but also the distribution of required investments over time plays a role in the feasibility of an alternative. Large investments at once are less desirable than projects than can be phased and funded over a period of time. Hence, this criterion is defined as the ability to acquire the required funds and the distribution of investments over the required time frame. Funding is focused on long-term capital investments rather than annual O&M cost which are evaluated with the expected cost criterion.

Alternatives with capital cost between $21 million and $30 million that primarily allow an even distribution of investments are rated as fair (3). Alternatives with capital cost greater than $40 million and/or uneven distribution of investment are rated as very poor (1), while alternatives with capital cost below $10 million are rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Although funding is not part of the GWMP goal, funding needs are directly related to cost, which is one of the primary evaluation criteria. Therefore, this criterion is assigned a weighting factor of 2.

Reliability

Because water demands are projected to double over the next twenty years, and the net groundwater pumping needs to decrease to achieve a sustainable groundwater balance, the reliance on imported water supplies will increase from 56 percent in year 2000 to about 70 to 80 percent in year 2020. Although the total amount of imported water required to meet future demand does not change between alternatives, with the exception of the amount of water conserved in alternatives 3 and 4, the reliability on imported supplies in consecutive drought years varies between alternatives. The alternatives are different in their conjunctive use operations as the capacities to recharge the groundwater basin with imported supplies vary.

For the purpose of alternative evaluation, reliability is defined as the ability to meet water demands in consecutive drought years when replenishment water is not available. One way to measure the reliability of imported supplies in drought years is to calculate the average percentage of imported water used to meet the water demands in the hydrologic drought period of 1988 through 1992 when replenishment water is not available. Alternatives that use between 70 and 79 percent imported water during these four years are rated as fair (3). Alternatives that use more than 90 percent imported water in this period are rated as very poor (1), and alternatives that use less than 60 percent imported water in this period rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Reliability is part of the GWMP goal and, therefore, is assigned a weighting factor of 2.

Water Quality

Water quality is defined as the degree in which the salt concentration, expressed in TDS (mg/L), increases under an alternative. The current average TDS concentration of the Elsinore Basin is 550 mg/L in the upper aquifer and 390 mg/L in the lower aquifer, and the proposed Basin Plan Objective is 480 mg/L. The changes in TDS concentration are evaluated over the same hydrologic 41-year period as used for the other analysis, using the average inflows and outflows as presented in **Table 6-2**. Alternatives that result in decreased TDS concentrations (of at least 10 percent less) are rated as excellent (5), while alternatives that show a significant increase (over 100 percent) are rates as very poor (1). The definitions for each rating category are presented in **Table 7-1**. Water Quality is part of the GWMP goal and, therefore, is assigned a weighting factor of 2.

Flexibility

Flexibility is defined as the ease with which plans can be changed to address unforeseen circumstances including the ability to alter the plan to account for changes in planning assumptions regarding future demand patterns, projected resources or other uncertainties. In general, alternatives that contain a combination of strategies are more flexible than alternatives that focus on solely one approach. However, some strategies are flexible by themselves, such as the ability of spreading basins to recharge multiple water sources versus injection wells that are limited to the use of water that meets drinking water standards. Alternatives that do not contain many structural components seem more flexible to adjust to unforeseen circumstances, such as higher water demands than projected, because money is not invested yet and can be used for any project to address the unforeseen condition. However, project delays reduce the flexibility to find the best solution or to deal with unforeseen problems with project implementation. As time is more limited, the longer projects are postponed. Alternatives that are considered fairly flexible are rated as fair (3), alternatives that do not have any flexibility are rated as very poor (1), and that are extremely flexible are rated excellent (5). The definitions for each rating category are presented in **Table 7-1**. Flexibility is not part of or directly related to any components of the GWMP goal; therefore, flexibility is assigned a weighting factor of 1.

Ease of Implementation

The ease of implementation is evaluated per alternative based on the ease of technical implementation of the various alternative components. Ease of implementation includes the

technical difficulties to construct facilities such as the spreading basins, as well as operational difficulties, technical limitations of water conservation devices, and the ease to achieve the desired degree of public participation in water conservation programs. Alternatives with some degree of technical difficulties are rated as fair (3), alternatives with a very high degree of technical difficulty as very poor (1), and alternatives with a no technical difficulty as excellent (5). The definitions for each rating category are presented in **Table 7-1**. Ease of implementation is not part of or directly related to any components of the GWMP goal and, therefore is assigned a weighting factor of 1.

EVALUATION OF ALTERNATIVES

Baseline B and the four alternatives are evaluated using the evaluation criteria and rating structure described previously. The evaluation and ratings are summarized in **Table 7-3**, while a more detailed discussion per each of the evaluation criteria is provided below.

Ability to Reduce Overdraft

The ability to reduce overdraft is evaluated using the groundwater model results. As presented in **Section 4**, the groundwater levels in Baseline B drop between 100 and 400 feet over the 41-year simulation period depending on the location in the Elsinore Basin. In general, groundwater levels decline more in the Back Basin, with Corydon Well showing the greatest water level decline, than in the area north of Lake Elsinore. The water levels predicted with the groundwater model per alternative are presented in **Appendix J**. Comparison graphs of Lincoln Street, North Island, and Corydon Well are used for the evaluation of the alternatives. These comparison graphs are presented on **Figure 7-1**, **Figure 7-2**, and **Figure 7-3**.

As shown in these graphs, the water levels in Alternative 2 are only slightly higher than the water levels in Baseline B, especially in the Back Basin area represented by Corydon Well where both scenarios drop from about 400 feet. In the area north or Lake Elsinore, represented by Lincoln Street Well, the effect of surface recharge in Alternative 2 is visible as water levels decline from 350 feet, while Baseline B about declines 450 feet. In the middle of the basin, represented by the North Island Well, the effect of surface recharge of Alternative 2 is almost diminished, as the predicted water levels are very similar, declining about 300 to 350 feet. The water levels in Alternative 2 are clearly the worst of all four alternatives. This indicates that surface spreading alone is not sufficient to achieve a sustainable groundwater balance. If more water could be recharged in Leach and McVicker Canyons, the water levels in the area north of Lake Elsinore are likely to increase, while the levels in the Back Basin area are likely to continue to decline, due to the uneven distribution of recharge and extraction.

Alternatives 1, 3, and 4 are fairly similar with respect to water levels. The water levels of Alternatives 1 and 4 are slightly higher than the water levels in Alternative 3 in the middle and south part of the basin (indicated by the North Island Well and Corydon Well). This is caused by the positive effect of the dual purpose wells in the Back Basin area on the water levels, and it demonstrates that in-lieu recharge is not as effective in the south part of the basin as in the north part of the basin due to the lack of natural recharge. The water levels in Lincoln Street Well indicate that in-lieu recharge in the north part of the basin is more effective, because the water levels of Alternative 3 are between the water levels of Alternatives 1 (lower than Alternative 3)

Figure 7-1
Water Level Comparison – Lincoln Street Well

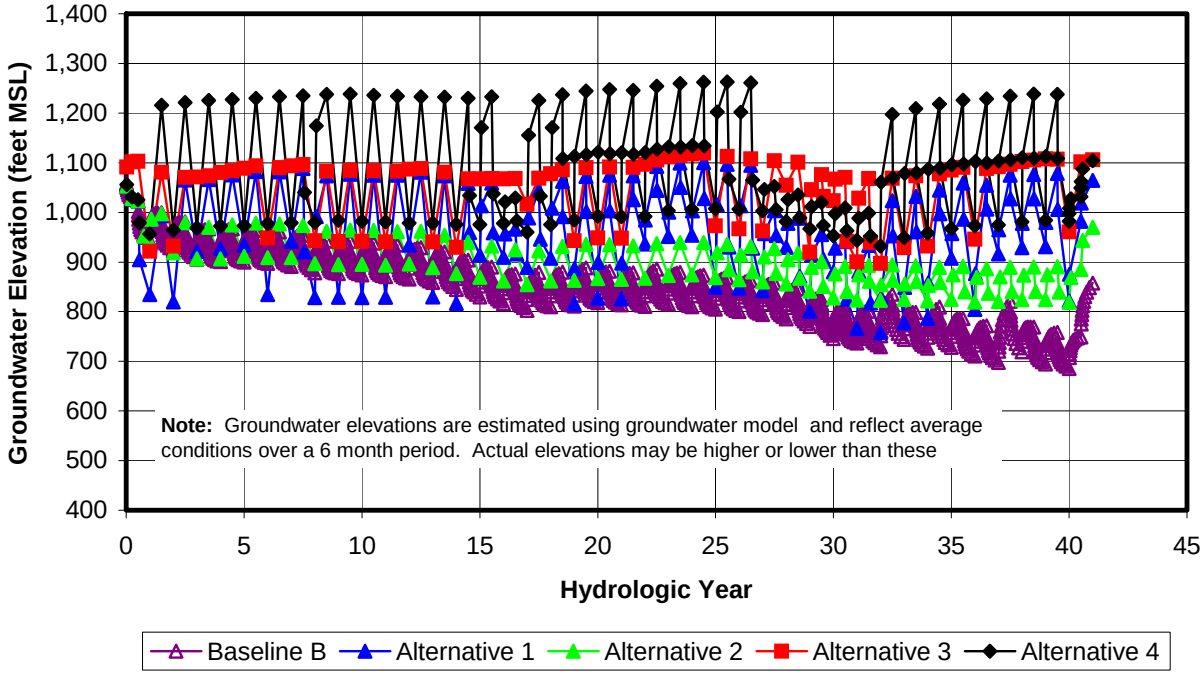


Figure 7-2
Water Level Comparison – North Island Well

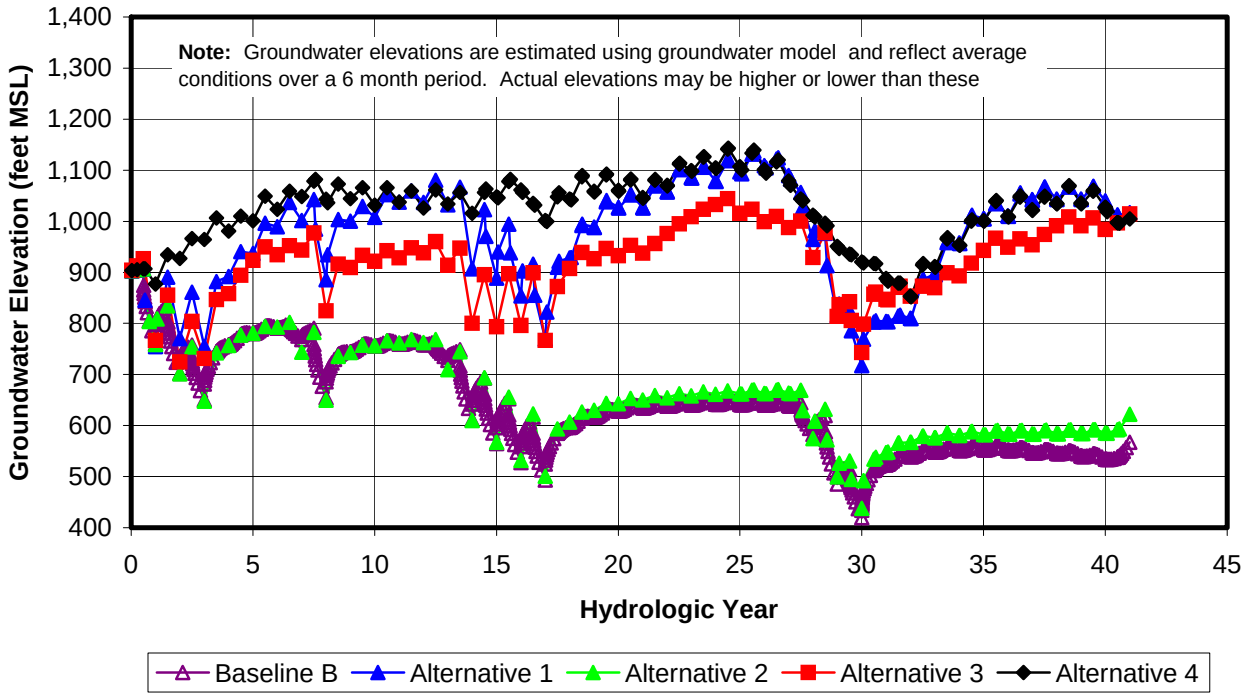


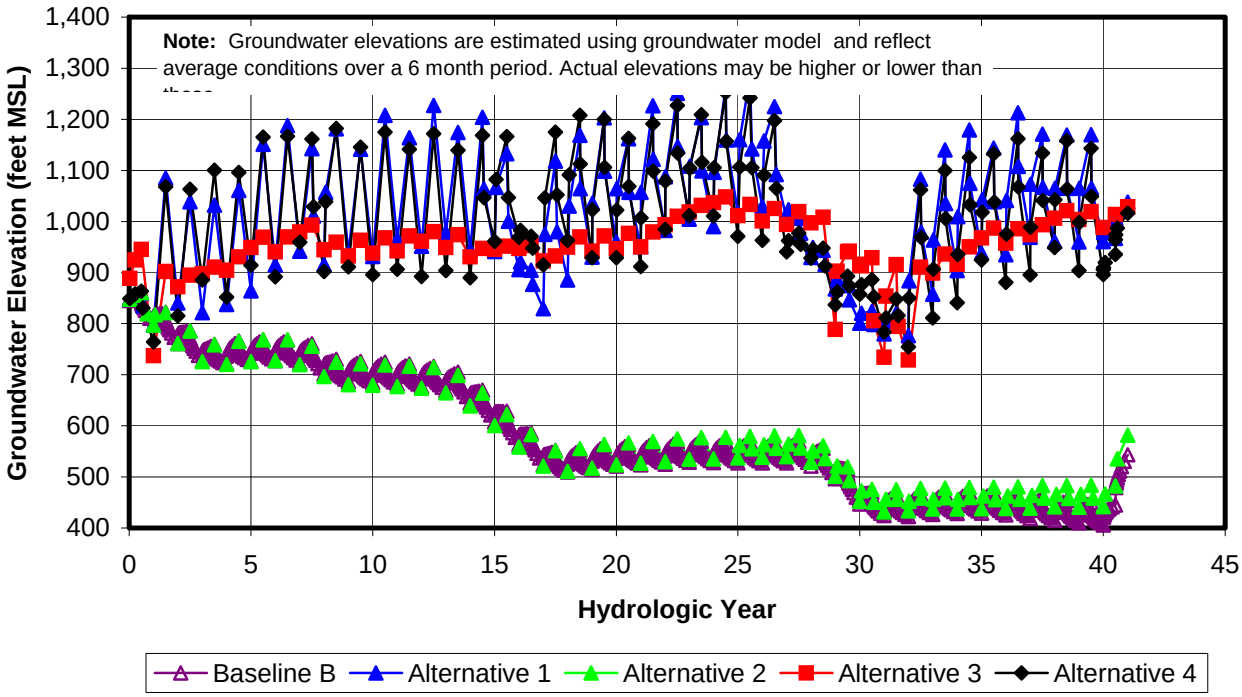
Table 7-3
Summary of Alternative Evaluation

Evaluation Criteria	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ability to Reduce Overdraft	1 • Groundwater balance is not achieved. • Zero artificial recharge. • Declining water levels to 400 ft. • Storage Deficit = 6,500 acre-ft/yr.	4 • Groundwater balance is achieved. • 6,700 acre-ft/yr injected. • 600 acre-ft/yr in-lieu recharge. • Stable water levels. • Storage Deficit = 0 acre-ft/yr.	2 • Groundwater balance is not achieved. • 4,800 acre-ft/yr surface spreading. • Declining water levels to 400 ft. • Storage Deficit = 3,800 acre-ft/yr.	3 • Groundwater balance is achieved. • 7,200 acre-ft/yr in-lieu recharge. • Stable water levels. • Storage Deficit = 200 acre-ft/yr.	5 • Groundwater balance is achieved. • 5,900 acre-ft/yr injected. • 600 acre-ft/yr in-lieu recharge. • Slightly increasing water levels. • Storage Deficit = 0 acre-ft/yr.
Expected Costs	4 • $428/acre-ft • $365/acre-ft (without common cost)	3 • $446/acre-ft • $438/acre-ft (without common cost)	3 • $457/acre-ft • $480/acre-ft (without common cost)	5 • $409/acre-ft • $288/acre-ft (without common cost)	4 • $425/acre-ft • $353/acre-ft (without common cost)
Environmental Impacts	1 • Steep declining water levels cause subsidence, which can not be mitigated. • Increase energy usage due to increased pumping lift.	4 • No significant environmental impact other than the construction of wells, pipelines and a PS. • Elimination of overdraft conditions is an environmental benefit.	2 • Use of canyons for spreading basins (30 acres) is likely to cause habitat losses, which may need mitigation. • Overdraft conditions remain, this can not be mitigated.	4 • No negative environmental impact as facilities other than the constructing of peaking wells. • Elimination of overdraft conditions is an environmental benefit. • Water Conservation	5 • No significant environmental impact other than the constructing of wells, pipelines and a PS. • Elimination of overdraft conditions is an environmental benefit. • Water Conservation • Better use of water resources by eliminating groundwater use for lake replenishment
Risk	2 • High risk that wells production will decrease due to declining water levels (resulting in higher cost for additional supplies and decreased reliability). • Moderate risk that additional imported supplies may not be available.	4 • Low risk with injection/extraction technology. • Low risk that the injection capacities are lower than estimated at the time of this GWMP. • Moderate risk that additional imported supplies may not be available.	1 • High risk that surface spreading is not feasible to the extend included in this alternative due to limitations in infiltration (depth to bedrock). • Pilot testing required to determine infiltration rates. • Moderate risk that additional imported supplies may not be available.	3 • Moderate risk that 10 percent water conservation is not achieved. • Moderate risk that additional imported supplies may not be available.	4 • Low risk with injection/extraction technology. • Low risk that the injection capacities are lower than estimated at the time of this GWMP. • Moderate risk that additional imported supplies may not be available.
Legal and Regulatory Issues	2 • Declining water levels are a potential for litigation and may require adjudication of the Elsinore Basin. This causes complex legal and regulatory issues.	3 • Construction permits. • Compliance with 40 CFR Part 144, only water that meets drinking water standards can used for injection. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives.	3 • Construction permits. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives. • Use of recycled water for spreading, is limited to 50 % of the total spreading amount or RO treatment is required.	4 • Construction permits. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 7.5 mgd of recycled water in Lake Elsinore.	2 • Construction permits. • Compliance with 40 CFR Part 144, only water that meets drinking water standards can used for injection. • Development/implementation of septic tank conversion policies required. • NPDES permit required for discharge of 17.7 mgd of recycled water in Lake Elsinore. • Meet Basin Plan objectives.
Public Acceptability	1 • Public is expected to vigorously oppose to unacceptable subsidence.	5 • Public is expected to support most components.	2 • The public is expected to oppose to some degree of subsidence. • The public may oppose to the construction of spreading basins in the canyons. • Public may oppose to use of recycled water for surface spreading.	3 • Public is expected to support most components of the alternative, however, 10 percent water conservation places a burden on public participation. • The alternative requires minimal construction.	4 • Public is expected to support most components.

Table 7-3 (Continued)
Summary of Alternative Evaluation

Evaluation Criteria	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Funding	1 • Capital Cost $56 million. • Fair distribution of investments.	3 • Capital Cost $30 million. • Uneven distribution of investments.	1 • Capital Cost $57 million. • Fair distribution of investments.	4 • Capital Cost $16 million. • Even distribution of investments.	4 • Capital Cost $24 million. • Fair distribution of investments.
Reliability	3 • 73% of water supply from MWD in consecutive drought years.	3 • 70% of water supply from MWDSC in consecutive drought years.	3 • 70% of water supply from MWDSC in consecutive drought years.	2 • 84% of water supply from MWDSC in consecutive drought years.	4 • 67% of water supply from MWDSC in consecutive drought years.
Water Quality	1 A significant increase in TDS concentration due to continue increase in salt from septic tanks and decreased basin storage volume	5 Decreasing TDS concentrations due to a reduction in salt from septic tanks and injection of lower TDS water, while maintaining the same storage volume	5 Decreasing TDS concentrations due to a reduction in salt from septic tanks and infiltration of lower TDS water, while maintaining the same storage volume	5 Decreasing TDS concentrations due to a reduction in salt from septic tanks, while maintaining the same storage volume	5 Decreasing TDS concentrations due to a reduction in salt from septic tanks and injection of lower TDS water, while maintaining the same storage volume
Flexibility	2 • Projects can be implemented in the future if well production declines or subsidence occurs. However, flexibility to adjust to unforeseen circumstances is low as the need for additional supplies increases the longer projects are postponed.	5 • Dual-purpose wells provide flexibility to inject/extract more water depending on demands/availability of MWDSC water. • Flexible to use multiple sources, water from Mills WTP, Skinner WTP, and Canyon Lake WTP. • Not flexible to use multiple water sources as injected water needs to comply with Title 22.	4 • Flexible to use multiple water sources for spreading; local runoff, treated imported water, untreated imported water, Canyon Lake WTP water, recycled water from the regional WWTP or EMWD. • Limited capacity of spreading basins to maximize use of replenishment water.	3 • Flexible to adjust to higher demands (lower water conservation) than anticipated with GW pumping. • Poor flexibility to implement new projects, as the need for additional supplies increases the longer projects are postponed. • Moderate flexibility to use replenishment water for in-lieu recharge as this amount is limited by (winter) water demands.	5 • Dual-purpose wells provide flexibility to inject/extract more water depending on the availability of MWDSC water. • Flexible to use multiple sources, water from Mills WTP, Skinner WTP, and Canyon Lake WTP. • Not flexible to use multiple water sources as injected water needs to comply with Title 22.
Ease of Implementation	3 • Construction required of 11 wells • Substantial re-equipment of wells • Construction of new pipeline for additional source.	4 • Construction required of 13 wells, 1 pipeline and 1 pumping station.	2 • Construction of spreading basins required in canyons, which is expected to be difficult due to rocks, and difficult accessibility of the upper part of leach canyon. • Construction of 17 wells, pipelines and a booster station. • Substantial re-equipment of wells.	3 • No construction required other than 8 wells. • Implementation of water conservation measures that contribute to 10 percent conservation may be difficult.	4 • Construction required of 11 new wells • Conversion of 6 existing wells to dual purpose. • Construction of 1 pipeline and 1 PS • Implementing water conservation. measured that contribute to 5 percent conservation.
Total Rating	**21**	**43**	**28**	**39**	**47**

Figure 7-3
Water Level Comparison – Corydon Well



and Alternative 4 (higher than Alternative 3). As indicated in the three graphs, the water levels in Alternative 3 do not show the same degree of fluctuation as the alternatives with injection and extraction cycles (Alternatives 1 and 4). For Alternative 3, water levels fluctuate about 200 to 300 feet in the north and south part of the basin respectively. Alternatives 1 and 4 show a wider range of 350-400 to 500 feet in the north and south part of the basin respectively. This indicates that the alternatives with dual-purpose wells exercise the basin storage more, which is a desired situation for conjunctive use operations.

In addition to water levels, the net groundwater storage is used as a measure for the ability to reduce overdraft. As shown in **Table 7-3**, Baseline B has an average storage deficit of 6,500 acre-ft. The storage deficit of alternative 2 is reduced to 3,900 acre-ft/yr. The groundwater basin is not balanced in this alternative due to the limited infiltration capacity of the surface spreading basins, which cannot be expanded in size due to site constraints. The storage deficit in Alternative 3 is reduced to 200 acre-ft/yr, while Alternatives 1 and 4 are both balanced.

Based on the storage deficits and the degree of declining water levels, Baseline B is rated as very poor, Alternative 2 as poor, Alternative 3 with a fair and Alternative 1 as good, and Alternative 4 as excellent (increasing storage).

Expected Cost

The total capital cost and the cost per acre-ft of water are calculated per alternative with the assumptions discussed earlier in this section. A detailed cost estimate per alternative is provided in **Appendix I**, which is summarized in **Table 7-4**.

Table 7-4
Cost Summary per Alternative

Item	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Capital Cost	$ 49,970,000	$ 30,020,000	$ 57,380,000	$ 15,760,000	$ 24,310,000
Annual Capital Cost	1,992,000	1,108,000	2,616,000	558,000	913,000
Annual O&M Cost	2,645,000	2,321,000	2,984,000	2,791,000	2,970,000
Annual Imported Water Cost	16,985,700	19,116,000	17,477,000	17,307,000	17,589,000
Total Annual Cost	$ 21,622,700	$ 22,545,000	$ 23,077,000	$ 20,656,000	$ 21,472,000
Supply (acre-ft/yr)	50,500	50,500	50,500	50,500	50,500
Unit Cost per acre-ft (at 3% discount rate)	**$428**	**$446**	**$457**	**$409**	**$425**
Unit Cost per acre-ft (at 2% discount rate)	$421	$442	$449	$407	$422
Unit Cost per acre-ft (at 4% discount rate)	$436	$451	$466	$412	$429

As shown in this table, the capital cost range significantly from $16 million to $57 million, while, the unit costs only show relatively small differences ranging from $409 to $457 per acre-ft at a three percent discount rate and including the cost and amount of imported water. The unit costs do not seem very sensitive to the discount rate used. These relatively small differences in unit cost are caused by the high contribution of purchased imported water costs, which are very similar between alternatives, ranging from $17 million to $19 million. Because the annual cost of alternative specific components is relatively small, the unit costs do not vary greatly. Although the unit costs are very similar, the effect on the groundwater basin is significant. By spending the same amount of money to meet the year 2020 water demands, more value is obtained with the alternatives that achieve a sustainable groundwater balance.

The capital cost of Baseline B is $50.0 million and includes 21 electrical well upgrades, re-equipping of 14 well due to declining water levels, construction of 11 peaking wells and the cost of bringing an additional supply source to the Districts service area. The additional supply is assumed to come from Mills WTP by constructing new pipelines ranging from 12-inch to 26-inch in diameter parallel to the TVP with a combined length of 18 miles. The total capital cost of this additional source is about $24.5 million. The annual cost of Baseline B is $21.6 million and includes the annual capital cost, energy cost of groundwater pumping of all wells, operating Canyon Lake WTP and purchase of imported water at Tier 1 and Tier 2 rates. The additional source water is assumed to cost the same as Tier 2 water. The unit cost of Baseline B is $428 per acre-ft.

The capital cost of Alternative 1 is $30.0 million and includes four well electrical upgrades, four peaking wells, four conversions of existing wells to dual purpose wells, ten new dual purpose

wells, a 30-inch diameter pipeline on Corydon Street, and a 800 HP pumping station. The annual cost of Alternative 1 is $22.5 million and includes the annual capital cost, energy cost of groundwater pumping of all wells and the new 800 HP pumping station, operating Canyon Lake WTP and purchase of imported water at Tier 1, Tier 2, and replenishment rates. The unit cost of Alternative 1 is $ 446 per acre-ft.

The capital cost of Alternative 2 is $57.4 million and includes 17 well electrical upgrades, 11 re-equipping of wells due to declining water levels, 11 peaking wells, five new extraction wells near the canyons, 30-acres of spreading ponds in Leach and McVicker Canyon, pipelines ranging from 12-inch to 36-inch in diameter and a combined length of about 4.5 miles to convey TVP water to the spreading ponds, and a 800 HP pumping station. The sizing of facilities is based on the peak capacity required, rather than the average infiltration amounts. The annual cost of Alternative 2 is $23.1 million and includes the annual capital cost, energy cost of groundwater pumping of all wells and the new 800 HP pumping station, operating Canyon Lake WTP and purchase of imported water at Tier 1, Tier 2, and replenishment rates. The unit cost of Alternative 2 is $ 457 per acre-ft. These cost estimates are based on the use of treated imported water (from TVP) as the only source for supplementing the local runoff in the spreading basins, which is determined the least expensive source based on a cost comparison of various sources discussion in **Section 6**.

The capital cost of Alternative 3 is $15.8 million and includes eight well electrical upgrades and eight peaking wells. The annual cost of Alternative 3 is $20.7 million and includes the annual capital cost, energy cost of groundwater pumping of all wells, water conservation programs, operating Canyon Lake WTP and purchase of imported water at Tier 1, Tier 2, and replenishment rates. The unit cost of Alternative 3 is $ 409 per acre-ft.

The capital cost of Alternative 4 is $24.3 million and includes four peaking wells, seven conversions of existing wells to dual purpose wells, seven new dual purpose wells, a 30-inch diameter pipeline on Corydon Street, and a 800 HP pumping station. The annual cost of Alternative 4 is $21.5 million and includes the annual capital cost, energy cost of groundwater pumping of all wells and the new 800 HP pumping station, water conservation programs, operating Canyon Lake WTP and purchase of imported water at Tier 1, Tier 2, and replenishment rates. The unit cost of Alternative 4 is $ 425 per acre-ft.

Because the cost including the purchase of water from MWDSC and the operation of Canyon Lake WTP do not show much variation between the alternatives, the cost of each alternative is also expressed without the common cost components. The amount and cost of both Tier 1 water and Canyon Lake WTP water is the same for all alternatives and Baseline B. The amounts and costs are subtracted from the unit cost presented in **Table 7-5**. In addition, the amount of Tier 2 water purchased in Baseline B and the associated cost are subtracted as well. By presenting the cost without these common cost components and water supply amounts, the cost differences associated with the project are magnified. As shown in **Table 7-5**, the unit cost of the project related water supply varies from $288 to $438 per acre-foot. The supply amounts used for these unit costs, include groundwater pumping, in-lieu water, incremental Tier 2 purchases in comparison to Baseline B and water conservation. Alternative 3 has the lowest unit cost as it includes two cheap water supplies, in-lieu recharge and water conservation. Alternative 4 is the

second cheapest with water conservation and more in-lieu recharge than Alternative 1. Alternative 2 is the most expensive alternative in both comparisons, as it does not have any cheap water sources. The alternatives are rated on the results presented in **Table 7-5** as **Table 7-4** does not show any variation due to the effect of common supply cost. Based on the criteria presented in **Table 7-1**, Alternatives 1 and 2 have a fair score (3), Baseline B and Alternative 4 a good score (4), and Alternative 3 an excellent score (5).

Table 7-5
Cost Summary per Alternative per acre-foot of overdraft reduction

Item	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Annual Cost [1]	$21,622,700	$22,545,000	$23,077,000	$20,656,000	$21,472,000
Common Cost – Canyon Lake WTP	$690,000	$690,000	$690,000	$690,000	$690,000
Common Cost - MWDSC at Tier 1	$5,568,000	$5,568,000	$5,568,000	$5,568,000	$5,568,000
Common Cost - MWDSC at Tier 2	$10,769,000	$10,769,000	$10,769,000	$10,769,000	$10,769,000
Total Common Cost	$17,027,000	$17,027,000	$17,027,000	$17,027,000	$17,027,000
Total Annual Cost without Common Cost	**$4,595,700**	**$5,518,000**	**$6,050,000**	**$3,629,000**	**$4,445,000**
Total Water Supply (acre-ft/yr)	50,500	50,500	50,500	50,500	50,500
Common Water Supply[2] (acre-ft/yr)	37,900	37,900	37,900	37,900	37,900
Project Water Supply [3] (acre-ft/yr)	**12,600**	**12,600**	**12,600**	**12,600**	**12,600**
Unit Cost ($/acre-ft)	**$365**	**$438**	**$480**	**$288**	**$353**

1 – See Table 7-4.
2 – Canyon Lake WTP (3,000 acre-ft/yr), Tier 1 (13,320 acre-ft/yr), and Tier 2 of Baseline B (21,580 acre-ft/yr)
3 – Total Water Supply minus Common Water Supply

Environmental Impacts

The evaluation of the environmental impacts include biological, cultural, land use, water quality, air quality, public health and safety, and other considerations. For the alternatives, the primary environmental impacts are changes in groundwater storage, potential of land subsidence, use of land that may have biological resources, impacts on habitat, water quality degradation, construction nuisances, and public health and safety. In addition, the best use of water resources and the level of environmental responsibility are evaluated.

The primary environmental impacts of Baseline B are increased energy usage due to the increased groundwater pumping lifts and the potential of subsidence both caused by declining water levels. Geotechnical surveys need to be conducted to estimate the magnitude of subsidence. However, when 1-3 foot of subsidence per 100 feet of drawdown is used to estimate the subsidence potential for soils with interbedded clays, a 400 feet water level decline may

result in subsidence ranging from 4-12 feet. Mitigation of subsidence is not possible, hence Baseline B is rated as very poor.

Alternative 1 does not have any significant environmental impact other than the construction of the groundwater wells, 3,000 lineal feet of pipeline and a pumping station. As construction nuisances are temporary and can be mitigated, these are considered as minimal negative impact. The elimination of overdraft conditions is an environmental benefit. The overall rating of Alternative 1 is good.

Alternative 2 includes the construction of 30 acres of spreading basins in McVicker and Leach Canyon as well as pipelines and a booster station to supplement runoff water with imported water. Based on the survey conducted for the Elsinore Basin Recharge Feasibility Study (MWH, 2003), no environmental impacts are identified for McVicker Canyon other than the pipeline construction. The west side of Leach Canyon is identified as a potential habitat for California gnatcatcher and Belding's orange-throated whiptail. In addition, a potentially historic farmhouse is identified as a cultural resource. The construction of spreading basins in Leach Canyon would also cause nuisance for the residents on the eastside of the lower spreading basins. The main environmental impact is the remaining overdraft conditions of the groundwater basin that may result in subsidence, which cannot be mitigated. The overall rating of Alternative 2 is poor.

Alternative 3 does not have any significant environmental impact other than the construction of the groundwater wells. As construction nuisances are temporary and can be mitigated, these are not considered as minimal negative impact. The elimination of overdraft conditions is an environmental benefit and ten percent water conservation is in-line with the District's mission statement to promote environmental responsibility. The overall rating of Alternative 4 is good.

Alternative 4 does not have any significant environmental impact other than the construction of the groundwater wells, 3,000 lineal feet of pipeline and a pumping station. As construction nuisances are temporary and can be mitigated, these are considered as minimal negative impact. The elimination of overdraft conditions is an environmental benefit. This Alternative has two environmental benefits. Similar to Alternative 3 this Alternative includes water conservation, which is in-line with the District's mission statement to promote environmental responsibility. Secondly, the use of recycled water for lake replenishment is environmentally preferable as it preserves more groundwater for a higher form of use, serving potable water demands. The overall rating of Alternative 1 is excellent.

Risk

Risk is defined as the chance that specific investments will not produce the desired results due to use of new technologies or other risks, such as the reduction in pumping capacity of wells due to declining water levels, the availability of new water supply sources, or unknown basin characteristics.

Baseline B has a high risk that the production capacity of groundwater wells will decrease due to declining water levels. In the water balances, the reduced in production is not included, hence the amount of water required from an additional source may be higher than calculated. Without a reduction in production capacity, the maximum amount of additional supply required is

2,440 acre-ft per six months or 4.4 mgd. Groundwater wells should provide the peaking capacity for days when the demand exceeds the average summer demand (1.25 times ADD). Decreasing groundwater production would not only increase the amount of additional supplies, but also increase the cost, and increase the reliance on imported supplies. Capital cost will increase as a larger diameter pipeline from the Woodcrest turnout or other location would be required. O&M cost may increase as well if a booster station is required to provide sufficient head for conveyance. Due to the high risk of reduced groundwater production and its undesirable consequences (higher cost and increase reliability on imported supplies), the overall rating of Baseline B is poor.

Alternative 1 includes the use of dual-purpose wells from groundwater recharge. Due to the extensive experience of this technology in the United States, the use of dual-purpose wells is considered a low risk. However, the injection capacities may be lower than estimated in the model simulations and balance calculation of this GWMP. If the injection capacities are found to be lower than assumed in this study, some of the proposed peaking wells could be equipped as dual-purpose wells achieve the same recharge capacity. If the concept of dual purpose is incorporated in the design of new wells, no additional costs are expected. Therefore, the risk of lower injection capacities on achieving the desired injection amount is low. Based on this, the overall rating of Alternative 1 is good.

Alternative 2 has a high risk of not achieving the desired results, as a more detailed analysis of the spreading basin sites has indicated two constraints of the proposed expanded basin size options as used in Alternative 2 (see **Table 5-6** and **Table 5-7**). The first constraint is that the site slopes in McVicker Canyon limits the feasible spreading basin size to about 6 acres compared with 15 acres in the maximum basin option. The same constraint applies to Leach Canyon which spreading basin sizes are limited to 6 and 8 acres compared to 14 and 11 acres for the lower and upper part of Leach Canyon respectively. The second constraint is the limited infiltration capacity due to soil characteristics. The depth to bedrock seems to be shallower than the initial estimate, which will limit the infiltration capacity. In addition, a spillway construction is identified in McVicker Canyon, which may daylight recharge water and prevent infiltration. Additional geologic survey and pilot testing are required to determine the depth to bedrock and infiltration rates. Due to the significant reduction in potential spreading basin size (20 acres versus 30 acres), this alternative has a high risk of realizing less groundwater recharge than anticipated. The overall rating of Alternative 2 is very poor.

Alternative 3 does not contain any construction other than the construction of the peaking wells. In periods that less replenishment water is available than anticipated, sufficient groundwater pumping capacity will exist to meet the water demand from groundwater. The main risk of not achieving the proposed results is cause by the proposed water conservation rate of ten percent. This is three times higher than the amount of water conservation projected in the Urban Water Management Plan (MWH, 2000). This relatively ambitious conservation goal is considered as a moderate risk, because previous studies have not indicated a ten percent water conservation potential. Therefore, Alternative 3 is rated as fair.

Alternative 4 includes the use of dual-purpose wells for groundwater recharge and five percent water conservation. The risk of dual-purpose wells is discussed under Alternative 1. Five

percent water conservation is considered achievable with existing technologies and increasing public awareness, thus and the risk of not achieving the desired degree of conservation is low. The overall rating of Alternative 4 is good.

Legal and Regulatory Issues

The degree of difficulty for compliance with existing regulations or obtaining legal approvals is evaluated for each alternative below. However, some existing regulations and plans apply to Baseline B and all four alternatives. These are:

- The agreement between the District and the City of Lake Elsinore to maintain the lake levels in Lake Elsinore and in the 350-acre wetland in the Back Basin area at 1,240 feet MSL.
- The NPDES permit issued in January 2002 by the RWQCB for a pilot project to release recycled water into Lake Elsinore up to 4,480 acre-ft/yr. This permit requires that the District adhere to strict monitoring of the nutrient levels of the lake. [Note, the Regional Board issued a revised NPDES permit to EVMWD for discharge to Temescal Wash and Lake Elsinore in March 2005.]
- The Basin Plan's water quality objectives of Lake Elsinore. These include:
  - TDS concentration not to exceed 2,000 mg/L
  - Inorganic nitrogen concentration not to exceed 1.5 mg/L
  - Dissolved oxygen concentration of 5 mg/L or above
  - Chlorine residual not to exceed 0.1 mg/L
  - Detailed regulations on fecal coliform bacteria, un-ionized ammonia and others.
- The Basin Plan's water quality objectives of the groundwater basin (see **Table 5-2**).
- Primary and secondary drinking water standards specified in the California Code or Regulations, Title 22 (see **Table 5-2**)
- The agreement between the District and EWD to participate in a Joint Groundwater Monitoring Program that specifies the monitoring requirements. The agreement established specific groundwater trigger points for Wisconsin well at 1,106 feet MSL and for Stewart well at 1,057 feet MSL to monitor groundwater level changes in the basin.
- A new NPDES permit needs to be obtained that allows discharge of 7.5 mgd of recycled water into Lake Elsinore for Baseline B and Alternatives 1, 2, and 3. Alternative 4 requires a NPDES permit with a capacity of 17.7 mgd.

Baseline B does not require compliance with any additional existing regulations or agreements, other than the permits required for the construction of the 11 new peaking wells and a new pipeline to convey additional source water to the District's service area. However, declining water levels may cause substantial subsidence, which can result in property damage and is a potential for litigation. Declining water levels results in adjudication of the Elsinore Basin, which causes complex legal and regulatory issues. In addition, the continuation of recharge from septic tanks at the existing levels potentially endangers the water quality of both the groundwater basin and Lake Elsinore. These issues are considered very significant; hence, the overall rating of Baseline B is very poor.

Alternative 1 requires permits for the construction of new dual-purpose wells, peaking wells, a pipeline and a booster station are required. For the conversion of septic tanks to sewer in the

high-risk zones of the basin, regulations need to be developed and implemented. The use of treated imported water for direct injection does meet the current federal requirements (40 CFR Part 144) that prohibit any injection activity that may endanger underground sources of drinking water (EPA, 1999). Dual-purpose wells are regulated under EPA's Underground Injection Control program as Class V wells. To prevent degradation of ambient ground water quality and protect the aquifer from clogging, it is recommended that water injected into aquifer recharge meet primary and secondary drinking water standards. As treated MWDSC water meets these drinking water standards, compliance with this regulation is not a legal issue. However, injection of imported water may not be in compliance with the Basin Plan objectives for TDS (currently 450 mg/L and expected to be 480 mg/L after the pending update) depending on the variation of the TDS concentration in MWDSC water. Compliance for nitrogen is not an issue, as MWDSC water does not exceed the proposed Basin Plan objective of 1 mg/L as N. Compliance is expected to be based on a 12-month running average. The overall rating of Alternative 1 is fair.

Alternative 2 requires permits for the construction of the spreading basins, new extraction wells, pipelines and a booster station. The construction of the spreading basins needs to be coordinated with RCFCWCD. During the construction of the spreading basins, dust emission need to be in compliance with current regulations, or dust control measures need to be taken. The groundwater quality is potentially impacted due to higher TDS concentrations in treated MWDSC water compared to groundwater. For the conversion of septic tanks to sewer in the high-risk zones of the basin, regulations need to be developed and implemented.

If recycled water would be used for surface spreading, compliance with DHS and the RWQCB is required. The RWQCB has a policy, Reclamation Policy – Resolution 77-1, that supports reclamation projects to assist in the increased need of water in California, primarily to support growth. The RWQCB and DHS set recycled water regulations. DHS' draft requirements for groundwater recharge by surface spreading, as of August 2002, defines the following:

- The maximum amount of recycled water that can be withdrawn at any domestic well is 50 percent
- The minimum underground retention time is six months
- The minimum horizontal distance to nearest well is 500 feet
- The minimum treatment requirements (turbidity equal or less than 2 NTUs; 5-log virus inactivation; 2.2. total coliform per 100 mL, maximum total nitrogen of 3 mg/L, TOC equal or less than 16 mg/L). In general, this is tertiary wastewater treatment and disinfection. Additional treatment for removal of organics by reverse osmosis and advanced oxidation is required when projects exceed 50 percent recycled water. (Tsuchihashi et al., 2002).

As shown in **Table 6-6**, the cost of spreading recycled water is much higher than the cost of spreading treated imported water. Therefore, these legal constraints would only apply if recycled water would be used. This would also increase the cost of Alternative 2, as all cost estimates are based on the use of treated imported water for surface spreading. The overall rating of legal and regulatory issues of Alternative 2 is poor when recycled water is used and fair if treated water is used.

Alternative 3 requires permits for the construction of new peaking wells, and the development and implementation of policies that regulate the conversion of septic tanks to sewer in the high-risk zone of the basin. As the legal and regulatory issues are minimal, Alternative 3 is rated as good.

Alternative 4 requires permits for the construction of new dual-purpose wells, peaking wells, a pipeline and a booster station. For the conversion of septic tanks to sewer in the high-risk zones of the basin, regulations need to be developed and implemented. To be in compliance with the current federal requirements (40 CFR Part 144) as discussed under Alternative 1, only treated imported water can be injected. The primary legal issue is compliance with the Basin Plan objectives for TDS. The overall rating of Alternative 4 is fair.

Public Acceptability

Public acceptability is rated by the anticipated degree of public approval or opposition to the components of an alternative, including financial impact, environmental impact, temporary inconveniences due to construction work, burden on the public for the participation in water conservation programs.

It is expected that Baseline B be vigorously opposed by the residents in the areas that have a high potential for subsidence due to declining water levels. The construction of peaking wells and pipelines are not expected to cause any public concern other than construction nuisances that are addressed under the environmental impacts. However, when water levels are declining, the owners of public wells are expected to vigorously oppose, as this would result in reduced pumping capacity and/or increase energy cost for pumping. In addition, Baseline B is not the most cost-effective management option as discussed under expected cost, which is also expected to cause resistance from the public, as the goal of the GWMP is to ensure a cost-efficient water supply. With the high potential of subsidence and property damage, Baseline B is rated as very poor.

Alternative 1 is not expected to cause any public concern other than the temporary construction nuisances. It is expected that the public will fully support this alternative as it achieves a balanced groundwater basin at reasonable cost. Alternative 1 is rated as excellent.

As the risk of subsidence and property damage remains in Alternative 2, although not to the same extent as in Baseline B, it is expected that the public would oppose this alternative. Similar to Baseline B, there are no cost savings to offset this concern. On the contrary, the cost of Alternative 2 is higher than Alternatives 1, 3, and 4. In addition, the public may oppose the construction of spreading basins in the canyons as this replaces some natural habitat. If recycled water is used for surface spreading, which is not assumed in this GWMP but a possibility for future use, public opposition would be expected based on experience in other groundwater basins. The overall rating of Alternative 2 is slightly better than Baseline B due to the lower degree of subsidence, thus is rated as poor.

Most components of Alternative 3 are expected to be supported by the public. However, ten percent water conservation places an increased burden on public participation, which could be

opposed by a portion of the residents and businesses. This alternative does not require much construction and is the most cost-effective. The overall rating of Alternative 3 is fair.

Alternative 4 is not expected to cause many public concerns other than the temporary construction nuisances. The water conservation goal of five percent is considered feasible without placing a significant burden on the public as Alternative 3. The first five percent of water conservation is achieved with less effort than the second five percent, as all "easy" water reductions are implemented first. With increased water awareness, it is expected that the public would support the idea of water conservation as long as investments and effort required from the public are considered reasonable. Based on this, it is expected that the public will fully support this alternative as it achieves a balanced groundwater basin at reasonable cost. Alternative 4 is rated as good.

Funding

As presented under the estimated cost, the total capital cost per alternative varies from $16 million to $57 million. The ability to acquire larger amounts for funding is generally more difficult than smaller amounts, however certain investments can be funded with grants, while others would be fully funded through loans. This does impact both the total costs for the District as well as the ease of acquiring funds. In addition, the distribution of acquiring funds in included in the evaluation.

Baseline B has the second highest capital cost of $50 million. These high cost are primarily due to the cost of bringing a new source to the District's service area and the cost of peaking wells that do not serve any other purpose as in Alternative 1 and 4. Although the cost of peaking wells can be spread over time depending on the demands, the cost of the pipelines for the additional source, which contributes to 45 percent of the capital cost, is an instantaneous investment. Baseline B does not qualify for any conjunctive use grant funding or MWDSC subsidies, funding opportunities are more limited compared to Alternatives 1 through 4. Due to the high capital cost, limited funding options, and limited opportunity to spread the investment over time, the funding of Baseline B is rated as poor.

Alternative 1 has a capital cost of $30 million which is close to half the capital cost of Baseline B. About 75 percent of these cost are the dual purpose wells and the associated pipeline and booster station. This is an instantaneous investment, while the remaining 25 percent of for peaking wells, which can easily be distributed over time when demands increase. Conjunctive use projects with dual-purpose wells are likely to qualify for future grants, such as AB303 and Proposition 13. Based on the moderate capital cost, the funding opportunities and uneven distribution of investments, the overall rating of Alternative 1 is fair.

Alternative 2 has a capital cost of $57.4 million, which is highest of all alternatives. About 60 percent of this is for the construction of the spreading basins and the associated pipelines, booster station, and extraction wells. The remaining 40 percent are for the construction of peaking wells, which can be distributed over time when demands increase. Conjunctive use projects with dual-purpose wells are likely to qualify for future grants, such as AB303 and Proposition 13. Based on the evaluation criteria as presented in **Table 7-1**, Alternative 2 is rated as poor.

Alternative 3 has a capital cost of $15.8 million, which is least expensive of all alternatives. As the entire cost capital cost are for new peaking wells or adjustment to existing wells, the investment is easily distributed over time. Conjunctive use projects with in-lieu recharge are likely to qualify for future grants, such as AB303 and Proposition 13. Based on the evaluation criteria as presented in **Table 7-1**, Alternative 1 is rated as good.

Alternative 4 has a capital cost of $24.3 million which is less than half the capital cost of Baseline B. About 70 percent of these cost are the dual-purpose wells and the associated pipeline and booster station. This is an instantaneous investment, while the remaining 30 percent of for peaking wells, which can easily be distributed over time when demands increase. Conjunctive use projects with dual-purpose wells are likely to qualify for future grants, such as AB303 and Proposition 13. Based on the relatively low capital cost, the funding opportunities and the fair distribution of investments, the overall rating of Alternative 4 is good.

Reliability

Reliability is evaluated as the ability to meet water demands in consecutive drought years when replenishment water is not available. The measure used to determine the reliability is the dependence of imported supplies during drought years. Based on the water balance calculations for the hydrologic conditions of the drought period 1988 through 1992, the amount of imported water used to meet the demands are calculated. **Table 7-6** presents these results and the rating as defined in **Table 7-1**.

Table 7-6
Reliability of Alternatives

Supply Source	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Groundwater Pumping	22%	25%	25%	9%	28%
Canyon Lake WTP	5%	5%	5%	6%	6%
Total Imported	73%	70%	70%	85%	67%
Total Supply / Demand	100%	100%	100%	100%	100%
Rating	**fair**	**fair**	**fair**	**poor**	**good**

Water Quality

The impact of the conditions of Baseline B and the four alternatives on the TDS concentration in the upper and lower aquifer are estimated with a preliminary mass balance calculation over the 41-year hydrologic period. It should be noted that the numbers presented below are only to provide an indication of TDS contents after 41-years of operating the basin under each of the alternatives. Collection of water quality samples and water quality modeling of the groundwater basin is required to obtain better information. However, the mass balance results presented in **Table 7-7** can be used to obtain an indication of general trends in TDS concentration.

As shown in **Table 7-7**, the TDS content increases significantly under Baseline B conditions, while the salt concentrations decrease under Alternatives 1 through 4. The decrease is a result of pumping high TDS water while the aquifers are recharges with lower TDS water partially as a

result of septic tank conversions. The possible effect of salt release from the bedrock sediments is not included in the mass balance, and it should be noted that the results of Baseline B and Alternative 2 are sensitive to the allocation of volume reduction between the upper and lower aquifers. More detailed calculations are provided in **Appendix J**. Based on these preliminary results, Baseline B is rated as very poor (1), while all four alternatives are rated as excellent (5) as the results indicate that the Basin Plan objective (480 mg/L) can be met with all four alternatives.

Table 7-7
Estimated TDS Concentration (mg/L)

Supply Source	Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Upper Aquifer					
Current Conditions	550	550	550	550	550
Estimated End Balance	2,052	506	507	543	494
Lower Aquifer					
Current Conditions	390	390	390	390	390
Estimated End Balance	320	382	344	369	379
Rating	**very poor**	**excellent**	**excellent**	**excellent**	**excellent**

Flexibility

Baseline B offers the flexibility to implement projects in the future if well production declines or subsidence occurs. As these projects are not part of Baseline B, the overall cost of this option would increase. Flexibility to adjust to unforeseen circumstances is low as the need for additional supplies increases the longer projects are postponed. If projects do not achieve the desired results, there is less time to test and implement new projects or make adjustments compared to alternatives that implement groundwater management projects early on. In addition, the cost of deferring groundwater management projects can be significant for the following reasons:

- The investment in an additional imported water source could be deferred, which translates into cost savings, if groundwater management projects are implemented to address the declining water levels.
- The cost of groundwater management projects will increase the longer projects are postponed as the groundwater deficit increases and larger capacity recharge facilities are required.
- Declining water levels will steadily increase groundwater pumping costs

In addition, to the limited time make adjustments and the increased cost of deferring groundwater management projects, Baseline B is not flexible manage the groundwater basin. Recharge other than in-lieu is not possible under Baseline B, thus the flexibility to recover the basin after unforeseen additional groundwater pumping, such as higher demands or lower availability of imported supplies, is very limited. Overall, the flexibility of Baseline B is poor.

Alternative 1 offers the flexibility to adjust to higher demands with additional groundwater pumping while managing the basin, as the dual purpose wells have the ability to inject more water depending on the availability of replenishment water. The use of dual-purpose wells for

recharge limits the number of sources that can be used, as injection water needs to meet drinking water regulations. However, the District has access to three sources of imported water that can be used for injection, water from Mills WTP, Skinner WTP, and Canyon Lake WTP when untreated water is purchased through the WR-18B turnout. It should be noted that the use of untreated MWDSC water may not comply with the Basin Plan objectives. The basin balance calculations demonstrate that Alternative 1 is capable of recovering groundwater levels after a drought period. Thus, it is flexible to adjust to various hydrologic conditions. The flexibility of Alternative 1 is rated as excellent.

Alternative 2 has the flexibility to use multiple water sources for surface spreading; local runoff, treated imported water from TVP and AVP, untreated imported water, Canyon Lake WTP water, and recycled water from Regional WWTP or EMWD. However, the recharge capacity of the spreading basin is limited and not sufficient manage the basin without other measures. Due to the limited recharge capacity, Alternative 2 does not have the flexibility to maximize the use of replenishment water when available. The flexibility of Alternative 2 is rated as fair.

Alternative 3 is flexible to adjust to higher demands with additional groundwater pumping or purchasing more imported water if ten percent water conservation is not achieved. However, as the need for additional supplies increases over time, there is less time to test and implement new projects to meet demands. This alternative has moderate flexibility to use replenishment water for in-lieu recharge as this amount is limited by the water demands in winter period. Overall, the flexibility of Alternative 3 is rated as fair.

Alternative 4 has the same flexibility characteristics as Alternative 1 with regards to dual-purpose wells and in-lieu recharge. It uses more recycled water for lake replenishment, which make the basin more available to store water during droughts. The flexibility of Alternative 4 is rated as excellent.

Ease of Implementation

The last evaluation criterion is the ease of implementation, which is defined as the degree of technical difficulty of the construction phase as well as operational constraints.

Baseline B does not require the use of any new technologies, and the construction of 11 peaking wells and pipeline for new source water is considered fairly easy to implement. Due to declining water levels of up to 400 feet, substantial re-equipment of wells is required to lower the pumps and add additional pump stages. Some technical difficulty is anticipated with the re-equipment of wells, especially if the well depth or casing diameter limits the ability to install new pumps. Overall, the ease of implementing Baseline B is rated as fair.

Alternative 1 requires the construction of 14 new wells, the conversion of four existing wells to dual-purpose wells, a pipeline and a booster station. Minimal technical difficulties are anticipated with the implementation of Alternative 1. Hence, this alternative is rated as good.

Alternative 2 requires the construction 16 wells and substantial re-equipment of existing wells to lower the pumps and add additional pump stages. The construction of the spreading basins is expected to be difficult due to site conditions and the difficult accessibility of the upper part of

Leach Canyon. In addition, the upper part of Leach Canyon contains many native trees that must be removed causing environmental damage, and pipelines are required that bring water to the top of the canyons. Overall, the construction of the spreading basins is expected to be difficult. The ease of implementing Alternative 2 is rated as poor.

Alternative 3 does not require substantial construction other than the eight peaking wells. However, implementation of water conservation measures that contribute to 10 percent conservation may be difficult as participation and investments of the public are required. The overall rating of Alternative 3 is fair.

Alternative 4 requires the construction of 11 new wells, the conversion of six existing wells to dual-purpose wells, a pipeline and a booster station. As described under public acceptability, implementation of water conservation measures that contribute to 5 percent water conservation is not anticipated to be difficult. Overall, minimal technical difficulties with the implementation are expected. Hence, this alternative is rated as good.

Selection of Preferred Alternative

The preferred alternative is selected based upon the evaluation criteria and consideration discussed in the previous paragraphs. **Table 7-8** provides a summary of the comparison and ranking of each alternative. The evaluation results indicate that Alternative 4 would best meet the evaluation criteria and with that, the objectives of the GWMP.

Table 7-8
Summary of Alternative Rating

Evaluation Criteria	Weighting Factor	Rating[1]				
		Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ability to Reduce Overdraft	3	1	4	2	3	5
Expected Costs	3	4	3	3	5	4
Environmental Impacts	3	1	4	2	4	5
Risk	2	2	4	1	3	4
Legal and Regulatory Issues	2	2	3	3	4	3
Public Acceptability	2	1	5	2	3	4
Funding	2	1	3	2	4	4
Reliability	2	3	3	3	2	4
Water Quality	1	1	5	5	5	5
Flexibility	1	2	5	3	3	5
Ease of Implementation	1	3	4	2	3	4
Total Rating		**21**	**43**	**28**	**39**	**47**
Weighted Rating		**42**	**83**	**53**	**79**	**94**

1 – A rating of 1 is the lowest, and a rating of 5 is the highest.

The overall ranking of the four alternatives is presented in **Table 7-9**. This table shows that Alternative 4 scores the highest of all alternatives with and without the use of weighting factors. The ranking order in which the alternatives score are the same with and without weighting

factors for all alternatives, which indicates that the outcome of the evaluation is not sensitive to the weighting factor assignment.

The second best alternative is Alternative 1, while Alternative 3 is the third best alternative. Alternatives 1, 3, and 4 have fairly similar scores. Alternative 2 does not score much higher than Baseline B and has about 55 to 60 percent of the score of the Alternative 4. Alternative 4 is selected as the preferred alternative because it has the highest overall rating and because the District and stakeholders have indicated that water conservation should be part of the final plan.

Table 7-9
Summary of Alternative Ranking

Ranking	Ranking[1]				
	Baseline B	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Total Score without weighting	21	43	28	39	47
Ranking without weighting	**5**	**2**	**4**	**3**	**1**
Total Score with weighting	42	83	53	79	94
Ranking with weighting	**5**	**2**	**4**	**3**	**1**

1 – A ranking of 1 is the highest, and a ranking of 5 is the lowest.

The implementation strategy of the preferred alternative, Alternative 4, is described in **Section 8**.

Section 8
Implementation Plan

INTRODUCTION

Implementation of the Elsinore Basin GWMP will require numerous decisions regarding the priorities for implementation, the financing mechanisms for various elements of the plan, potential cooperative agreements with other agencies, and balancing water needs with available resources. This section discusses the recommendations for managing EVMWD's groundwater resources, and the financial and implementation strategies needed to actualize the proposed activities.

COMPONENTS OF THE RECOMMENDED PLAN

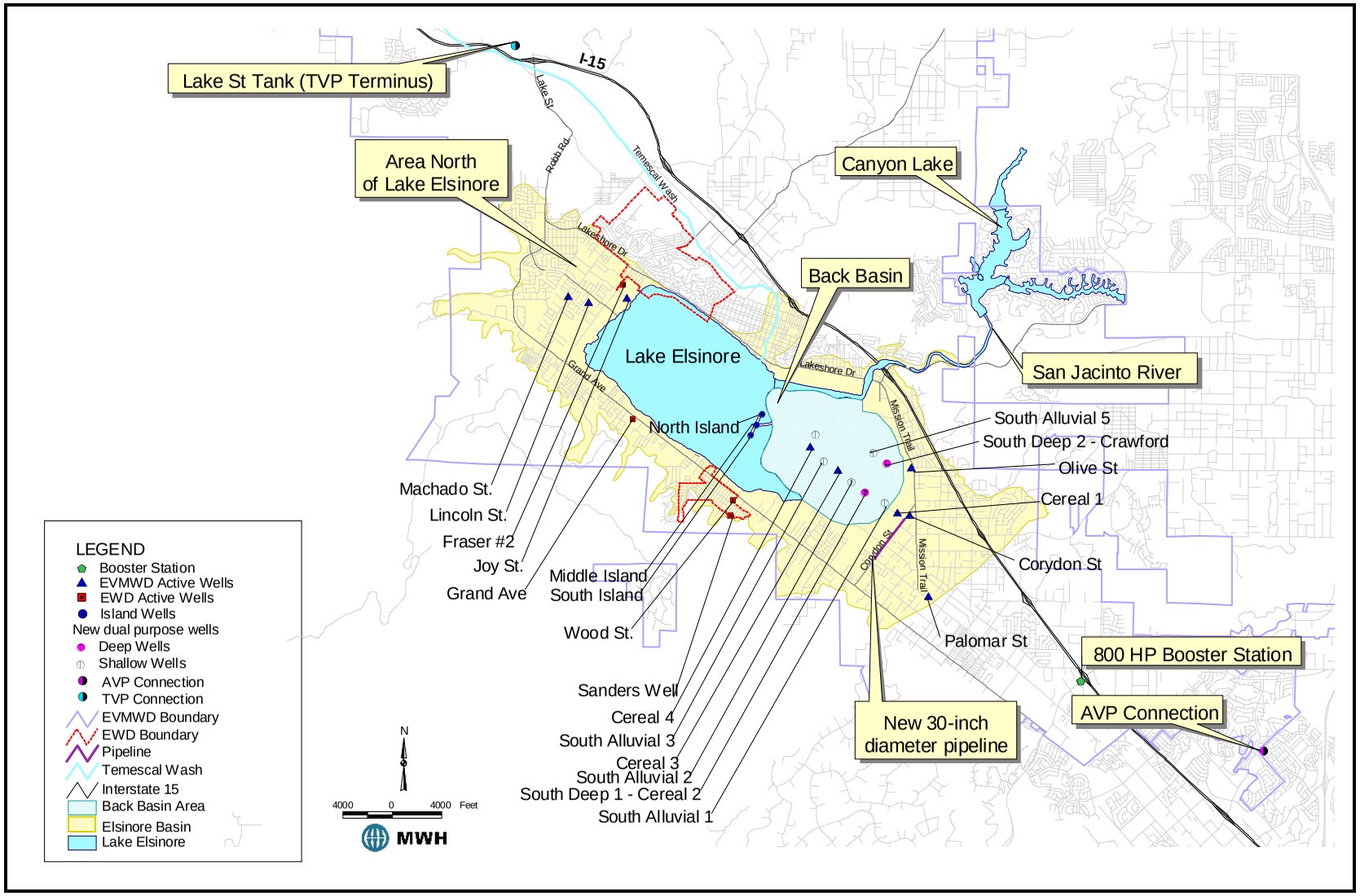
The recommended plan includes water conservation, dual-purpose wells for basin recharge, the use of recycled water as the primary source for lake replenishment, and a basin monitoring program. In addition, the plan contains recommendations for stakeholder involvement through an advisory committee, wellhead protection, well construction and abandonment procedures, the development of septic tank policies, and agency coordination. Each of these components is discussed below. A map depicting the location of the structural components required for the implementation of the recommended plan is presented in **Figure 8-1**.

Water Conservation

The prudent use of water is the focus of many utilities, regulatory agencies and the public throughout the nation. Population growth, environmental concerns, periodic droughts and the economics of new water supply development demonstrate the need to make efficient use of the available water supplies. Water conservation is described as any beneficial reduction in water use or reduction in water losses. Conservation measures can be applied to all water uses; however, in the service areas of EVMWD and EWD, the primary focus of water conservation is on municipal uses including irrigation. The minimum water conservation goals for the recommended plan is 5 percent. Water conservation measures that are part of the recommended plan are:

- Residential plumbing retrofits,
- Water system audits, leak detection and repair,
- Financial incentives for large landscape irrigation,
- Promotion of low water use landscaping,
- Promotion of high-efficiency appliances,
- ULF toilet replacement program, and
- Public information to increase water awareness.

Figure 8-1
Components of the Recommended Plan



- Use of recycled water for landscape irrigation and other non-potable uses.
- School education programs.
- Water use audits for commercial, industrial, and institutional users.
- Implementation of commercial, industrial, and institutional water conservation programs.
- Assignment of water conservation coordinator.
- Development and enforcement of water waste prohibition.
- Water audits programs for residential customers.

These measures are estimated to reduce the total projected water demand for year 2020 from 50,500 to 48,000 acre-ft/yr. This level of water conservation must be achieved to ensure the additional water supplies will not be required.

Per State law, the District has completed and adopted an urban water management plan (UWMP) in 2000 which is required to be updated every five years according to the California Water Code, Sections 10610-10656. This UWMP includes most of the water conservation measures listed above and estimated that these will achieve about 3 percent water conservation due to implementation of BMPs. Additional measures such as the promotion of low water landscaping or higher participation rates in municipal programs are required to achieve the water conservation goal of 5 percent.

State law establishes a number of policies regarding water conservation and the use of recycled water and it mandates water conservation techniques, which have been already implemented in the District. Examples of these policies are:

- California plumbing codes have required the installation of ULF toilets and low-flow showerheads on all new construction since 1992.
- The *Water Conservation in Landscaping Act* (California Government Code, Sections 65591-65600) required each city and county to adopt a water efficiency ordinance for landscaping.
- The *Water Recycling in Landscaping Act* (California Government Code, Sections 65601-65607) require recycled water producers to notify local agencies of the availability of recycled water and requires local agencies to adopt and enforce a recycled water ordinance within 180 days of being notified.

In December 2002, the District has signed the *Memorandum of Understanding Regarding Urban Water Conservation* (MOU) that commits participating water agencies to make a "good faith effort" to develop comprehensive conservation Best Management Practices (BMPs) programs using sound economic criteria. This GWMP considers water conservation on an equal basis with other water management options and is one of the key components of the recommended plan.

Water conservation may be expanded for large-scale irrigation users such as schools and golf courses by increasing the use of recycled water for irrigation. There are three principal sources of recycled water, the Regional WWTP and the regional water reclamation facilities of EMWD and Rancho California Water District (RCWD) that will discharge their effluent in the near future through a new pipeline from EMWD. The potential users of recycled water will be identified in an upcoming study, the Wildomar Recycled Water Master Plan. To determine the full potential and economic feasibility of an expanded recycled water network, the 1992 non-potable water

master plan should be updated with a separate study that covers the entire service area of EVWMD and EWD. The recommended plan does not include the expansion of the recycled water network as part of the water conservation measures. This could be included in the future updates of the GWMP.

Minimizing Basin Pumping

In addition to conservation there is a need to minimize basin pumping for all potable use, including pumping from the Island wells for lake replenishment. Using groundwater to recharge the lake causes an increase in the amount water that is needed for recharging the basin. There is a lot of potable water being used for non-potable purposes. For example, irrigation sprinkler systems currently use potable water. If you can capture some of the septic tank water, treat it and use it to off-set potable water being used to keep grass green that saves the water that is normally pumped out of the basin or imported in.

Groundwater Recharge with Dual Purpose Wells

Groundwater recharge is a critical tool for modern water management. In the recommended plan, groundwater recharge involves the injection of treated imported water into the groundwater aquifer through dual-purpose wells that can both extract and inject water. Dual-purpose wells would be installed in the Back Basin area as well as in the area north of Lake Elsinore (see **Figure 8-1**). The dual-purpose wells are distributed over the entire groundwater basin to allow management of groundwater levels throughout the basin. Concentrating all dual-purpose wells in one area would also require more capital investments for booster stations and/or pipelines to convey water from the imported water connections to the injection locations. It would also limit the ability to manage water levels effectively and increase well interference. The recommended plan includes the 14 dual-purpose wells as listed in **Table 8-1**.

Table 8-1
Summary of Dual Purpose Wells

Area	Quantity	Description	Extraction Capacity (gpm)	Injection Capacity (gpm)
Back Basin Area	3	Cereal 1, 3, and 4 (conversion to dual p.)	1,750	1,400
	1	Corydon (conversion to dual p.)	1,000	750
	2	Crawford and Cereal 2 (new)	1,750	1,400
	5	South Alluvial 1 through 5 (new)	700	350
Area North of Lake Elsinore	1	Joy Street (equipped as dual p.)	1,000	750
	2	Deep Dual-Purpose Wells (new)	1,000	750
Total	**14**		**7,200**	**5,400**

Other Facilities

In addition to the dual-purpose wells listed in **Table 8-1**, the recommended plan requires the construction of the following facilities and pipelines. The locations of these facilities are indicated in **Figure 8-1**.

- Four additional wells are required for peaking to meet MDD. These wells should have an extraction capacity of at least 1,000 gpm each, otherwise more peaking wells are required.
- An in-line booster station of 800 HP (15,000 gpm at 100 feet of TDH) to increase the head in the Loop Zone when AVP water is required for injection in the Back Basin. This booster station is currently proposed near the intersection of Clinton Keith Road and Interstate 15. A more in-depth analysis is recommended to determine the best location.
- A 4,000 lineal foot 30-inch diameter pipeline on Corydon Street is required to convey groundwater when the Back Basin dual-purpose wells are in extraction mode. The capacity of existing pipelines is not sufficient to distribute the water directly in the Loop Zone.

Lake Level Maintenance

Maintenance of water levels in Lake Elsinore would be accomplished with a combination of recycled water and groundwater when the lake level drops below 1,240 feet MSL. Recycled water would be used as the primary source of replenishment water up to 17.7 mgd. This is the projected capacity of the Regional Plant in year 2020 minus 0.5 mgd reserved for discharge to Temescal Wash. One of the three Island Wells would be used as the secondary source when the recycled water supply is not adequate to maintain the lake level at 1,240 feet MSL in year 2020, while all three wells are required to maintain lake levels before year 2020 when less recycled water is available. Based on lake balance calculations as described in **Appendix F**, replenishment with groundwater would occur twice in 41 years with an average of five acre-ft/yr. EVMWD should continue to pursue Regional Board approval for discharge of Regional Plant effluent into Lake Elsinore when needed to maintain the elevation. This will require a combination of phosphorus removal at the plant and nitrogen offsets to comply with the Lake Elsinore TMDL. EVMWD should gradually reduce the use of Island Well water until the recycled water supply is sufficient to meet the total lake replenishment need.

[Note: that since the draft plan was prepared, EVMWD has developed a plan to commenced lake replenishment when water levels drop below elevation 1,247 feet MSL to reduce the likelihood that levels will drop below elevation 1,240 feet MSL.]

Surface Spreading

Although the use of surface spreading facilities is not included in the recommended plan, it is recommended that EVMWD further investigate the possibilities of surface recharge in Railroad Canyon. Discussions between EVMWD and MWDSC are required to determine if raw water can be obtained from MWDSC at the turnout 12 miles upstream from Canyon Lake and then spilled over Railroad Canyon Dam to be infiltrated in the San Jacinto River before reaching Lake Elsinore. Access to State Water Project water is desirable due to its lower TDS. This source of lake replenishment water will indirectly offset the amount of Tier 2 water that needs to be purchased for potable demand needs, as more groundwater is preserved for potable water needs.

Use of Recycled Water

The recommended plan limits the use of recycled water to the use for lake replenishment as discussed above. However, the pipeline from the EMWD Temecula Regional plant to the

Temescal Wash discharge location near Wasson Sill in the Lake outlet channel, brings additional recycled water to EVMWD's service area when the production of recycled water exceeds EMWD's recycled water demand. This new recycled water source offers the potential for the expansion of recycled water use within the District's service area. Neither the use of EMWD recycled water nor the expansion of the recycled water system are included in this GWMP as this is beyond the scope of this project. The purpose of this component is to recognize that this additional recycled water source may be available. It is recommended that potential recycled water demands be identified and the feasibility of a dual water system be determined in a future recycled water planning study. An expansion of the use of recycled water may result in a reduced need for peaking wells. It should be noted that the availability of recycled water will increase with growth, and that the current shortage of recycled water is expected to change to an excess of recycled water in the future.

Advisory Committee

This plan recommends that an Advisory Committee should be formed that represents the users of the Elsinore Basin. This committee may consist of five members, with three members from EVMWD, one member from EWD, and one member representing the private pumpers in the Elsinore Basin. EVMWD's Board of Directors would appoint the members of the Advisory Committee. The Advisory Committee would be involved with the following programs and activities:

- Provide advise on the implementation of the Groundwater Management Plan,
- Provide advise on the implementation of the Monitoring Program, and
- Provide advice on the development and implementation of Well Construction, Destruction, and Abandonment Policies.

The Advisory Committee shall provide their comments on these activities to the EVMWD Board of Directors.

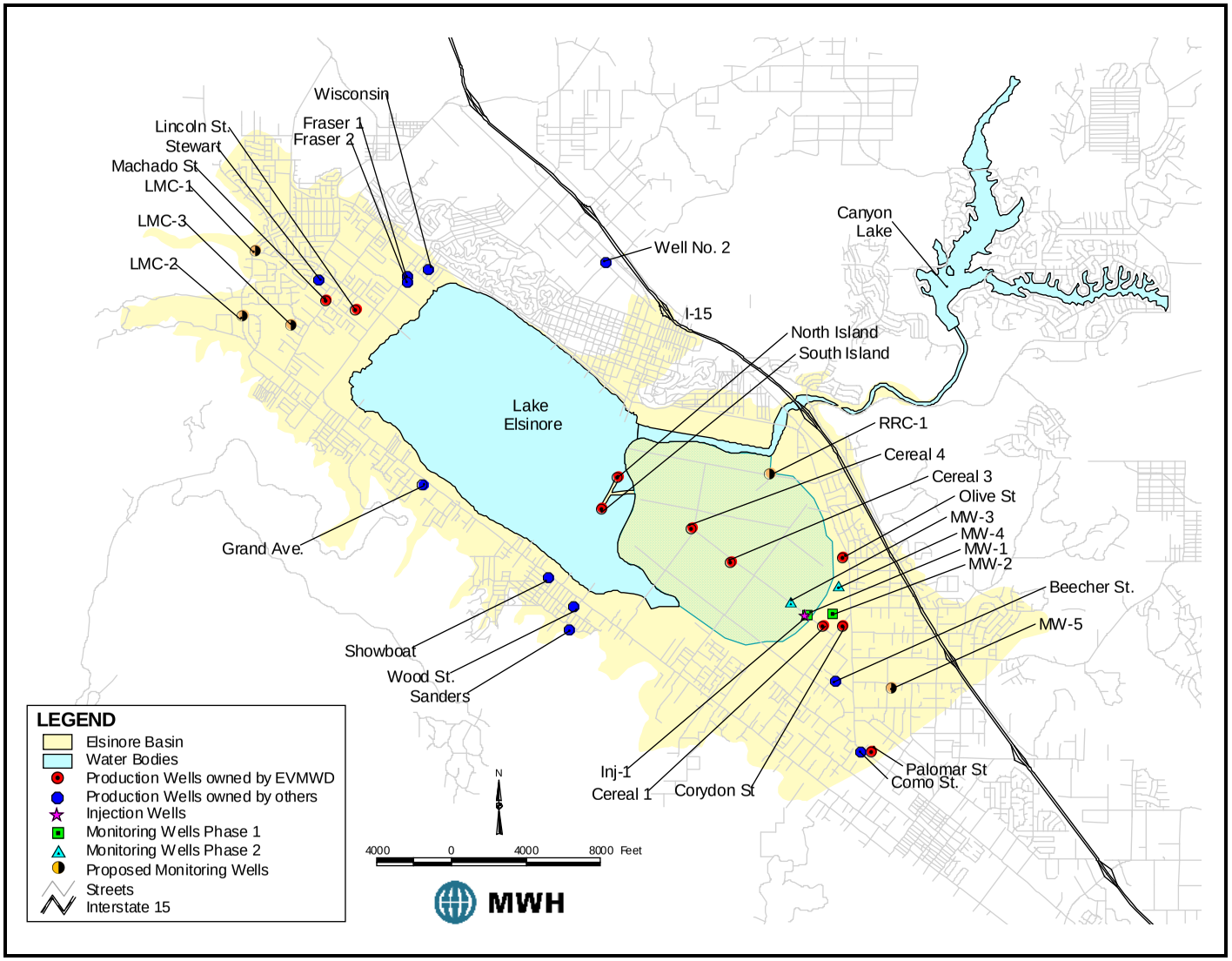
Monitoring Program

As the Plan is implemented, the District's ongoing groundwater monitoring program will play an integral role in understanding the basin response to different plan elements. The effectiveness of the Plan will be measured through its impacts on groundwater levels, water quality and subsidence potential.

A basin monitoring program is important to better understand the groundwater basin and to measure the effects of the activities that are implemented. In addition, basin monitoring provides a basis for effective adaptive management. The monitoring program that is developed as part of this GWMP is presented in **Appendix K** (MWH, 2003). The monitoring program incorporates the Joint Groundwater Monitoring Program that was established by the May 2000 agreement between EVMWD and EWD. The key components of the proposed monitoring plan are listed below and the locations of monitoring wells are identified in **Figure 8-2**.

- Conduct a well canvass to obtain information from private well owners. These additional background data can be used to further characterize the basin to guide EVMWD's future

Figure 8-2
Location of Monitoring Wells



groundwater supply needs. A canvass of private wells owners was conducted in 2004 that identified about 34 active private wells in the basin.

- Construct five new monitoring wells, three nested piezometer wells and two single wells. These wells will be used to obtain additional background water level and water quality data to characterize the basin. In addition, these wells can be used to monitor the impact of future facilities. One of these five new monitoring wells was recently drilled at McVicker Canyon while another was constructed near the San Jacinto River near The Diamond, Lake Elsinore's minor league stadium.
- Measure water levels in existing production and monitoring wells and the new monitoring wells on a monthly basis. Monthly data is important to understanding the seasonal variations in water levels throughout the basin and confirm the basin yield.
- Collect water quality data from the existing wells on an annual basis and the new monitoring wells two times annually. Changes in water quality may be caused by operations throughout the basin. New monitoring wells should be monitored more frequently to obtain background data for comparison to future water quality.
- Perform spinner logging to identify where most of the production comes from in existing production wells. These data may indicate the depth to which new production wells should be drilled in the future.
- Perform water quality zone testing, in conjunction with the spinner logging. This analysis can be used to isolate which areas are causing variations in water quality. This may include continuous water quality logging or zone specific testing.
- Perform continuous aquifer testing. The data can be used to confirm transmissivity and storativity estimates that can used to estimate future drawdown and basin yield.
- Perform surface water monitoring of Lake Elsinore, the San Jacinto River and Leach and McVicker Canyons.
- Perform land subsidence monitoring, which should initially consist of a GPS monument network.

The information collected through this monitoring program will lead to more efficient implementation of management activities, as it would provide guidance for adjusting management parameters according to the results over time. The data collection will play an integral role in the District's understanding of the basin's response to different plan elements and provide a baseline that can be used to evaluate the success of the GWMP and other projects. Information gathered on the effectiveness of individual plan element can be used for future updates of the GWMP.

Well Construction, Destruction and Abandonment Policies

Improperly constructed wells can result in poor yield and contaminated groundwater by establishing a pathway for pollutants to enter a well, allow communication between aquifers of varying quality, or the unauthorized disposal of waste into the well. This GWMP recommends that well construction, destruction, and abandonment policies be developed in cooperation with Riverside County. These policies should include the following principles:

- All wells drilled in the Elsinore Basin must be in compliance with the California Water Code §13700 through §13806.

- All well drilling contractors must be in possession of an active C-57 Contractor's license.
- Permits for the drilling, deepening, modification, or repair of any well must be obtained and be in accordance with Riverside County Ordinance 682.3. These permits should conform to well construction standards that are specified in DWR Bulletins 74-81 and 74-90.
- All wells within the Elsinore Basin, whether active, inactive, abandoned or improperly destroyed, should be identified by conducting a well canvass. All identified wells should be included in the groundwater GIS.
- The status of all wells should be evaluated to identify which wells should be destroyed and which wells can be capped or retained as monitoring wells. If no future use is anticipated, wells must be properly destroyed according to the destruction procedures are also specified in the DWR Bulletins 74-81 and 74-90. If future use is anticipated, wells can be capped and maintained as outlined in Riverside County Ordinance 682.3.
- Coordination between Riverside County and the District should take place to ensure that property owners, who are responsible for proper well destruction and capping of wells, follow the destruction procedures and guidelines.

Septic Tank Conversion Plan and Policies

The recommended plan presumes that at least all septic tanks in the high-risk zone, as shown in **Figure 5-2**, should be connected to the sewer system by year 2020. Approximately 2,900 septic tanks, which is about 80 percent of all the septic tanks in the basin, are located in this high-risk zone and need to be connected to the sewer system, while no additional septic tanks are added within the high-risk zone. The District is currently developing the policies to accomplish the conversion of at least all septic tanks is the high-risk zone.

Integrated Planning

Due to the integrated nature of water resources in the Elsinore Basin, it will be critical that future projects consider their potential effects on the management of the basin. As described in Section 1, management decisions regarding the source of water used for lake replenishment could affect the availability of groundwater for potable use. Similarly, flood control activities may divert stormwater that previously percolated into the groundwater basin into Lake Elsinore, reducing basin recharge. EVMWD will need to monitor land use planning activities of the City of Lake Elsinore and the County of Riverside to ensure that proposed developments do not adversely affect the water resources of the basin. It is recommended that EVMWD periodically meet with the City and the County to review development plans and develop collaborative solutions to potential problems that could affect the groundwater resources of the basin.

Periodic Reporting and GWMP Updating

As basin manager, EVMWD will need to prepare periodic reports documenting the conditions of the groundwater basin. This "State of the Basin" report should summarize historical monitoring data as collected under the basin monitoring program and include a description of management activities implemented since adoption of plan. This report would provide information on the condition of the basin to the basin advisory committee that could be used in making management recommendations for the basin. It is recommended that the report be updated bi-annually.

The GWMP should not be a static document. As development proceeds in the basin, the challenges affecting EVMWD will change. In addition, as work proceeds on the recommendations of this plan, new knowledge will be gained which could affect the methods used to manage the basin. Consequently, EVMWD, in conjunction with the Basin Advisory Committee, should perform a comprehensive review of the GWMP and make periodic adjustments to reflect changes in land use and development as well as knowledge gained from the construction and operation of new wells. As part of the review, consideration should be given to updating the groundwater model of the basin to more accurately reflect the current state of hydrogeological understanding of the basin.

IMPLEMENTATION

The implementation plan consist of a discussion of the project cost, financing options, phasing of activities, phasing of cost, operation of the basin, and agency coordination.

Costs of the Recommended Plan

The total capital and annual costs of the recommended plan are summarized in **Table 8-2.** As shown in this table, the total capital costs are $24.3 million, which corresponds to an annual investment of $0.73 million at a discount rate of 3 percent. Other annual cost include $0.9 million for groundwater pumping, and $17.6 million for the purchase of imported water from MWDSC, and $2.0 million for others. The total annual costs are $20.6 million, which equals $422 per acre-foot of base water demand. The costs presented in this plan are based on an Engineering News Record (ENR) Construction Cost Index (CCI) of 7,572 (Los Angeles, March, 2003).

Funding Options

The primary beneficiaries of the GWMP are the municipal water users in the Elsinore Basin, EVMWD and EWD. Private pumpers throughout the basin with generally small domestic demands will either be beneficially impacted or experience no impacts. The plan's cost should be allocated between the existing users and future growth-related users (through connection fees). As Elsinore Basin groundwater is supplied to customers outside the basin area, all customers in the entire combined service area of the District and EWD should pay for the cost of this plan. Cost savings experienced by local private pumpers should be an incentive to participate in the implementation of this GWMP. The capital cost required for structural improvement projects need to be financed by the District and recovered based on the sale of water. As shown in the cost comparison in **Section 7**, the unit cost of implementing the recommended plan of the GWMP is about the same as the continuation of current operations as presented in Baseline B, thus funding of the plan is not anticipated to be an issue. However, the recommended plan requires that most of the investments are made early on, while the cost of Baseline B are more equally spread over time. The capital cost of the recommended plan is $31 million lower than Baseline B. Mechanisms for financing include the following:

- Water rates
- General property taxes
- Grants, such as DWR construction grants
- Developer fees

Table 8-2
Summary of Capital and Annual Cost

Cost Type	Project Description	Capital Cost	Annual Cost
Capital Cost	4 Peaking Wells	$ 7,480,000	$ 194,000
	6 Conversion of Existing Wells to Dual Purpose Wells	$ 600,000	$ 37,000
	Equipping Joy Street as a Dual Purpose Well	$ 100,000	$ 7,000
	7 New Dual Purpose Wells	$ 13,090,000	$ 339,000
	30-inch diameter pipeline on Corydon Street (4,000 LF)	$ 1,360,000	$ 50,000
	800 HP in-line PS (near Clinton Keith Rd./I-15)	$ 1,680,000	$ 103,000
	Subtotal	**$ 24,310,000**	**$ 730,000**
O&M Cost	**Quantity (acre-feet/yr)**	**Cost Item**	**Annual Cost**
	8,188	Groundwater Pumping in Back Basin Area	$ 691,000
	2,132	Groundwater Pumping N/O Lake	$ 166,000
	380	Groundwater Pumping EWD	$ 31,000
	0	Groundwater Pumping for Lake Replenishment	$ -
	3,400	Recycled water for Lake Replenishment	$ 510,000
	3,000	Canyon Lake WTP	$ 690,000
	13,320	Purchase of MWD Water (Tier 1)	$ 5,568,000
	19,880	Purchase of MWD Water (Tier 2)	$ 9,921,000
	5,900	Purchase of MWD Water for Injection	$ 1,770,000
	1,100	Purchase of MWD Water for In-Lieu recharge	$ 330,000
	12,000	Pumping Cost in-line PS (near Clinton Keith Rd./I-15)	$ 232,000
	2,500	Water Conservation	$ 650,000
	71,800	**Subtotal**	**$ 20,559,000**
Total			**$ 21,472,000**

It is not possible to predict the specific financing mechanisms that will be applied to each of the elements of the recommended plan. Funding will likely be through a combination of mechanisms that best meet the needs of the District. Public input regarding financing options should be sought as specific items are proposed or constructed.

Phasing of Activities

An implementation plan has been developed which describes the phasing of the various project components over the next twenty years. The phasing of this project and other components is presented in **Figure 8-3**.

The following factors are considered per project in the phasing of project components:

- The impact of the project on the groundwater balance
- The estimated construction time
- The need for the project in relation to the water demands
- The distribution of cost over time

Figure 8-3
Phasing of Activities

Project	2003-2005	2006-2010	2011-2015	2016-2020
4 Peaking Wells				
Conversion of 6 Existing Wells to Dual Purpose Wells				
Equipping Joy Street as a Dual Purpose Well				
7 New Dual Purpose Wells				
30-inch diameter pipeline on Corydon Street (4,000 LF)				
800 HP in-line PS (near Clinton Keith Rd./I-15)				
Water Conservation				

The implementation of dual-purpose wells in the Back Basin has already started with pilot testing. Design of the full-scale facilities is underway as part of a grant application under Proposition 13. To allow injection of treated imported water as soon as possible, it is recommended that the all dual purpose wells and the associated booster station be implemented as soon as possible. As shown in Figure 8-3, all related projects are phased for the period 2003-2005. The pipeline at Corydon Street is postponed till the period 2006-2010 as the need for this pipeline is demand-driven and is required for extraction only. The current well configuration is assumed to be sufficient to meet MDD till at least 2005. With the installation of the eight new dual-purpose wells (Joy Street and seven new dual-purpose wells), the available supply capacity is increased and can meet MDD up to year 2018. The four peaking wells are therefore phased in the last period, 2016-2020. Water conservation is an on-going effort as many of the water conservation measures are focused on public participation, which needs to be carried out continuously to include the future growth-related customers.

Phasing of Cost

Based on the phasing of activities as described above, the distribution of capital investments is calculated and presented in **Table 8-3**. This table does not include annual cost and can be used to update the District's Capital Improvement Program and rate studies.

Table 8-3
Phasing of Capital Cost (in $1,000)

Project	2003-2005	2006-2010	2011-2015	2016-2020
4 Peaking Wells	$ -	$ -	$ -	$ 7,480
Conversion of 6 Existing Wells to Dual Purpose Wells	$ 600	$ -	$ -	$ -
Equipping Joy Street as a Dual Purpose Well	$ 100	$ -	$ -	$ -
7 New Dual Purpose Wells	$ 13,090	$ -	$ -	$ -
30-inch diameter pipeline on Corydon Street (4,000 LF)	$ -	$ 1,360	$ -	$ -
800 HP in-line PS (near Clinton Keith Rd./I-15)	$ 1,680	$ -	$ -	$ -
Total	**$ 15,470**	**$ 1,360**	**$ -**	**$ 7,480**

As shown in this table, the capital investments are not evenly distributed over time. Deferring a portion of the injection projects is possible, for example the wells in the area north of Lake Elsinore; however, the groundwater basin is managed best when injection takes places at both locations. In addition, deferring the implementation of dual-purpose wells will advance the need for peaking wells. Since the cost of new dual-purpose wells and peaking wells are the same, deferring the injection projects would not change the cost distribution significantly.

Operation of the Basin

The basin will require an operation plan that varies over the time. The GWMP provides an operational strategy for the demand conditions in year 2020. The operation plan would address the operational strategy under various supply and demand scenarios for the intermediate periods, as demands and available supplies vary over time. This plan would also include an emergency supply plan that describes the system operations under drought conditions.

The in-lieu operation of the basin can start immediately, provided that MWDSC has replenishment water available. Once the dual-purpose wells and associated facilities are in place, conjunctive use operations can start to recharge the groundwater basin during wet periods and provide storage for dry periods. In general, injection would take place between October and March in years when replenishment water is available, which depends on the hydrologic conditions of the sources that contribute to MWDSC's overall supply. It should be noted that injection may be possible year around during wet years if excess replenishment water is available. The dual-purpose wells would be used for extraction in the summer months of dry years when the demands increase and the available imported supply from MWDSC decreases. The injection and extraction cycles of the recommended plan as a function of the hydrologic conditions of 1960 through 2001 are presented in **Figure 6-7**. During the 41-year hydrologic cycle, about 240,000 acre-feet of imported water would be injected. With these operations, the groundwater basin remains in a long-term balance, meaning that the amount extracted is equal to the amount replenished over the 41-year hydrologic analysis period. To exercise all the wells regularly, cycling the use of dual-purpose wells for extraction along with the regular production wells is recommended. The use of groundwater for lake replenishment is very limited in the recommended plan. This is discussed in more detail under Lake Level Maintenance.

The water supply distributions for the year 2020 demands in an average, wet and a dry year are presented in **Figure 6-8**. As shown in this figure, the peaking wells are only required in dry years, when demands increase, and when the production of Canyon Lake WTP is almost zero. To provide a more detailed picture of the conjunctive use operation in the recommended plan, the water supply mix during average rainfall years, wet years and dry years are presented on a monthly basis in **Figure 8-4**, **Figure 8-5,** and **Figure 8-6** respectively.

These figures indicate the need for additional peaking wells to meet the water demand in the summer months under dry year conditions. During average rainfall and wet years, peaking wells are likely to be needed as well on to meet MDD, as the graphs only present the average demand of the summer months, which is about 20 percent lower than MDD. Figure 8-6 shows that the injection potential is zero in dry years, while during average and wet years injection can take place from October through March. The system demands in October require full use of the imported water connection capacity; hence, injection can not take place. Once the demands drop, the imported water can be used for groundwater recharge.

Figure 8-4
Water Supply Mix during an Average Rainfall Year

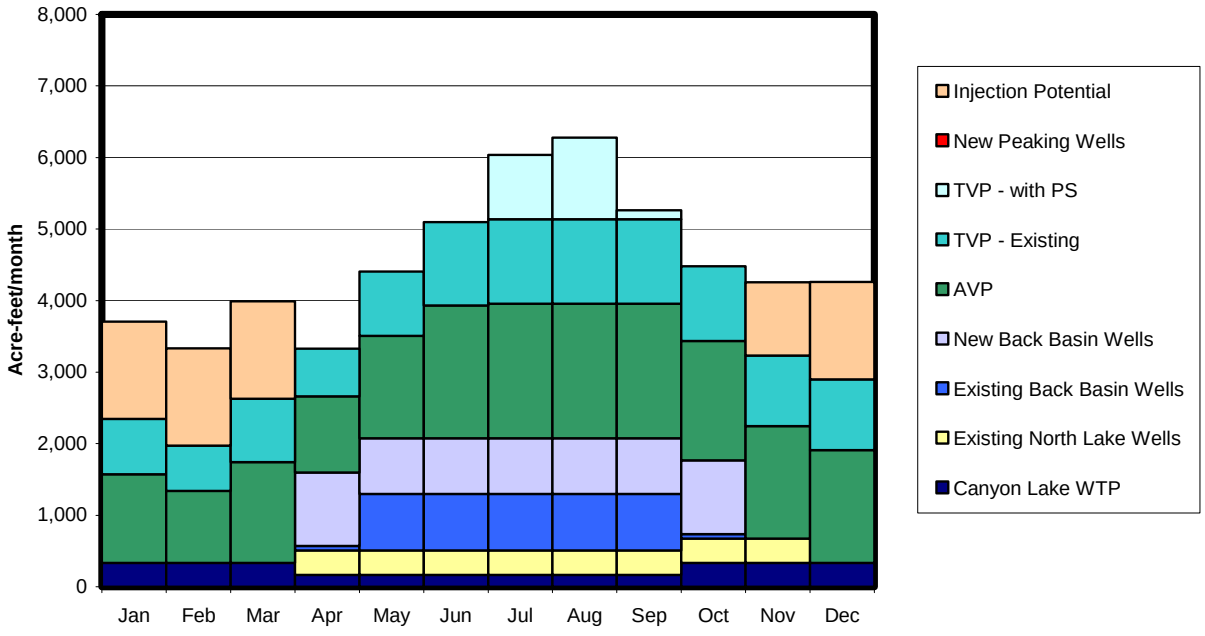


Figure 8-5
Water Supply Mix during a Wet Year

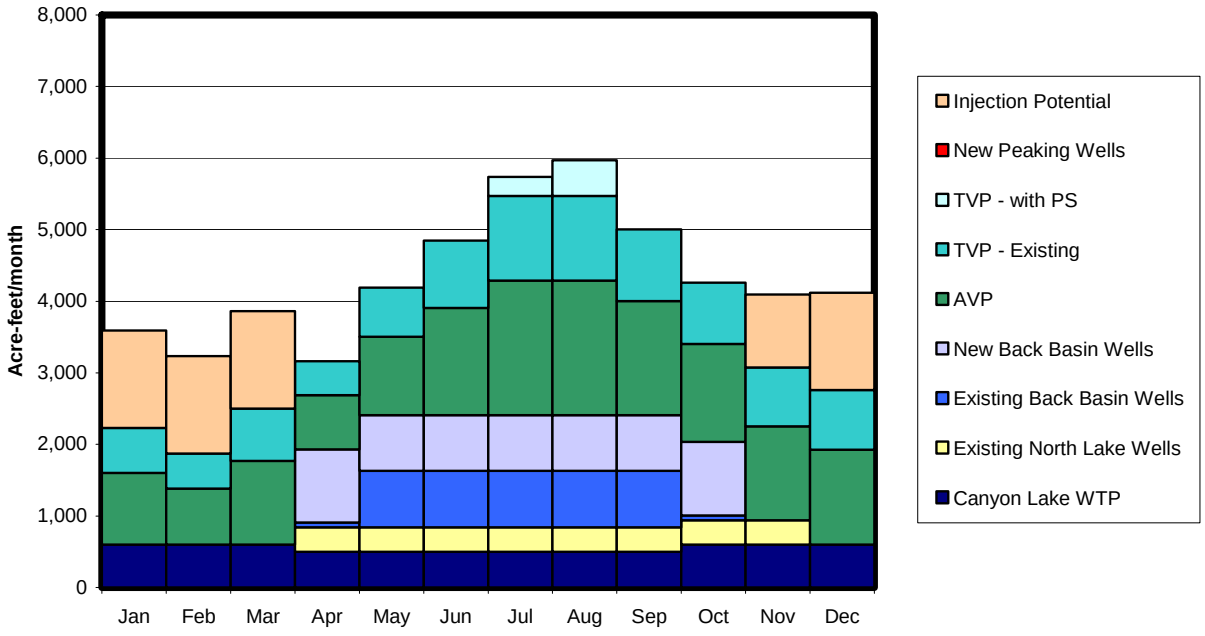
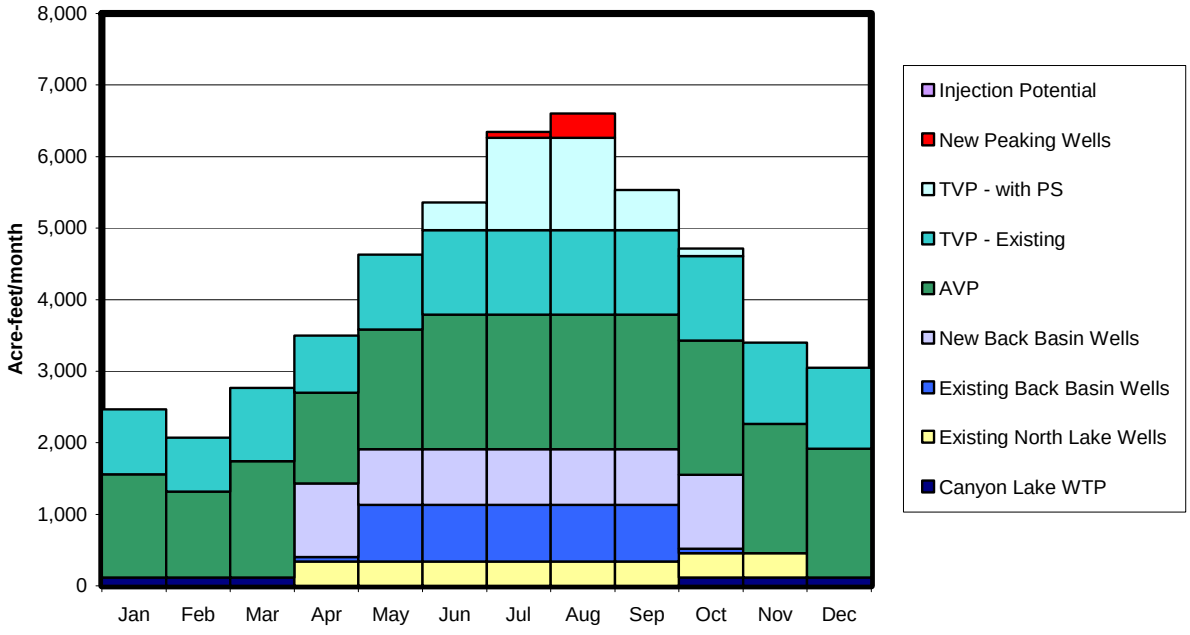


Figure 8-6
Water Supply Mix during a Dry Year



The graphs also show the difference in production of Canyon Lake WTP. During wet years, the TVP pumping station needs to operate two months per year, while this increase to four months under dry year conditions. Injection is estimated to take place in eight out of ten years.

Agency Coordination

For successful implementation of this GWMP, coordination of activities, plans and programs between the District and other agencies is required. **Table 8-4** summarizes the agencies involved and the associated activities that are described under the recommendations of the recommended plan earlier in this section.

CONCLUSION

The goal of the Elsinore Basin GWMP is to ensure a reliable, high quality, cost-efficient, groundwater supply for the users of the Elsinore Basin in an environmentally friendly manner. If the Plan is to succeed, it must be a living document that is flexible and can be adapted to meet the changing needs of the Elsinore Valley area. As management elements are established and results of implementation strategies are quantified, the GWMP should be periodically evaluated to determine how well it is meeting the needs of the Elsinore Valley area, to consider new information and opportunities, and if needed to make appropriate adjustments. The success of this GWMP will allow the Elsinore Valley to grow and double its demands over the next 20 years, with a reliable, affordable, and stable water supply.

Table 8-4
Summary of Agency Coordination

Agency and Basin Users	Activities/Plan/Programs that require Coordination
Advisory Committee	• Monitoring Program • Well Construction, Destruction, and Abandonment Policies • Septic Tank Conversion Policies • Feedback on the GWMP to the District Board of Directors
City of Lake Elsinore	• Lake Level Maintenance Agreement (Lake Elsinore)
DWR	• Well logs • Possible Grant Opportunities
EMWD/RCWD	• Construction of Reclaimed Water Pipeline • Availability of Reclaimed water
EWD	• Joint Groundwater Monitoring Program • Enhanced Monitoring Program of GWMP
Private Pumpers	• Well Canvass • Well Destruction/Capping of Wells
Riverside County	• Permits for the drilling, deepening, modification or repair of wells • Well Destruction/Capping of Wells • Planning Documents (e.g. general and specific plans)
RWQCB	• Groundwater Contamination Notices • Revisions of the Santa Ana Basin Plan Objectives • Reclaimed water projects • Current discharge of Reclaimed water in Lake Elsinore • NPDES permit
SWRCB	• Production records of public and private pumpers

Appendix A
References

American Society of Civil Engineers, 1987. *Ground Water Management*, ASCE Manual and Reports on Engineering Practice No. 40.

Ayres Associates, *An Evaluation of Sunset Park Landscape Irrigation System Conservation Program* prepared for the City of Tampa, 1995. http://www.ficus.usf.edu/docs/water_conserve/

Ayres Associates, *Single-Family Residential Toilet Rebate Program Evaluation* prepared for the City of Tampa, 1994. http://www.ficus.usf.edu/docs/water_conserve/

Ayres Associates, *The Impact of Water Conserving Plumbing Fixtures On Residential Water Use Characteristics* prepared for the City of Tampa, 1993.

Black and Veatch, *Back Basin Study* prepared for Elsinore Valley Municipal Water District, June 1995.

Bouwer, H., *Causes of Infiltration decreases in systems for artificial recharge*.

California Code of Regulations, Title 22, 2003. Drinking Water Regulations Title 22, 2003.

California Code of Regulations, Sections 10752-10754, Water Code.

California Code of Regulations, Sections 65601-65607, Water Recycling in Landscaping Act.

California Code of Regulations, Sections 65591-65600, Water Conservation in Landscaping Act

California Regional Water Quality Control Board Santa Ana Region, 1995. Water Quality Control Plan Santa Ana River Basin (Basin Plan)

California Department of Water Resources, 1981. Investigation of Ground Water Supply for Stabilization of Level of Lake Elsinore, Riverside County.

California Department of Water Resources, 2000. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California.

California Department of Water Resources, 2002. Unpublished driller's logs.

California Division of Mines and Geology, 1969. Geologic Atlas of California. Santa Ana Sheet.

California State Water Resources Board, 1953. Elsinore Basin Investigation, Bulletin 9, 105p.

California State Water Resources Board, 1959. Santa Ana River Investigation, Appendix B, Geology of San Jacinto and Elsinore Basins, Bulletin 15.

California Water Code, 2005a. Division 2 – Water, Part 5 - Recordation of Water Extractions and Diversions, Section 4999-5009, http://www.leginfo.ca.gov/

California Water Code, 2005,b. Division 6 - Conservation, Development, and Utilization of State Water Resources, Part 2.6 - Urban Water Management Planning, Sections 10610-10656, http://www.leginfo.ca.gov/

California Water Code, 2005,b. Division 6 - Conservation, Development, and Utilization of State Water Resources, Part 2.75 - Groundwater Management, Sections 10750-10755.4, http://www.leginfo.ca.gov/

CH2MHill, *Technical Memorandum No. 4 – Lake Elsinore Historic Inflows* prepared for Elsinore Valley Municipal Water District, December 2002.

CH2MHill, *Water Resources Management Plan – Phase 1 Existing Water Supply System Assessment* prepared for the agencies in the Fresno/Clovis Metropolitan Area, January 1992.

CH2MHill, *Water Resources Management Plan – Phase 2 Water Supply Alternatives* prepared for the agencies in the Fresno/Clovis Metropolitan Area, May 1992.

CH2MHill, *Water Resources Management Plan – Phase 2 Implementation Plan* prepared for the agencies in the Fresno/Clovis Metropolitan Area, May 1994.

City of Lake Elsinore, *Lake Elsinore General Plan*, 1990.

Department of Water Resources, Washoe County, Nevada, Sewering Project of Spanish Springs, http://www.co.washoe.nv.us/water_dept/ss_sewer/index.htm

East Bay Municipal Utility District, *Landscape Comparison Survey*, 1992

East Bay Municipal Utility District, *Water Conservation Market Penetration Study*, 2002, http://waterresources-inc.com/ExecSumm.pdf/

EPA, *The Class V Underground Injection Control Study*, Volume 21 Aquifer Recharge and Aquifer Storage and Recovery Wells, September, 1999.

EVWMD, *Groundwater Management Plan West San Jacinto Groundwater Basin*, June, 1995.

EVMWD, District website http://www.evmwd.com, 2003.

EVWMD and EWD, 2000. Monitoring and Mitigation Program – Elsinore Valley Groundwater Basin.

Federal Energy Policy Act of 1992 (PL 102-486)

Fox, Robert C, 1991b. Summary of Well Construction Cereal Street Well No. 3 Prepared for Elsinore Valley Municipal Water District

Fox, Robert C., 1984. Summary of Water Well Construction. Lincoln Street Well No. 2. Prepared for Elsinore Valley Municipal Water District.

Fox, Robert C., 1985. Aquifer Test on the Corydon Street Well Field. Prepared for Elsinore Valley Municipal Water District.

Fox, Robert C., 1991a. Summary of Well Construction Cereal Street Well No. 4. Prepared for Elsinore Valley Municipal Water District

Fox, Robert ., 1999. Groundwater in Storage – Lake Elsinore Groundwater Basin. Prepared for Elsinore Valley Municipal Water District, April.

GDS Associates Inc., *Quantifying the Effectiveness of Various Water Conservation Techniques in Texas* prepared for the Texas Development Board, 2000.

Geoscience Support Services, Inc, 1994. Ground Water Recharge Feasibility Study Final Report. Prepared for Elsinore Valley Municipal Water District.

Geoscience Support Services, Inc., 1999. Detailed Technical Specifications for the Machado Street Well. Prepared for Elsinore Valley Municipal Water District.

Harding-Lawson Associates, 1978. Elsinore Valley Gravity Study. Unpublished Report. Prepared for California DWR. 20p.

Harding-Lawson Associates, 1980. Elsinore Lake Geophysical Survey. Unpublished Report. Prepared for California DWR, 28p.

http://www.ficus.usf.edu/docs/water_conserve/

http://www.mwd.dst.ca.us/mwdh2o/pages/yourwater/ccr02/ccr07.html, 2003

http://www.twdb.state.tx.us/assistance/conservation/gdsstudy.htm/

James M. Montgomery, *Reclaimed/Non-potable Water Master Plan* for Elsinore Valley Municipal Water District, April 1992.

Kennedy/Jenks Consultants, 2003. Wastewater Master Plan. Prepared for Elsinore Valley Municipal Water District. June 2003

Kennedy/Jenks Consultants, *Drinking Water Source Assessment and Protection Plan* for Elsinore Valley Municipal Water District, March 2002.

LADWP Website: http://www.ladwp.com/water/conserv/, 2003

Logan, J., 1964. Estimating Transmissibility from Routine Production Tests of Production Wells, *Groundwater*, Vol 2, No. 35, 35-37.

Means, RS, 2003. Heavy Construction Data – 17th Annual Edition.

MWH (formerly Montgomery Watson) in association with Maddaus Water Management and The Weber Group, *Urban Water Management Plan* prepared for Elsinore Valley Municipal Water District, January, 2000.

MWH (formerly Montgomery Watson), *NPDES Permit for Discharge to Lake Elsinore – Engineering Feasibility Study* for Elsinore Valley Municipal Water District, February 2002.

MWH (formerly Montgomery Watson), *Water Resources Development Plan* prepared for Elsinore Valley Municipal Water District, February 1997.

MWH *Elsinore Basin Recharge Feasibility Study – Draft* prepared for Elsinore Valley Municipal Water District, 2003.

MWH *Coachella Valley Final Water Management Plan* prepared for Coachella Valley Water District, September 2002.

MWD Annual Water Quality Report 2001, MWD Website

MWD Website: http://www.mwd.dst.ca.us/mwdh2o/pages/conserv/program02.html, 2003

MWH (formerly Montgomery Watson), *Distribution System Master Plan* prepared for Elsinore Valley Municipal Water District, May 2002.

MWDSC, 2003. Investments to Protect, Ensure Water Quality Drive First Increase in Cost of Treated Water in Seven Years. Published on http://www.mwd.dst.ca.us/mwdh2o/pages/news/press_releases/2003-03/WaterQuality.htm.

Neblett & Associates, 1998. Fault Investigation – Liberty Development Project Phase I – Lake Elsinore California. Prepared for TMC Communities.

Neblett & Associates, 1999. Geotechnical Review and Hydrogeologic Assessment – Concept Grading Plan – Liberty Development Project. Prepared for The Town Group, Irvine CA.

New Brunswick Environmental Trust Fund , Septic Tanks Conversion Program of the New Brunswick Environmental Trust Fund and the Chaleur Bay Watersheds.

Regional Water Quality Control Board, 1995. Santa Ana River Basin Plan.

Regional Water Quality Control Board, 2003. http://www.geotracker.swrcb.ca.gov/casereports

Regional Water Quality Control Board, 2003. Personal communication with MWH. April, 2003.

Regional Water Quality Control Board, 2004a. Resolution No. R8-2004-0001 – Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate an Updated Total Dissolved Solids (TDS) and Nitrogen Management

Regional Water Quality Control Board, 2004b. Resolution No. R8-2004-0037 – Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Nutrient Total Maximum Daily Loads (TMDLs) for Lake Elsinore and Canyon Lake

Riverside County Flood Control and Water Conservation District, Isohyetal Map of Average Annual Precipitation.

Riverside County Flood Control District, 1978. Hydrology Manual.

Riverside County Flood Control District, 2002. Precipitation and stream gauge data.

Riverside County, *Riverside County Comprehensive General Plan*, 1994.Riverside County Water Budget Formula, 2001.

State of California Water Resources Control Board, 1991. Information Relating to Recordation of Water Extractions and Diversions (91-3 WR).

Todd, D.K., 1980. *Groundwater Hydrology, Second Edition.* New York: John Wiley and Sons.

Tsuchihashi, R., Sakaji, R., Asano, T., 2002. Health Aspects of Groundwater Recharge with Recycled Water. Hawaii Water Environment Association, 2002 Reuse Conference.

University of California Davis, Information Center for the Environment ICE MAPS. Published at: http://icemaps.des.ucdavis.edu/icemaps2/ICEMapInit.html

Waterloo Hydrogeologic, 2002. Visual MODFLOW PRO v. 3.0, build 180.

Appendix B
List of Abbreviations

The abbreviations used in this report are listed in **Table B-1**.

Table B-1
List of Abbreviations

Abbreviation	Description
acre-ft/yr	Acre-feet per Year
ADD	Average Day Demand
APN	Assessor's Parcel Number
ASR	Aquifer Storage and Recovery
AVP	Auld Valley Pipeline
BBIPP	Back Basin Injection Pilot Project
BMP	Best Management Practices
CAFG	California Department of Fish and Game
CCI	Construction Cost Index
CEQA	California Environmental Quality Act
CPT	Cone Penetrometer Test
CY	Cubic Yard
DHS	Department of Health Services
DWR	Department of Water Resources
EIR	Environmental Impact Report
EMWD	Eastern Municipal Water District
ENR	Engineering News Record
EPA	Environmental Protection Agency
ESRI	Environmental Systems Research Institute
ET	Evapotranspiration
EVMWD	Elsinore Valley Municipal Water District
EWD	Elsinore Water District
FCD	Flood Control District
GIS	Geographic Information System
GMA	Groundwater Management Agency
GWMP	Groundwater Management Plan
HE	High Efficiency
I-15	Interstate 15
LADWP	Los Angeles Department of Water and Power
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
mgd	million gallons per day
mg/L	milligram per liter
MDD	Maximum Day Demand
MMD	Maximum Monthly Demand

Table B-1(Continued)
List of Abbreviations

Abbreviation	Description
MOU	Memorandum of Understanding
MSL	Mean Sea Level (feet)
MWDSC	Metropolitan Water District of Southern California
MWH	Montgomery Watson Harza
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PEIR	Program Environmental Impact Report
psi	Pounds per square inch
RCFCD	Riverside County Flood Control District
RCFCWCD	Riverside County Flood Control and Water Conservation District
RCWD	Rancho County Water District
RWQCB	Regional Water Quality Control Board
RWWTP	Regional Wastewater Treatment Plant
SAWPA	Santa Ana Watershed Project Authority
SJRWT	San Jacinto River Raw Water Turnout
SWP	State Water Project
SWRCB	State Water Resources Control Board
TBD	To be determined
TDS	Total Dissolved Solids (mg/L)
TRC	Technical Review Committee
TVP	Temescal Valley Pipeline
ULF	Ultra Low Flow
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WCFSP	Water Conservation Field Serviced Program
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Appendix C
Stakeholder Involvement and Management Plan Adoption

This appendix contains the following documents:

- Meeting Minutes - Stakeholder Planning Meeting No. 1 - May 9, 2002
- Meeting Minutes - Stakeholder Planning Meeting No. 2 – June 4, 2002
- Meeting Minutes - Stakeholder Meeting No. 1 – October 3, 2002
- Meeting Minutes - Stakeholder Meeting No. 2 – February 5, 2003
- Notice of Public Hearing – Preparation of Groundwater Management Plan for the Elsinore Groundwater Basin – published May 25, 2004 and June 1, 2004
- Publication of Resolution of Intent to Prepare a Groundwater Management Plan – adopted June 10, 2004
- Public Meeting Announcement - Public Meeting on Groundwater Management Plan – August 10, 2004
- Presentation – Public Meeting on Groundwater Management Plan – August 10, 2004
- Notice of Availability/Notice of Intent to Adopt a Mitigate Negative Declaration – Groundwater Management Plan for the Elsinore Basin – January 18, 2005
- Notice of Public Hearing – Adoption of a Groundwater Management Plan for the Elsinore Basin – published February 25, 2005 and March 4, 2005.
- Resolution No. 05-03-06 – Elsinore Valley Municipal Water District – Adoption of Groundwater Management Plan – adopted March 24, 2005.

MEETING MINUTES

Stakeholder Planning Meeting
EVMWD/DWR/MWH
May 9, 2002

Attendees:

Dale E. Schafer – DWR Facilitator
Mansour Hojabry. - DWR Coordinator
Mir Fattahi.– EVMWD
George Cambero – EVMWD present for discussion of stakeholders
Chris Petersen. - MWH

Discussion Items

Purpose of Meeting: Mir explained that part of the groundwater program is to do outreach to public and private agencies and pumpers. The purpose of this meeting is to:

- determine who we invite to stakeholder meetings, what information we present at the meetings, planning for meeting with stakeholders because we don't want to be surprised at the meeting,
- This is the first of 2 planning meetings before we go before stakeholders. Second meeting will be with Ron Young, General Manager and Phil Miller District Engineer.
- GM's main concern is not the public water agencies, but the private well owners, because they are often more resist to groundwater projects.

Overview of Project: Mir explained that EVMWD has 1 grant from AB303, and 2 Prop 13 Grants totaling $1.8M projects. AB303 has to be done by June 2003. The Back Basin Pilot Project needs to move quickly to be eligible for the last round of Prop 13 funding.

1. Stakeholder Identification

It was mentioned that EVMWD divide the list of stakeholders into public pumpers and private pumpers. Then we should develop criteria for inviting each. A preliminary listing of stakeholders was provided by Mir.

<u>List of potential stakeholders–</u>

- City of Lake Elsinore
- Elsinore Water District
- County of Riverside
- SAWPA
- DWP
- RWQCB
- SDHS
- City of Corona – Coldwater Basin
- MWD
- Western MWD -
- Eastern MWD
- Farm Mutual Water Company

Mir will identify contacts and phone numbers for each of these agencies.

George Cambero explained that:

- Private pumping volumes are recorded with the County of Riverside and DWR – It is the pumpers responsibility to report to the appropriate agencies, but they are not metered, so there is no way to verify absolute pumping volumes.

- Groundwater level declines have occurred in the last 5 years and George can provide records.
- Farm Mutual Water Company has 2 domestic wells
- Whitney Water Company uses groundwater for bottled water, they have 2 wells and they sell to locals

2. Invitation of Stakeholders to participate in Groundwater Planning Process

- Dale explained that it is not impossible to get all the pumpers to attend a stakeholders meeting, so EVMWD should try and identify an association or advocate group for these pumpers that could be in attendance. This person can go back and educate the reluctant pumpers not in attendance at the stakeholders meeting.
- Limit this to someone who pumps 10-25 AF/Y or more. Because these people are required by law to report to DWR.

3. Stakeholder Education

Concerning communication style at the stakeholders meeting, Dale recommends the following:

- Be very forth coming with information, because these people will have their own thoughts, so this needs to be countered with solid scientific fact
- Get the best scientific information available to educate the stakeholders,

4. Structure of Stakeholder Meetings

The group discussed the following ideas:

- Have two separate meetings, 1 with public agencies, 1 with individual pumpers
- Begin with general presentation to give them an overview of the project. Similar to presentation at the Western MWD board meeting back in September.
- Following the presentation Dale will begin questioning the attendees to better understand their concerns,
- Provide a forum for these people to provide written statements of concern,
- Identify what the stakeholder concerns are right away, because these are the things that could lead to litigation later on. Dale thought this could be done through a questionnaire. Use this information to identify strategy for dealing with these concerns.
- Public information meetings – at a restaurant, serve a light dinner in a non-threatening environment.

Chris introduced the idea of a stakeholder matrix to target different stakeholder groups with the appropriate information. Chris will further develop the matrix for discussion at the next planning meeting.

AB 303 Stakeholder Involvement		
Stakeholder Groups	**Pumpers Impacted by water level or quality changes in Elsinore Basin**	**Entities Outside Elsinore Basin but inside EVMWD service area**
Public Water Agencies	Meeting Type A, Medium Priority	Meeting Type C, Medium Priority
Private Water Agencies	Meeting Type B, High Priority	Meeting Type D-passive involvement, Low Priority
Other Interest Groups	Invited to Meeting Listed above	

- Other interest groups include institutional Groups like Fish and Game, RWQCB, State DHS, USGS, or local environmental groups (i.e. “Save the Lake”)

Frequency of Stakeholder Meetings

5. Location of Stakeholder Meetings

6. Other

Meeting Handouts:

- Well Owner Workshop Flyer – Mansuor
- Elsinore Basin Well Location Map - Mir

Attachment: Outreach plan from AB303 application

Public Outreach

STAKEHOLDER COLLABORATION PLAN

Collaboration with area stakeholders will be an integral part of developing a successful Groundwater Management Plan. Key elements of EVMWD's Stakeholder Collaboration Plan include:

- **Informative Mailing** – EVMWD staff will develop a brochure describing the Water Management Plan for wide distribution to area stakeholders. The brochure will also serve as the announcement of the Initial Public Hearing. Stakeholders will include: Santa Ana Regional Water Quality Control Board (Jerry Thibault), City of Lake Elsinore (Dick Watenpaugh), Santa Ana Watershed Project Authority (Joe Grindstaff), interested citizen groups and individuals, Western MWD (Don Harriger) Elsinore Water District (Sharon Sweesey), City of Canyon Lake (Del Powers), Metropolitan Water District (Robert Harding).
- **Initial Public Hearing** – The first hearing for the project will serve as a public forum to determine if a Groundwater Management Plan should be developed. EVMWD will present initial information on the project and review project goals and expectations. All public meetings for the project will be held at EVMWD's headquarters in Lake Elsinore.
- **Public Scoping Meeting** – A second public meeting will allow more detailed discussion of the Groundwater Management Plan and public input on alternatives development. The second public meeting will be widely advertised and held in a workshop format to maximize stakeholder participation.
- **Formation of a Citizen's Advisory Committee (CAC)** – EVMWD will facilitate development of a Citizen's Advisory Committee (CAC) to guide development of the Groundwater Management Plan. The CAC will be afforded meeting space at EVMWD's headquarters and access to project information as it is developed. The goal will be to develop an open dialog between EVMWD staff and CAC members. Questions and comments posed by the CAC will be answered in a public forum.
- **Board Meeting Updates** – Updates on the Groundwater Management Plan will be made at three EVMWD Board meetings during the project. Board meetings are generally held twice per month and are open to the public. The Board also holds two public study sessions per month.
- **Final Public Hearing** – The final public hearing will be held after publication of the draft Groundwater Management Plan. Comments received from stakeholders will be fully addressed by EVMWD.

• EVMWD COMMUNITY OUTREACH ACTIVITIES

EVMWD has a long history and established method for outreach to the local community. The Director of Legislative and Community Affairs and supporting staff work to educate the public, including local school children, on water resources issues. A sampling of existing public outreach efforts and tools are describe below. Examples of EVMWD outreach materials are also included in this application as **Attachment 2**

- **The EVMWD Website** (http://www.evmwd.com) – The site provides easy access to information of concern to EVMWD customers. From identifying the correct contact person to finding out the percentage of groundwater in the local water supply, the site is a convenient and ever expanding tool. Meeting announcements for the Groundwater Management Plan and other project materials will be posted on EVMWD's website.
- **Speakers Bureau** – EVMWD staff make a wide array of presentations to local community groups as well as school children. For example, *Project Wet* is a portable groundwater model presentation that introduces students to the concepts of the water cycle, watershed protection, water well hydrology, and conservation.

- **Landscape Workshop** – In an effort to facilitate water conservation, EVMWD's Landscape Workshop program is in its 11th year. Topics include landscape design, drip irrigation, and sprinkler troubleshooting.
- **Outreach to Schools** – In addition to making presentations in classrooms, EVMWD staff provides tours of water and wastewater facilities. The District also co-sponsors mini-grants for area teachers for the development of water education lessons.

Chris Petersen

PASADENA MUNICIPAL RECEIVED JUN 1 2 2002 SERVICES DEPT.
MWH
MONTGOMERY WATSON HARZA

Groundwater Management Plan
Elsinore and Coldwater Basin Assessment

Planning Meeting No. 2
June 4, 2002

Attendees:

Dale E. Schafer – DWR Facilitator
Mansour Hojabry – DWR Coordinator
Carl J. Hauge – DWR Chief Hydrogeologist
Phil Miller – EVMWD District Engineer
Greg Morrison – EVMWD Director of Legislative and Community affairs
Mir Fattahi – EVMWD Senior Engineer

- This meeting was the continuation of the previous meeting held on May 9, 2202, in which a stakeholder meeting for the Groundwater Management Plan (project) was being planned.
- There will be two- (2) separate public outreach meetings, one for Elsinore Basin, and one for Coldwater Basin.
- The purpose of this meeting was to make final decisions and preparations for the meeting and determine who should be invited to the stakeholders meeting, the format, and issues that should be addressed and discussed.
- EVMWD has identified the list of public agencies, and will identify list of private pumpers who should be notified and invited to the meeting. Below are the list of public agencies:

Elsinore Basin
City of Lake Elsinore
Elsinore Water District
County of Riverside
RWQCB
SAWPA
DWR
SDHS
MWD
Western MWD
Eastern MWD
Farm Mutual Water Company
City of Canyon Lake

Coldwater Basin
City of Corona
Lee Lake Water District
County of Riverside
RWQCB
SAWPA
DWR
SDHS
MWD
Western MWD

- EVMWD had issued a press release on July 25, 2002 about the project.
- EVMWD will have more information available at its web-site about the project and up to date progress.

- Greg Morrison will contact Supervisor Buster's office to inform him of the project and request a staff member to participate in Technical Review Committee (TRC).
- Greg Morrison will have a Town Hall meeting with three (3) local groups to introduce the project and benefit to the local area

    1. Wildomar MAC
    2. Lakeland Village
    3. Vista De-Lago Association

- Mir Fattahi will gather the list of contact persons with public agencies to be invited to the meeting
- Mir Fattahi will the contact following people who will be in TRC. They'll meet quarterly or on an as needed basis, especially prior to quarterly report to DWR. Meetings will be held at EVMWD headquarter.

    1. Carl Hauge – DWR
    2. Roy Herndon – Orange County Water District
    3. Behrooz Mortazavi – Eastern MWD
    4. Roger Shintaku – Independent Consultant
    5. Representative form Supervisor Buster's office

- Stakeholders meeting will be held at Town Hall or local Schools, open forum with food and drinks provided by EVMWD.
- Mir Fattahi and MWH (EVMWD consultant) will put together a list of private pumpers name and address (where possible) to send information flyer, and meeting notices.
- Meeting will start with comments from EVMWD, followed by MWH presentation about the project, and DWR remarks about the importance of the project and discussion of similar projects in and around the State.

ELSINORE VALLEY MUNICIPAL WATER DISTRICT
Element I – Elsinore Basin Groundwater Management Plan

MINUTES
Stakeholders' Meeting
October 3, 2002

Contents

- **Sign-in Sheet**
- **Presentation:** ***What Does SB 1938 Do for Groundwater Management***
  Carl Hauge, Department of Water Resources
- **Presentation:** ***Grant and Loan Programs for Groundwater Management***
  Eric Hong, Department of Water Resources
- **Presentation:** ***Groundwater Management in the Elsinore Valley***
  Mark Abbott, MWH
- **Question and Answer Session**

QUESTION AND ANSWER SESSION

notes taken by Beth McDonough (MWH) and Inge Wiersema (MWH)

20-25 Attendees (see attached sign-in sheet)

Introduction: Ron Young, General Manager, Elsinore Valley Municipal Water District (EVMWD)

The Department of Water Resources (DWR) has sponsored (50%) the District to prepare the *Groundwater Management Plan* to look at conjunctive use in the Elsinore Basin. Increase storage to decrease demands.

Speaker Panel:

- Carl Hauge, Chief Hydrogeologist, DWR
- Eric Hong, Chief, San Joaquin Valley/Southern California Section, DWR
- Dale Schaefer, Mediator/Facilitator, California Center for Public Dispute Resolution
- Mark Abbott, Project Manager, MWH

Presentation: Proposition 13 / AB 303 Funding by: Eric Hong, DWR

Q. Jack Wamsley, Canyon Lake City Council, JPA Board: If 60 projects are submitted and only 20 are accepted, are criteria not well defined?

Prop 13	$ 349.8 M requested	60 projects submitted
	$ 103 M awarded	17 projects awarded
AB 303	$ 107 M requested	51 projects submitted
	$ 4.4 M awarded	21 projects awarded

A. Eric Hong: Ranking criteria are established to pick the best projects. Additional workshops were held to help applicants understand the minimum requirements. Many applicants do not meet the minimum criteria to be evaluated to receive funding.

Carl Hauge: All of the available funds were distributed. The highest ranked projects received funds.

Q. Edith Stafford: Review; 17 projects were approved for Prop. 13 in 2001-2002. What was the total amount of money available?

A. Eric Hong: $103M was available and $349M requested.

Presentation: EVMWD Groundwater Management Plan by: Mark Abbott, MWH

Q. Jack Wamsley: If we are looking at recharging at the end of the basin, how will that affect the water elevations in the north island wells (NIWs)?

A. Mark Abbott: This will be part of our project, to evaluate the effects of injection on the NIWs.

Q. Gary Grant: Is water stationary or is there an underground river (moving)? He lives in the higher plane area, north of here (Highland Park). His wells are going dry. He understands that water rights are in certain geographical areas.

A. Mark Abbott: This basin is closed. This project's main focus is to store water in the basin for increased yield in dry years. We are in the very early stages of project development.

Q. Edith Stafford: She is interested in the wet years. Are we studying run-off in wet years, containing it, and storing it underground? (If lake overflows to ocean, wouldn't we want to look at capturing the overflow to groundwater storage? (see attached sketch).)

A. Mark Abbott: Flood control is first concern. 1. option is to recharge import water; 2. option is to capture and store flood water for recharge. Other agencies in California (e.g., Orange County) are evaluating this source for groundwater recharge.

Q. Gale Lerma: How does a person keep up with progress of committees of this project?

A. Mir Fattahi, EVMWD: Workshops continue and progress reports are posted on website. Call him if you have any questions.

Mark Abbott: We hope to use the workshops to answer any questions.

Q. Nick Fosco: Will water prices go up or down as a result of this project? If it is water under our ground, we should not pay more for it.

A. Mark Abbott: A cost benefit analysis will be done on all alternatives included in this project.

Ron Young: All sources of water come to the District at different prices; additional supplies and groundwater storage costs are unknown, if additional supplies of water are required, then costs may change.

Q. Nick Fosco: Domenigoni (Diamond Valley) reservoir is that for us? It is so close.

A. Ron Young: Eastside reservoir is a reliability for winter wet years for Metropolitan Water District (MWD) to use for dry years same as the conjunctive use program. It is not enough to meet all future demands.

Q. Nick Fosco: Where are we (EVMWD) in the pecking order?

A. Ron Young: There are 33 member agencies, and everyone is at the same level.

Q. Nick Fosco: Will our (EVMWD) geographical location help us?

A. Ron Young: It helps all in California; MWD is working on keeping supplies adequate.

Q. Pat Kilroy, City of Lake Elsinore: What are sources for recharge?

A. Mark Abbott: Potable drinking water from Mills and Skinner Treatment Plants. The water needs to meet DHS and groundwater basin objectives; the pilot test is using Skinner water. Skinner or Mills (through the Temescal Valley Pipeline) water will be used for the full scale project.

Q. Pat Kilroy: Hard money for water, is EVMWD looking to adjudicating basin?

A. Mark Abbott: Doesn't want to speak on behalf of the District, but no one is wanting to adjudicate the basin. This project will benefit all the users of the Basin.

Q. Gary Grant: 3 pumps have been installed in the lake for recreation. They are straws into the basin. Is the price of water determined by EVMWD?

A. Mark Abbott: The Lake and EVMWD customers will benefit from the Groundwater Management Plan.

Ron Young: We are sharing the basin and until more data are available, we will not know how the basin will react. EVMWD is doing a study and if management can supply to fill white area on graph (demand), if we can use wet flow to store water in the groundwater basin; a lot of pumpers who are using groundwater will benefit. The recharge areas are outside of EVMWD's boundaries, but may help the entire basin.

Q. Pat Kilroy: I do not know of many people that actually drink tap water. What role will conservation play?

A. Mark Abbott: The alternatives include four areas one of which is conservation. The four areas are recharge, direct storage, in-lieu pumping, and conservation.

Q. Pat Kilroy: Is conservation shown in the dry year graph?

A. Mark Abbott: It will be looked at.

Q. Pat Kilroy: In Lake Elsinore water quality is good in the higher level and salty in the lower levels; is there more than one aquifer?

A. Carl Hauge: MWH indicated 2 aquifers; all of California has decreasing water quality I the deeper levels.

Mark Abbott: He further described 2 aquifers at the bottom of the Fernando Group and the lower water quality. The water quality commonly degrades, but we are really only looking at upper 2000 feet of the aquifer.

Q. Nick Fosco: Are minerals addressed in program, arsenic may be present because of old mining activities.

A. Mark Abbott: One strategy is to look at water quality.

Q. Nick Fosco: Is there any detection system?

A. Mark Abbott: District regularly performs water quality sampling.

Ron Young: Annual water quality data is posted on the District's website.

Carl Hauge: Also, arsenic is naturally occurring in California groundwater.

Q. Pat Kilroy: 20-25 square miles with 1 foot or less rainfall per year; have we developed the amount of water that will be placed into the groundwater basin and the safe yield?

A. Mark Abbott: We are gathering data now and will develop water balance for the water model.

Q. Jack Wamsley: Are we working with group from back east – TetraTech? Funding by District San Jacinto Watershed Authority (SJWSA) TMDL Regional Board.

A. Mark Abbott: Thank you – contact Mark Knorr

Q. Jeff Hesley, Elsinore Water District: Can we get copies of the Groundwater Management Plans?

A. Mark Abbott: We are hoping to put the information on the website; we will not be writing the text until the information is presented to the Stakeholders.

Q. Nick Fosco: Are cisterns cost prohibitive?

A. Mark Abbott: Cisterns are generally for private homes – other uses than potable have been evaluated for other projects.

Ron Young: In Bermuda every house has a special roof to collect water for drinking water; there is not enough rain here.

Q. Robert Wilders, Farm Mutual Water Company: Oil companies can determine size of underground storage, have you looked at contacting them?

A. Carl Hauge: Slumberjay – big difference in oil field and water; money. There is a big difference in trying to move into the water department. The technology is too expensive.

Elsinore Valley Municipal Water District

ELSINORE BASIN GROUNDWATER MANAGEMENT PLAN

Stakeholders' Meeting
Wednesday, February 5, 2003
Minutes

Phil Miller (EVMWD): Thank you for coming tonight to our second Stakeholders' Meeting on our Elsinore Basin Groundwater Management Plan. I am just going to do a couple quick introductions, then turn it over to Montgomery Watson Harza for our presentation for this evening. I am Phil Miller, I am the District Engineer for Elsinore Valley. Tonight's presentation will be performed by Mark Abbott, Matt Hacker, Inge Wiersema, and Dave Ringel of Montgomery Watson Harza. I would also like to acknowledge Eric Hong and Dale Schafer, representing the Department of Water Resources tonight. And last, but certainly not least, I would like to acknowledge our newest director, Director Chris Highland. And with that, I am going to turn the show over to Mark.

Mark Abbott (MWH): Thank you Phil. So, all I have got here tonight … it is our second Stakeholder meeting – many of you, hopefully, were with us back in October; we look forward to share with you where we are and where we are going with the project. I am Mark Abbott, I am MWH's Project Manager on this effort. Matt Hacker is our Project Geologist; he is working on several of the projects. Inge Wiersema is our Team Leader on the Management Plan itself. And Dave Ringel is our Senior Technical expert.

We have a little agenda for tonight. As Phil mentioned, we want to talk to you about the Groundwater Management Plan. We want to review with you the goals and objectives that We have set for the project itself – the directives. Inge is going to talk to you about the project status – the work We have done since we were last together in October. Then review some of the work We have completed so far as far as the Management Plans, looking at the alternatives. And then We will talk a little about the upcoming activities and where we go from here.

I want to touch briefly on some of the issues and what we are facing. We have identified a number issues that the Basin is looking at as far as groundwater management; providing water for the citizens and all the users and people that rely on water here in the basin. We will touch a little more on these in detail in a few minutes. The question is "why do we need a Groundwater Management Plan?". We have put together kind of a problem statement – we feel water demand is projected to double over the next 20 years here at the Elsinore Basin. Cooperative groundwater management is required to achieve a sustainable water balance in the Basin. There is a lot of people that rely on water from the groundwater basin for their …. the Lake needs water, the people need water, the environment has a water need, so we want to do a management plan that will try to meet all those goals with this. Our goal is to ensure a reliable, high-quality, cost-efficient groundwater supply for the use in the Elsinore Basin in an environmentally responsible manner. These are great words and we wanted to present them to you tonight – this is really where we are going with this project and it is still a draft. We want you to have the opportunity to take a look at this and provide comments to us if you have them. We going to be spending, hopefully, the next 1½ hours with you, talking about this project, getting your

comments – so, if at any point during the presentation, either now or later, please feel free to speak up and ask any questions or give comments.

The benefit of implementing a Groundwater Plan is to increase the water supply or reliability. A lot of the water comes in as import – we show it on those issues in 2020, 80% of the water supply is going to be imported to the Basin from outside the area. So we want to try to increase the reliability, so that during those droughts, instead of dry periods, that portions of demand can be met with supply stored in the basin. We want to minimize water quality risk. We need to recognize the fact that bringing in water from a different area, is going to have a different water quality. We need to make sure we can control that and make sure there are not problems associated with storing that water here in the basin. As we said in our goal, Stakeholders involvement is key – everybody who has use of the water in the basin, needs to be involved in this process to promote it; to provide knowledge we need to manage it, we need to know what is there. The other thing we say is "maximize the use of lower cost water sources." No matter what we do, we are still going to rely on imported water to store. There is only a finite amount of water in the basin, so to increase that storage, we have to bring it in. But there is a lot of water that flows through the basin right now that is either lost down the wash or is maybe … find better uses of it. So we want to be able to find water that is a lowest cost and try to use that and capture that and store it for future use. We have mentioned a drought-proof water supply – through the groundwater storage project, we think that a portion of the water supply for the basin could come from within the basin and become more of a drought-proof supply. And of course, the basin has a lot of storage capacity, it is a very large basin and has the potential to store a large volume of water.

Project status: we were together here back in October, we had our first Stakeholder Meeting where we actually presented to you all the groundwater management efforts that are currently undergoing here in the Elsinore Basin. Since we got together, we have completed, developed, and compiled all the information and developed a good understanding of the basin and how it works. Developed a monitoring plan to actually keep track and expand the knowledge, identify the holes and data gaps, and we are right now preparing a groundwater model to use in evaluation of different alternatives for groundwater storage. And of course, here we are in the beginning of February, we are having our second Stakeholders' Meeting, first to bring you up to speed with what we have learned over the last few months, and also to start the discussion about what type of alternative management strategies are available to us to help promote that goal. So that being said, I would like to turn it over now to Inge, who is going to talk to you about the work we have done to date. And I will be your tour guide here on the computer and see how it goes.

Elsinore Basin

Slide #10

Inge Wiersema: Thank you Mark. I will update you on the work that we have completed to date and then we will go over the alternatives. The first thing we did is looked at the water demand as compared to the supply sources that are available. And, as Mark said, the water demand doubles

in 20 years, so we are right here and it is going to go all the way up to about 50,000 acre-feet on an average basis. There are multiple supply sources – there are some wells, Canyon Lake Water Treatment Plant, and there is imported supplies from both Temescal Valley Pipeline and Auld Valley Pipeline. There are additional supply sources required and that starts in about 2010-2012.

Slide #11

The additional supply is only required in years normal dry years with respect to local precipitation. In a normal year the water demand is about average, while in a dry year demands will increase. Thus the total demand is a little higher, while at the same time, some of the supply sources, such as Canyon Lake Water Treatment Plant will produce smaller amounts of water. And that will result in a fairly large amount of additional supplies required 5,000 acre-feet. And in a normal year, it is about half, about 2,500 acre-feet of additional supplies. While in a wet year, you actually have lower demands because of less irrigation and you have more water available from the treatment plant, so you do not need additional supplies. So, I just want to point out, the needs are dependant on the actual rainfall available and whether it is a dry or wet year.

Slide #12

Secondly, what we did is we collected a lot of the information to start this project. Most of the information is being collected and stored in a GIS – all the well information and geology, faults. Everything that we need to know about a basin is pretty much stored in the GIS. And then there is some other collected information that could not be compiled in the GIS format, that helped us gain a better understanding of the basin.

Slide #13

The yellow shading in the back that is pretty much the boundary of the Elsinore Basin and there is two fault zones – there is the Glen Ivy Fault that actually also extends out of the basin boundary and then on the south side of the lake, you have the Wildomar Fault Zone. So there is all these fault lines in the Basin that makes the basin fairly complicated. MWH has a good understanding of the basin at this point.

Slide #14

The groundwater generally flows from the north side to the south side of the basin, and that is primarily because there is a lot more pumping going on this side of the basin, so that results in lower water levels. While the water level on this side of the basin, where there is more recharge from the mountains through the canyons, is more stable. The groundwater levels here are more stable over the past 10 years and levels here are declining a little bit.

Slide #15

To get a better understanding of the basin, we developed some cross-sections. Section A-A' that cuts right through the basin. The basis consists of two aquifers shaded in yellow is the upper alluvial aquifer and shaded in gray is the lower Fernando Group aquifer. There is a clay layer separating the two aquifers. The water levels that we just showed you in the previous slide represent the water level in this aquifer. Then there is the Bedford Canyon Formation (the blue shaded area) which is more of a rock formation. There is no water flow from the lake down to the alluvial aquifer as there is a clay layer that separates the lake from the upper aquifer.

Q: That shallower aquifer, does it continue south through Wildomar and heading south further?

Mark Abbott : No, it does not. The Fernando Group actually comes up to land surface and the alluvium does not extend down to the south.

Q: So you are saying the flow does not continue south and Temecula is not pumping our groundwater?

Mark Abbott : Under certain circumstances, you could have flow down there, but you would have to have water very high up. So no, the activities in Temecula are not taking the water.

Q: What is GIS?

Inge Wiersema: it is the Geographical Information System … the best way to think about it is it is a graphical interface, like a map with a database attached.

Q: Is it available to us?

Inge Wiersema: The District has all the information.

Mark Abbott : It is actually a data base, it is just a graphical data base – it is geographic in that you have points on the map that you can point to and pull up attributes for that particular point.

Q: I do not even have the name of your company here – on the Agenda, I do not even have who you guys are …

Inge Wiersema: MWH

Dave Ringel: Montgomery Watson Harza, and we are consultants to the District.

Inge Wiersema: So, a GIS is a map and in the back of the map there is a data base that has all the information that is presented on the map.

So, that is the understanding of the basin – there is two aquifers and you can store water in either the upper or the lower aquifer and I will go into more detail on that in a little bit.

Slide #17

Another thing we did in the past few months is to make a water balance to look at all the inflows in the basin and the outflows. So the inflows into the basin will be precipitation, water that comes down the watershed. Infiltration through the San Jacinto River that comes down from Canyon Lake – so it will actually infiltrate from the river into the basin. Return flows through use – this can be irrigation water that will infiltrate to the basin or returns from the septic tanks. And then there is subsurface flows, which are flows between the basin and the other underground flows – we determined those are zero because the basin is isolated.

Slide #18

And then there is outflows – the only outflow that we have identified is the groundwater pumping to supply the demand in the basin's. If you look over the past 10 years, this is a water year starting in October going to September, from 1990 to 2000. The average difference is minus 1,300 acre-feet per year. I want to point out it is an average over a 10-year period, there was less inflow than there was outflow. But as you can see in the next slide, this varied over the 10 years. So if you have a wet year, those 3 years are relatively wet, you have a lot more inflow than outflow – so in those years you have a positive water balance. And as you can see, over 11 years, we only had 3 years that had substantial rainfall. So, we will get an El Nino this year, and we will get a lot of water. So it is very dependent on the climate. If it is a lot of rain, the balance is positive; and if it is dry the balance will be negative for the year – natural pattern of flow that will vary on a year to year basis.

Slide #19

The last thing we submitted to the District was a monitoring program. What you see here is all the wells in the basin that we have included in this monitoring program. All the blue dots are the existing wells; and then there are eight red dots that are future wells or wells that are currently in the process of being installed. Those include both wells from the District, all incorporating into a combined monitoring program.

What is a monitoring program? The District measures all sorts of information; water quality information and water level data for the groundwater levels. And we have proposed that only water level information is collected on a monthly basis and the water quality information is annually, with the exception of the inactive and new wells where we do not have data for a period of time, then we will collect two samples for the first year and after that it will be also an annual sample taking. This is proposed for all the wells that you saw on the previous slide.

Q: Did you include any other water departments in your study?

<u>Inge Wiersema</u>: Elsinore Water District is included in this as well. Yes, it is a combined effort.

Q: Why are you running water quality only once a year?

Inge Wiersema: Water quality data does not change – on a very small increment of time – water levels are much more varying over time based on seasonal fluctuations.

Q: So this is only the level, it does not have to do with what is in the water?

Inge Wiersema: Right – the water quality is actually what is in the water … but groundwater moves very slow, so there is not a lot of mixing it goes on a long time scale, so the water quality does not vary on a weekly basis.

Q: Do you know if they already have a problem over by Lakeland Village with – they drilled wells and then they were not able to use them because there is some kind of poison in them?

Inge Wiersema: I am not familiar with that.

Phil Miller: Yes there are some contaminated wells at Lakeland Village …

Q: If all this stuff is in that purple area on your map, what is to keep it from contaminating this stuff?

Phil Miller: There is small wells and there is a small contamination area that I know exists, but I am not particularly familiar with it.

Q: Would not they have picked it up on their monitoring?

Phil Miller: No.

Inge Wiersema: We would pick it up on the wells that are closely located to it. So if you are monitoring this well, you will not notice it at the groundwater level.

Q: So you have not actually monitored those yet?

Dave Ringel: No, this is a proposed plan.

Inge Wiersema: We are supposed to collect more data on the water quality and levels.

Q: I was wondering what caused all those septic tanks over there to evidentially get in the wells?

Inge Wiersema: There are septic tanks all around the lake area and there is one well where there are bacterial problems, but we are not sure whether that is related to the septic tanks at this point.

Q: On the west end of the lake, when they had the floods back in the 80s, all those trailers and everything that were not able to be moved out of there, with the outhouses and everything – I do not think that situation was ever taken care of …

Mark Abbott : One thing we would like to point out – we pointed at the geology is that the upper 100 feet is a series of interbedded clays and sands, so there is really a good separation between

the zone where those septic tanks are and where the water withdrawals actually occur. The dark orange you see between the yellow and the gray, is actually a fairly competent aquitard, a clay layer that separates those two zones. On that particular cross-section, the majority of the withdrawals are occurring from what we call the Fernando Group which starts at a depth of around 500 feet below the ground surface. So, typically in an area where you see that the aquifer is really thick is on the south side of the lake.

Q: Aren't all those septic tanks contaminating the lake? You know, most places, you have septic tanks within 100 yards of a body of water, especially a lake, you got problems.

Mark Abbott : I am not familiar with any septic tanks within 100 yards of the lake itself.

Phil Miller: In Lakeland Village and that side of the lake there are septic tanks. We did sewer it years ago, but not everybody hooked up. There is speculation that part of the lake's problems are related to septic tanks, but I do not think anybody has made a direct correlation.

Comment (continuation of preceding question): Well you know, years ago, you done any skiing in that lake, you broke out with ear infection and a rash and the whole nine yards.

Comment: EVMWD did a study on septic tanks around the lake and found negative contamination. That was less than 10 years ago.

Comment (continuation of preceding question): Yes but that is kind of hard to believe.

Dale Schaefer: I think it might be a good idea to contain your questions. I think all of these are really good discussion points and I would like to hear all of them, but I think we ought to let them finish their presentation and note your questions and then ask them later. Not that we are not going to address the questions, Phil is sitting here and he is going to address the questions; but I think we need to let these guys finish their presentation and then we will get into a question period – I think we will have enough time. If you have questions concerning what she is talking about right now, great! And the rest of them, let us hold till after – is that okay with everyone?

Slide #21

Inge Wiersema: So far on the monitoring plan, one of the things that concludes all the information that we have gathered is that we have a much better understanding of the entire water balance. And as Mark said earlier, the goal of this plan is to provide a management plan that will be sustainable water balancing the entire basin – that does not mean just the Elsinore Basin but also talk about the lake. There is a lot of interaction between all these water bodies. Most of the water that will come to the Elsinore Basin comes from the canyons and the watershed. And there is some extra water coming from San Jacinto watershed and will enter the basin through Canyon Lake. That is where most of the inflow comes from to the basin. Some of the run-off from the watershed will actually ends up in the lake. There is a lot of evaporation from the lake and there are other imported supplies that will end in Canyon Lake and that water

will go to the Elsinore Basin through infiltration or it will go directly to the San Jacinto in the river to the Elsinore Lake.

Water from Canyon Lake can be treated in a water treatment plant, as I pointed out in the first figure – these are potable demands. Potable demands are also served from import of water, from either Temescal Valley Pipeline or the Auld Valley Pipeline connection, and then there is a whole stream of waste water and recycled water related to the Elsinore Basin and some of these discharges go through Temescal Wash. And all these interactions need to be taken into account in the Groundwater Management Plan – we cannot just look only at the basin or only at the lake; it is a lot of interaction. To maintain lake level, there needs to be water pumped from the basin to the lake to maintain the levels. We have looked at this, identified all the interactions and now we are at the point of quantifying these and moving on to developing alternatives.

That brings us to the alternative discussion. First to verify a little bit, how that works. Mark talked about our management issues, the reasons why we do this groundwater management plan, and our goals. There are different strategies that I want to identify in a little bit on how to address these issues and these goals. For each strategy there are multiple activities; I will go into detail pretty soon, but for example if you do some surface spreading, you can do it in one location or another which are defined as different activities. Then we will link alternatives that can either contain activities that will be included in each alternative or certain activities will be specific for alternatives. The reason we do this is so we can evaluate a whole package of activities and evaluate what would be the best way to manage the groundwater basin. So, over here for today also is to get your feedback on if maybe we have overlooked some of these issues and if there is other activities that we have not identified yet that you think really a good idea to be implemented in this groundwater management plan.

So, let us go over the main issues that we have identified so far. As discussed, groundwater … the water demand will double in the next 20 years – that is just the demand of the Elsinore Water District. Because of this increase, there will be more reliance on imported water. So, what was identified in the water management plan is that in 2020, 80% of the water that we serve to the customers comes from imported supplies. That does not include all the water that needs to be used for lake augmentation. So in total, we can conclude that the demand on groundwater is increasing due to the increase of water demand. It is also seen over the past 10 years, the groundwater levels have been declining. At least in the area south of the lake, water levels have been declining. While in the area north of the lake, water levels have been fairly stable. Those are issues when it comes to water quantity. Then there are some water quality issues – arsenic and some other issues – that we need to take into account when we do this groundwater management plan. One of the other things that we have identified doing this GIS, is about 300 wells in the basin and there is only a small portion of them – about 8 – are production wells of the District and then there is a lot of other wells that the status is unknown and maybe some of these wells are not abandoned properly and they pose a threat to groundwater quality as these wells provide a connection from the surface to groundwater aquifer. So, these are all the issues that we want to address in this management plan.

Q: What was the source of the arsenic contamination?

Inge Wiersema: It is a natural occurring problem.

Mark Abbott : The Federal government reduced the standard on arsenic. So that we are reducing it down to a level below – lower than where it is now.

Q: What about radon? We have a lot – because of our geography here, I know that radon … because of the granite – it is naturally occurring in granite – are you testing for that too?

Matt Hacker: No detection of Radon in this area.

Slide #25

Inge Wiersema: So to address all these management issues that I just went over, there is a number of strategies that we can use to obtain the goals that we have envisioned. These are strategies that may be you have some other ideas – we have been thinking about dual-purpose wells; those are injection wells that inject imported water into the surface, into the aquifer and then in times of drought, we can extract the water again. So dual-purpose means you can both inject and extract water. Surface spreading – that means there are surface spreading basins in the canyon, so there is a lot of run-off into rainfall – you can actually infiltrate that water more effectively and recharge the groundwater basin. New supply sources, as indicated in the slide with all the arrows (#21), the raw water turnout from Metropolitan that is maybe a new source, we will go over a few more examples in a little bit.

Pumping restrictions may be a strategy. Water conservation – I have already noted that would be a good solution to reduce a little of the peak demand increase. Basin monitoring – that would be a strategy that we will carry throughout all the alternatives – monitoring will be important no matter what alternative will be chosen, as proposed in the monitoring plan. We have in-lieu recharge – which means that you, rather than that existing pumper pumps water out of the basin the demand gets supplied with imported water. Then the pumper does not have to pump, and the basin will recharge by itself as you do not need to extract water from the basin. And, of coarse, Stakeholder involvement is an important strategy that we will continue to follow on.

Slide #26

When we go to the next level, we have our management issues – these are strategies again – and then below are some activities that we have identified. So, for single purpose wells we have identified that it is possible to do ASR (aquifer storage and recovery) north of the lake and south of the lake. For surface spreading we have identified multiple locations, did some evaluations, and identified two locations – McVicker Canyon and Leach Canyon, that are very feasible locations for surface spreading; and then in Railroad Canyon there will be more surface recharge, where by discharging more water from the raw water turnout, and having more water flowing through San Jacinto River that will also result in more infiltration.

In-lieu can be accomplished by either using imported water or Canyon Lake Water Treatment Plant water. New supply sources, as I mentioned, were the raw water turnout, we can expand the reclaimed water demand. Earlier this week we had another meeting which brought up the idea of dam modification or maybe other imported water sources.

Pumping restrictions – that will mean that you will operate station under safe yield. For water conservation, there are different activities that you can do – financial incentives; you can do some landscaping, called "xeriscaping", where you use plans that do not use as much water as a lawn for example; and you want to create more water awareness, so people are more aware of conserving their water. Basin monitoring – we have the existing monitoring going on and the expanded network as proposed in the monitoring plan to get a better handle on the information. Not only to get the information, but also operate the basin with knowing what is going on.

Surface flows can be monitored better to have a better handle on how much water is available to be recharged. We can also use the groundwater model that we have created for this project. It runs different scenarios and updates the way you could manage the basin most effectively. And then Stakeholders' involvement is another strategy that we need to continue.

Q: What is that line – Lake Elsinore Dam Modification?

Mark Abbott: It was brought up by the City that maybe we could raise the weir elevation on the dam to store more water – it would in a sense be a new supply source by increasing the amount of water stored within the lake, especially in those periods when it really rains a lot and you have got water …

Continuation of previous question: Are you talking about the outflow weir?

Mark Abbott: Yes.

Q: I am trying to figure out which – where the dam they are talking about is … by the Back Basin?

Phil Miller: It is not really a dam – they are talking about the outlet channel that has a weir at the famous 1255 elevation – about raising that spill up to a number of a higher elevation.

Mark Abbott: We are not sure that it is really feasible to do that – there are flood control issues. But it has been brought up as an option, and we are going to look at it just to see if it is possible.

Q: I do not know if this is appropriate yet. Why is the outflow going to double – what areas is Elsinore Municipal Water District servicing – is the water staying local or are we exporting it to Corona or Horsethief Canyon or what is going on?

Inge Wiersema: The water demand increase means you pump more water out of the basin.

Q: Can't we control the growth or something? How far … or where does our water go? What communities do we service?

Phil Miller: The cities of Canyon Lake, Lake Elsinore, Murietta, and the incorporated Riverside County areas like Lakeland Village. The District extends basically from the Horsethief Development as far south as … we are not a box, but Clinton-Keith Road is probably our southerly boundary and parts of Cal Oaks.

… That is where most of the development is going to be because of the topography here it is kind of hard to build houses and tract homes … Horsethief Canyon …

Inge Wiersema: There is a lot of development proposed north of the freeway.

Mark Abbott: Just to keep moving on this … hold the thought, but let us get through the end of this one … we are almost there I promise.

Slide #27

Inge Wiersema: So we have the different strategies and different activities and no more than different activities and combine them into alternatives that we will evaluate in the Groundwater Management Plan and we will look at four alternatives is what we have come up with so far. They have more of a theme – so one alternative will focus mostly on dual-purpose wells, the injection and extraction wells. The second one will focus more on using surface spreading as an opportunity to recharge the basin. Then the third alternative will look at the combination of in-lieu recharge and water conservation. Then the combination alternative – what we have proposed so far is to work on these three alternatives, collect a lot of information, cost environmental constraints, difficulties of implementation, work out all the details, and then combine that information into a "best" alternative – and that will be the combination alternative were you take the "best" of each alternative 1 through 3. Here is a little table that we have developed … (table was hard to see) … Inge will read –

Slide #28

Alternative 1 – Dual-Purpose Wells: activities that are included are dual-purpose wells north of the lake and south of the lake. As a new supply source, other imported water, the existing imported water supply, and maybe additional imported water to inject it in dual-purpose wells. In periods when there is a lot of water available in wet years, when Metropolitan has excess of water and also in the winter months … store all the water underground and pump it out during the dry months or the dry years.

Water awareness … under water complications, is an activity that we have included in all three alternatives.

Basin monitoring – existing network, expanded network, monitoring service flows and using the model to manage the basin are all activities that we have included in all alternatives, so we do not make a distinction. Stakeholder involvement is also included in all the activities.

The things that make Alternative 1 unique are dual-purpose wells and using imported water as a supply source.

Alternative 2 – Surface Spreading: included all the surface spreading locations that we have found feasible at this point in the project, McVicker Canyon, Leach Canyon, and Railroad Canyon. And now we have selected the San Jacinto River turnout as the source, because that can be used for a Railroad Canyon recharge and that water will be used as recharge

Another idea was to sewering or septic tanks to collect that water, treat, and make it available for either recharge or to use it as supplementing the lake and therefore saving some water to be pumped out for lake leveling.

Alternative 3: The distinctive components that we have selected are in-lieu recharge, both from import long-term water and also Canyon Lake Water Treatment Plant water.

Q: Can you explain what in-lieu recharge is?

Inge Wiersema: With in-lieu recharge you supply imported water directly to pumpers that currently take water out of the basin. So, those people do not have to pump water out of the basin. Water will naturally continue to flow into the basin. When there is no outflow, the basin will recharge.

Mark Abbott: The pumpers we are talking about is Elsinore Valley Municipal Water District. We are not asking people to shut off their wells at this point.

Q: Can I ask a question about the surface spreading? Is this when you take the reclaimed water put it over a specific area and let it flow down?

Inge Wiersema: Currently we are thinking of using mostly runoff water and import water for spreading in the spreading basins which are constructed for that purpose and then it will infiltrate. Reclaimed water may be an option to be used as well.

Mark Abbott: Actually, they are not really big holes full of water, they are going to be open areas of land when water is available. About 90% of the time it is just going to be grass or vegetation or whatever is in it. When it rains, we will try to capture that water when we can to store. During dry periods, if we find it financially feasible, we will pipe imported water up and use that to recharge the groundwater supply. I hesitate to say that there are going to be big holes of water. During the summer, it is not going to make sense to store the recharge water.

Q: So, you are going to take an area and you are going to create a place where the water can trickle down through– will you have to go through a kind of environmental study …

Inge Wiersema: Absolutely.

Mark Abbott: We have already started some of that work. We are not looking at modifying any current activities. The county has some flood control areas up Leach and McVicker Canyons

where they have some debris basing. We are working with the County right now to see about the possibilities to make some slight modifications to existing facilities, already in place for this purpose. Because right now, water just passes through them. We are trying to see if we can do something to capture that water, store it, and slow it down a little bit so that it has more time to infiltrate.

-- additional discussion about this topic … too quiet, not clear enough to transcribe.

Inge Wiersema: I think that concludes the Alternatives. We have proposed to look at other imported water and we have this idea about the lake dam modifications – we will evaluate them before it becomes part of an alternative to see what flood control issues are and that will bring up.

For water conservation, we have included options as xeriscaping and financial incentives, and evaluate what types of possibilities there are to stimulate water conservation to a level as high as possible. Once we have evaluated all these three alternatives we can fill in the table for the fourth alternative, and compose it such that it will be the most optimum alternative from different perspectives.

Mark Abbott: Any other questions or comments about the activities or strategies that need clarification? Any ideas you have on better ways to manage the water …

Q: I do not see controlled growth – you have your graphs, you have your comfort zones, why not tell these developers "I am sorry, here is what we have." Why are we letting out permits for thousands of homes being built, when we only have so much water?

Mark Abbott: This does not answer your question, but I just want to touch one issue somewhat related. We are not talking about providing a source of water for the entire district service area. We are just trying, at this point, to find out what the basin storage is. The focus of our study is not growth-related, in fact in reality, it is not even demand-related. It is a matter of we have got a basin, a groundwater basin, that has a certain amount of storage. What can we do within that basin to manage the water resources, to increase the yield, to give us some protection no matter whether the demand is 50,000 acre-feet/year or 10,000 acre-feet/year; no matter what happens with growth – maybe all the projections are way off, maybe it is only going to be half of that. The growth is driving the project because there is a need to provide a more reliable source, but the project is not going to find a water supply for all the growth. The project is going to find a way to manage the basin, to get more water for the existing district and the future growth.

Comment: The future growth can be managed by control … you are doubling your demands – but where is the demand coming from for future growth. … maybe we cannot do some of that stuff …

Mark Abbott: Nothing we do is going to relieve the need for imported water. All we are trying to do with this project is to better time our purchases … when you are in the middle of a drought, the water is the most expensive; when you are in the middle of a rainy period, the water gets very

cheap – Supply and Demand. So what we want to do is buy the water when it is cheap and plentiful and store it and have it available to us when it is needed. I am not trying to avoid your question, it is just that we are not really looking at the growth issues, we just looking at how do we better manage the water resources.

Q: On Alternative 1, that is where you propose special wells. You are going to put water in them when it is cheap, and then take the water out when it is dry – is that right?

Mark Abbott: That is close enough.

Inge Wiersema: You do not use those wells in the period that there is water available you just give it to the District to buy more import water directly and pump less out of the basin. And in periods where the water gets expensive, you will pump more out.

Mark Abbott: Let us back up a few slides … this might help answer your question. Right now, these are output … that is the water being pumped out of the basin; wherever it is going is the outflow. If we can reduce that number to kind of bring it more in balance with what the inflows are … so we are talking about just stop pumping water. Instead of using water from the groundwater basin to meet demand, find more water and bring it in. So we can balance the situation by simply reducing our pumpages to meet or be closer to inflows on any given year. It is a very cheap way to do it. I mean, it is expensive to buy the water, but it is very easy … you just rest the wells while the natural recharge to fill up the basin.

Inge Wiersema: You do not need any additional facilities.

Mark Abbott: Can you hold on – I do not think I have answered this question. I just want to go back to one of the issues that we brought up is that, with the current usage in the basin, we said that we know the groundwater management – even if you take out the demand over the next 20 years**,** groundwater levels decline. So, even without the growth, there is still a need for the project. So even with the way it is today, you will need some sort of groundwater management.

Q: So, you were asking us to consider the three different alternatives?

Inge Wiersema: I was asking if people had other ideas on different activities or different approaches that would not include in the list so far and we can consider when we evaluate these alternatives. That was the question.

Q: Lee, Lake Elsinore – You are talking about pumping water back into the well – how many acre-feet are you talking about in your project, how many acre-feet can you store?

Mark Abbott: We did a pilot project back in September/October where we took one of the existing production wells and over a 2-week period we pumped about 88 feet of water. Just allowing water flows naturally through the existing system pressure. We did see an increase in storage in the basin. And that was at a rate of about 2M gallons a day that we stored over the 2-week period.

Q: Does it actually conserve water, how does that play into changing the water in the basin or the possibility of sewering septic tanks?

Inge Wiersema: It just makes the water available to you in a different way and, currently, the water in the septic tanks will infiltrate into the basin. And there are some quality issues. If you actually sewer the people you will collect the wastewater and be able to treat it. Once it is treated you have more flexibility to use it. You can use the water to augment the lake for example and more flexibility to use it the way you want.

Q: That is not necessarily true, when you are on a septic system, that water actually goes into the surrounding area and enters the leach field and it percolates down anyway.

Mark Abbott: It does not leach into an area that you can take advantage of. Right now – we talked about the geology – the upper 100 feet is interbedded clays and sands – with the water up in that area, though not necessarily bad, there is things that happen up there, but that does not necessarily give water that we can have access to.

Q: I see what you are saying – you are saying if you switch it off of septic tanks, the Water District will have more advantage for water. Who would pick up the bill?

Mark Abbott: The real benefit – there is a lot of potable water being used for non-potable purposes. Irrigation sprinkler systems are a wonderful example – if you can capture some of that septic tank water, treat it and use it to off-set potable water being used to keep grass green that saves the water that is normally pumped out of the basin or imported in. It is going to be multiple uses of the same water.

Q: Are you also talking about a system where you can take your shower water and also your wash water?

Mark Abbott: At this point, we are really looking in the District's side of the system, not once it goes into your house … and when it comes back out of your house, we want it back if we can … but what you do with it inside of your house, I do not think we are going to change the regulations.

Q: When you are talking about switching, the people in Lakeland Village off septic and onto sewers, who will pick up that cost?

Mark Abbott: We would evaluate – the cost of that would be incorporated into an evaluation …

Q (continuation of preceding question): So they would not come out and say "now you have to spend $10,000 to go into it"?

Mark Abbott: There will be some recommendations made and there will be some decisions made and that is why we are going to continue the Stakeholder involvement process, the Public

Hearings and if that is a recommendation, you will hear about it and have an opportunity to comment it.

Q: Just one more question on that same issue – is that a significant amount of water?

Mark Abbott: It is not insignificant. If the demand is 20,000 acre-feet and the water goes in at 20,000, that water is going to come back out. Maybe not all of it, but if half of it comes back out, and we can reuse it for another purpose …

Inge Wiersema: The additional source is not needed, it is not that high – you have seen in the beginning the bar chart, it is not a very thick piece of the bar. So, you have 10 percent more supply available by sewering the current septic tanks, that would definitely help. It is definitely worth considering because of the amount. But if it is really small, then it would not help us to solve, the problems that we are trying to solve.

Q: There is one area of water source that you are not considering. The major amount that comes in about every 10 or 11 years, in a very wet year, we were thinking not about how to conserve it, but how do we get rid of it, and we are hell bent on sending it down to the Pacific Ocean, when we should be trying to save as much of it as we can.

Inge Wiersema: That was part of the idea.

Q (continuation of preceding question): You did not really expand on it – you hid the thought of raising the sill at the outflow channel, but you did not talk about the other half of that. We really should raise the sill at the outflow channel and lower the sill to the Back Basin. Do not think about putting 9,000 houses there. Store water and replenish the aquifer, we could have a variable-height sill to the Back Basin, eliminate that first flow which is extremely contaminated, eliminate the very last flow in let us say Mystic Lake overflows and is very contaminated, and take the middle flows where the water is quite clean, put it in the Back Basin and pump it down as rapidly as we can.

Mark Abbott: One of our goals, you may remember, that there was a board up there that said "maximize use of lower cost water". We may not have said it the way you did, but there is always the flood control issues and whatever we do, we have to remember that there is competing uses for the water. Not only the people that want to use the water, there is the people that want to get rid of the water because they do not want to have water in their house. So, yes it is in there; it may not be quite as big a role as … we are going to look at the possibilities of producing the sill elevating, and maybe it is a temporary-type of sill, but realizing also the results of the regulatory agencies such as the Corps of Engineer limits the flexibility of the things we can do.

Inge Wiersema: Also, the surface spreading of the basin, if you have a lot more rainfall in those years and you have to build facilities to capture a lot more rain, and two of the main canyons that are currently producing a lot of water that will actually reach the lake. By installing the spreading basins, you do capture a lot of that water in those years when you do not know how to

get rid of the water. So we are thinking about using that opportunity to maximize the capture of rainfall.

Mark Abbott: And also, we are restricted to only the surface spreading and surface recharge. If we put water into an injection well, Federal requirements state you can only put drinking water into a well. When you do direct recharge right into the aquifer system, it has to be drinking water.

Q: Can you use the Back Basin as a spreading unit?

Mark Abbott: There is a lot of clays … we have looked at the geology in the Back Basin area; what has happened is that all the deposits have come down are sediments of the surrounding hills and what has happened in the area of the lake – historically, the Lake is much larger, but what happens when that lake is larger you get a lot of very fine sediments that build up at the bottom. As we talked about earlier, there is a hundred-foot plus layer of interbedded clays and sand and what happens is that restricts the ability of water to recharge. So, just like we mentioned, Lake Elsinore does not really recharge the aquifer system, nor would water kept at land surface recharge the area of the Back Basin.

Inge Wiersema: Actually the opposite will happen – there is a lot of water ponding on the Back Basin because it does not infiltrate very easy, because of all these fine sediments, you will lose more water because there is a larger surface area – you have more water evaporating. And that has been one of the reason, or that has been THE reason that the lake has been reduced in size. To reduce the loss, due to evaporation.

Q: Lee, Lake Elsinore: Would really make sense would be to talk to people that seem to be in the know. When a water level in a lake is so low, why do not you put a dike across the berm, pump the water out of it, go in there with scrapers and get down there 4, 6, 8, 10, 12 feet, whatever, and then pump the water back? And do that until they go all the way through the lake. That way they got a lot of sediment out of it, a lot garbage out of it. During a heavy rain, do you ever watch the water come down that drainage ditch there by the west end of the lake there? When they put out all the signs on Grand – "Running Water" – you see all the garbage floating down across Grand going into the lake. There is nothing catching that stuff – it all ends up in the lake. I have seen bicycles, I have seen grocery carts floating down that ditch many times.

Inge Wiersema: I think that is mostly a flood control problem.

Mark Abbott: That is an issue that is important, but it is

Q: Lee, Lake Elsinore: We are talking about water.

Mark Abbott: Yes, I know – this probably is not the right venue to have the particular conversation.

Q: Daryl Hickman, Tuscany Hills – I am a neophyte to this area and I have always heard that it had salt water – where is the salt water underground? Is that flowing through here too somewhere, is it natural?

Mark Abbott: You are probably talking about the mineral springs … Matt, can you show us where the mineral springs.

Matt points out the location of the hot springs, basin areas and faults.

Inge Wiersema: The last thing that I want to talk about is the evaluation criteria that we will use to evaluate the three alternatives.

1. Reliability of Supply – One of the major reasons why we do this study is to improve the District's reliability on water in periods when there is a drought and there is not much water available, so when we evaluate the alternatives, we look at how drought-proof the water supply is in each alternative.

2. Water Quality. Different alternatives will have different effects on the water quality in the basin. If you inject imported water with high salt content or if you spread the water by passing through to the aquifer, a different effect on each alternative that will impact the water quality or may not impact the water quality at all.

3. Utilization of the Basin's Storage Capacity. The basin can be operated under different water levels and we are in the process of determining what the range is, what the highest and the lowest water level that we can fluctuate the levels within and all the water that can store using the basin. So, in the wet years, you will inject as much water or recharge as much water as possible, levels will go up; and then in dryer years, you will pump the levels down. And this operating range will be evaluated, how much we use the basin in each alternative.

4. Cost Efficiency – first we will look at costs for all these activities and then determine how efficient is it – how much reliability will we get for the money; how much initial supply will we get by implementing a certain alternative or activity. In each activity – different implementation; certain activities require a lot of construction or permitting, so one alternative may be a lot easier to implement than the others. So we will evaluate the alternatives like that.

5. Flexibility – if you do surface recharge or spreading, you think of different water quality to spread the water. You can use treated water, runoff water coming down a hill, you can use raw imported water that is not treated. Where as you directly inject the water into those dual-purpose wells, you need to have water of drinking water quality – so that is the import water. So, it is less flexible for future situations.

6. Environmental Impacts have to do with construction impact. Water quality is evaluated separately. Certain activities will have more environmental constraints than others. So we will look at all that.

7. And then we will look at Stakeholder Acceptance and how it will impact the Stakeholders and what can be done to satisfy all the needs of the Stakeholders.

Those are the criteria that we will use to evaluate the alternatives. That is where we are and Mark will talk about one of the last things that we are going to do.

Mark Abbott: We started this meeting with a discussion of where we have been and I want to finish it up with where we are going to be over the next few months. We are here, the beginning of February, we are having our second Stakeholder meeting we wanted to present where we are at to you, get your feedback, which we are doing right now. Based on what we have heard, not only through you all, but through the Technical Advisory Committee that the District's put together, we are now going to go back and start evaluating and developing these different alternatives with information we saw on that matrix that Inge talked about. Then from there, once we have developed these alternatives and given some life to them, describe and build them up a little bit more, we will be evaluating them. The bottom line is that by the middle of May, we plan to put out a final draft of our Groundwater Management Plan, which will then go back up to the State - we have not really talked about their role in this, but they are kind of overseeing the effort, they are providing some funding for the District to actually go through this process. So, our goal right now is that by May 15, we would have a final draft of a Groundwater Management Plan available for review.

One thing I just realized we did not touch on in the beginning is the District's website. At this point, we had that presentation in October, the website is going through an upgrade. We hope to have that finished shortly. Once it is finished, all the information will be available on the website. If there is any – this presentation, as well as the last presentation, and there is work products – all the stuff we have talked about as far as the project status, really comes from the work products we have been preparing. We call them Technical Memoranda, which will – we have got four or five of them out now and as they come out, they will be finalized and put into the final report as different sections. So, those will also be available on the website. They will be contact information – myself, Phil. So, if you want to get additional information or if you are having trouble printing it off, we can printed it off for you and send it to you. For the time being, if you are interested in getting this information, please let me know, we can send you a CD that has the presentations that we gave at the last Stakeholder Meeting, as well as today's presentation.

Right now we are in the final efforts of putting together the groundwater model. We expect to have it complete by the middle of February and have that documented. We also can take out today from the discussions we have had, finalize the alternatives and get those documented. So, starting February 15th through roughly the middle of April, we will be doing all of our evaluations. And then between April 10th and May 15th, actually compiling the final draft of the report.

I think that concludes the formal part of our presentation. So, now we can go back into your question and answers. If you have any questions about what you have seen so far, or any other

questions – I would like to keep it focused on groundwater management. And I would add, again, identify yourself and where you are from.

Dale Schaefer: I wanted to just emphasize that if you want contact with any of us, we need contact information from you. So be sure that you sign up, that you give us some kind of way that we can get in touch with you. If you do not have an email, then give phone, fax, some other way. Because I know you all do not have email, but you might have a way that you would like to be contacted, whether it be through mail, through fax. Make sure that when you leave, that you give as much information as you can about who you are, and then if you want to speak to us we can call you or you can call us – either way.

Q: I have got a question about input from the community – you had one previous meeting like this and I am kind of curious if you will have one more.

Mark Abbott: From this point, we will be making presentations to the District Board.

Q: Do you go to the different governments and governmental agencies that affect this valley and have they received – have they been given an opportunity (I guess) to provide input into this or is this solely a water project .

Mark Abbott: Well, the easy answer is "yes". Actually, the District has put together, as I referred to earlier, a Technical Advisory Committee. On that committee, we have brought in some experts from local government as well as from State. For instance, Carl Hauge, who is the Chief Hydrogeologist who works with Eric at the Department of Water Resources. He sits on this committee, so he is looking over our shoulder, giving us suggestions, you know "gee, this is the way they did it wherever." We also have Behrooz Mortazavi from Eastern Municipal Water District who is serving on that Technical Advisory Committee. Roy Herndon from Orange County, the guy at the other end of the SAWPA Temescal wash to capture water we do not get. As well as some local experts and we have also invited some Stakeholders to this meeting as well. And also, we are also talking – you mentioned Riverside Flood Control District – we are talking to them; Western Municipal Water District who is the member agency that Elsinore is a submember agency to Metropolitan. We have gone to Metropolitan Water District, we given similar presentations to them. So I guess the short answer is "yes".

Phil Miller: Let me add to that … we have representatives from the City of Lake Elsinore here tonight, Bob Buster's office is here tonight, the Elsinore Water District is here tonight …

Q: Can you go back and look at the map of the basin, please? Elsinore is up there, but not in the basin. What area is in the basin? Has Lakeland Village Association been notified?

Yes, the Supervisor's Office.

Q: Wait a minute, why the Supervisor's office? We are right there, we have 8 people here. Why aren't you guys communicating with Lakeland Village Association?

Dale Schaefer: Lakeland Village will be contacted.

Q: Pete Dawson, Lakeland Village – you mentioned a couple times that the Riverside County Flood Control - as having been affiliated with them for nine years now, I can tell you, you and they regularly misrepresent themselves as Riverside County Flood Control, when they are, in fact, Riverside County Flood Control and Conservation District. And time after time, I have tried to emphasize that with that organization and now, it seems, perhaps with you. That is the half of the organization that is so un-represented and that is probably the most important part of that organization – it really should be. The conservation of water is going to be much more important in the future than how the heck to send it to the Pacific Ocean. I think perhaps, they should be here hearing your reference information. They should be considering how can they rather than build a debris basin, build a facility to store stormwater so that they can recharge the aquifer.

Mark Abbott: That is our goal in talking to them, is to get them to modify some of their facilities. So rather than getting the water to run through, to slow it down and give it a chance to percolate.

Q: Pete Dawson, Lakeland Village – I heard you suggest that – it seems to me that that is a big emphasis that perhaps you need to go further with, perhaps kind of pushing them – they need more than a gentle prod in that area.

Mark Abbott: I agree. We have noted your comment. There is a tremendous opportunity to capture water in some of these canyons and existing basins. But realizing that we are limited by the flood control requirements on one side and the habitat on the other side. There is only so much we can do and we want to try to find the maximum we can do and still protect the people downstream from getting flooded out and the environment upstream from killing off the habitat.

Q: Linda Wright, Lakeland Village – I am concerned that, and I may be totally wrong, but do not we have an excess of reclaimed water that we have available?

Phil Miller: There is a tremendous shortage.

Q (continuation of preceding question): of reclaimed water? I thought that they had enlarged the plant, and they still have a shortage?

Phil Miller: Well, yes. We have enlarged the plant, and we are going to have a whole lot of new customers some day with that, but there will be a shortage of reclaimed water for a long time.

Linda Wright: That will explain why we do not use more reclaimed water in some areas if we do not have enough, right?

Mark Abbott: Realizing that the suggestion was made, that is it financial feasible to sewer more areas, to create more reclaimed water to offset more non-potable demands? So, in a sense, we are looking at it – it is in there.

Q: Have you thought about where in the Canyons is land available for spreading basins?

Mark Abbott: Actually, one of the ongoing efforts right now, it is really kind of a piece of the – we have not really talked about it – is three service spreading options as Inge mentioned. (Mark points the location out on the maps.) Leach Canyon is here, McVicker Canyon is here, Railroad Canyon runs through here. There is already, in this area here, this is where the flood control facilities are right now for Riverside County. There is two areas – a long strip of land and then the debris dam and then another area up above that. So, there is an area, in fact before we even started on the project 10 years ago, people were looking at these two particular places as being potential sites. The other thing we know – this is Railroad Canyon, we know water comes through here and it passes across this part of the Back Basin. Remember there is a fault that runs through here, called the Glen Ivy Fault, there is another fault, the Sedco fault, we have got some offset in the sediments. There is been references to an area called the Sedco Cone, where water seems to flow in and just disappear into the groundwater system. So, we have done some of the preliminary environmental habitat investigation and we have seen that, based on what is up here, there is really no opportunity to construct a facility for surface spreading. But, we have to remember that water balance – there is a lot of water that comes down the San Jacinto that just recharges – this is really the only area that gets water into the south end of the lake and the groundwater basin. So, I guess the short answer is "yes" – there is three main areas, two fairly small areas where we think we can probably have natural recharge, where we can capture between 500 to 2,000 acre-feet/year based on average growth conditions. And that can go up very high, if you start also bringing imported water to put in there when it is available. We can also, by discharging imported water at this turnout in the San Jacinto River, the more water that flows through the river, spill over the dam and recharge this part of the aquifer, because it's the Sedco cone and it recharges. That is the theory. Now, we are doing the work now to try to see if we do recharge this, where does that benefit. Is the fault restricting flow down in this area. We do not think so, we think the is the recharge area where the water comes from.

Q: Darryl Hickman, Lake Elsinore – Would you have to put a dam or something to capture the water?

Mark Abbott: Are you talking about this stretch in here? The recharge rates are very high – Matt's done some work looking at it. And 2,000 acre-feet was their average recharge that occurs in the Back Basin. What we are talking the sediments right along this river channel here, soak up the water because the offsets of the fault. In this particular area the clay isn't quite as thick So, there is an opportunity, we think at this point that if we can keep water flowing into this area here, that will actually benefit the groundwater basin.

Matt Hacker: That is actually – in the stream channel itself, there is a certain capacity for when it rains for it to infiltrate in the San Jacinto River Channel itself. And that channel is about 51 acres, so can get whatever water will infiltrate over a time period, in a 51-acre area, that pretty much is just the river channel itself. So that is what we have calculated as you can get about 2,000 acre-feet plus or minus, just in the channel itself per year.

Inge Wiersema: And we are not planning to construct anything, because there are some environmental constraints.

Matt Hacker: So that what currently occurs now. If you added more water you can get more infiltration in the river channel itself, without doing any modifications to the existing structure.

Q: There is an infiltration of groundwater from the inland channel – how much of the 15,000 acre-feet of water did we lose out of the lake due to evaporation?

Mark Abbott: I guess the simple answer for that is to take a look at our budget. The numbers we have put together now in this particular effort we kind of treat the lake as a black box, because once it goes into the lake, it no longer benefits the groundwater system. So we have not done a lot of accounting for the water in the lake – evaporative losses. So, over the past 10 years of the existing flows that have gone into the lake, have resulted in an average of 2,200 acre-feet per year of recharge into the Elsinore Basin.

Q: I do not recall it ever being mentioned that we were losing water from the lake and that area through the Sedco cone I was under the impression that that was a old channel that was on the other side of the dike?

Mark Abbott: There is a lot of history in the Sedco Cone. Everybody has seen that … we actually tried to map it and everybody we talked to has different locations. The only thing we had to really go by was when they dug … I believe that the best story we have – and I say "story" because this is just someone's experience and what they remember seeing – when they dug this channel, they uncovered a layer of clay. That layer of clay was continuous through a certain spot and then disappear. And as water came down through this channel, it ran over the clay, as soon as it hit the sand it would disappear. So, what we think is – we do not know exactly where the clay was, but we suspect that where it went from clay to sand is where the fault is. So that was where you had the offset of the sediments. So that created that recharge feature that allows water to recharge the aquifer.

Mark Abbott: And the area to look at is really up in here – so it is

Matt Hacker: You can actually see it when you are looking and you come across on where the freeway comes in, you can see a whole bunch of bushes in the river. And all of a sudden, right at just south of where the freeway ramp comes over, the bushes stop. And that is probably where the clay comes in, allowing water to sit on top of the clay. When the clay drops down, the water can no longer sit on the clay, because it is dropped down quite a bit. So that is where the vegetation stops.

(continued at the map) So, this is all bushy, grassy stuff right here. And then come right here, right as you pass underneath the freeway, and this time of year, it will be grassy on the top and lots of big bushes and nothing on the other side. So that tells you that is probably right about where the fault is and that is probably where we can get a lot of infiltration in through that area

right south of that fault. So there about 51 acres from here to here and if you get down in there and look and see what the fault type is, it takes water pretty well.

Q: Linda Wright – If you purchase water and you put it into Canyon Lake and it comes down, will there be some kind of quality check on that water?

Mark Abbott: I am not aware of …

Q: (continued from preceding question) That would be part of your monitoring would not it?

Mark Abbott: Yes, oh yes, yes.

Q: (continued from preceding question) Would you monitor every time you introduced water?

Mark Abbott: Our basin monitoring … earlier we talked about the existing expanded network – that is the groundwater system. If we are looking at a new surface source or new source of water, depending upon what it is, we would be looking at the surface flows – whether it be water quality or water quantity. To be honest with you, I do not think we have really addressed significantly the water quality issues – that is a comment we will take back and incorporated into our alternatives.

Q: Daryl Hickman, Lake Elsinore – My concern is that if we were trying to fill the lake, should we put some kind of barrier back there to prevent the water so it can wait a little before it gets washed out?.

Mark Abbott: Well, Matt what was … I mean, the percentage of water that actually goes into there is very small …

Matt Hacker: It is like, the total amount of flow that is coming down the San Jacinto River, over the past 10 years, is about 17,000 acre-feet – that includes all the big storms and everything. We are having about 2,000 is going into the groundwater basin. So that is roughly 10 percent goes into the groundwater basin and 90 percent of it goes into the lake. That is where the calculations come in, in allowing that you do not exceed the infiltration capacity of the river channel itself. So that the water that you are putting in there, you get most of it into the groundwater basin. And I am not sure if I want to go too much further than that.

Dave Ringel: You bring up an interesting point. I think it really gets back to that really complicated flow chart that everything is so interrelated here, that if you divert water or percolate water from the San Jacinto River, it does not get into the lake and it reduces the amount of natural inflows. That would create a demand for some other source. Those sources right now are principally recycled water or pumping additional groundwater. So it is a question of did the water percolate into the ground in that channel and then get pumped out and get put back in the lake, or do we manage it a little differently so we can maximize that use and maybe get two benefits out of that water. That is really what we are trying to do – is see how we can operate the groundwater basin without causing lake management issues at the same time.

Phil Miller: I will close by saying thanks for coming tonight. We appreciate your input; it will all be incorporated into Groundwater Management Plan. And once again, sorry about the website, but it will get there. Thanks a lot.

Mark Abbott: We will be available here for a few minutes, if you have questions or would like to give us some information to send you something else.

THE PRESS-ENTERPRISE

Corona-Norco Independent, Elsinore Sun-Tribune, Rancho News, Sun City News, Menifee Valley News

3512 Fourteenth Street
Riverside CA 92501-3878
909-684-1200
909-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P.)

PROOF OF PUBLICATION OF

LE-Open

Ad Desc.: Groundwater Basin

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper of general circulation, printed and published daily in the city of Riverside, County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673 and under date of August 25, 1995, Case Number 267864; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

05-25-04
06-01-04

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

Date: Jun. 1, 2004
At: Riverside, California

ELSINORE VALLEY MWD

PO BOX 3000
MARGIE ARMSTRONG
LAKE ELSINORE CA 92531

Ad #: 5879537

PO #:

Agency #: _____

Ad Copy:

NOTICE OF PUBLIC HEARING ELSINORE VALLEY MUNICIPAL WATER DISTRICT PREPARATION OF A GROUNDWATER MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER BASIN

The Elsinore Valley Municipal Water District (EVMWD) intends to conduct a public hearing at its Board of Directors meeting on June 10, 2004 to obtain input from interested parties on whether to prepare a groundwater management plan for the Elsinore Groundwater Basin. The Elsinore Groundwater Basin generally consists of the valley fill surrounding Lake Elsinore and is bounded on north and west by the Santa Ana Mountains, on the east by Glen Ivy and Freeway faults, and on the south by a groundwater divide with the Murrieta Basin.

The Elsinore Groundwater Basin is an important component of the water supply of the EVMWD, the Elsinore Water District, and numerous private pumpers. EVMWD plans to prepare and adopt a groundwater management plan in accordance with Section 10750 et seq. of the California Water Code. EVMWD invites public comment on whether to prepare groundwater management plan. For additional information, please contact:

5/25,6/1

RECEIVED
APR 11 2005
ADMIN. DEPT.
EVMWD

THE PRESS-ENTERPRISE

Corona-Norco Independent, Elsinore Sun-Tribune, Rancho News, Sun City News, Menifee Valley News

3512 Fourteenth Street
Riverside CA 92501-3878
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P.)

PROOF OF PUBLICATION OF

LE-Open

Ad Desc.: 04-05-01

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper of general circulation, printed and published daily in the city of Riverside, County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673 and under date of August 25, 1995, Case Number 267864; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

02-19-05
02-26-05

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

Date: Feb. 26, 2005
At: Riverside, California

ELSINORE VALLEY MWD

PO BOX 3000
MARGIE ARMSTRONG
LAKE ELSINORE CA 92531

Ad #: 6574381

PO #:

Agency #: _____

Ad Copy:

RESOLUTION NO. 04-06-01
ELSINORE VALLEY MUNICIPAL WATER DISTRICT
INTENT TO PREPARE A GROUNDWATER MANAGEMENT PLAN

WHEREAS, water demands in the Elsinore Valley Municipal Water District are projected to more than double in the next twenty years; and

WHEREAS, groundwater from the Elsinore Groundwater Basin is an important water supply component of the Elsinore Valley Municipal Water District's, the Elsinore Water District and private pumpers; and

WHEREAS, the Elsinore Groundwater Basin has experienced recent water level declines that threaten the long-term sustainability of this supply; and

WHEREAS, California Water Code Section 10750, et seq., (AB 3030, as amended) provides that any local agency whose service area includes a groundwater basin, or a portion of a groundwater basin, that is not subject to groundwater management pursuant to other provisions of law or a court judgment or decree, may, by ordinance or by resolution, adopt and implement a groundwater management plan for all or a portion of its service area; and

WHEREAS, the Elsinore Groundwater Basin is not currently subject to groundwater management by a local agency or a watermaster pursuant to other provisions of law or a court order, judgment, or decree; and

WHEREAS, the Elsinore Valley Municipal Water District has committed to the development of a groundwater management plan for the Elsinore Groundwater Basin; and

WHEREAS, the Elsinore Valley Municipal Water District has published notice of a public hearing pursuant to Section 6066 of the California Government Code, has conducted a public hearing and no public objection has been expressed regarding the District preparing a groundwater management plan for the Elsinore Groundwater Basin.

NOW, THEREFORE, BE IT RESOLVED that the Elsinore Valley Municipal Water District intends to prepare a groundwater management plan for the purpose of establishing and implementing a groundwater management program for the Elsinore Groundwater Basin, in accordance with Water Code Section 10750, et seq., subject to final approval by the Board of Directors and the landowner protest provision of California Water Code Section 10753.6; and

BE IT FURTHER RESOLVED that the Elsinore Valley Municipal Water District invites interested parties to participate in developing the groundwater management plan.

APPROVED, ADOPTED AND SIGNED on the 10th day of June 2004.

Terese Quintanar
Board Secretary/Administrative Services Supervisor
Elsinore Valley Municipal Water District
(951) 674-3146, extension 8223

2/19,26

RECEIVED
MAR 07 2005
ADMIN. DEPT.
EVMWD

Elsinore Valley Municipal Water District

P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531-3000
(909) 674-3146
Fax: (909) 674-9872

Public Meeting Announcement

The Elsinore Valley Municipal Water District (EVMWD) would like to invite you to a public stakeholder meeting for the Elsinore Basin Groundwater Management Plan (GWMP). The meeting is being held to present the Draft Final GWMP that has been prepared to assist with the management of the groundwater basin. The meeting will include the following agenda items:

1. Summary of GWMP
2. Public Comment Procedures
3. Adoption Process

The meeting date, time and location is as follows:

Date:	Tuesday, August 10, 2004
Time:	6:00 PM to 8:00 PM
Location:	Elsinore Valley Municipal Water District Administration Office 31315 Chaney Street Lake Elsinore, California 92531

Please contact Mr. Joe Mouawad, Senior Engineer at (909) 674-3146, extension 8347 if you have any questions regarding this meeting.

Copies of the GWMP are available for review during normal business hours at the District Offices, 31315 Chaney Street, and the public library both in the city of Lake Elsinore. Electronic copies are also available, for you to keep, during normal business hours at the District Offices.

EVMWD Public Meeting

Presentation To:

Public Meeting

August 10, 2004

Elsinore Basin Groundwater Management Plan

Discussion Items

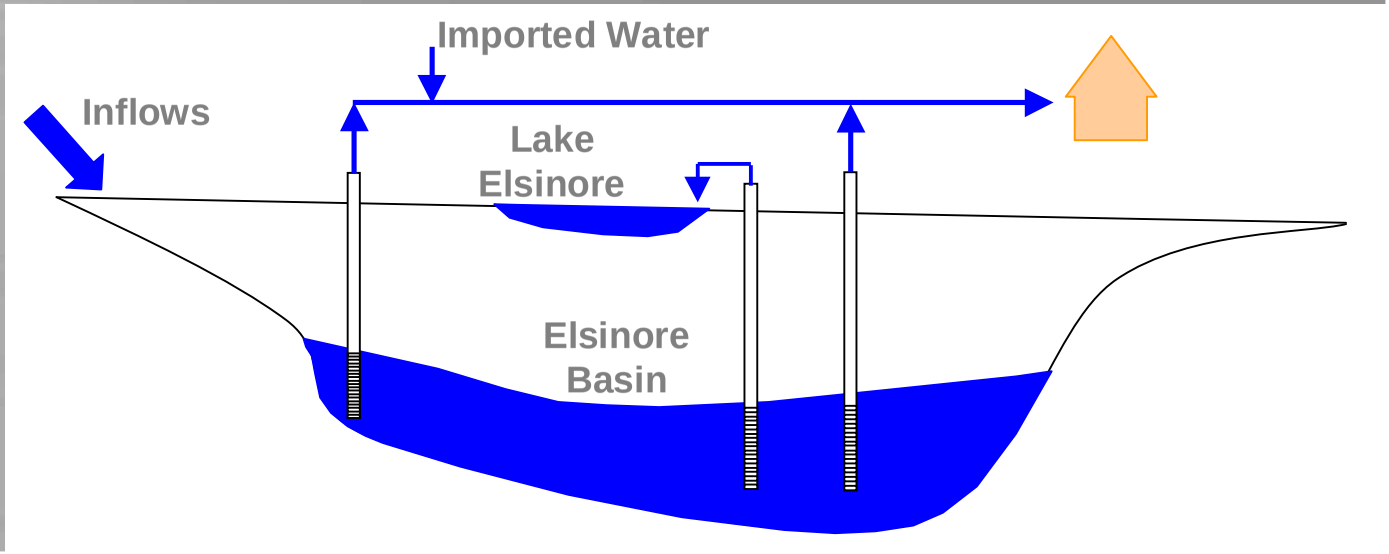
- Definitions
- Management Plan Development
- Implementation and Adoption

EVMWD Public Meeting

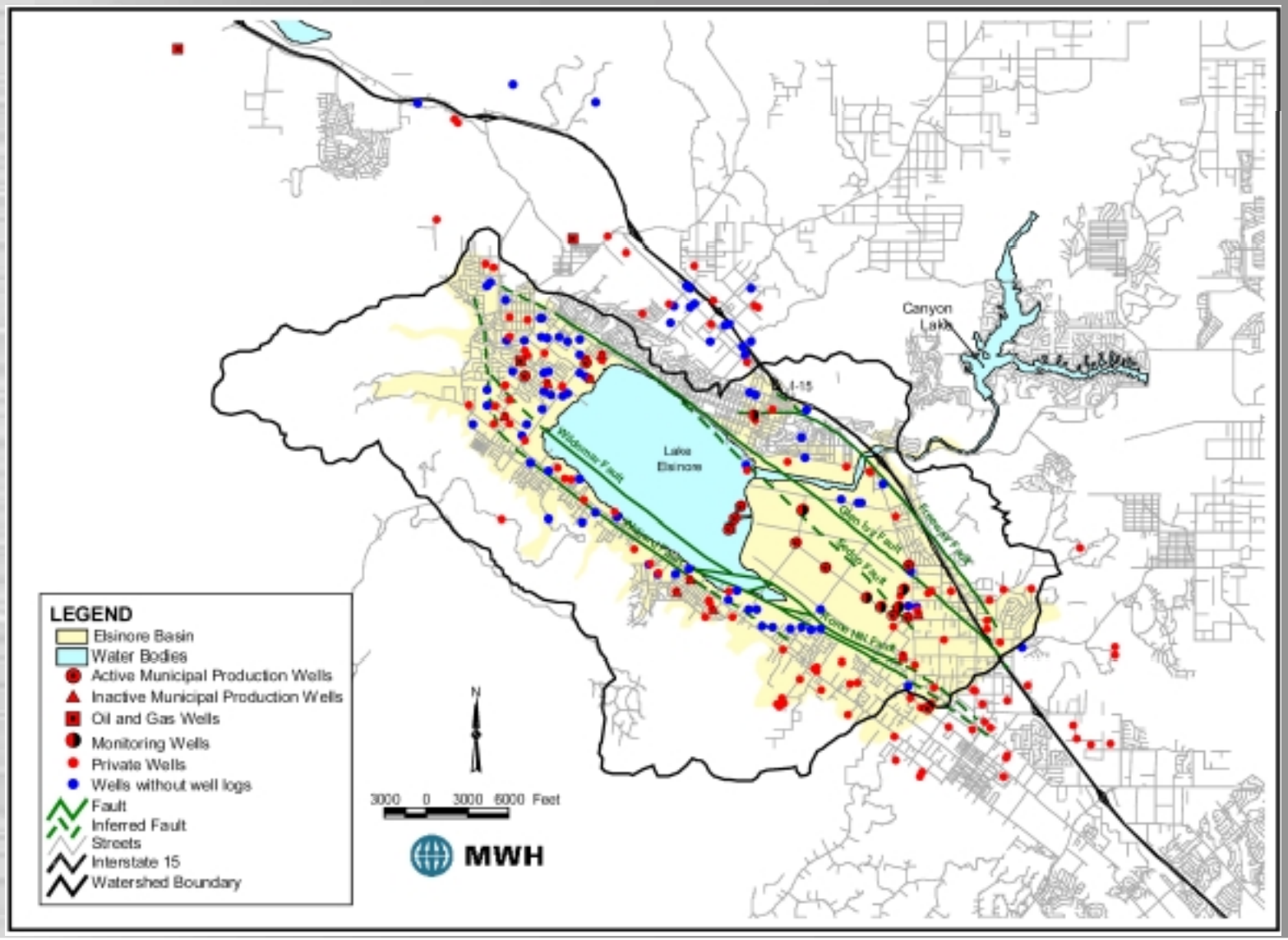
Definitions

Groundwater Basin

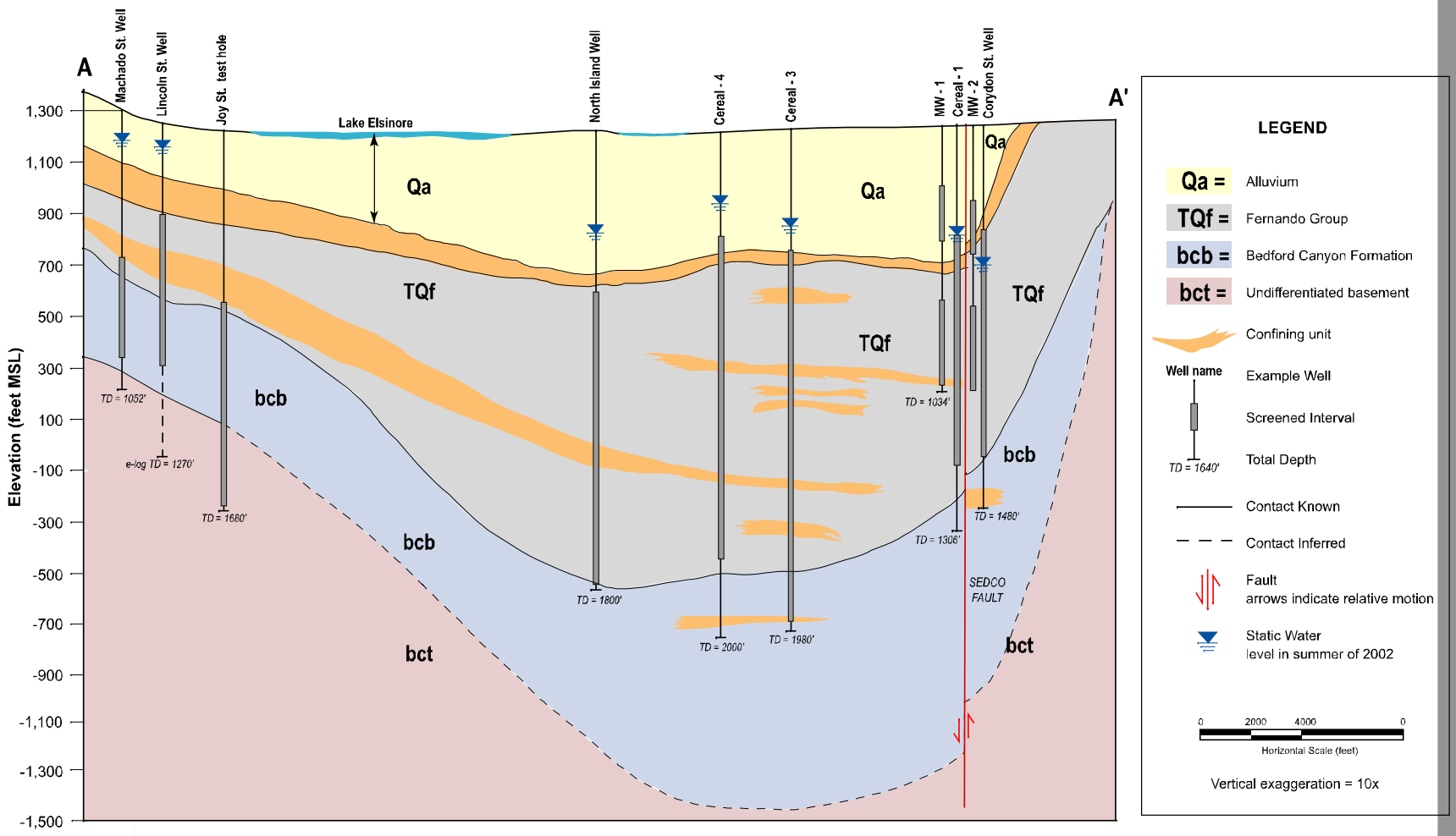
- An **aquifer** is a body of rock or sediment that is porous and can store, transmit, or yield significant quantities of groundwater to wells and springs.
- A **groundwater basin** is an alluvial aquifer or a stacked series of aquifers with well defined boundaries and a definable bottom.



Elsinore Basin



Cross Section of Elsinore Basin



EVMWD Public Meeting

Management Plan Development

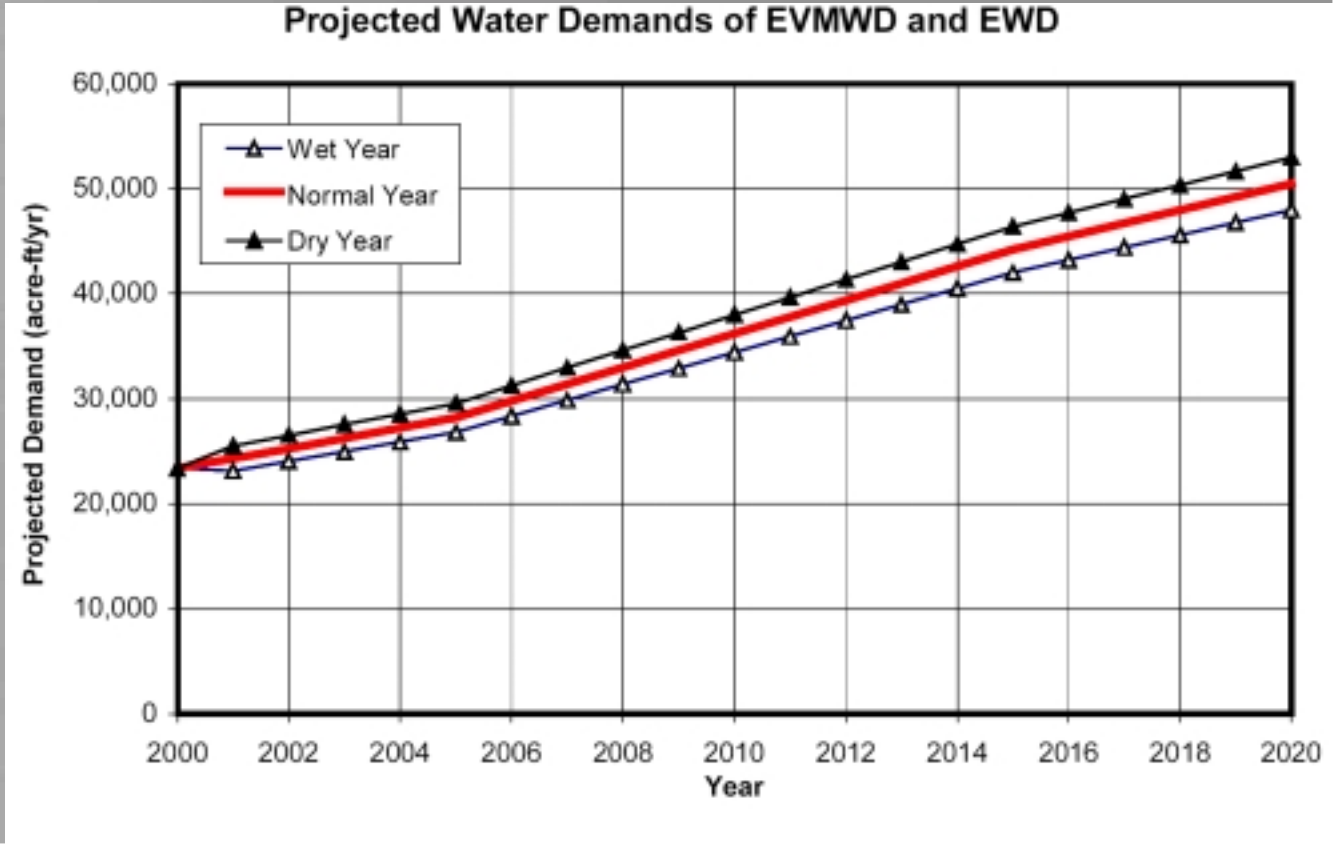
Groundwater Management Plan

- A **Groundwater Management Plan (GWMP)** is a plan intended to provide a better understanding of a groundwater basin and to provide recommended management strategies.

- **Assembly Bill 3030 (AB3030) and Senate Bill 1938 (SB1938)** provide legal authority to prepare groundwater management plans. The intent of AB3030 is to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdiction.

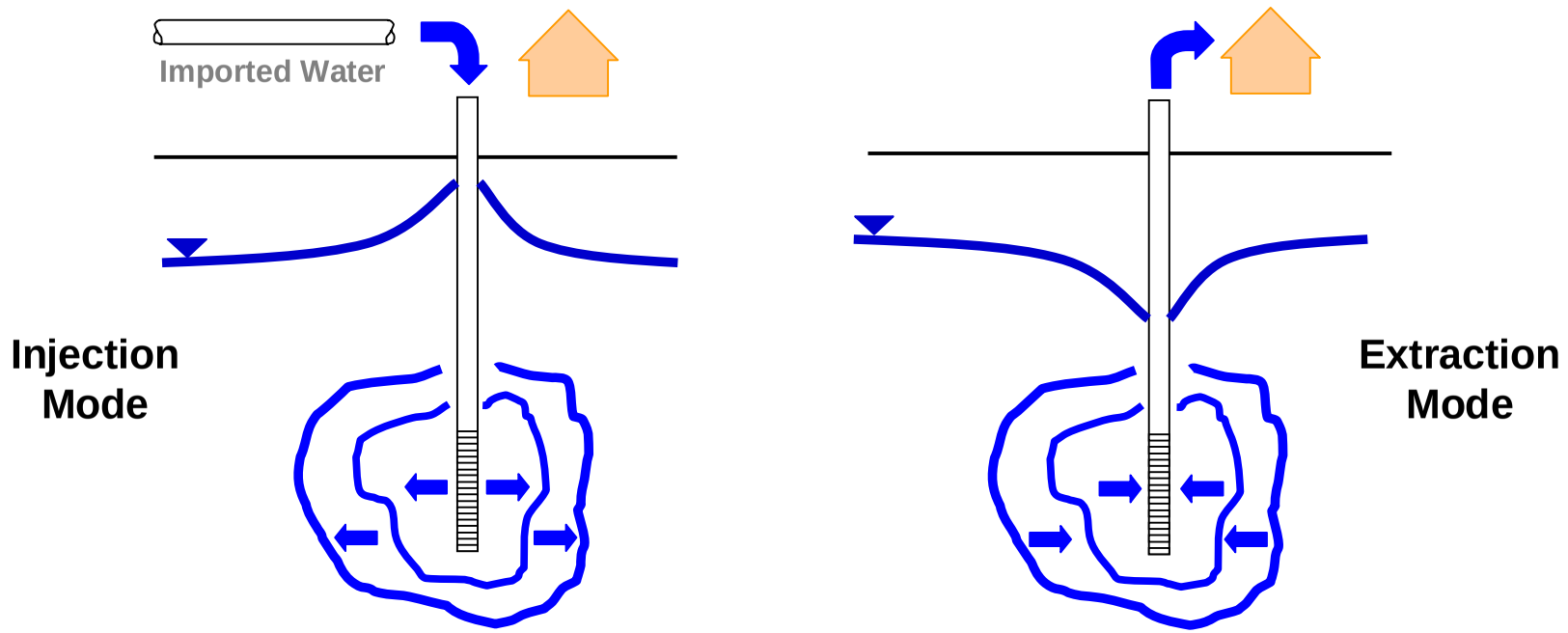
Why do we need a GWMP?

"Because water demand is projected to double in the next 20 years, cooperative groundwater management is required to achieve a sustainable water balance in the Elsinore Basin."



What is the Goal of the GWMP?

"The goal of this GWMP is to ensure a reliable, high quality, cost-efficient groundwater supply for the users of the Elsinore Basin in an environmentally responsible manner."



Elsinore Basin Specifics

- **Safe Yield -** *The safe yield (maximum quantity of water that can be continuously withdrawn from the basin without adverse affects) of the basin is estimated to be 5,000 acre-feet.*

- **Inflows -** *The estimated inflow into the Elsinore Basin is 6,100 acre-feet per year.*

- **Outflows -** *During the base period of 1990-2000 approximately 7,900 acre-feet of water was pumped from the Elsinore Basin.*

What is in a GWMP?

- Description of Basin
- Problems and Issues
- Potential Solutions
- Evaluation of Alternatives
- Implementation Plan

Management Issues

- Declining Water Levels/Overdraft
- Increasing Water Demands
- Lake Elsinore Replenishment Needs
- Well Head Protection
- Groundwater Contamination
- Well Construction/Destruction/Abandonment Policies
- Compliance with Drinking Water Reg's & Basin Plan
- Expansion of Basin Monitoring
- Subsidence

Management Strategies

- Storage of Imported Water using Dual Purpose Wells
- Storage of Imported Water using Surface Spreading
- Increase Use of Local Supplies with Surface Spreading
- Save Groundwater for Dry Years with In-Lieu Recharge
- Save Groundwater for Potable Use Only
- Develop New Sources of Supply
- Water Conservation
- Measure Progress with Basin Monitoring
- Protect Groundwater Quality with New Policies

What Alternatives were Considered?

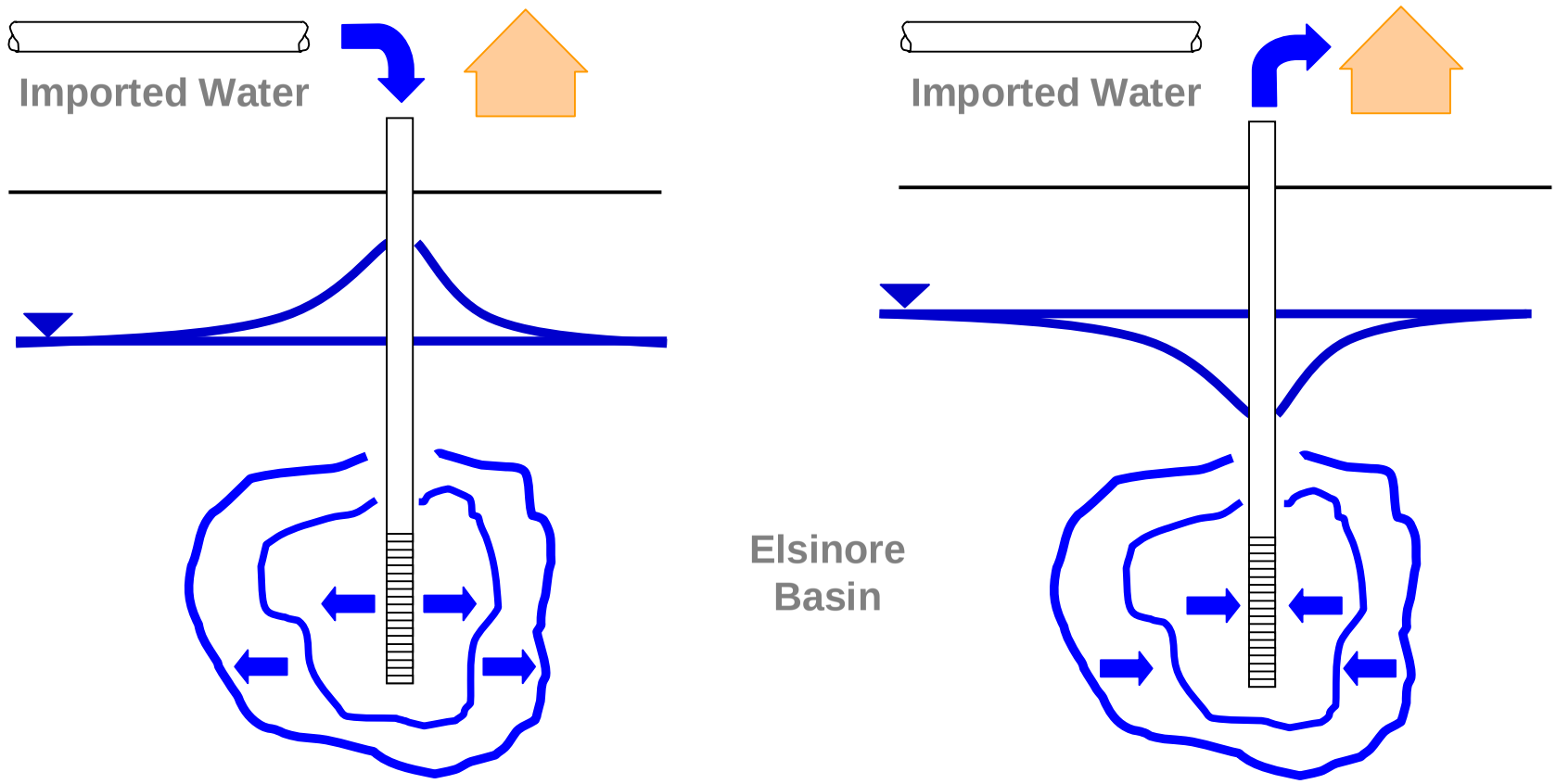
- Alternative 1 - Dual Purpose Wells
- Alternative 2 - Surface Spreading
- Alternative 3 - In-lieu Recharge
- Alternative 4 - Combination

All Four Alternatives Included the Following:

- At Least 4 New Peaking Wells
- Convert Septic Tanks to Sewer System
- Advisory Committee

Alternative 1 - Dual Purpose Wells

- 10 New and 4 Converted Dual-Purpose Wells
- Island Wells (3)



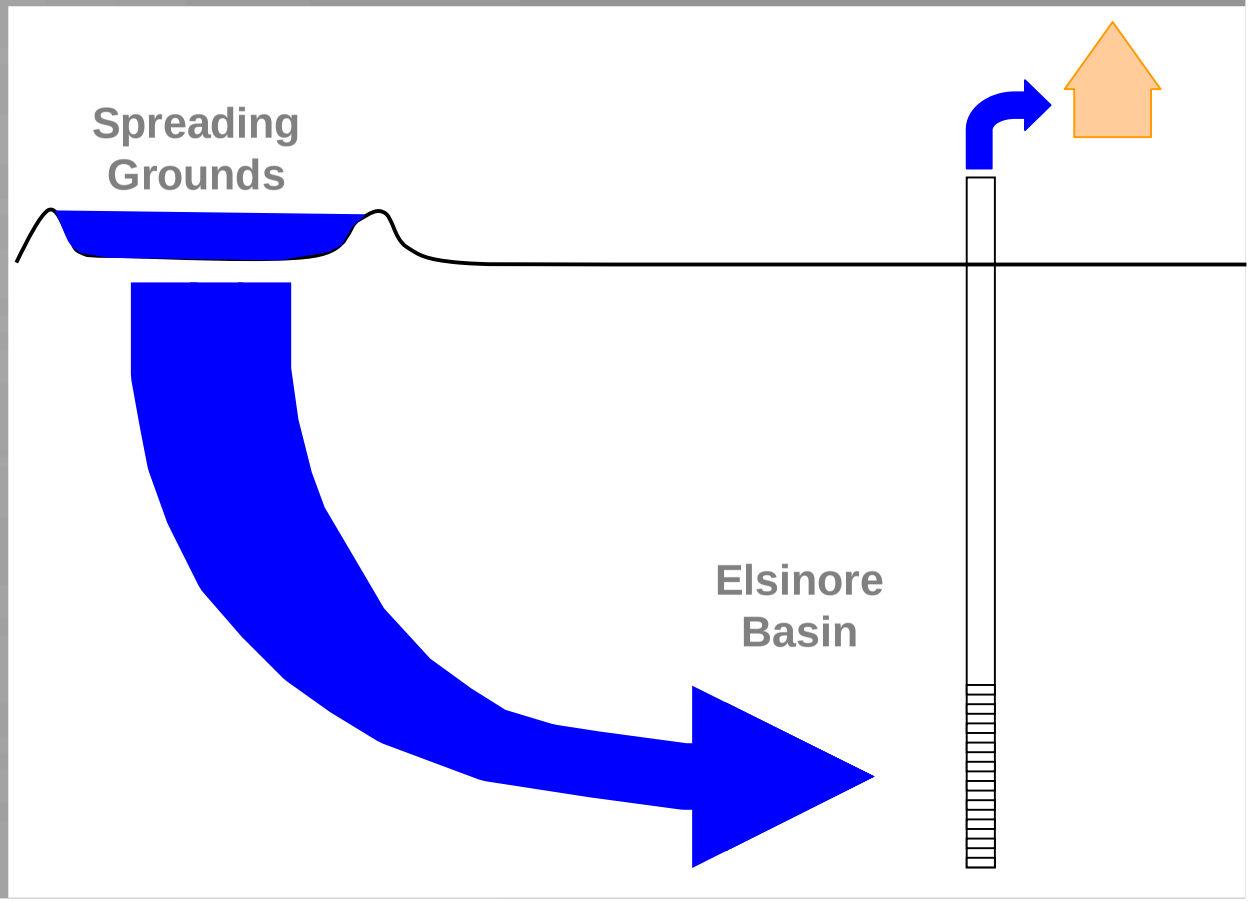
Alternative 2 - Surface Spreading

- Surface Spreading in: Leach Canyon (25 acres) and McVicker Canyon (15 acres)

- 5 New Extraction Wells

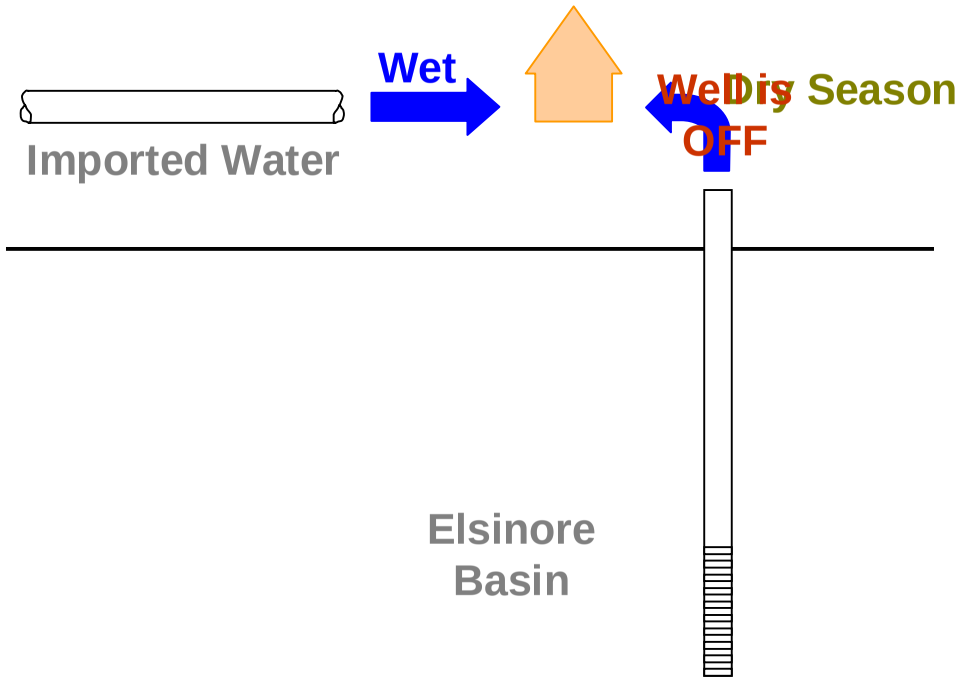
- 11 New Peaking Wells

- Island Wells (3)



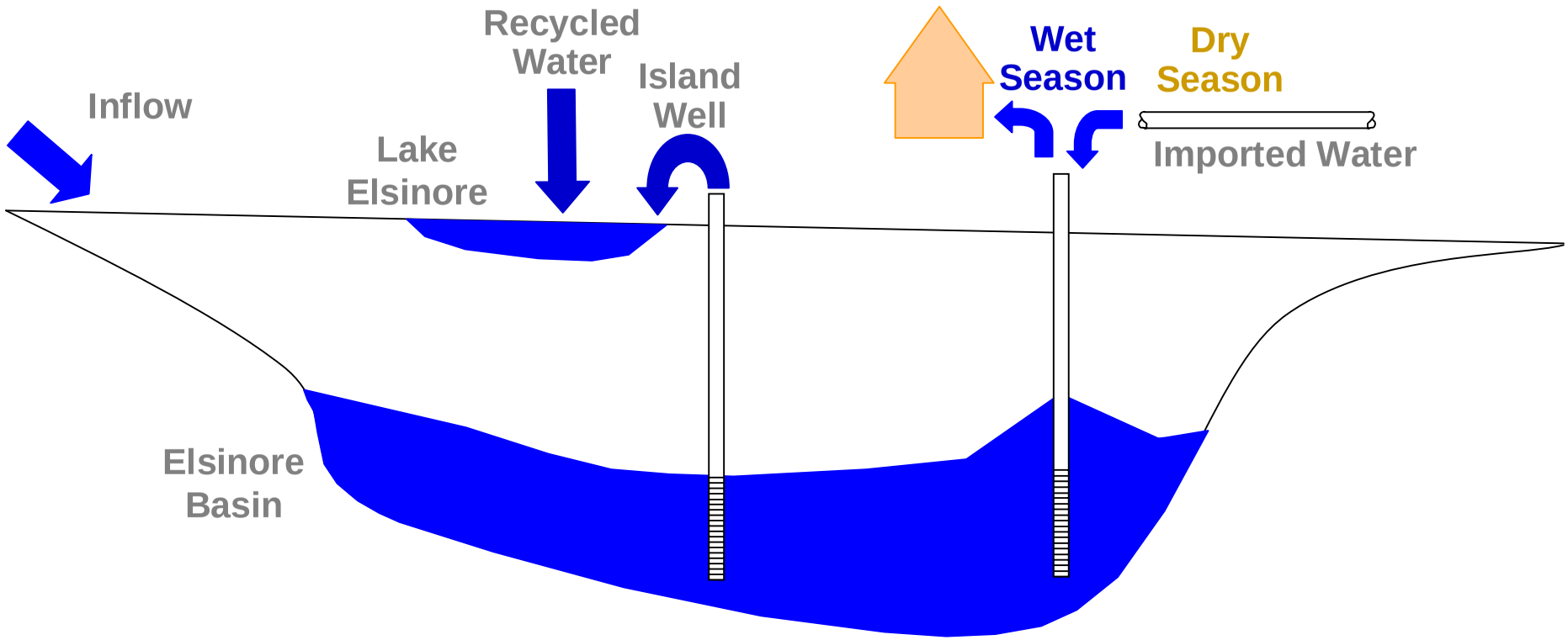
Alternative 3 - In-Lieu Recharge

- In-Lieu Recharge
- 10% Conservation
- 8 New Peaking Wells
- Island Wells (3)



Alternative 4 - Combination

- 7 New and 6 Converted Dual-Purpose Wells
- Lake Make-up with 17.7 mgd recycled water and 1 Island Well



Alternative Evaluation Criteria

- Ability to reduce overdraft
- Expected cost
- Environmental impacts

} Weighting Factor 3

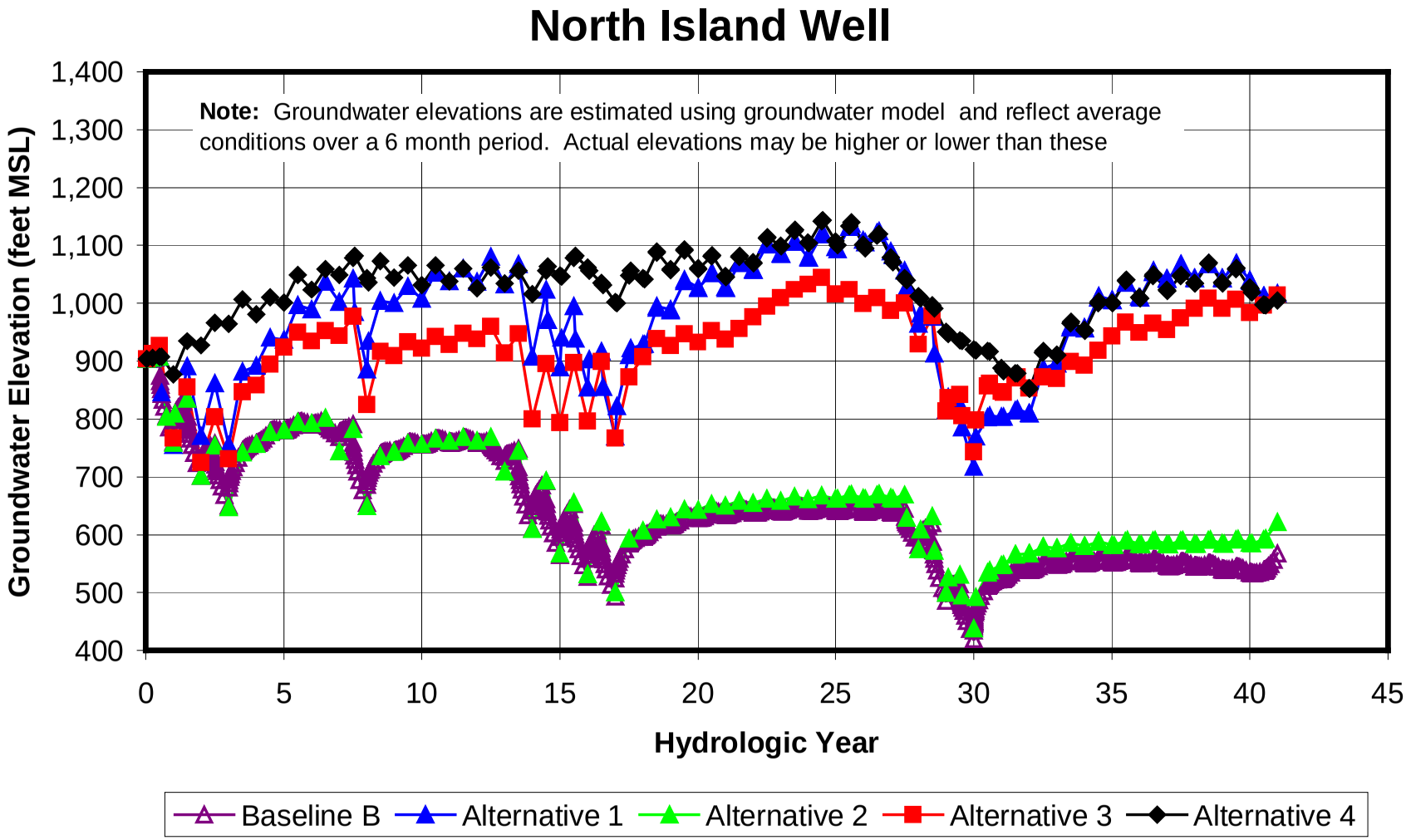
- Risk
- Legal & Regulatory issues
- Public acceptability
- Funding

} Weighting Factor 2

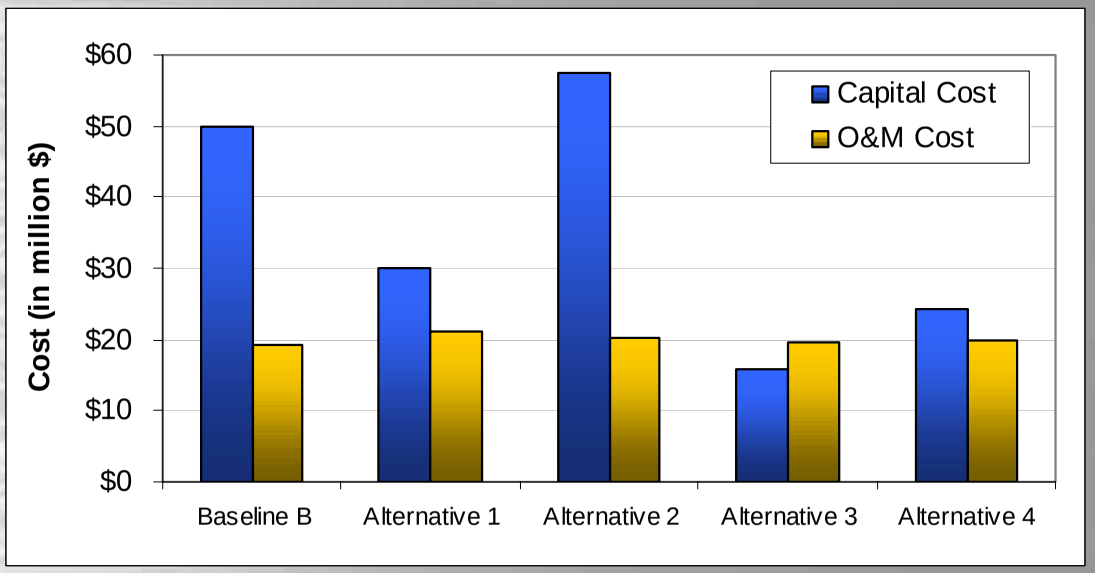
- Flexibility
- Reliability
- Implementation

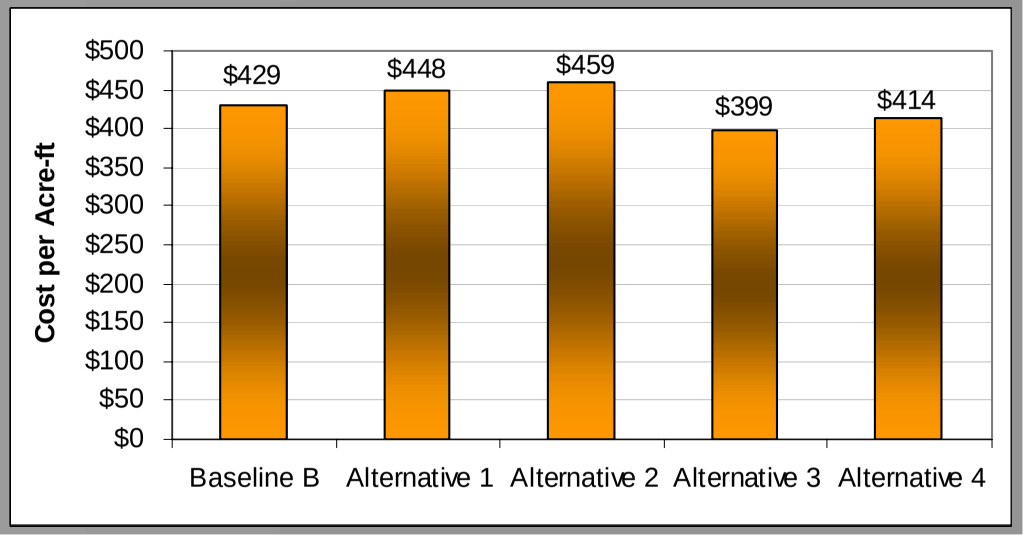
} Weighting Factor 1

Alternatives Evaluation
Ability to Reduce Overdraft



Alternatives Evaluation Expected Cost





Alternatives Evaluation Evaluation Summary

Evaluation Criteria	Weighting Factor	Rating				
		Baseline B	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ability to Reduce Overdraft	3	1	4	2	3	4
Expected Costs	3	3	3	3	4	3
Environmental Impacts	3	1	4	2	4	4
Risk	2	2	4	1	3	4
Legal and Regulatory Implementation	2	2	3	3	4	3
Public Acceptability	2	1	5	2	3	4
Funding	2	1	3	2	4	4
Flexibility	1	2	5	3	3	5
Reliability	1	3	3	3	2	4
Ease of Implementation	1	3	4	2	3	4
Total Rating	**MAX 50**	**19**	**38**	**23**	**33**	**39**
Weighted Rating	**MAX 100**	**35**	**75**	**45**	**69**	**76**

Note: Alternative 4 is the preferred alternative.

EVMWD Public Meeting

Implementation Plan and Adoption

What is in the Proposed GWMP?

- Groundwater Storage Facilities
- Basin Operating Plan
- Groundwater Monitoring Plan
- Formation of Basin Advisory Committee

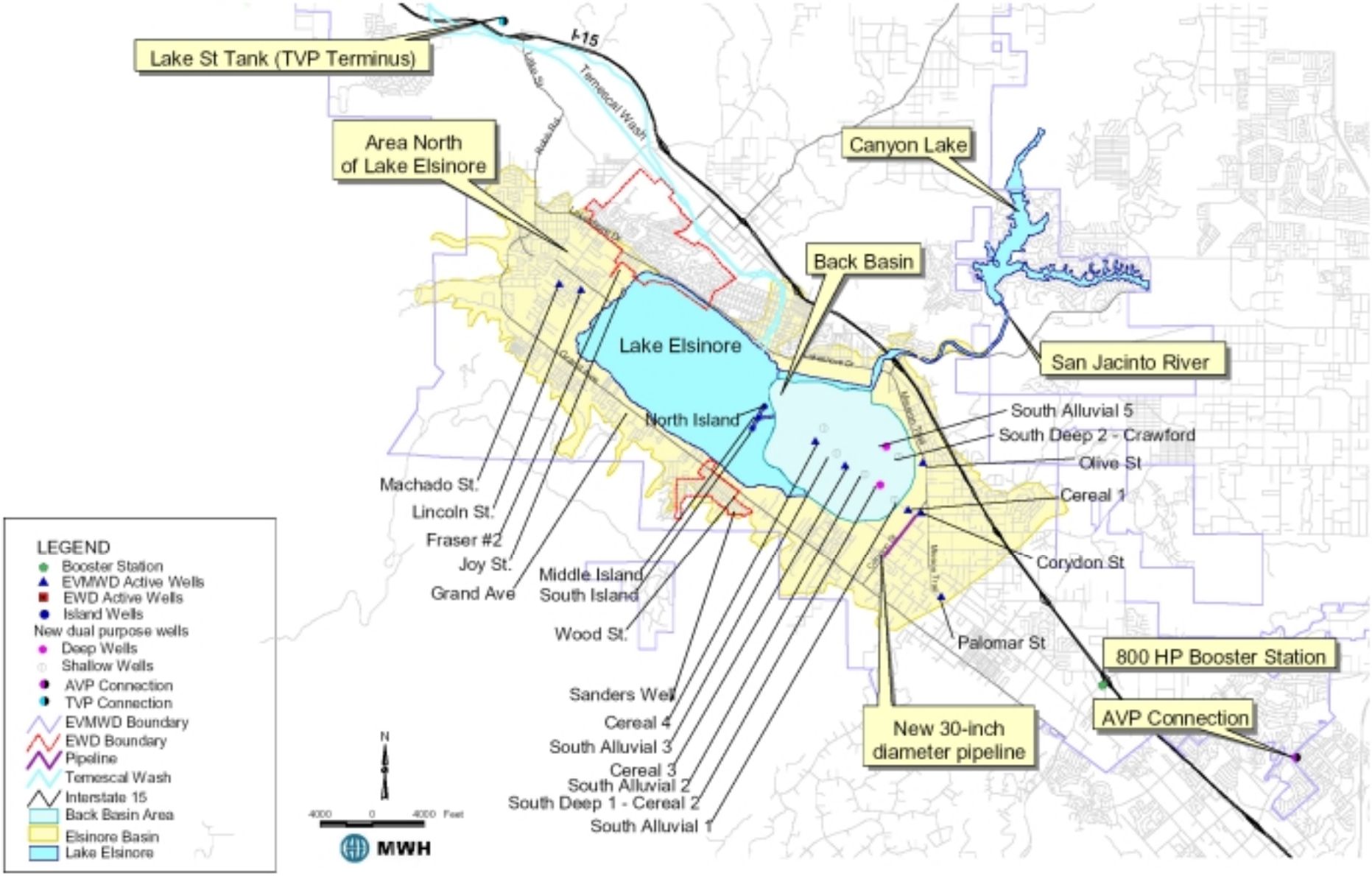
What Facilities Are Proposed?

Summary of Proposed Plan

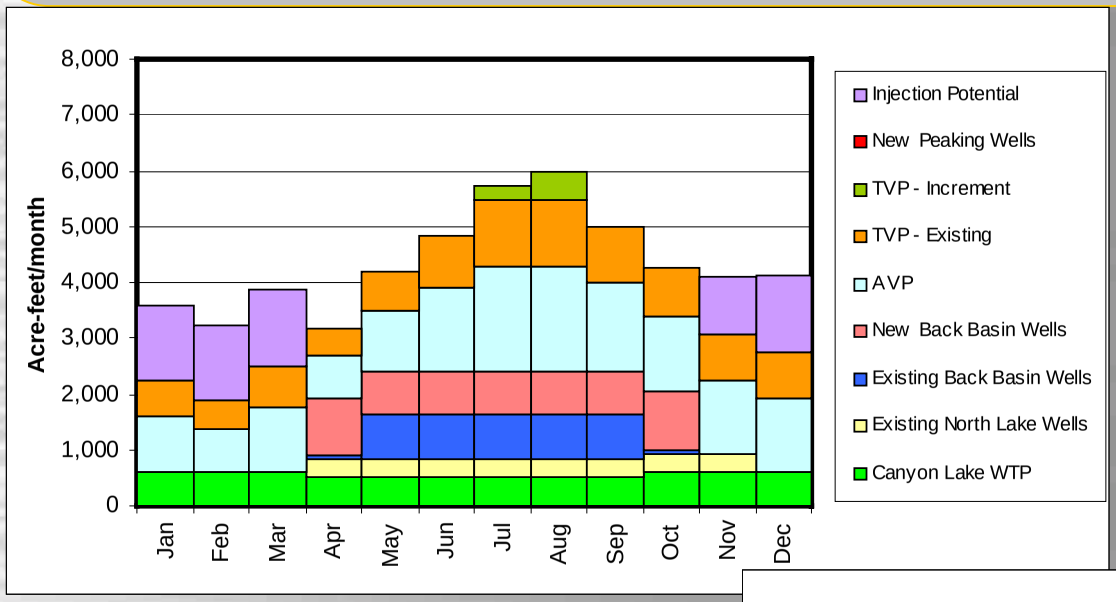
- 14 dual-purpose wells

  (7 new, 6 converted, and one existing)
- 4 new peaking wells
- 1-800 HP Pump Station
- 4,000 ft of 30-inch diameter pipeline
- Lake make-up with recycled water (17.7 mgd)

Summary of Proposed Plan

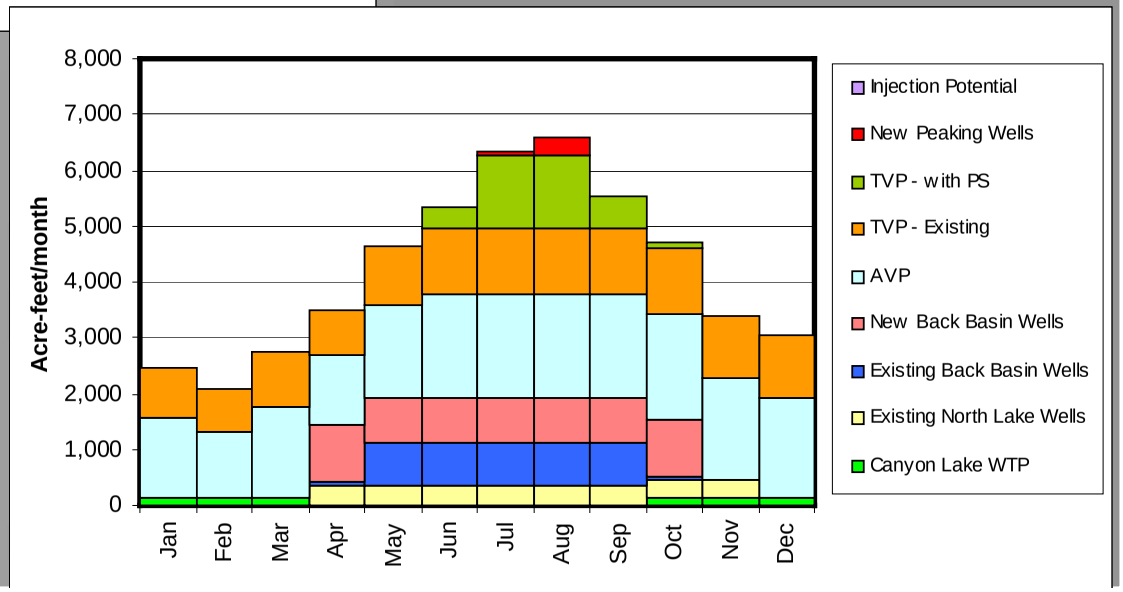


Operation of the Elsinore Basin



Wet Year

Dry Year



Monitoring Plan
Summary of Recommendations

- Well Canvas - locations and usage
- Construction of 5 new Monitoring Wells
- GW level and production - monthly
- GW quality - annually
- Spinner logging + WQ zone testing
- Aquifer testing
- Surface flows - monthly
- Subsidence

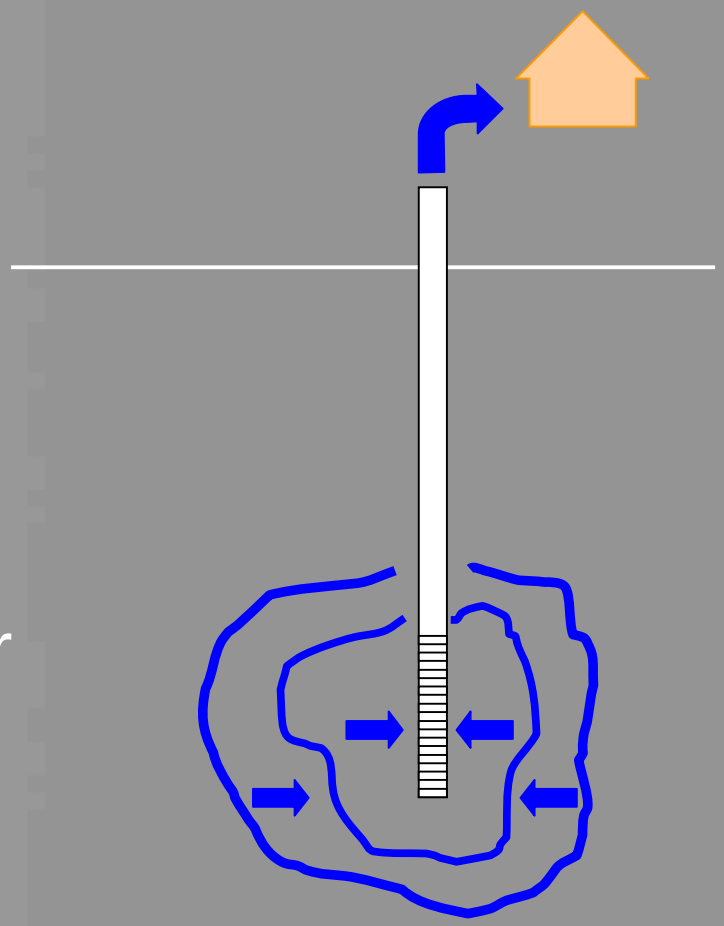
Implementation Plan Advisory Committee

Tasks

- Implementation of Monitoring Plan
- Development and Implementation of:
  - Well Construction, Destruction, & Abandonment Policies
  - Septic Tank Conversion Policies
  - Agency Coordination

How does the GWMP Affect my Well?

- No proposed changes to the operation of privately owned wells.
- Possible assistance with collection and tabulation of production data.
- No proposed taxes or fees for privately owned wells.
- More reliable source of water from the Elsinore Basin.

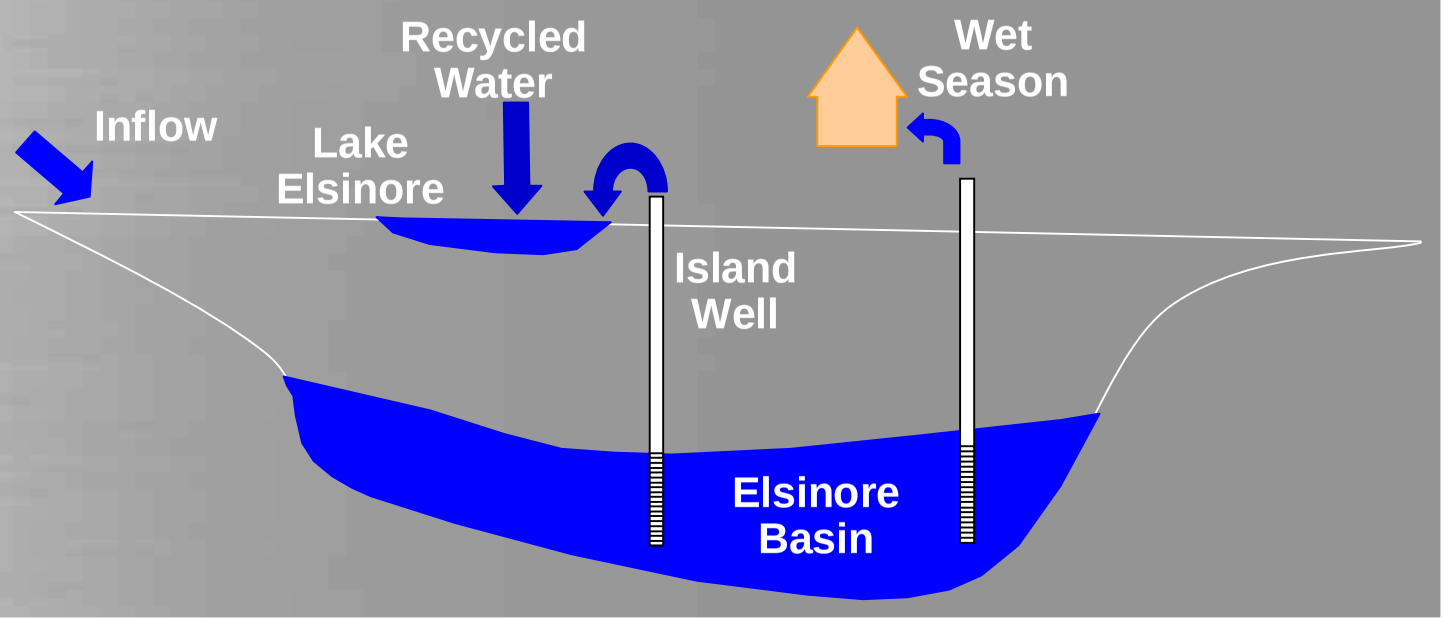


Adoption Procedures

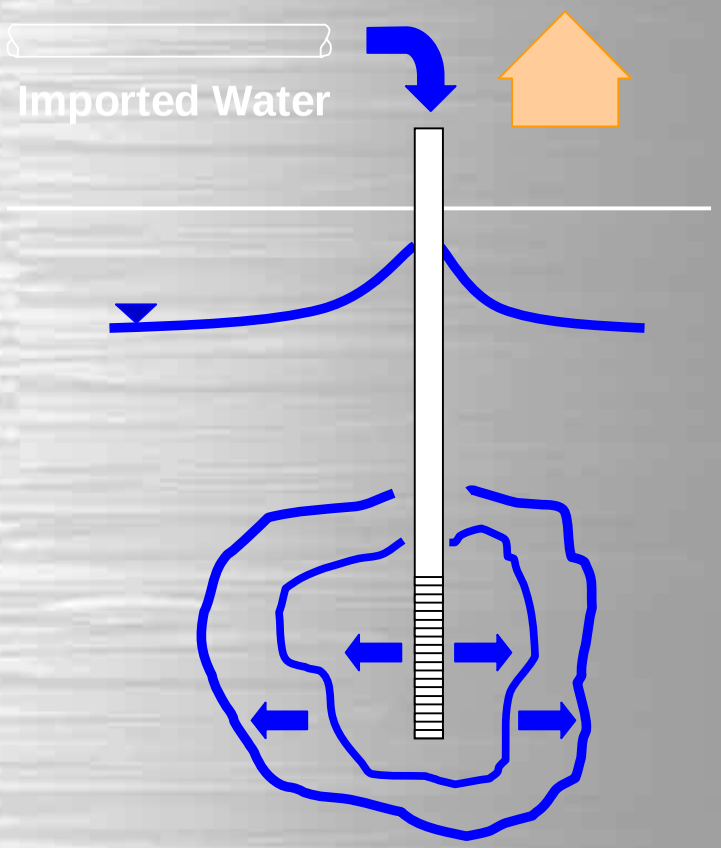
- Adopt the Resolution of Intention (ROI)
- Obtain Public Input on Plan (until August 25, 2004)
- Prepare Environmental Documents
- Finalize the Groundwater Management Plan
- Public Review of Environmental Documents
- Public Hearing to Certify Environmental Documents, Receive Protests and Adopt the Final Groundwater Management Plan

Environmental Documents

- Initial Environmental Study (IES)
- Mitigation Negative Declaration (MND)
- Mitigation Monitoring and Reporting Plan (MMRP)
- Notice of Determination (NOD)
- Findings



Adoption Schedule



- Draft Final GWMP Completed in June 2003
- ROI adopted by the Board on June 10, 2004
- Complete the Environmental Documents in November 2004
- Adopt the Environmental Documents and the GWMP in December 2004

EVMWD Public Meeting

Presentation To:

Public Meeting

August 10, 2004

Elsinore Basin Groundwater Management Plan

THE PRESS-ENTERPRISE

Corona-Norco Independent, Elsinore Sun-Tribune, Rancho News, Sun City News, Menifee Valley News

3512 Fourteenth Street
Riverside CA 92501-3878
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P.)

PROOF OF PUBLICATION OF

LE-Open

Ad Desc.: Groundwater Management Plan

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper of general circulation, printed and published daily in the city of Riverside, County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673 and under date of August 25, 1995, Case Number 267864; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

01-18-05

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

Date: Jan. 18, 2005
At: Riverside, California

ELSINORE VALLEY MWD

PO BOX 3000
MARGIE ARMSTRONG
LAKE ELSINORE CA 92531

Ad #: 6483214

PO #:

Agency #: _____

Ad Copy:

NOTICE OF AVAILABILITY/NOTICE OF INTENT TO ADOPT A MITIGATED NEGATIVE DECLARATION ELSINORE VALLEY MUNICIPAL WATER DISTRICT

GROUNDWATER MANAGEMENT PLAN FOR THE ELSINORE BASIN

Notice is hereby given that the Elsinore Valley Municipal Water District (EVMWD) has completed an Initial Study of the project described as the Elsinore Basin Groundwater Management Plan (GWMP), Lake Elsinore, western Riverside County, California. The Elsinore Basin underlies Lake Elsinore and the Back Basin and surrounding recharge areas.

The GWMP evaluated the groundwater basin to ensure a reliable groundwater supply for existing and future conditions through year 2020. The GWMP concluded with a plan for implementation of proposed plan elements:

1. Water Conservation
2. Policies for Well Construction, Destruction and Abandonment
3. Septic Tank Policies and Plan
4. Formation of an Advisory Committee
5. Groundwater Recharge with Dual Purpose Wells (Injection - Extraction)
6. Lake Elsinore Level Maintenance
7. Surface Spreading in Railroad Canyon
8. Groundwater Monitoring Program
9. Use of Recycled Water to Offset Potable Water Irrigation Demand

This Initial Study addresses the overall impacts on the Elsinore Basin of implementing the GWMP and those proposed project elements for early construction. The proposed project elements to be constructed that are evaluated in the Initial Study consist of 4,000 feet of 30-inch pipeline constructed in Corydon Street between Cereal Street and Palomar Street, and an in-line booster pumping station in Wildomar near Clinton Keith Road and Stable Lanes Road, south of the Interstate 15 Freeway.

The Initial Study was completed in accordance with the District's Guidelines implementing the California Environmental Quality Act. This Initial Study was undertaken for the purpose of deciding whether the project may have a significant effect on the environment. On the basis of such Initial Study, the District's Staff has concluded that the project will not have a significant effect on the environment with implementation of identified mitigation measures, and has therefore prepared a Draft Mitigated Negative Declaration. The Initial Study reflects the independent judgment of the District. The proposed project sites are not on lists compiled pursuant to Government Code section 65962.5. The project is not considered a project of statewide, regional or areawide significance. The proposed project will not affect highways or other facilities under the jurisdiction of the State Department of Transportation. A scoping meeting will not be held by the lead agency.

Copies of the Initial Study and draft Mitigated Negative Declaration are on file at the District's offices: 31315 Chaney Street, Lake Elsinore, CA 992351, and are available for public review during normal working hours.

The comment period is from January 18 to February 18, 2005. Any person wishing to comment on this matter must submit such comments in writing to Mr. Joe Mouawad at the District prior to the end date. Mr. Mouawad may also be contacted for further information at (951) 674-3146. Comments of all Responsible Agencies are also requested.

The EVMWD Board of Directors will consider the Project and the Mitigated Negative Declaration. If the Board of Directors finds that the project will not have a significant effect on the environment, it may adopt the Mitigated Negative Declaration and associated Mitigation Monitoring and Reporting Plan. This means that the Board of Directors may proceed to consider the project without the preparation of an Environmental Impact Report.

Date Received for Filing:
Staff
Title: Senior Engineer 1/18

RECEIVED
JAN 2 6 2005
FINANCE DEPT.

$219.70

THE PRESS-ENTERPRISE

Corona-Norco Independent, Elsinore Sun-Tribune, Rancho News, Sun City News, Menifee Valley News

3512 Fourteenth Street
Riverside CA 92501-3878
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P.)

PROOF OF PUBLICATION OF

LE-Open

Ad Desc.: Groundwater Mgmt Plan

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper of general circulation, printed and published daily in the city of Riverside, County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673 and under date of August 25, 1995, Case Number 267864; that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

02-25-05
03-04-05

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

Date: Mar. 4, 2005
At: Riverside, California

ELSINORE VALLEY MWD

PO BOX 3000
MARGIE ARMSTRONG
LAKE ELSINORE CA 92531

Ad #: 6584102

PO #:

Agency #: _____

Ad Copy:

NOTICE OF PUBLIC HEARING ELSINORE VALLEY MUNICIPAL WATER DISTRICT ADOPTION OF A GROUNDWATER MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER BASIN

The Elsinore Valley Municipal Water District (EVMWD) intends to conduct a public hearing at its Board of Directors meeting on March 10, 2005 to a groundwater management plan for the Elsinore Groundwater Basin. The Elsinore Groundwater Basin generally consists of the valley fill surrounding Lake Elsinore and is bounded on north and west by the Santa Ana Mountains, on the east by Glen Ivy and Freeway faults, and on the south by a groundwater divide with the Murrieta Basin.

The Elsinore Groundwater Basin is an important component of the water supply of the EVMWD, the Elsinore Water District, and numerous private pumpers. The groundwater management plan describes the goals, objectives and recommended management actions needed to effectively manage the basin and ensure the reliability of this critical water supply. EVMWD plans to adopt a groundwater management plan in accordance with Section 10750 et seq. of the California Water Code. EVMWD invites the public to attend and provide comment on whether to adopt a groundwater management plan. Any protests by landowners within the area covered by this plan must be provided to EVMWD in writing prior to the completion of this hearing and must include the landowner's signature and a description of the land owned sufficient to identify the land. For additional information, please contact:
Joe Mouawad,
Senior Engineer
Elsinore Valley Municipal Water District
31315 Chaney Street
Lake Elsinore,
California 92531-3000
(951) 674-3146 2/25,3/4

RECEIVED
MAR 14 2005
ADMIN. DEPT.
EVMWD

RESOLUTION NO. 05-03-06

ELSINORE VALLEY MUNICIPAL WATER DISTRICT
ADOPTION OF GROUNDWATER MANAGEMENT PLAN

WHEREAS, the Elsinore Valley Municipal Water District Board of Directors adopted a resolution of intent to prepare a groundwater management plan on June 10, 2004; and

WHEREAS, the District has prepared a draft groundwater management plan entitled "Elsinore Basin Groundwater Management Plan"; and

WHEREAS, the District has made copies of the plan available to the public and notice of the public hearing on whether to adopt the draft Groundwater Management Plan was given in the manner prescribed by law; and

WHEREAS, all persons desiring to be heard at the public hearing were given the opportunity to present their views to the Board of Directors and any written communications received by the District concerning adoption of the plan were publicly presented at the public hearing of March 10, 2005; and

WHEREAS, the District has considered all protests to the adoption of the plan and has determined that a majority protest under Section 10753.6 of the California Water Code does not exist.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of Elsinore Valley Municipal Water District finds that it is in the best interest of the District and the groundwater producers to adopt the Elsinore Basin Groundwater Management Plan pursuant to Part 2.75 (commencing with Section 10750) of Division 6 of the California Water Code and that the General Manager is authorized to take all actions reasonably necessary to carry out the intent of Elsinore Basin Groundwater Management Plan.

APPROVED, ADOPTED AND SIGNED this 24th day of March, 2005.

Kristine M. Anderson, President of the
Board of Directors of
Elsinore Valley Municipal Water District

ATTEST:

Terese Quintanar, Board Secretary of the
Board of Directors of
Elsinore Valley Municipal Water District

STATE OF CALIFORNIA)
) ss:
COUNTY OF RIVERSIDE)

I, Terese Quintanar, Secretary of the Board of Directors of the Elsinore Valley Municipal Water District, do hereby certify that the foregoing Resolution No. 05-03-06, was duly adopted by said Board at its Regular Meeting held on March 24, 2005, and that it was so adopted by the following roll call vote:

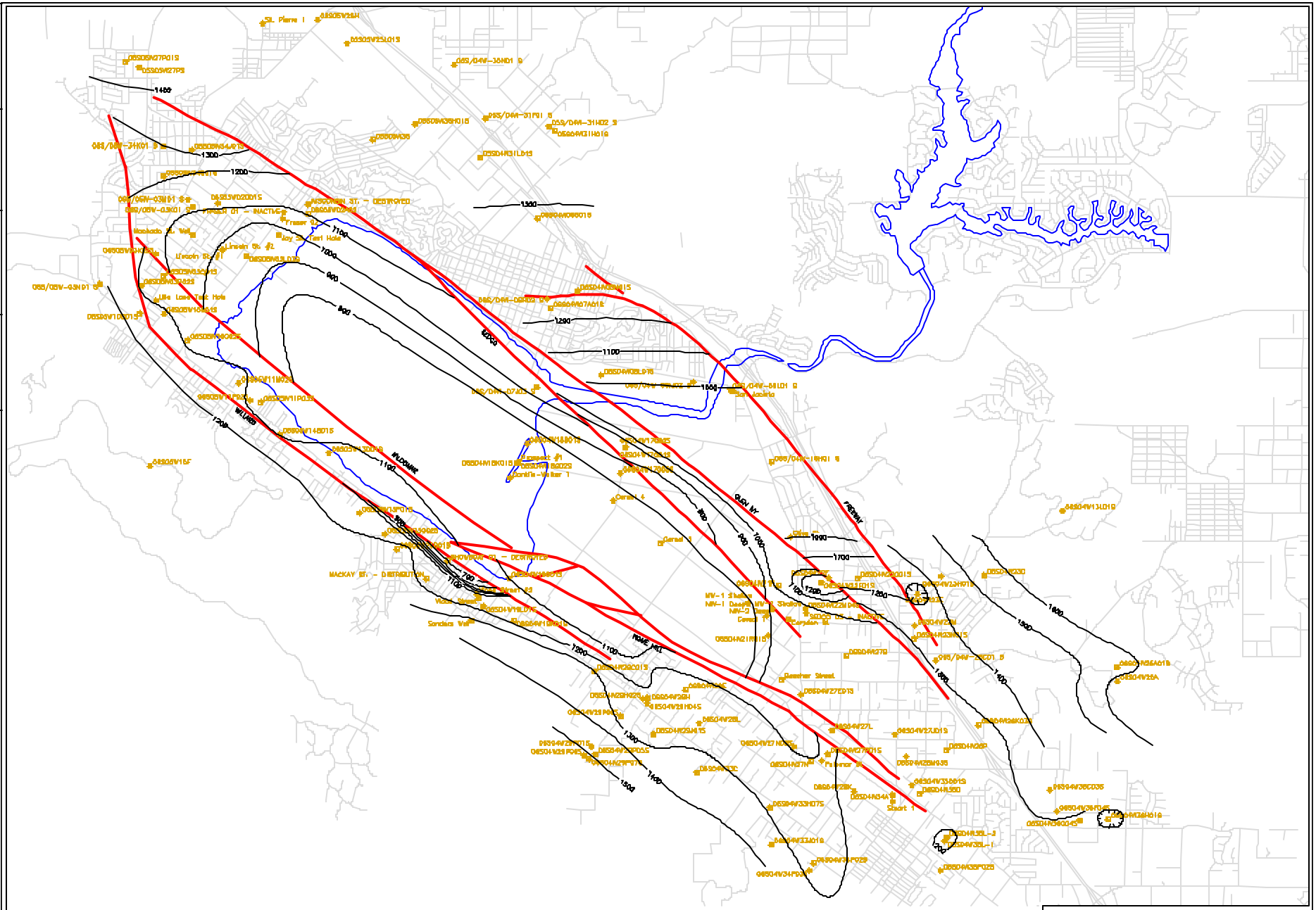
AYES: Anderson, Hyland, Ryan, Wicke, Williams

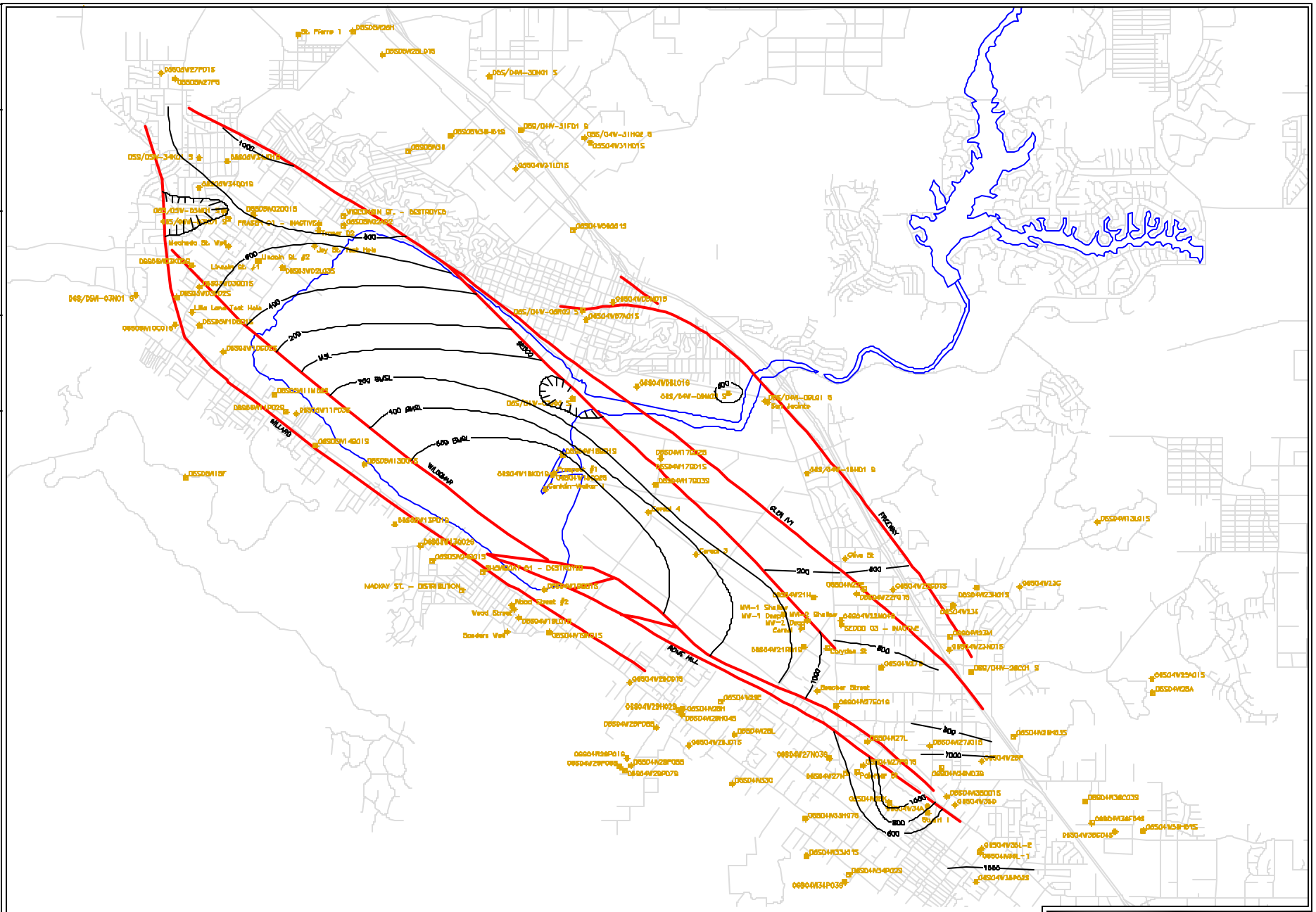
NOES: None

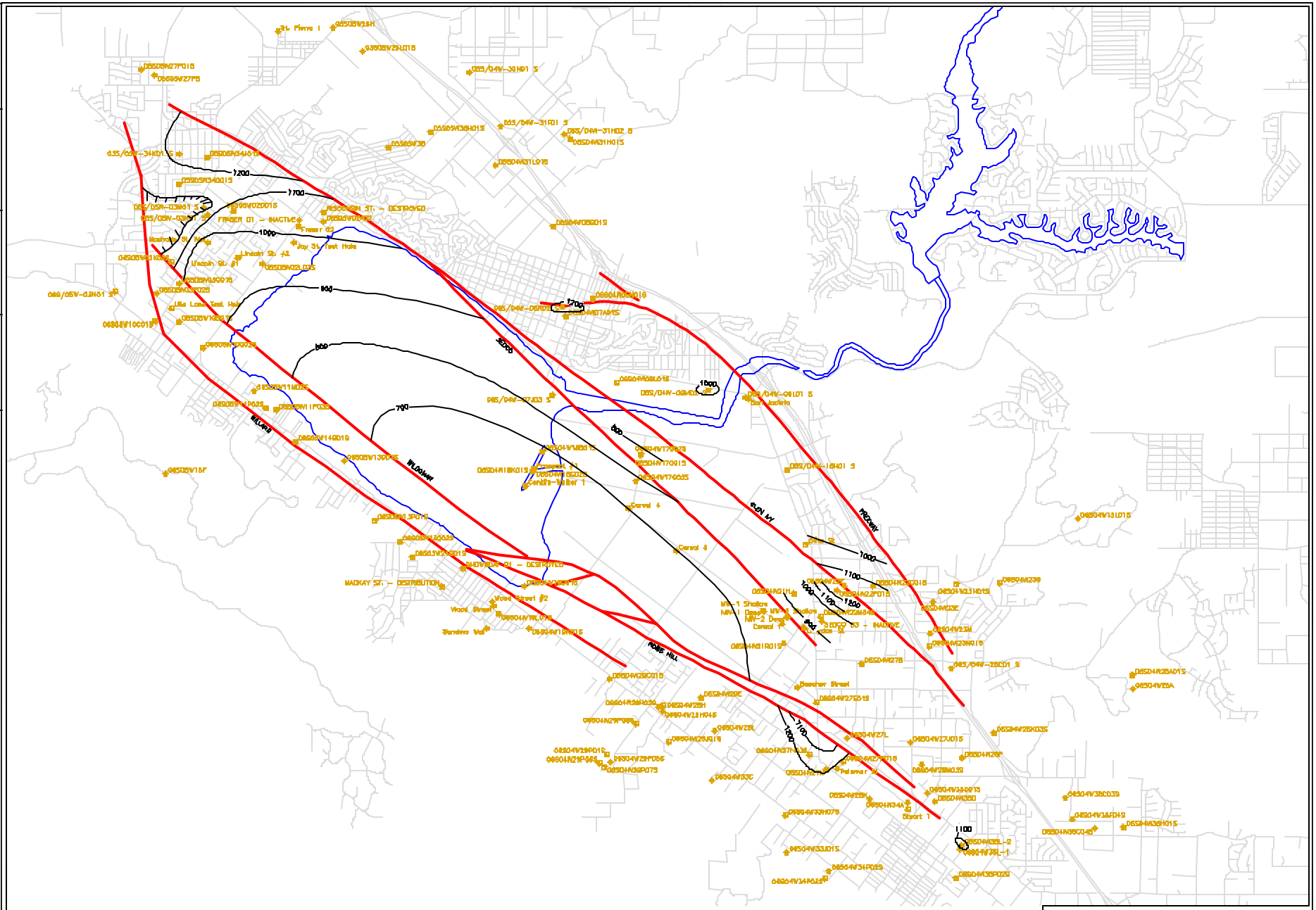
ABSENT: None

ABSTAIN: None

Terese Quintanar, Secretary of the
Board of Directors of the
Elsinore Valley Municipal Water District


LEGEND
FAULT (KNOWN)
WATER BODY BOUNDARY
FORMATION NOT PRESENT
NOTES:
CONTOUR INTERVAL 100 FEET
CONTOURS DASHED WHERE INFERRED
0
3000
6000
1" = 3000'
ELSINORE VALLEY MUNICIPAL WATER DISTRICT
ELSINORE BASIN, CALIFORNIA
STRUCTURAL CONTOUR MAP OF
BASE OF ALLUVIUM (Qal & Qt)
FIGURE D-1
MWH


LEGEND
FAULT (KNOWN)
WATER BODY BOUNDARY
FORMATION NOT PRESENT
NOTES:
CONTOUR INTERVAL 200 FEET
CONTOURS DASHED WHERE INFERRED
0 3000 6000
1" = 3000'
ELSINORE VALLEY MUNICIPAL WATER DISTRICT
ELSINORE BASIN, CALIFORNIA
STRUCTURAL CONTOUR MAP OF
BASE OF FERNANDO GROUP (TQf)
FIGURE D-2
MWH



LEGEND:

- FAULT (KNOWN)
- WATER BODY BOUNDARY
- FORMATION NOT PRESENT

NOTES:

CONTOUR INTERVAL 100 FEET

CONTOURS DASHED WHERE INFERRED

0 3000 6000

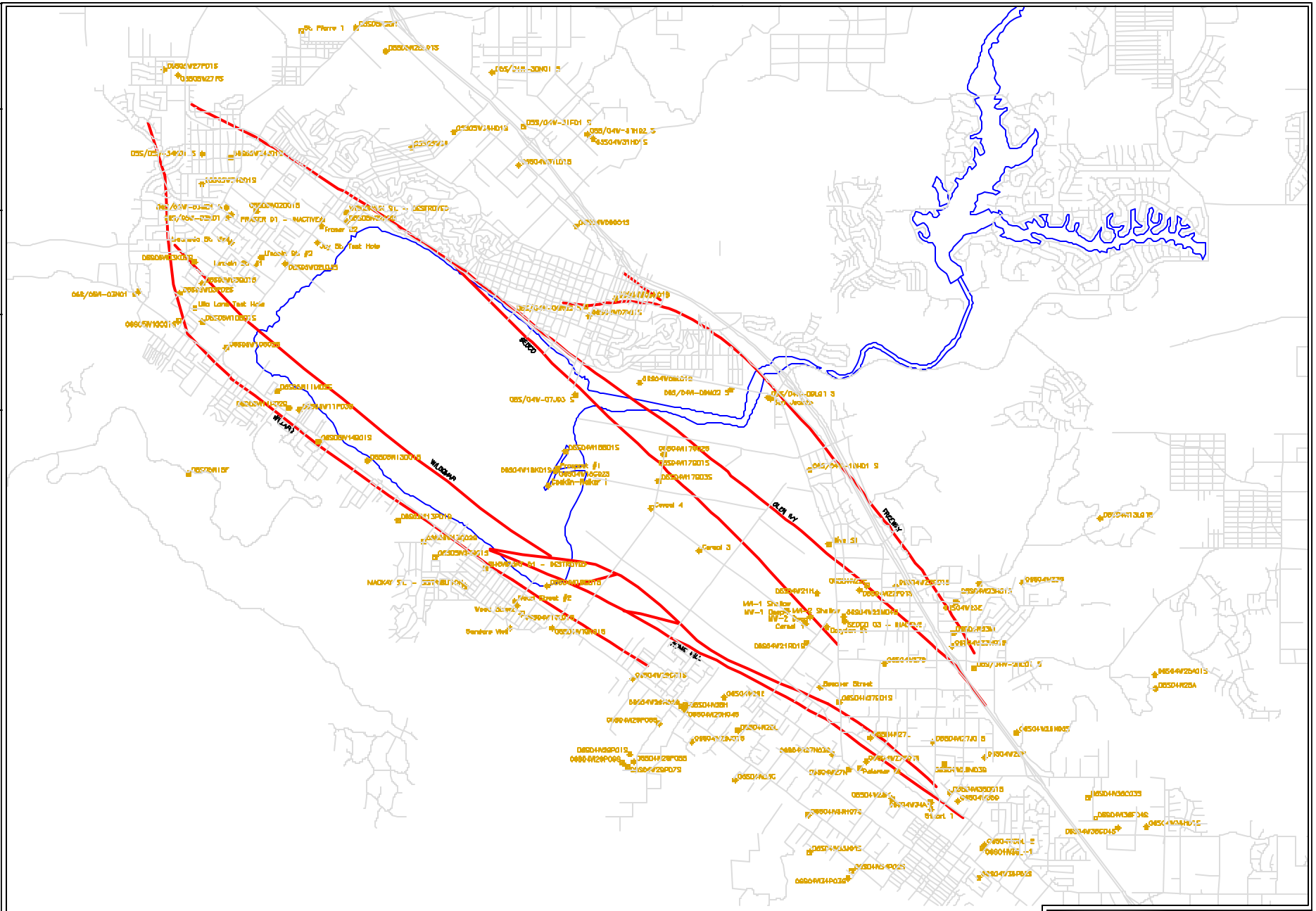
1" = 3000'

ELSINORE VALLEY MUNICIPAL WATER DISTRICT
ELSINORE BASIN, CALIFORNIA

STRUCTURAL CONTOUR MAP OF
BASE OF AQUITARD (Aqt)

FIGURE D-3

MWH



LEGEND

FAULT (KNOWN)

WATER BODY BOUNDARY

NOTES:

CONTOUR INTERVAL 200 FEET

CONTOURS DASHED WHERE INFERRED

MSL = MEAN SEA LEVEL

BMSL = BELOW MEAN SEA LEVEL

0 3000 6000

1"= 3000'

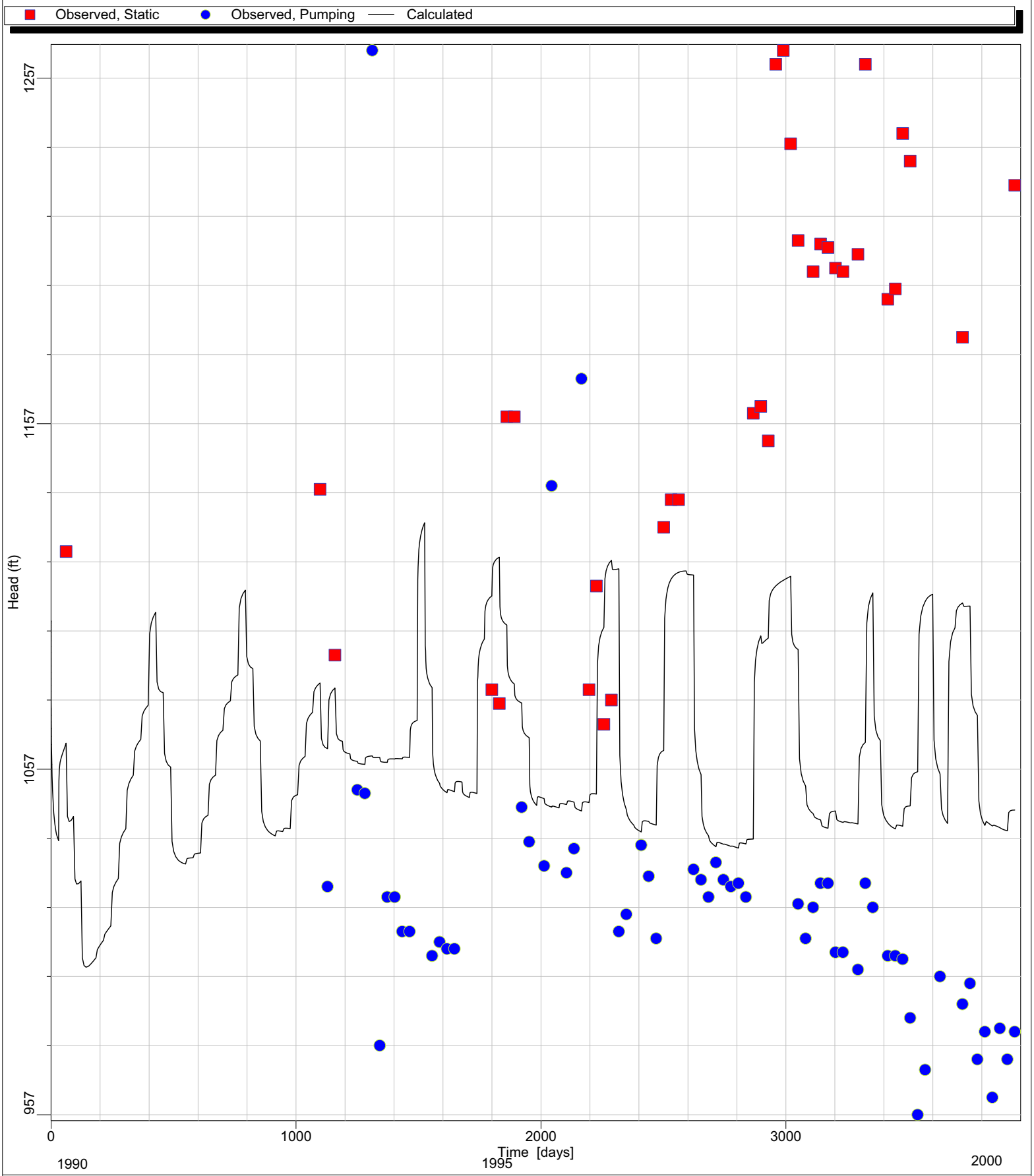
ELSINORE VALLEY MUNICIPAL WATER DISTRICT
ELSINORE BASIN, CALIFORNIA

STRUCTURAL CONTOUR MAP OF BASE OF BEDFORD CANYON FORMATION (bcb)

FIGURE D-4

MWH

Figure E-1 - Head vs. Time (Lincoln)

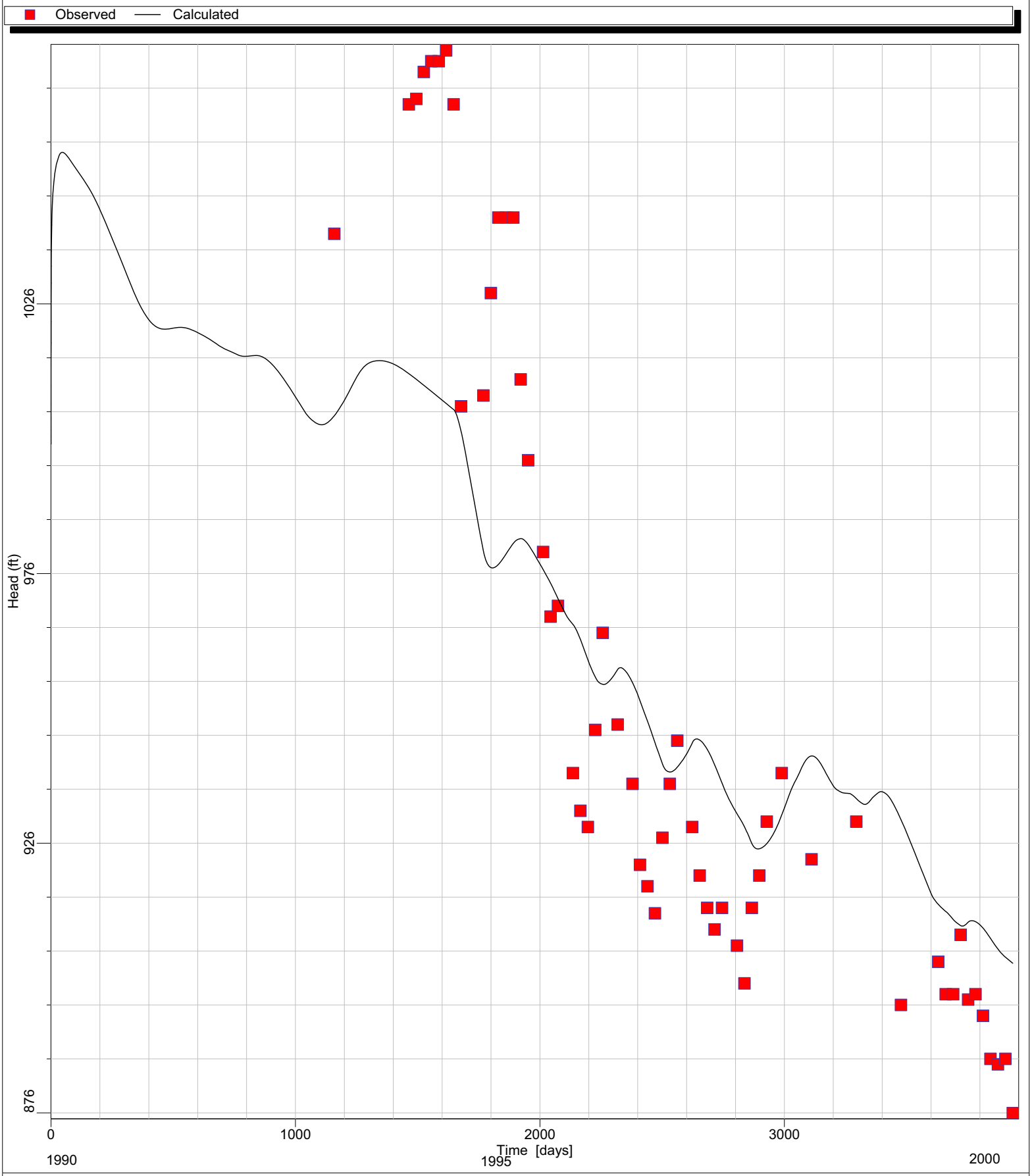


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-2 - Head vs. Time (North Island)

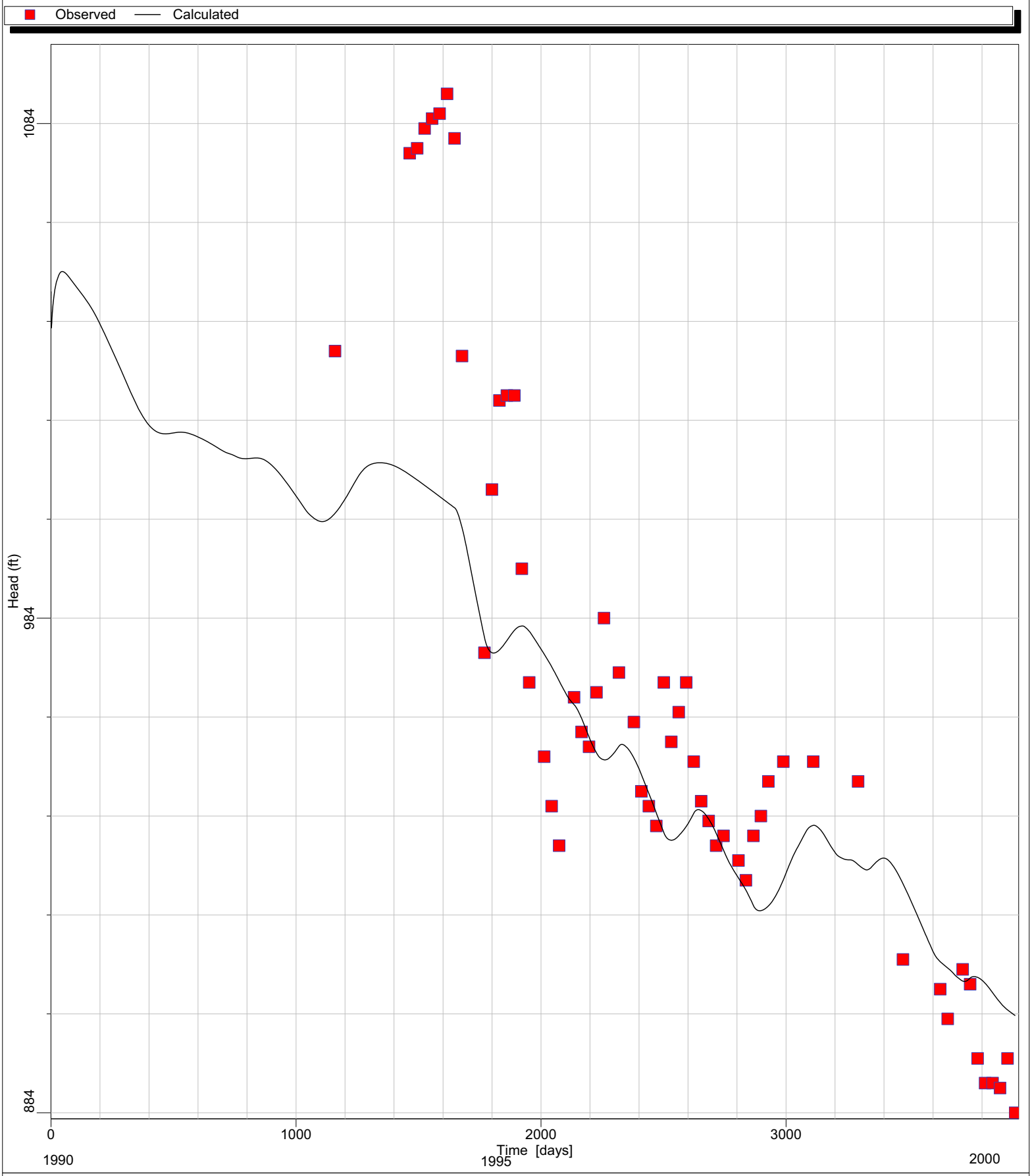


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-3 - Head vs. Time (South Island)

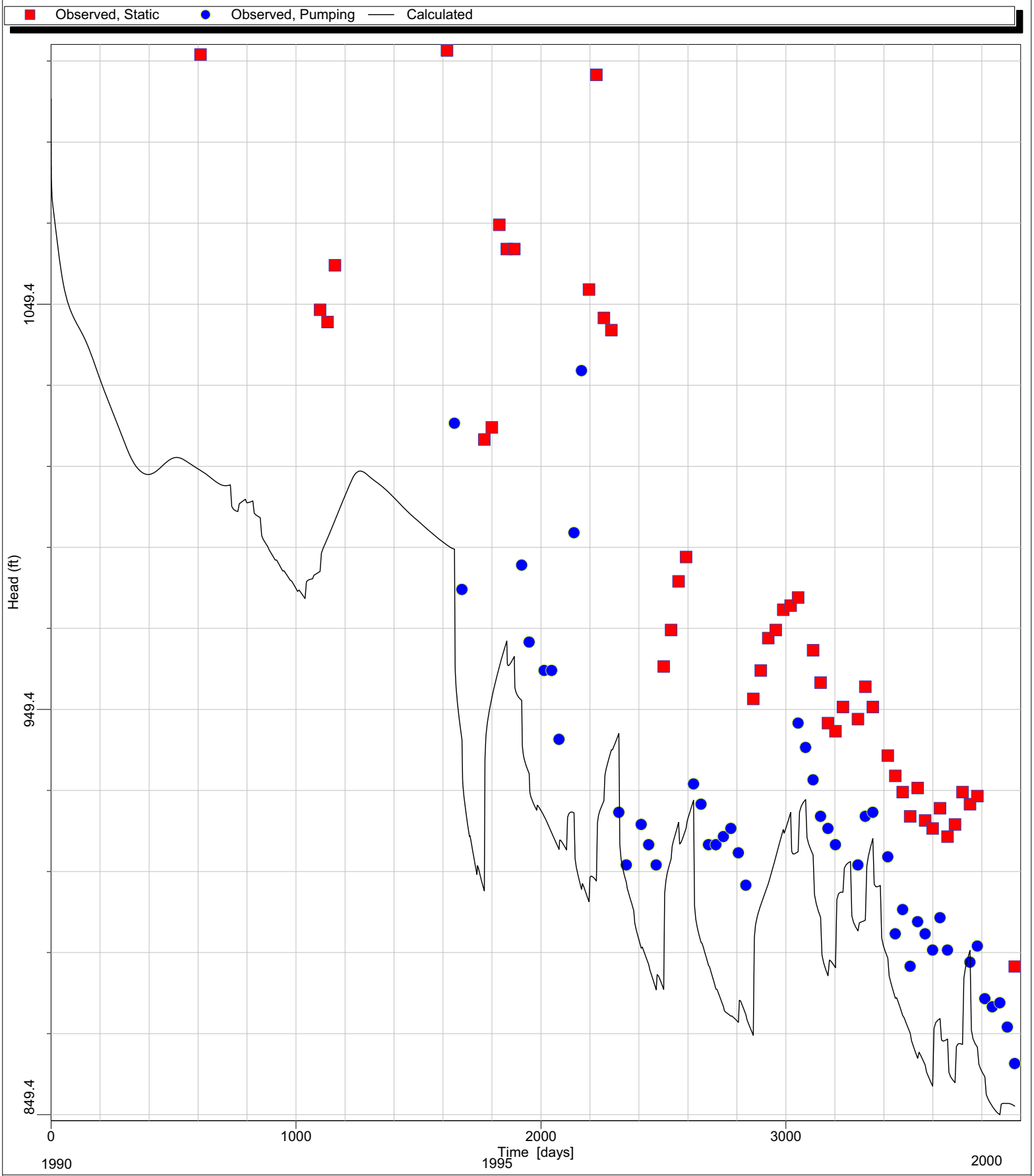


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-4 - Head vs. Time (Cereal 4)

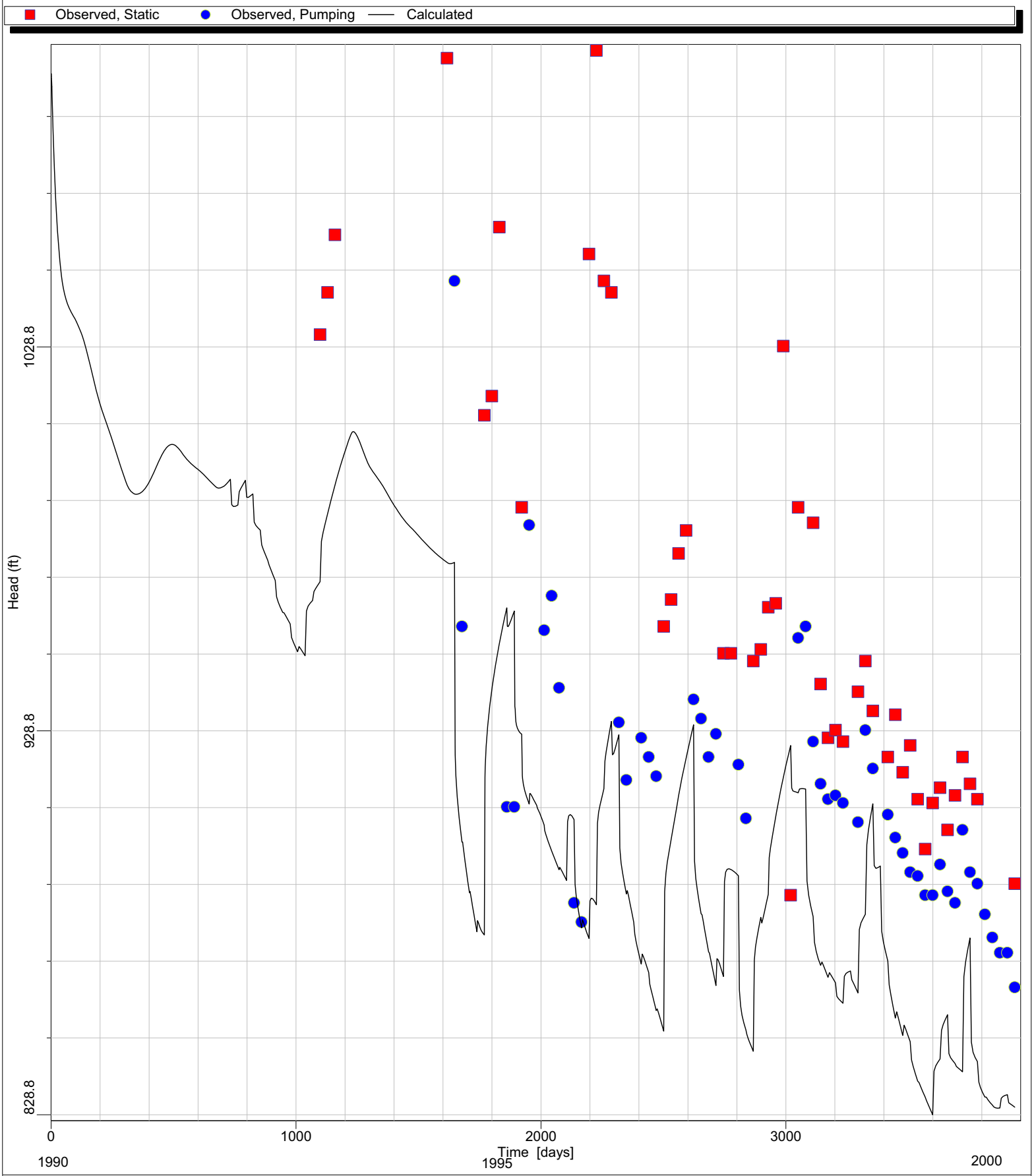


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-5 - Head vs. Time (Cereal 3)

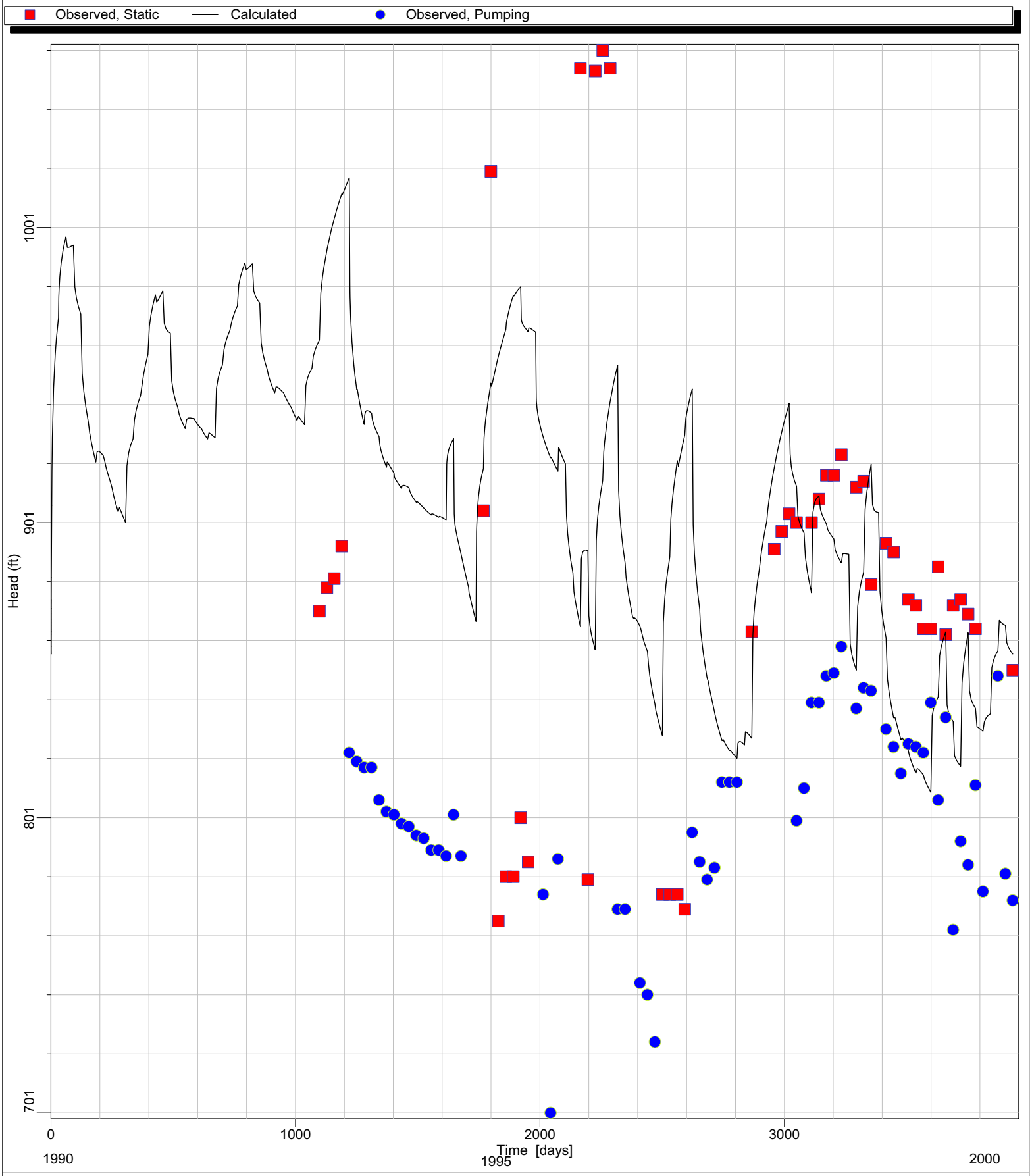


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-6 - Head vs. Time (Cereal 1)

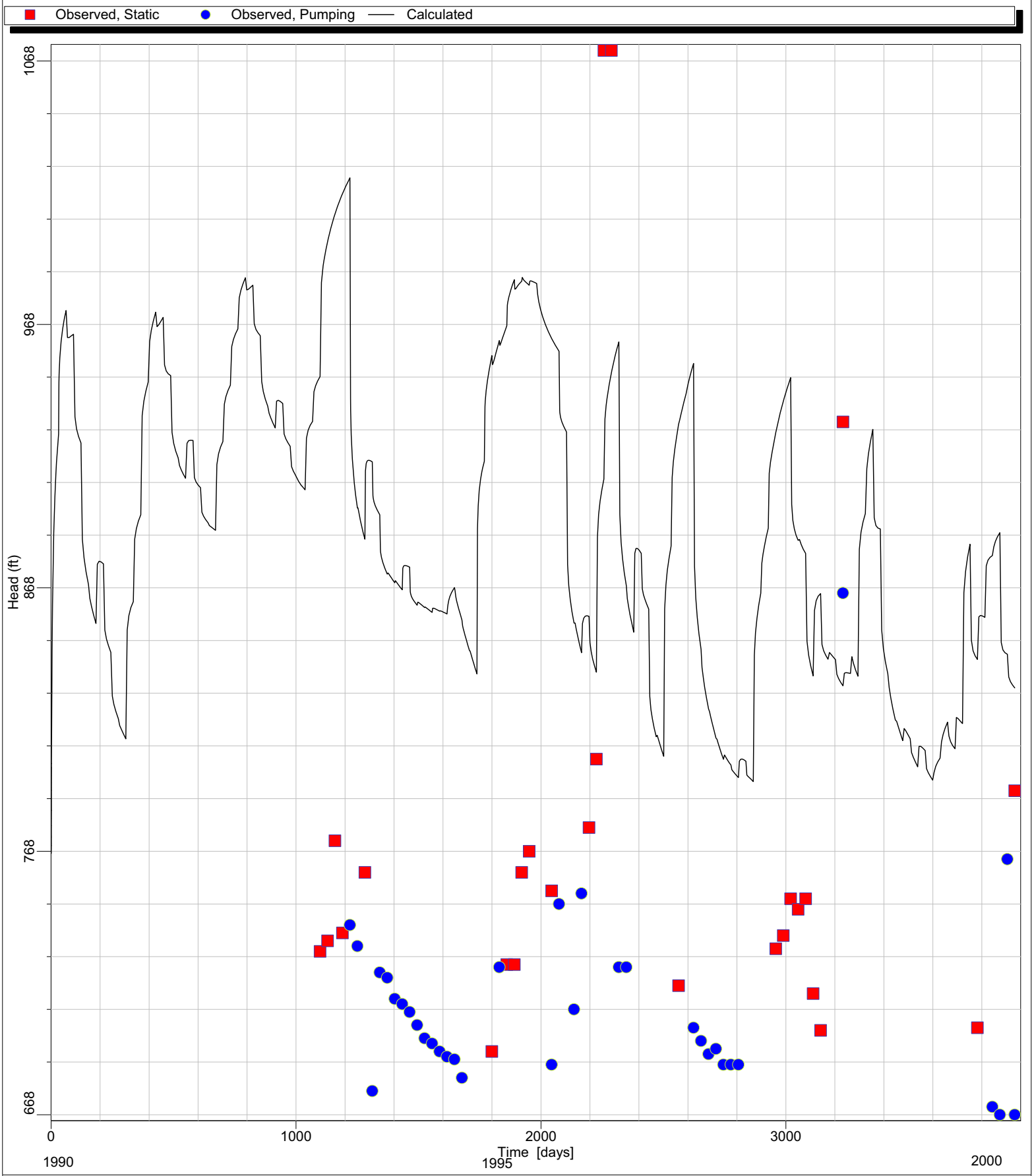


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-7 - Head vs. Time (Corydon)

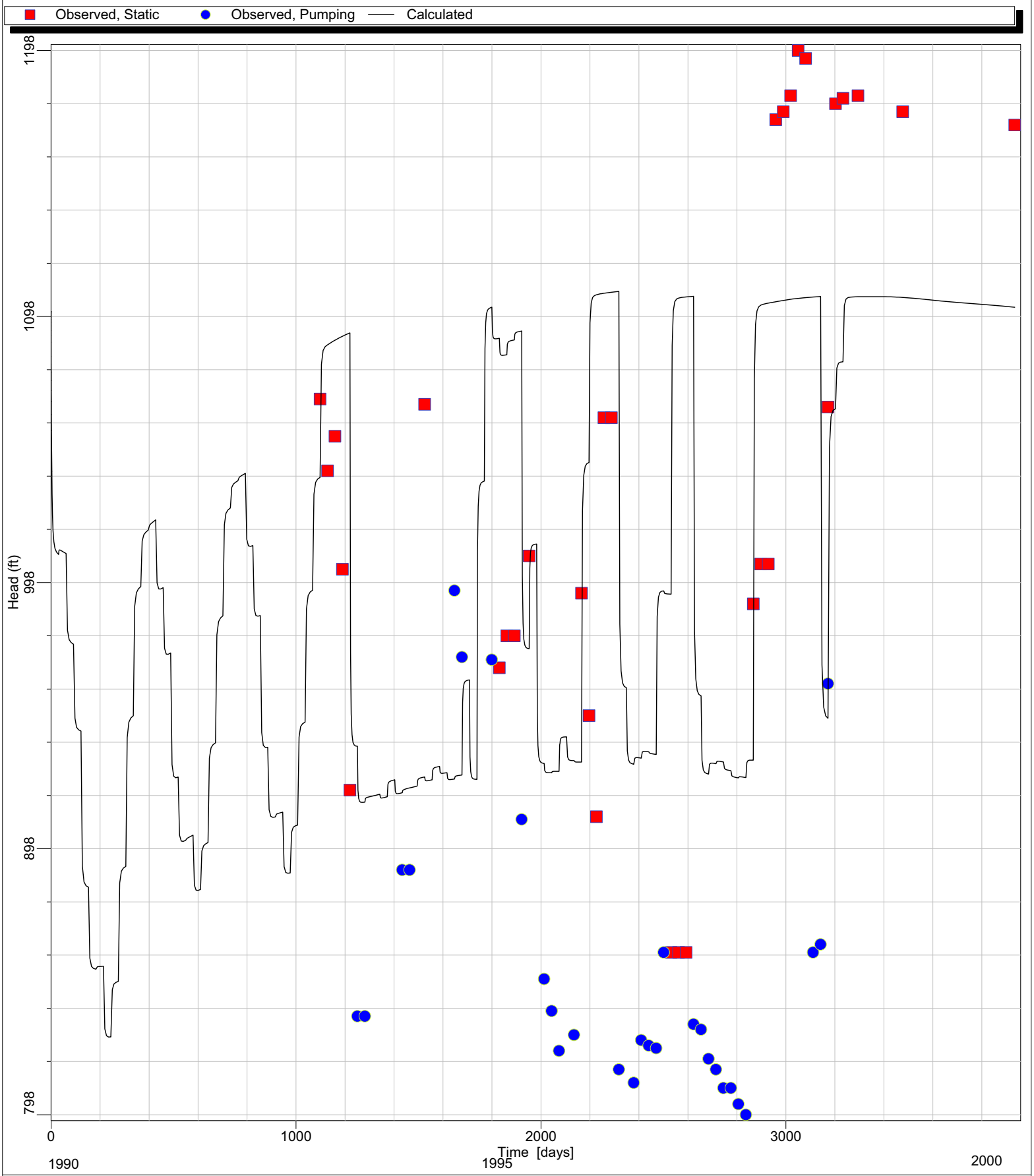


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-8 - Head vs. Time (Olive St)

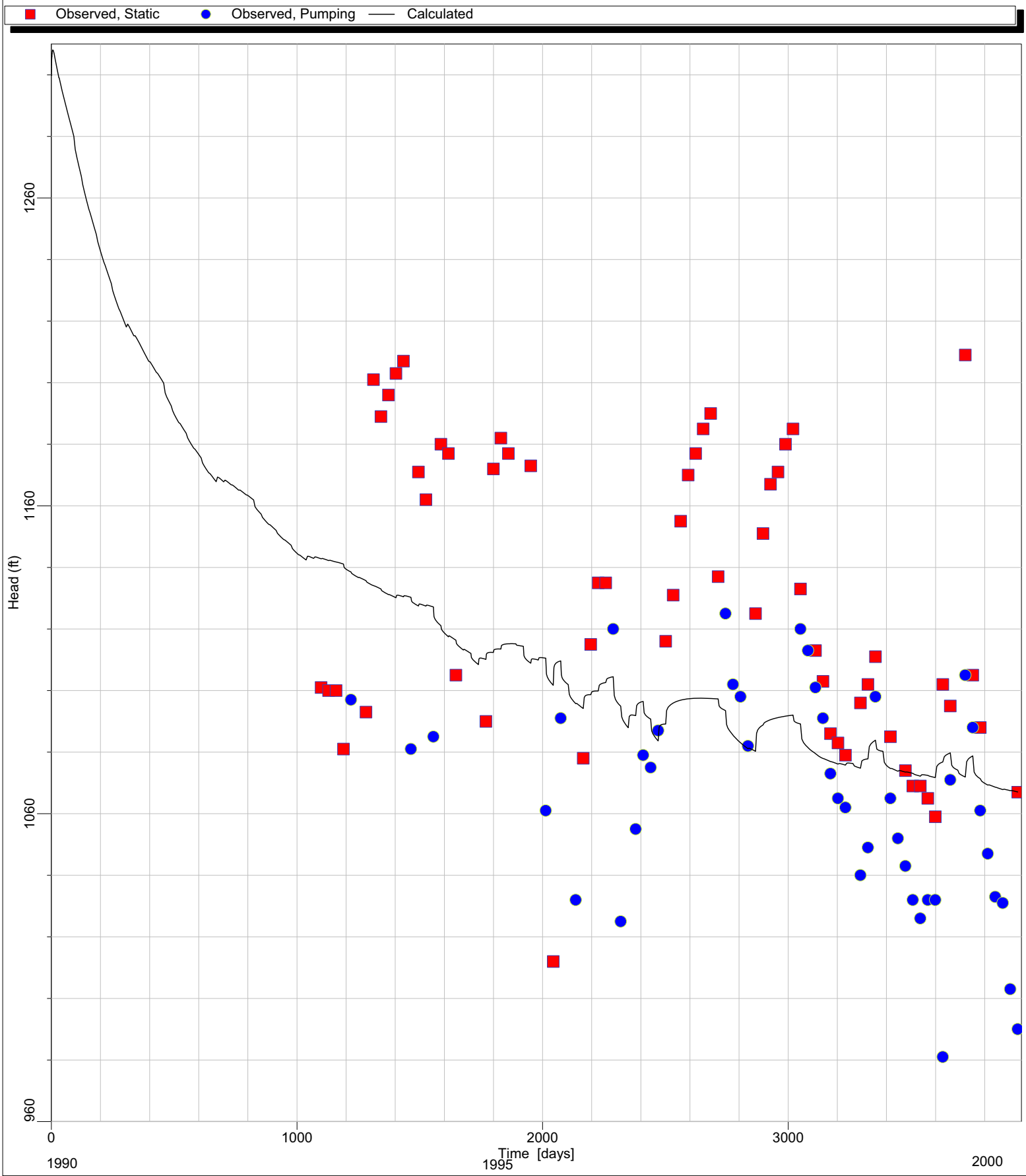


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-9 - Head vs. Time (Palomar)

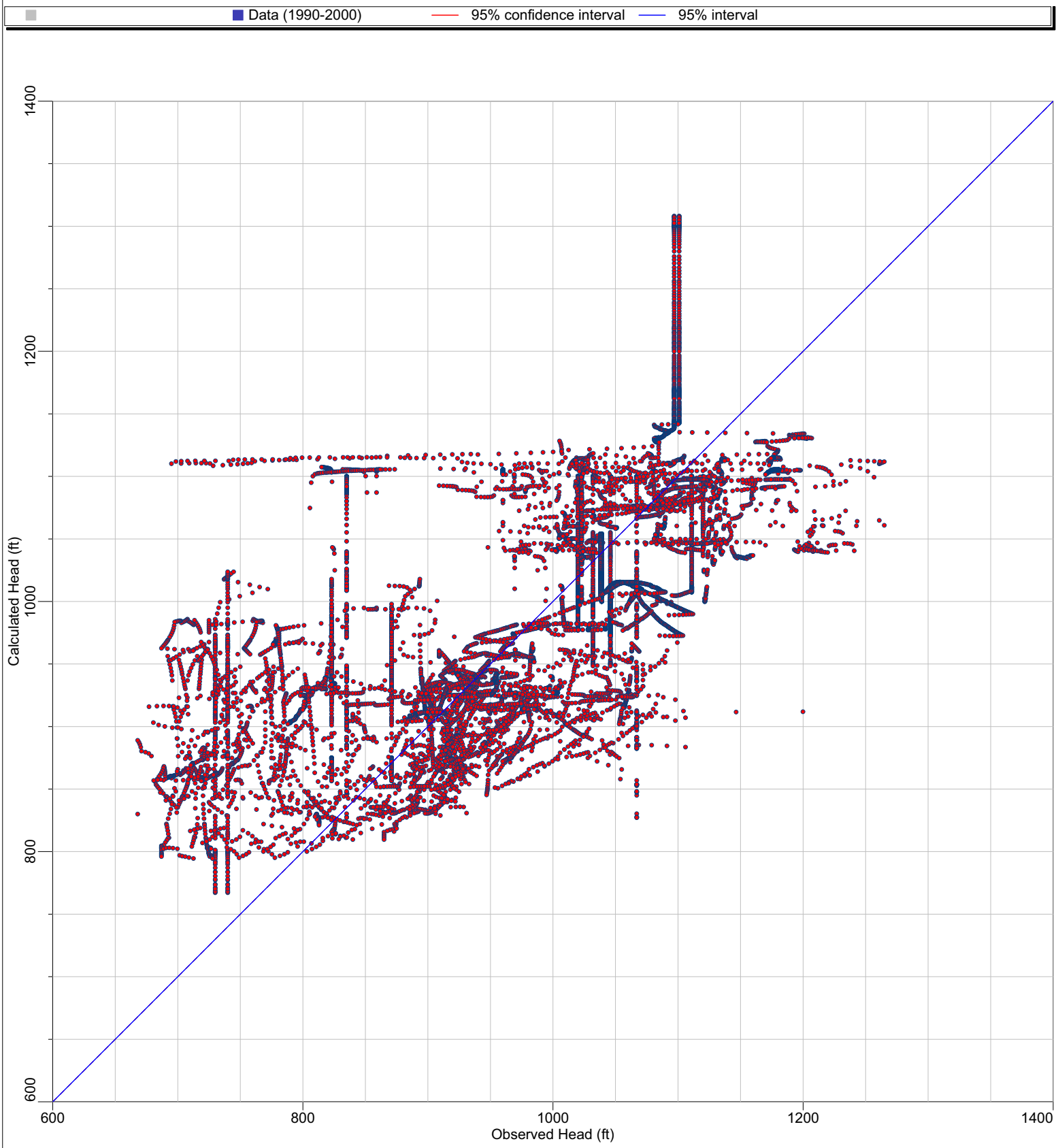


EVWMD
T(0)=January 1990

MWH

Project: Elsinore Basin
Modeller: MWH

Figure E-10 - Model Calibration (1990-2000)

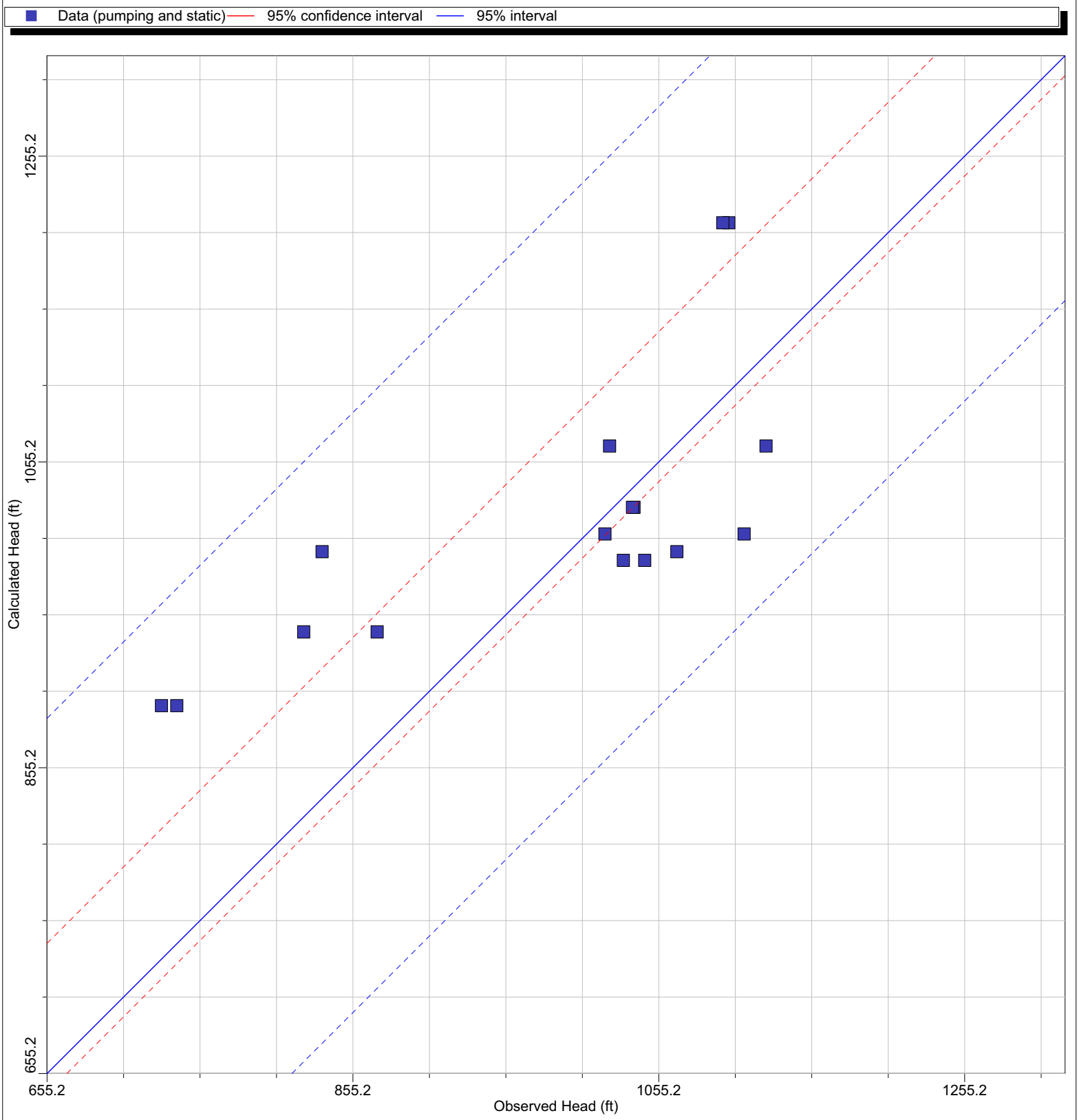


T(0)=January 1990
All static and pumping heads shown.

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-11 - Model Calibration (January 1991)



Num.Points : 16
Max. Residual: 165.7774 (ft) at Cory/Cory
Min. Residual: -11.89063 (ft) at C_4p/C_4p
Residual Mean : 36.1099 (ft)
Absolute Residual Mean : 82.01377 (ft)

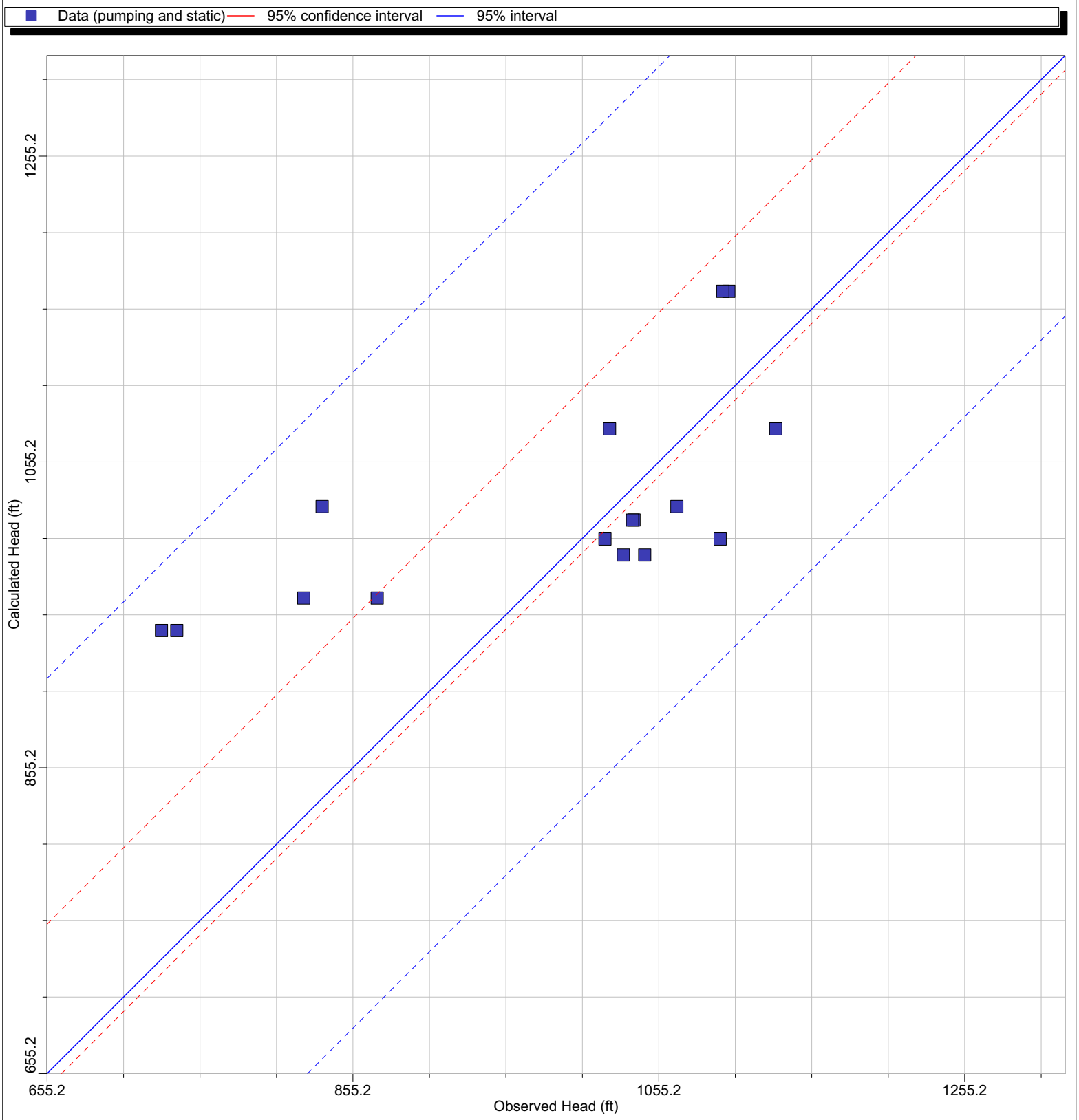
Standard Error of the Estimate : 23.13704 (ft)
Root mean squared : 96.61141 (ft)
Normalized RMS : 24.44039 (%)
Correlation coefficient : 0.7245784

T(0)=January 1990
Time Shown: 366 days (January 1991)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-12 - Model Calibration (January 1992)



Num.Points : 16
Max. Residual: 214.9662 (ft) at Cory/Cory
Min. Residual: -15.19879 (ft) at C_4p/C_4p
Residual Mean : 44.08617 (ft)
Absolute Residual Mean : 85.76492 (ft)

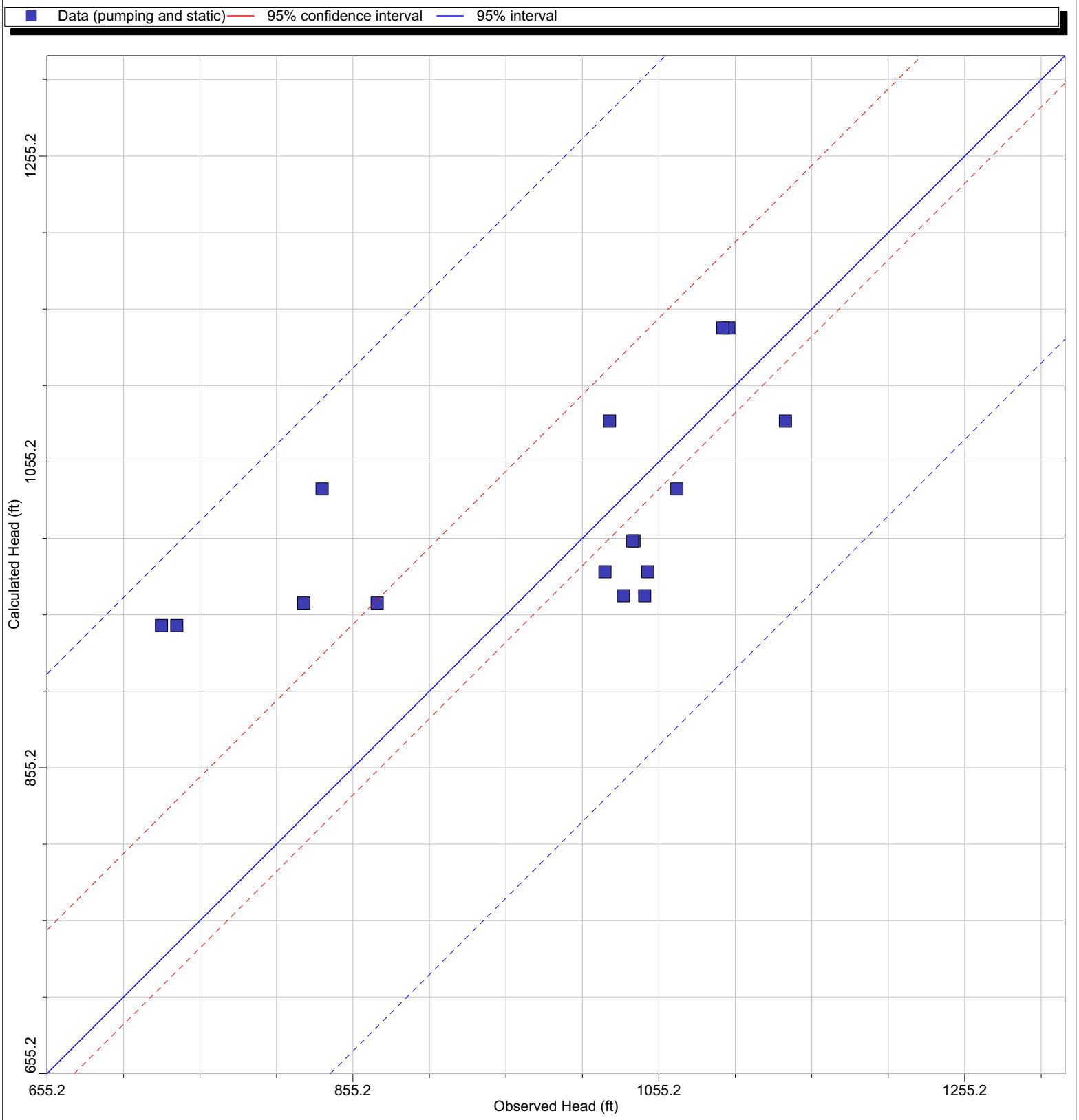
Standard Error of the Estimate : 25.28128 (ft)
Root mean squared : 107.3813 (ft)
Normalized RMS : 26.73523 (%)
Correlation coefficient : 0.6741636

T(0)=January 1990
Time Shown: 732 days (January 1992)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-13 - Model Calibration (January 1993)



Num.Points : 16
Max. Residual: 218.2281 (ft) at Cory/Cory
Min. Residual: -29.44702 (ft) at O/O
Residual Mean : 38.01263 (ft)
Absolute Residual Mean : 87.90433 (ft)

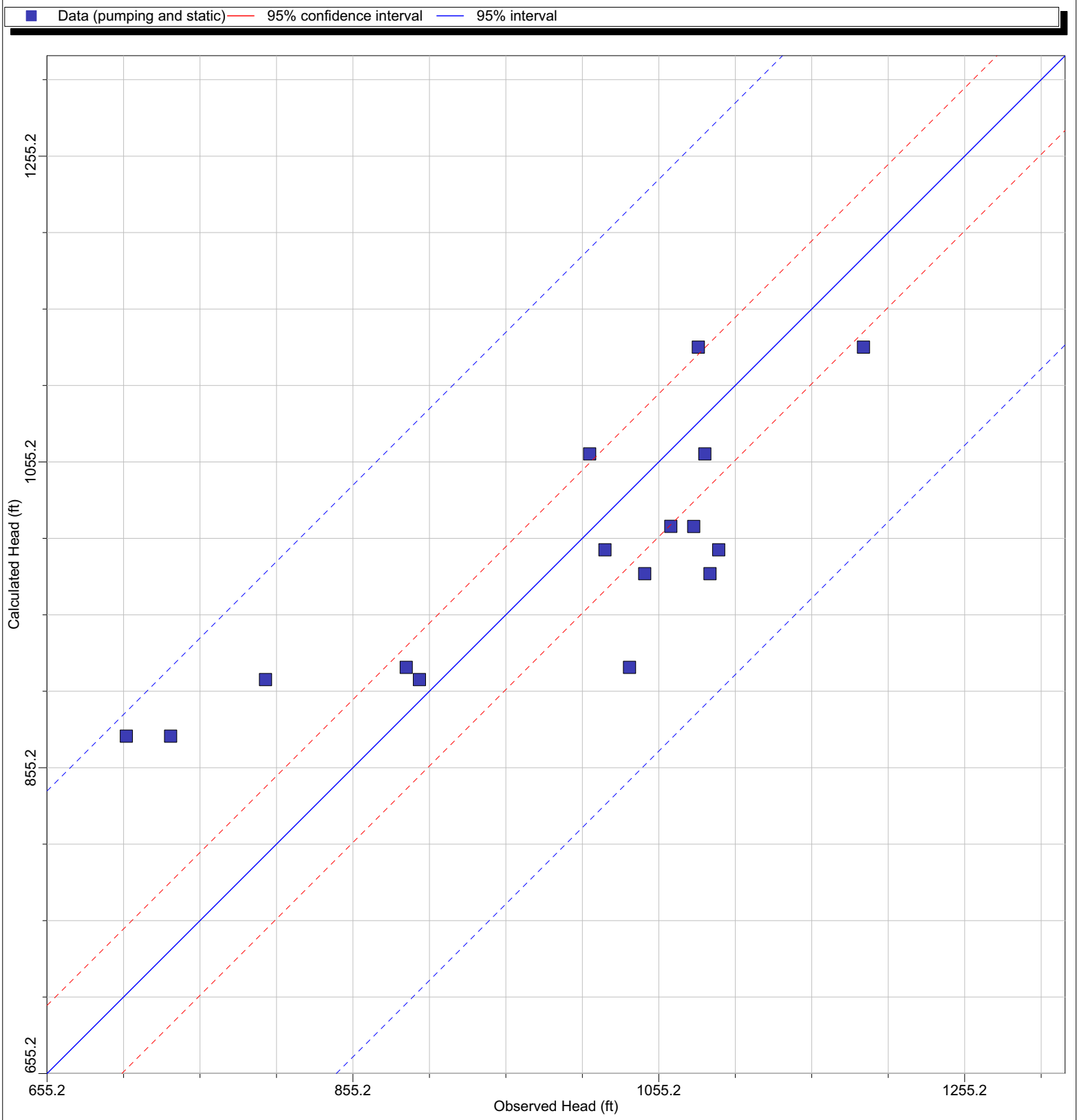
Standard Error of the Estimate : 26.33583 (ft)
Root mean squared : 108.8513 (ft)
Normalized RMS : 26.67923 (%)
Correlation coefficient : 0.612077

T(0)=January 1990
Time Shown: 1098 days (January 1993)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-14 - Model Calibration (January 1994)



Num.Points : 16
Max. Residual: 168.864 (ft) at Cory_p/Cory_p
Min. Residual: 14.19927 (ft) at C_1/C_1
Residual Mean : -2.170574 (ft)
Absolute Residual Mean : 73.2122 (ft)

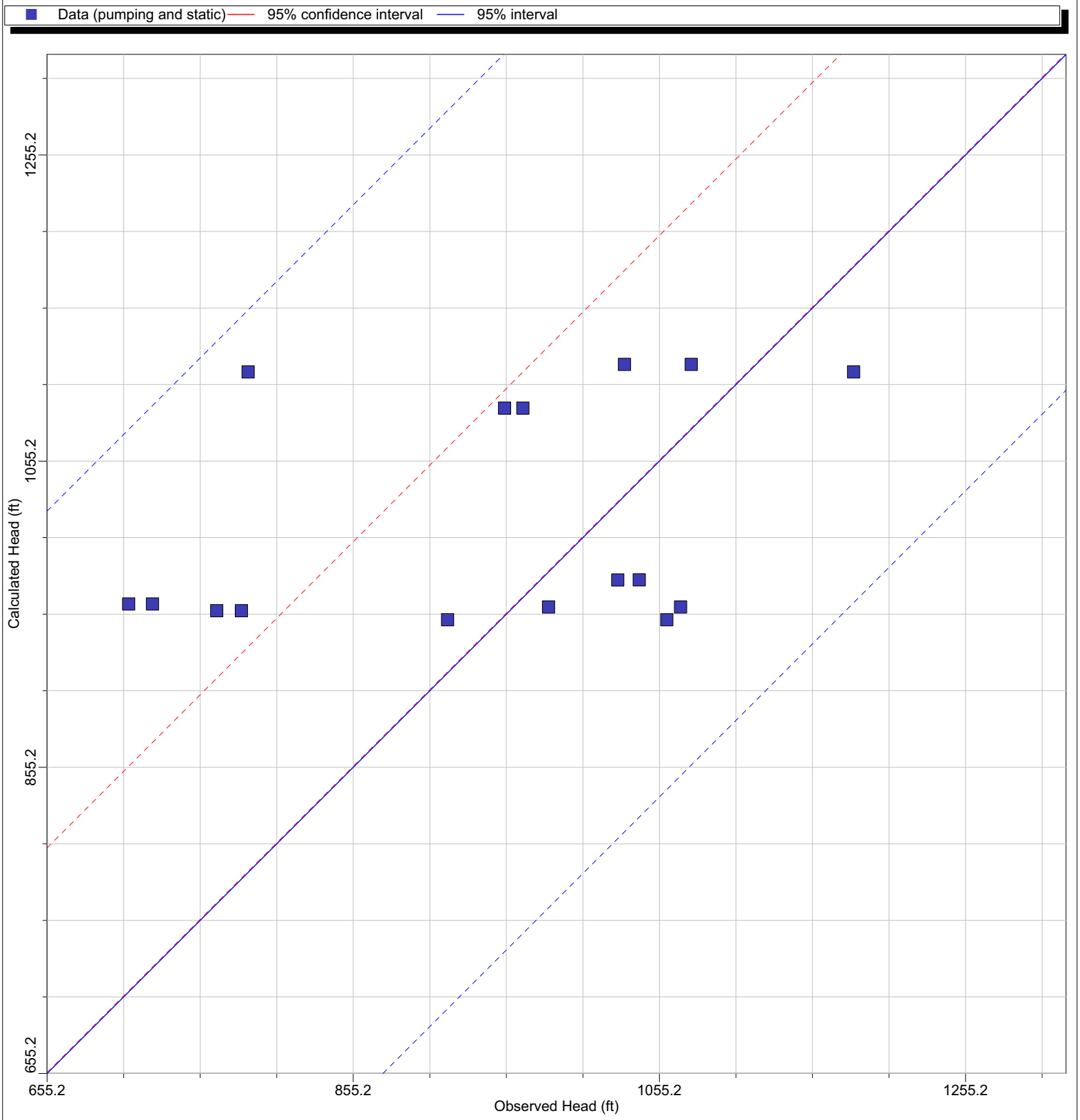
Standard Error of the Estimate : 22.04592 (ft)
Root mean squared : 85.41105 (ft)
Normalized RMS : 17.72014 (%)
Correlation coefficient : 0.8158778

T(0)=January 1990
Time Shown: 1464days (January 1994)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-15 - Model Calibration (January 1995)



Num.Points : 16
Max. Residual: 326.995 (ft) at P_p/P_p
Min. Residual: -22.82623 (ft) at C_4p/C_4p
Residual Mean : 74.01883 (ft)
Absolute Residual Mean : 126.9661 (ft)

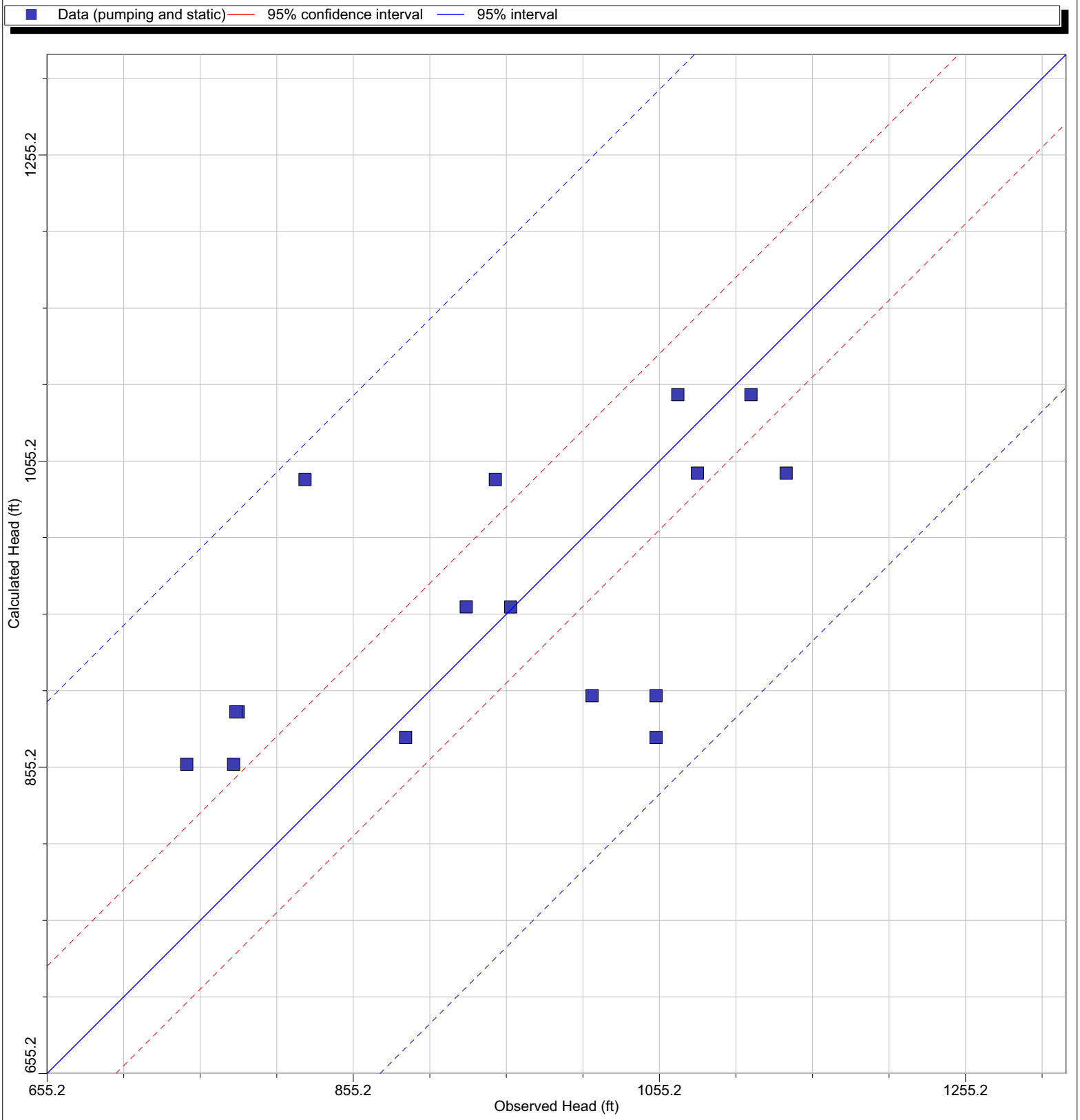
Standard Error of the Estimate : 34.59231 (ft)
Root mean squared : 153.0627 (ft)
Normalized RMS : 32.32582 (%)
Correlation coefficient : 0.3457494

T(0)=January 1990
Time Shown: 1830 days (January 1995)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-16 - Model Calibration (January 1996)



Num.Points : 16
Max. Residual: 219.4797 (ft) at O_p/O_p
Min. Residual: 1.971375 (ft) at S_Is/S_Is
Residual Mean : 12.59436 (ft)
Absolute Residual Mean : 86.70548 (ft)

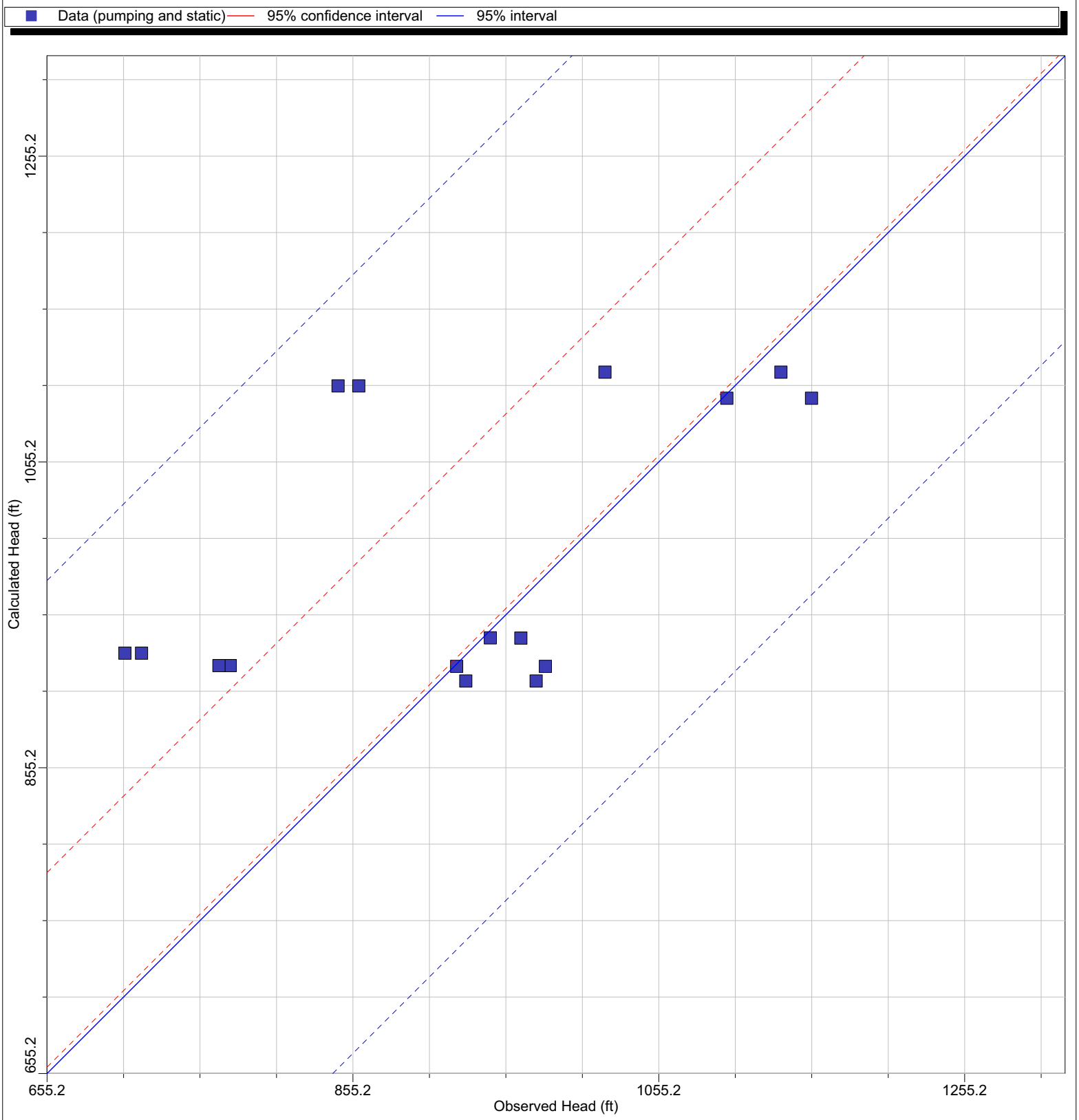
Standard Error of the Estimate : 27.14255 (ft)
Root mean squared : 105.8744 (ft)
Normalized RMS : 27.03636 (%)
Correlation coefficient : 0.5883181

T(0)=January 1990
Time Shown: 2196 days (January 1996)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-17 - Model Calibration (January 1997)



Num.Points : 16
Max. Residual: 259.4382 (ft) at O_p/O_p
Min. Residual: -1.482666 (ft) at C_4p/C_4p
Residual Mean : 67.80388 (ft)
Absolute Residual Mean : 99.42454 (ft)

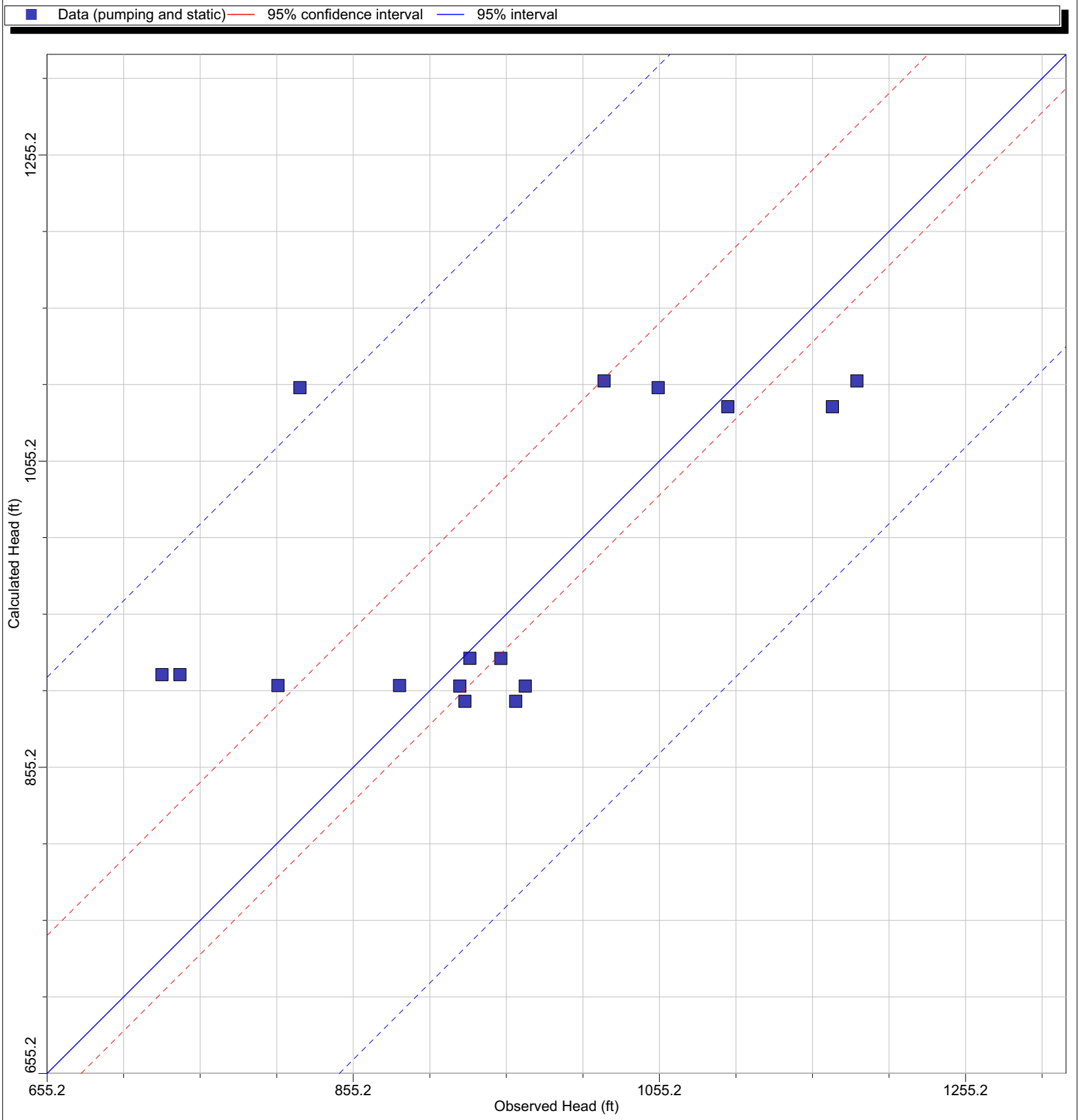
Standard Error of the Estimate : 30.02689 (ft)
Root mean squared : 134.6164 (ft)
Normalized RMS : 29.98881 (%)
Correlation coefficient : 0.526229

T(0)=January 1990
Time Shown: 2562 days (January 1997)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-18 - Model Calibration (January 1998)



Num.Points : 16
Max. Residual: 282.868 (ft) at O_p/O_p
Min. Residual: -4.922827 (ft) at N_Is/N_Is
Residual Mean : 33.94425 (ft)
Absolute Residual Mean : 79.20999 (ft)

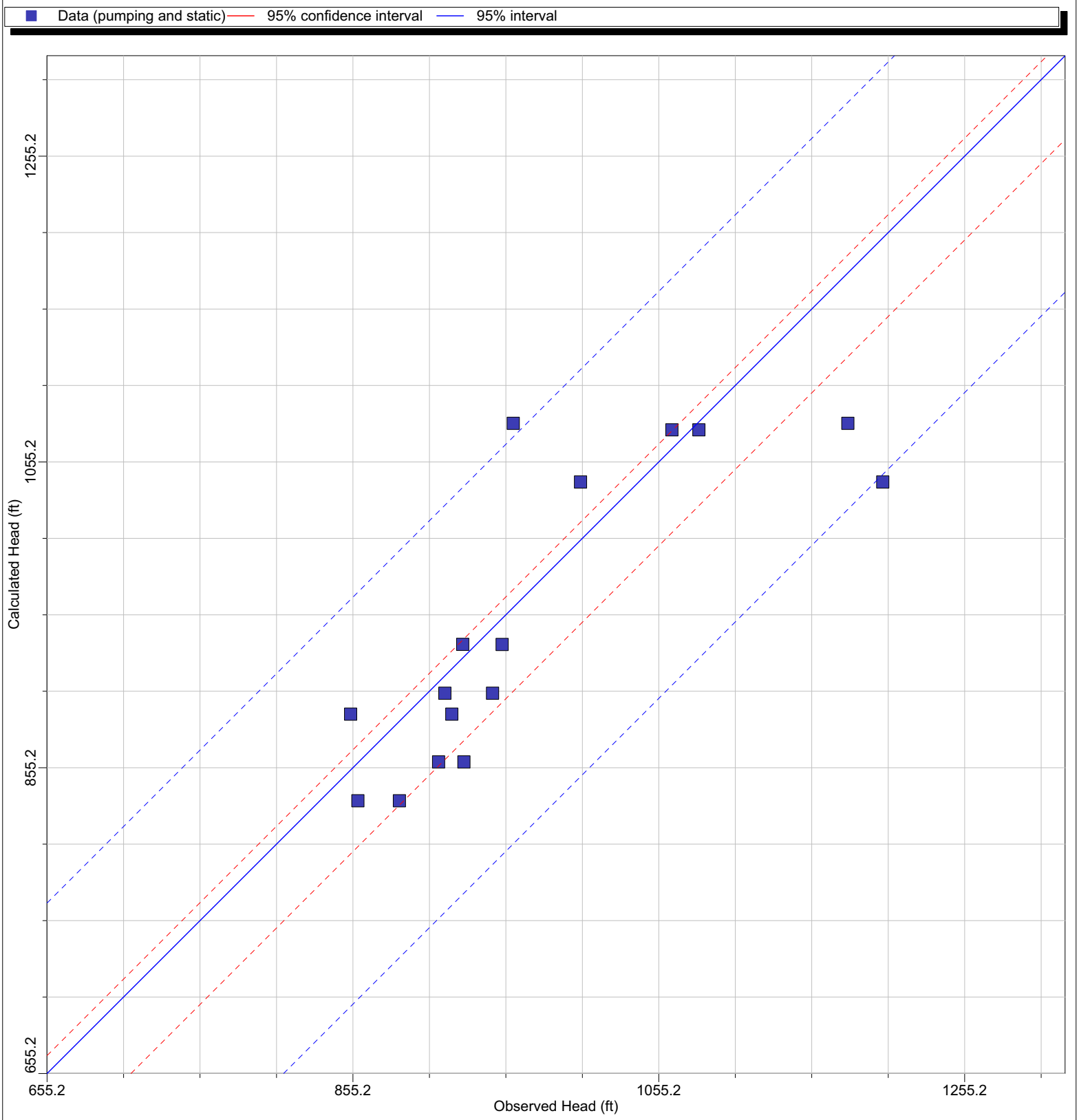
Standard Error of the Estimate : 26.51521 (ft)
Root mean squared : 108.1576 (ft)
Normalized RMS : 23.82415 (%)
Correlation coefficient : 0.627241

T(0)=January 1990
Time Shown: 2937 days (January 1998)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-19 - Model Calibration (January 1999)



Num.Points : 16
Max. Residual: -159.5461 (ft) at L/L
Min. Residual: -5.171691 (ft) at P/P
Residual Mean : -21.55193 (ft)
Absolute Residual Mean : 48.60233 (ft)

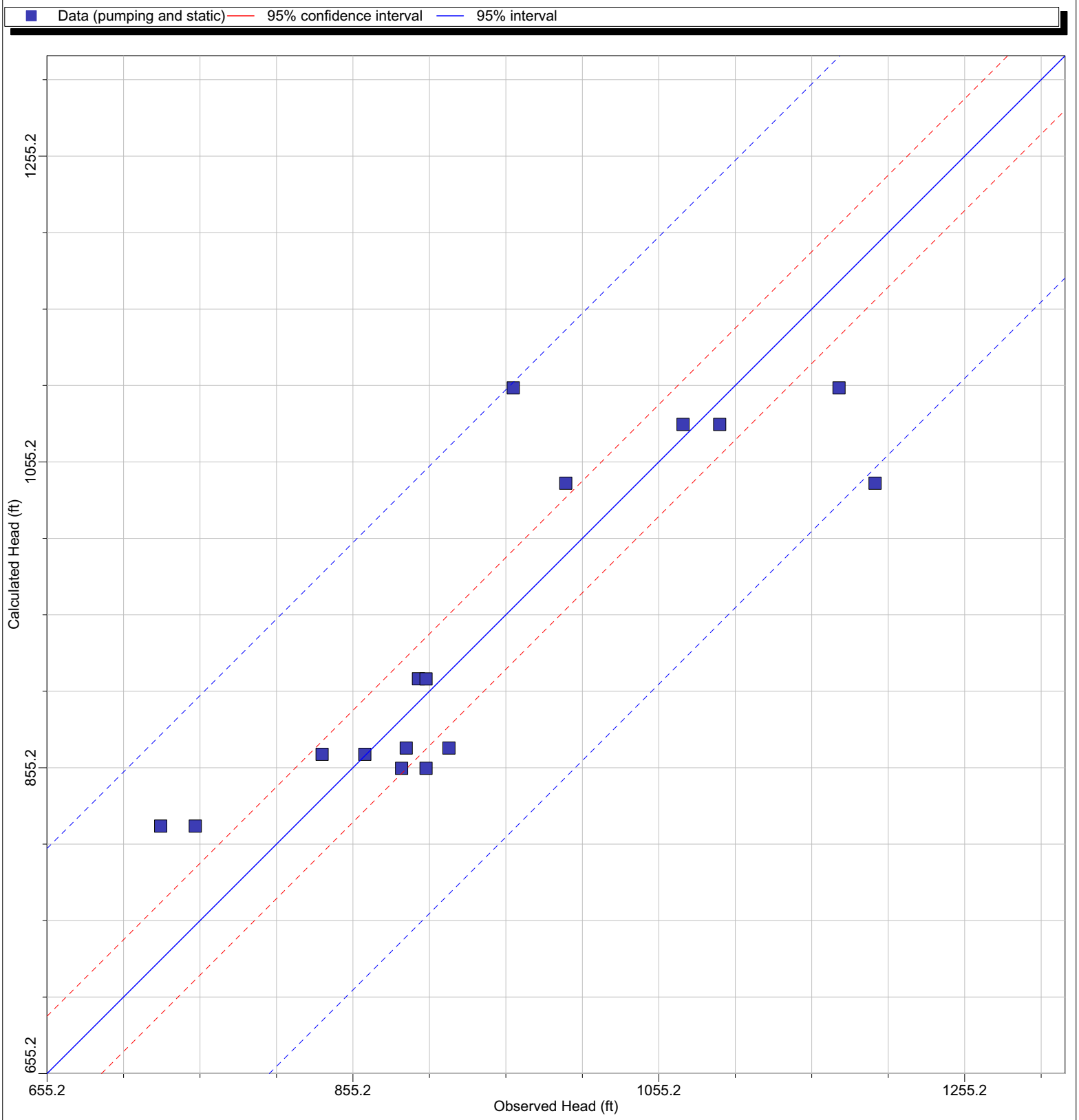
Standard Error of the Estimate : 15.6949 (ft)
Root mean squared : 64.49366 (ft)
Normalized RMS : 18.5379 (%)
Correlation coefficient : 0.8089869

T(0)=January 1990
Time Shown: 3215 days (January 1999)

MWH

Project: Elsinore Basin
Modeller: cdd

Figure E-20 - Model Calibration (January 2000)



Num.Points : 16
Max. Residual: -155.2866 (ft) at L/L
Min. Residual: 0.9388428 (ft) at C_1/C_1
Residual Mean : 0.9484441 (ft)
Absolute Residual Mean : 49.9602 (ft)

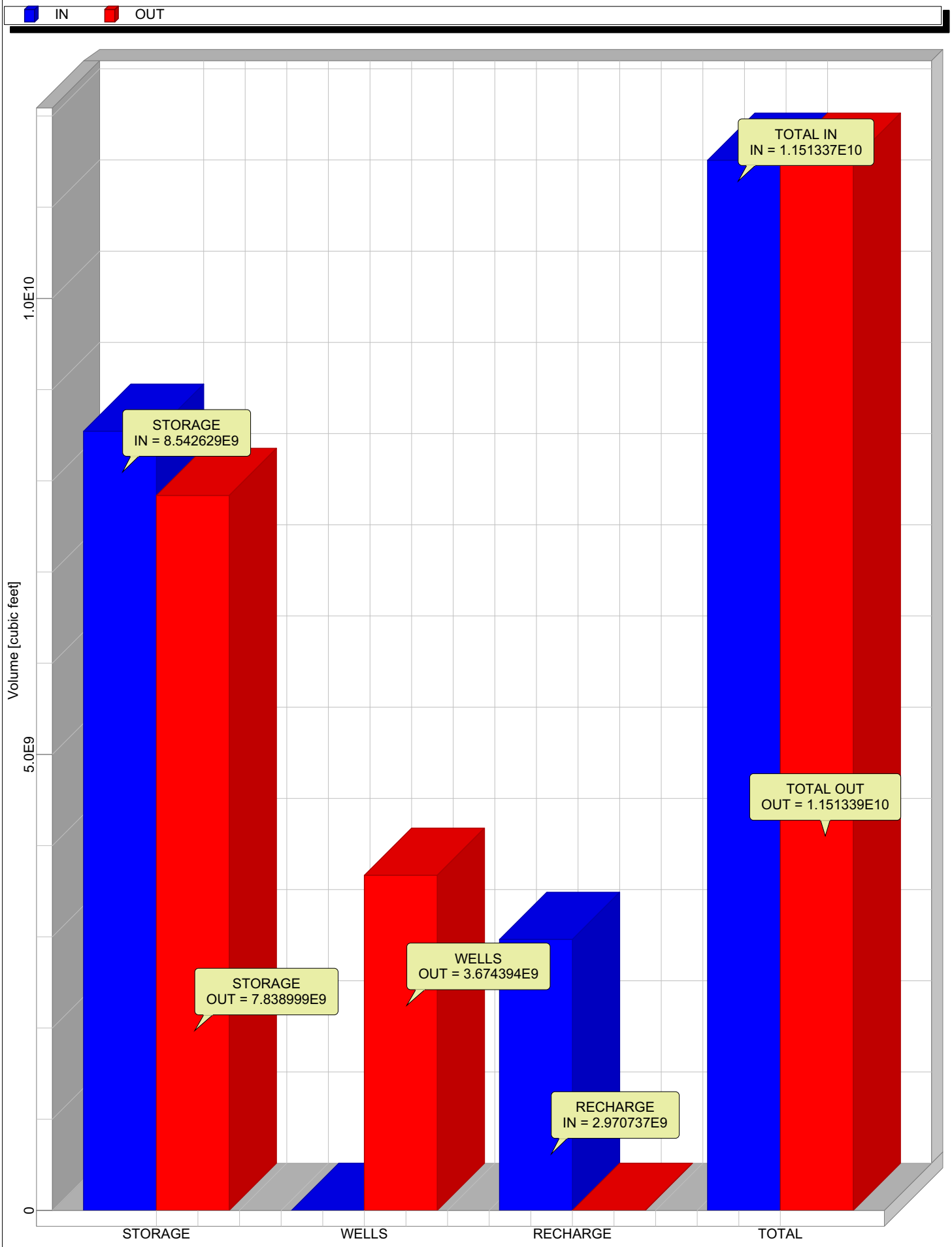
Standard Error of the Estimate : 17.25176 (ft)
Root mean squared : 66.82251 (ft)
Normalized RMS : 14.3067 (%)
Correlation coefficient : 0.8594786

T(0)=January 1990
Time Shown: 3660 days (January 2000)

MWH

Project: Elsinore Basin
Modeller: cdd

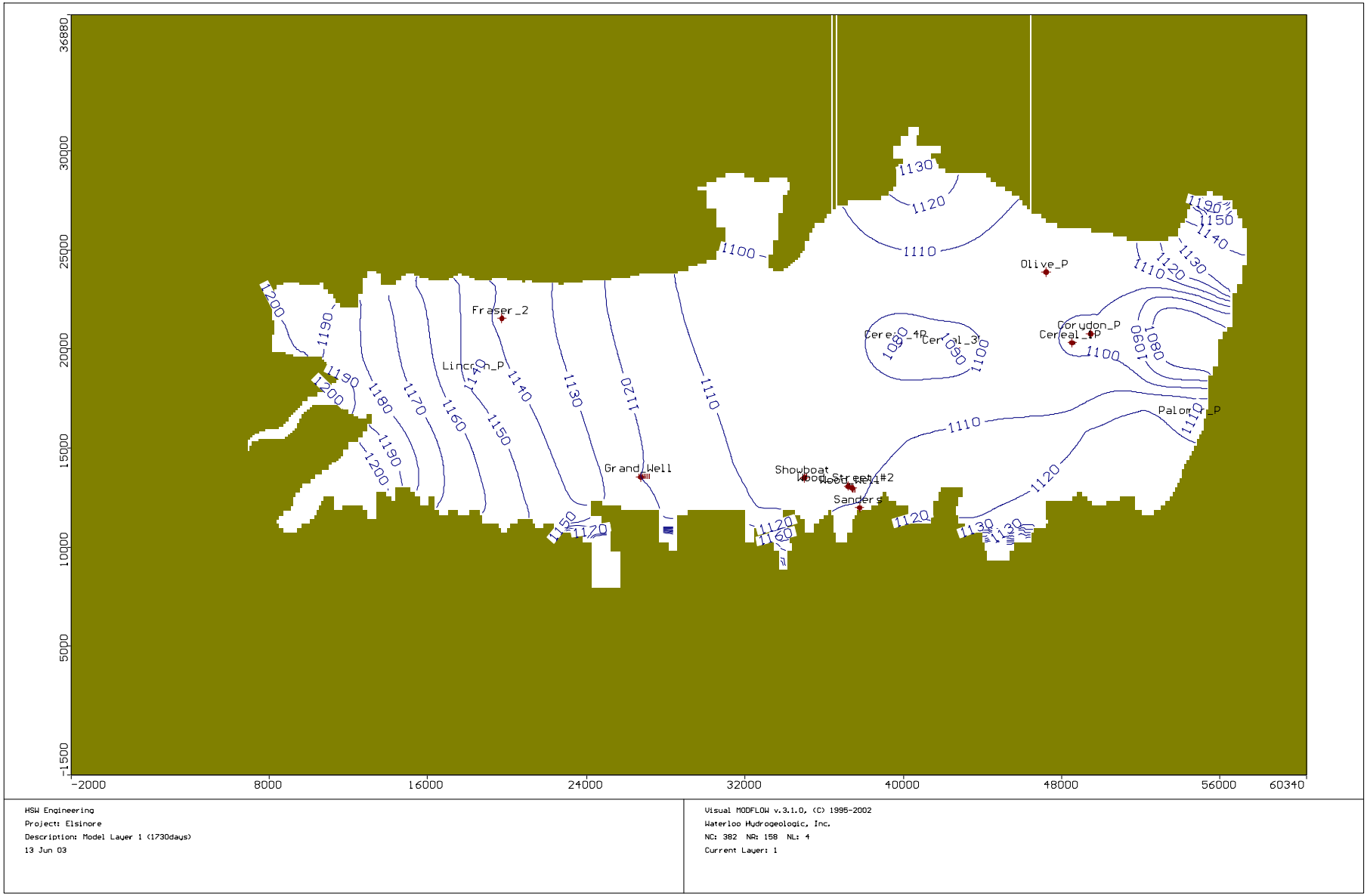
Figure E-21 - Mass Balance



MWH

Mass Balance: MODFLOW
Date: 3/23/2003

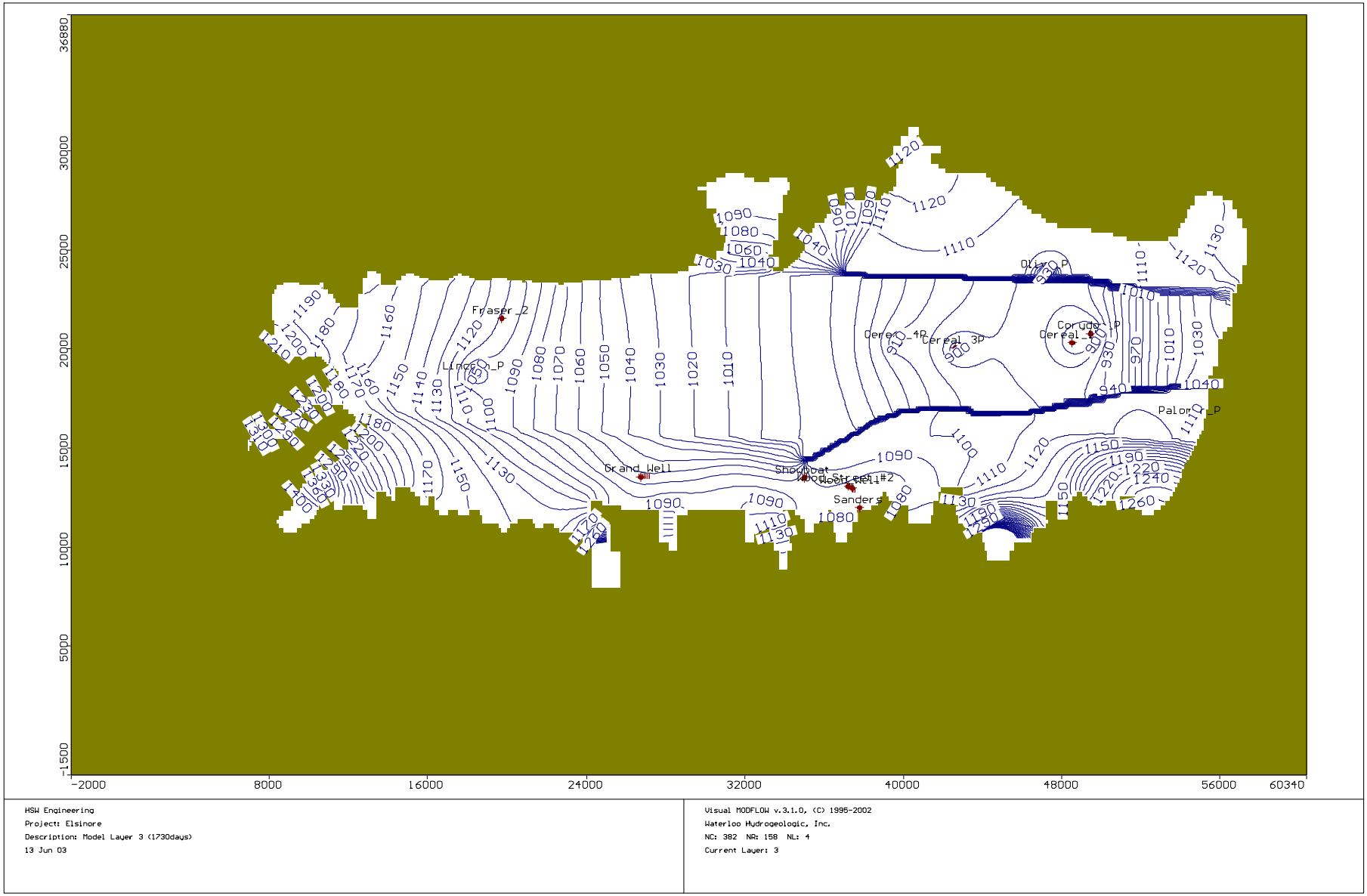
Figure E-22
Calculated Equipotentials and Flow Directions: Model Layer 1



HSW Engineering
Project: Elsinore
Description: Model Layer 1 (1730days)
13 Jun 03

Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 382 NR: 158 NL: 4
Current Layer: 1

Figure E-23
Calculated Equipotentials and Flow Directions: Model Layer 3



HSW Engineering
Project: Elsinore
Description: Model Layer 3 (1730days)
13 Jun 03

Visual MODFLOW v.3.1.0, (C) 1995-2002
Waterloo Hydrogeologic, Inc.
NC: 382 NR: 158 NL: 4
Current Layer: 3

APPENDIX F – LAKE REPLENISHMENT ANALYSIS

The following describes the methodology for determining the amount of water required to maintain the level of Lake Elsinore.

Lake Level Assumptions

The following presents the relationship between the surface area and the volume of the Lake and the lake level.

Figure F-1
Surface Area versus Lake Level

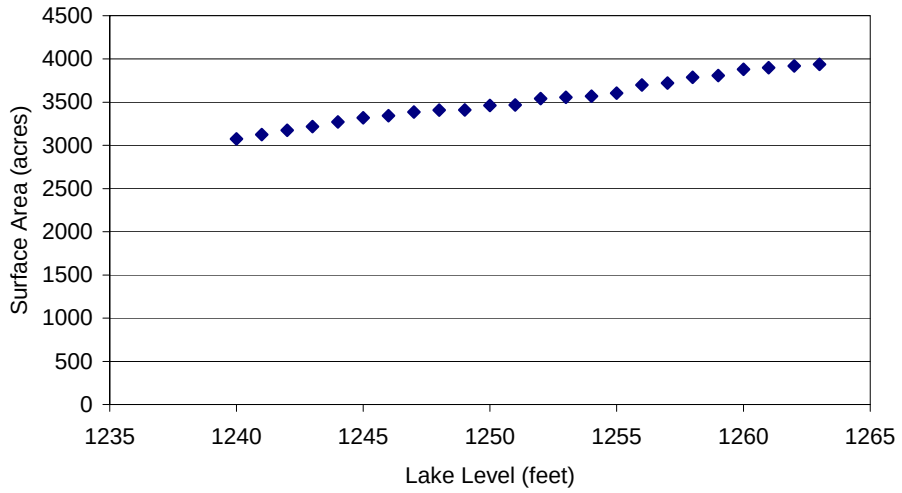
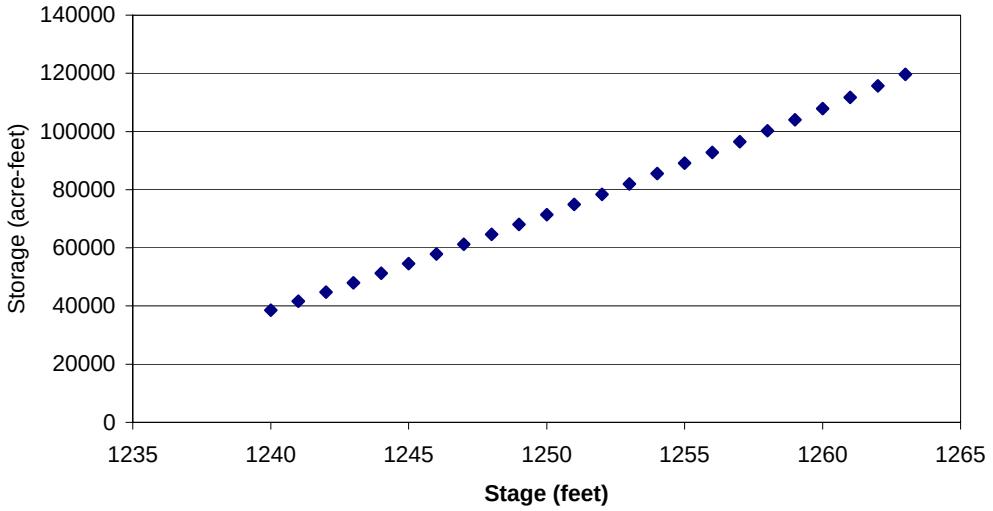


Figure F-2
Stage Storage



The lake parameters were extrapolated above 1263 feet MSL and below 1240 feet MSL.

For modeling purposes, it was assumed that the minimum average lake level was 1229 feet MSL (at which point the lake would be dry). It was also assumed that the lake would overflow to Temescal wash above a level of 1255 feet MSL and spill into the Back Basin at an elevation above 1263 MSL. For simplicity, the model does not differentiate between these overflows and simply assumes that all overflow goes to Temescal Wash.

Historical Balance and Calibration

Inflows to Lake Elsinore include precipitation directly on the lake, inflow from the San Jacinto River, runoff from the local watershed, and lake makeup. For the calibration period, no lake makeup was assumed. Outflows include evaporation and spills to Temescal Wash. The range in inflows and outflows to Lake Elsinore are provided in the following table.

Annual Lake Elsinore Balance (1961-2001)

Parameter	Units	Dry Year 1961	Wet Year 1980	Average
Inflows	AF	1,700	179,200	18,900
Outflows	AF	-15,100	-163,100	-20,000
Net	AF	-13,400	16,100	-1,100

The precipitation (in acre-ft) onto Lake Elsinore was determined by indexing the average precipitation for each time period based upon the County of Riverside isohyetal map and multiplying it by the area of the lake (based upon the previous time step).

The inflow from the San Jacinto River was calculated assuming that flows less than about 15 cfs would be infiltrated into the groundwater basin. Anything over 15 cfs would flow into Lake Elsinore.

The inflows from the remainder of the watershed were estimated using a modification of the results obtained from the San Jacinto Watershed Modeling System software (TetraTech, 2003). The watershed modeling software calculates runoff and nutrient loading from the San Jacinto watershed into Lake Elsinore for the time period from 1990 to 2001. Because the watershed modeling software did not include results prior to 1990, the runoff data calculated using the methodology described in Tech Memo No.3 was compared. In general, the calculated runoff from the runoff model was on the order of 15 percent of the calculated runoff as described in Tech Memo No. 3. This difference occurs because the calculation presented in Tech Memo No. 3 assumes that all runoff generated during a storm event makes it to Lake Elsinore. In reality, factors such as depression storage, evaporation of ponded water and shallow infiltration likely account for the difference.

Figure F-3
Summer Comparison

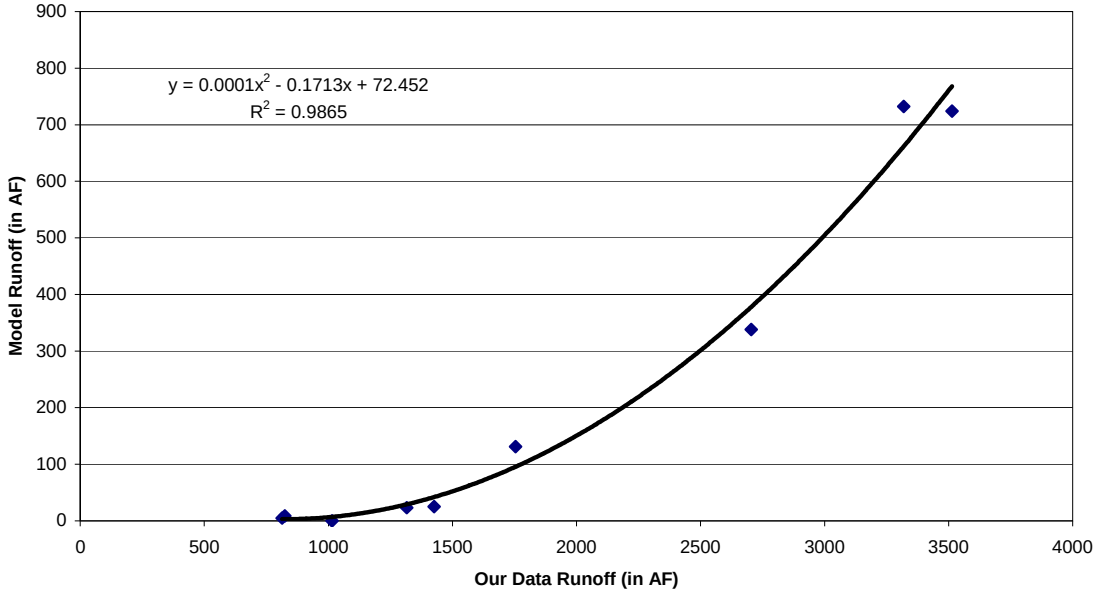
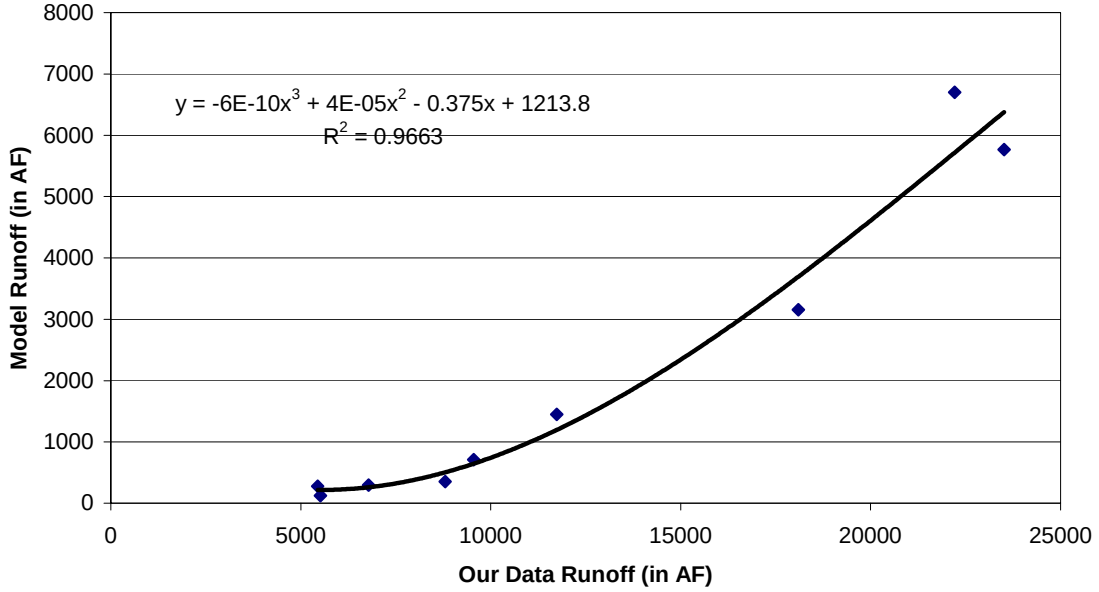


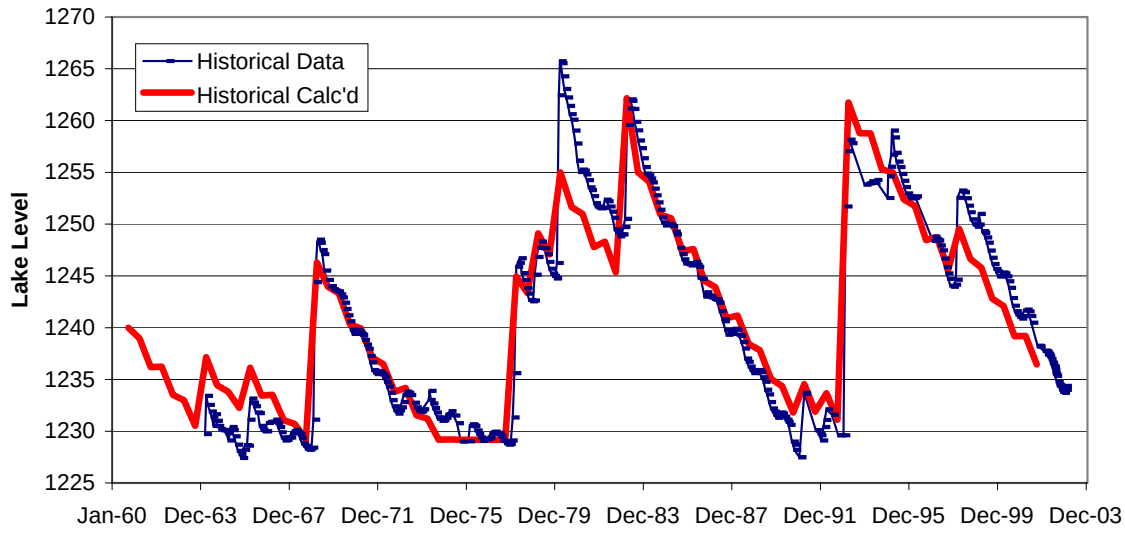
Figure F-4
Winter Comparison



Therefore, the winter and summer runoff data for the historical time period 1961 to 2001 as calculated in TM I-3 were adjusted according to the formulas described above.

Based upon the assumptions summarized above, a simple spreadsheet model was created to model the changes in lake level with historical chances in inflow and outflow. A comparison between the calculated lake level and the actual lake level is provided below.

Figure F-5
Historical Levels of Lake Elsinore



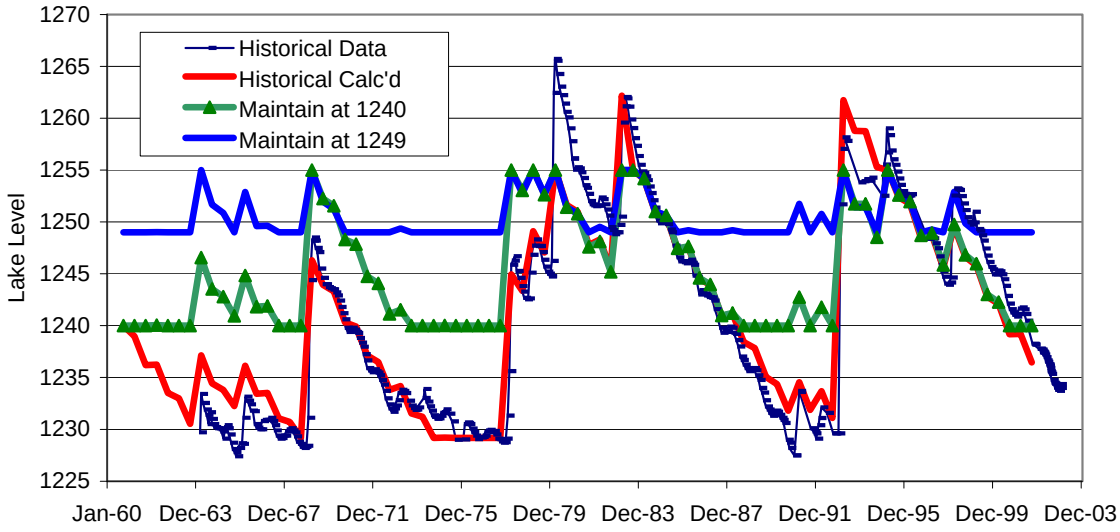
Projected Balance

Lake Levels were calculated assuming both an operating level of 1240 feet MSL and 1249 feet MSL to evaluate the volume of lake makeup water required under each scenario given historical inflows and outflows from the lake. They are described below.

Based upon our discussions with District staff, the following assumptions regarding the Lake for baseline conditions were applied:

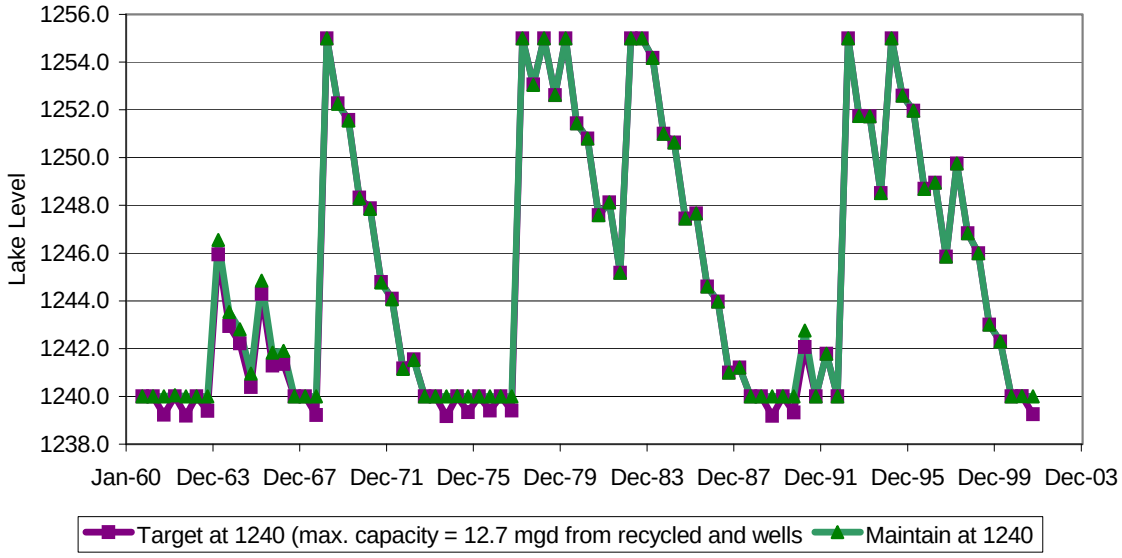
- The target lake level is 1240 feet MSL
- To maintain the lake at this level, approximately 7.5 mgd of reclaimed water would be available for lake makeup
- Once the reclaimed water supply had reached capacity, the wells could be pumped at approximately 5.2 mgd/
- No additional supplies would be available unless lake levels dropped below 1240 feet MSL for more than 2 consecutive 6 month periods

Figure F-6
Projected Levels of Lake Elsinore



The results compared to maintaining the lake at 1240 feet MSL are provided in the following figure.

Figure D-7
Levels of Lake Elsinore when maintained at 1240 feet MSL

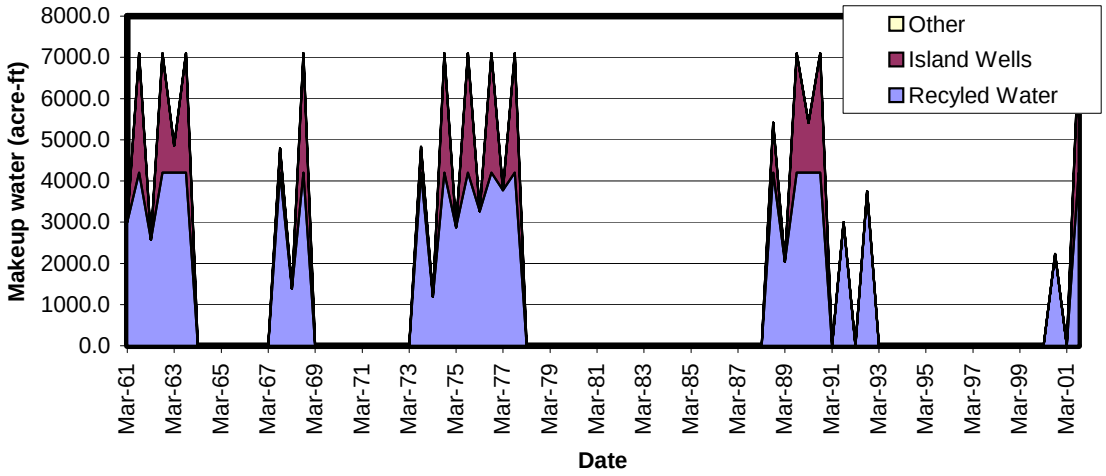


This figure indicates that projected lake levels do not drop below 1240 feet MSL in consecutive 6-month periods. . The makeup water requirements are summarized below.

Table F-1
Summary of Lake Level Maintenance

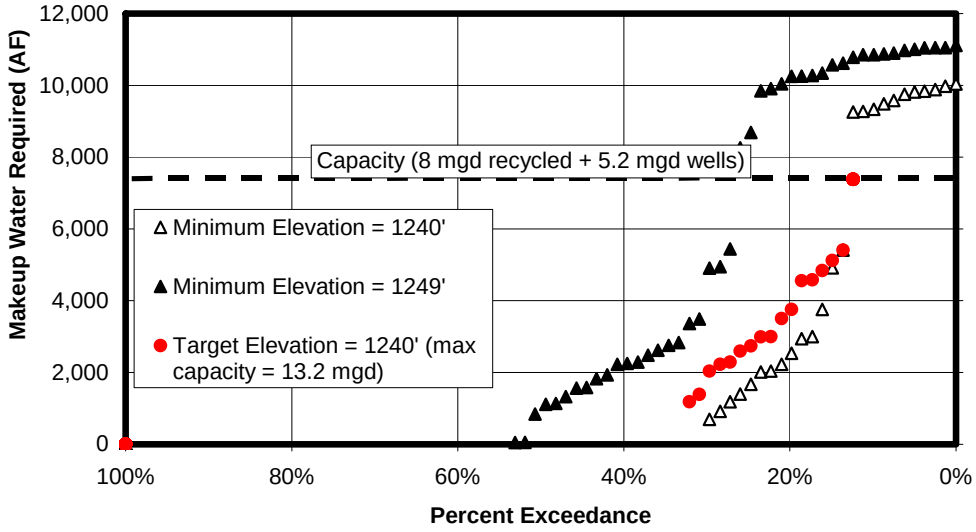
Parameter	Units	1980 Wet Year	1961 Dry Year	Average
Maintain Minimum Level = 1240'				
Inflows				
Natural Inflows	AF/yr	180,000	2,000	19,000
Lake Makeup	AF/yr	-	13,000	3,000
Total Inflows	AF/yr	**180,000**	**15,000**	**22,000**
Outflows				
Evaporation	AF/yr	23,000	14,000	15,000
Outflows to Temescal Wash	AF/yr	161,000	-	7,000
Total Outflows	AF/yr	**184,000**	**14,000**	**22,000**
Average Lake Elevation	ft MSL	1,245		
Maintain Minimum Level = 1249'				
Inflows				
Natural Inflows	AF/yr	180,000	2,000	19,000
Lake Makeup	AF/yr	-	14,000	7,000
Total Inflows	AF/yr	**180,000**	**16,000**	**26,000**
Outflows				
Evaporation	AF/yr	23,000	16,000	16,000
Outflows to Temescal Wash	AF/yr	161,000	-	10,000
Total Outflows	AF/yr	**184,000**	**16,000**	**26,000**
Average Lake Elevation	ft MSL	1,251		
Additional Calculations				
Average Lake Elevation - No Action	ft MSL	1,241		
Average Water to Temescal Wash	AF/yr	5,000		
Difference between 1249' and 1240'		**Average**		
Additional Water for Lake Makeup	AF/yr	3,400		
Additional Water to Temescal Wash	AF/yr	2,700		
% of Lake Makeup to Temescal Wash	AF/yr	80%		
Difference between 1240' and no action				
Additional Water for Lake Makeup	AF/yr	3,400		
Additional Water to Temescal Wash	AF/yr	1,800		
% of Lake Makeup to Temescal Wash	AF/yr	55%		

Figure F-8
Replenishment Requirements for Level Maintenance at 1240 feet MSL



The following shows the frequency in which lake makeup will be required. As shown in this figure, lake makeup water will be required approximately 35 percent of the time. Similarly, about 15 percent of the time, there will not be enough capacity to meet all of the lake makeup requirements and the lake level will drop below 1240 feet MSL.

Figure F-9
Semi-Annual Lake Replenishment Frequency Curve



Differences in Volume of Lake Make-Up Water Required

There are several reasons for different results between the 1997 MWH study, the 2004 CH2Mhill study, and the GWMP. These differences are described below.

The hydrologic analysis performed for the 1997 MWH study used the period of 1928 through 1991 with monthly time steps based on data developed by the U. S. Army Corps of Engineers (COE) for the Lake Management Program. MWH evaluated several alternatives for make-up water into the lake including one involving the discharge of 13 mgd of recycled water (3 mgd from the Regional Plant and 10 mgd from Eastern MWD) to the lake. This alternative was able to maintain the lake at elevation 1,240 ft msl. The modeling performed for this alternative indicated that make-up water was taken 55 percent of the months or an average inflow of 8,008 acre-ft/yr (13 mgd × 1,120 acre-ft/yr/mgd × 0.55).

The LESJWA Nutrient Removal Study prepared by CH2M-Hill used the 1928 to 2000 hydrologic period; this additional nine years included two years of very high runoff into the lake. CH2M-Hill estimated that the make-up water needed to maintain the lake elevation at 1240 ft was 13,800 acre-ft/yr (equal to evaporation at a 1,247 ft lake level less 1,400 acre-ft/yr of local runoff) in dry years. CH2M-Hill assumed that up to 7.5 mgd of recycled water from the Regional Plant and 5,000 acre-ft/yr of groundwater from the Island Wells was available for lake make-up with the remainder coming from EMWD. This evaluation computed an average make-up water need of 6,611 acre-ft/yr (see Appendix B of that report) and then adjusted that average to 8,000 acre-ft/yr presumably based on the findings of the 1997 MWH study.

The CH2M-Hill hydrologic evaluation differed from the 1997 evaluation in several ways. First, it did not include direct precipitation on the lake surface. Direct precipitation provides an average of about 3,300 acre-ft/yr of inflow to the lake when maintained at a minimum elevation of 1,240 ft msl. This would reduce the amount of make-up water required for the lake. CH2M-Hill also used unadjusted San Jacinto River flows as measured at the USGS gauge. The 1997 used the same COE data used previously by Black and Veatch for the Lake Elsinore Management Plan. This data was no longer available. For the GWMP, MWH estimated that an average of 1,300 acre-ft/yr of river water infiltrates into the groundwater basin. Since this water was included in CH2M-Hill's water balance, the make-up water to the lake would increase by this amount. If CH2M-Hill's water balance were adjusted for direct precipitation and losses to infiltration, the average make-up water needs would be reduced from 6,600 acre-ft/yr to about 4,600 acre-ft/yr.

For the GWMP, the hydrologic analysis period chosen was October 1960 through September 2001. This period was chosen because it had essentially the same local precipitation (11.96 inches) for the Lake Elsinore rain gauge as the period of January 1928 through December 2001 (11.83 inches). However, the San Jacinto River inflows to the lake as measured at the USGS gauge during the 1960-2001 period was about 27 percent wetter than the 1928-2001 period. This difference in the hydrologic periods adds about 2,900 acre-ft more inflow from the San Jacinto River and local runoff to the lake for the GWMP analysis than the 1928-2000 hydrologic period

used by CH2M-Hill. If the longer hydrologic period were used in the GWMP, this difference in local flows would increase the average amount of make-up water for Alternative 4 (the Preferred Plan) from 3,400 acre-ft/yr to about 4,500 acre-ft/yr. This value is essentially the same as the adjusted CH2M-Hill value.

MWH has assumed that the available sources of supply for lake make-up include up to 7.5 mgd of recycled water from the District's Regional Wastewater Reclamation Plant and up to 5.2 mgd of groundwater from the Island Wells for Alternatives 1 through 3. Effluent from Eastern MWD was excluded due to its anticipated availability primarily in the winter months of wet years when make-up water was less likely to be needed. The amount of District effluent was increased in Alternative 4 (the Preferred Plan) to 17.7 mgd based on projected sewer flows in 2020, the planning year for the GWMP. The average lake makeup amount was calculated in the GWMP by evaluating the lake inflows and outflows under conditions that existed over the historical time period of 1961 to 2001 and then identifying the amount of supplemental water required to maintain a lake level of 1240 MSL under those conditions.

The difference between the adjusted CH2M-Hill and the GWMP average amounts and the 1997 average of 8,000 acre-ft/yr are believed to be the result of the analytical approaches used. Both the CH2M-Hill analysis and the GWMP computed the annual volume of make-up water needed to raise the elevation at the end of the year to 1,240 ft msl. In addition to using a different set of natural inflows to the lake, the 1997 report evaluated the result of putting a fixed amount of water in the lake in each month that the elevation was below 1,240. The higher summer evaporation rates are believed to account for these differences.

In summary, there are differences between the various studies, mostly the result of different hydrologic analysis periods. The most significant difference between the GWMP and the CH2M-Hill report is emphasis on reducing groundwater pumping to a bare minimum. MWH will add a discussion of these difference in the Final GWMP.

Local Runoff

The District agrees that before additional runoff is captured for surface spreading, an analysis should be performed to determine the effect of capturing the runoff on lake levels. In fact, such an analysis was performed for those GWMP alternatives that considered spreading of local runoff. However, surface spreading is not included in the recommended alternative due to its high cost and relatively low benefit in terms of groundwater yield. Therefore, it is not part of the proposed GWMP program.

Compliance with Nutrient TMDL of Recycled Water for Lake Replenishment

The GWMP includes recycled water as a component of the lake makeup water and appreciates the support provided by the City. As the City is aware, a separate EIR is being prepared by LESJWA to address the potential effects of recycled water use for lake make-up. The District envisions that that document will support the District's NPDES permit for discharge of Regional Plant effluent to Lake Elsinore. The LESJWA EIR, for which the LESJWA Nutrient Removal

Study, MWH's review of that study, MWH's Feasibility Study, and LESJWA's proposed subsurface in-lake aeration system are now the project description, evaluates the proposed nutrient TMDL requirements by the Santa Ana Regional Water Quality Control Board, existing effluent nutrient concentrations and loading requirements, nutrient removal approaches at the Regional Plant, and potential nutrient offsets. Conclusions of the Regional Board's Technical Report and other studies are also considered in the EIR.

The District has long held that the addition of recycled water to Lake Elsinore is an environmental enhancement measure. As the City is aware from recent LESJWA TAC meetings, the Regional Board's target nutrient concentrations and loadings for supplemental water to Lake Elsinore under the TMDL process have not been adopted. The Regional Plant NPDES permit was adopted on March 4, 2005. The District is committed to meeting the permit requirements through a combination of effluent treatment, offsets through the lake aeration, and others if appropriate.

Higher Use and Replacement of Groundwater with Recycled Water

The District agrees that the environmental enhancement of a natural lake with groundwater is on a par with most other uses of groundwater and the wide range of domestic water uses. As a water supplier, the District is keenly aware that water is a scarce resource in southern California that needs to be managed for its highest and best uses. This is reflected in the District's conservation programs, ongoing and in the GWMP, to reduce domestic water use.

With the rapidly-occurring development in the District's service area, most of which is within and approved by the City, the District's first supply priority must be provision of water for drinking and other domestic uses. Therefore, the GWMP includes an aggressive water conservation program that includes: residential plumbing retrofits, water system and water use audits, leak detection and repair, financial incentives for large landscape irrigation, promotion of low water use landscaping, promotion of high-efficiency appliances, a ULF toilet replacement program, public information programs to increase water awareness, use of recycled water for landscape irrigation and other non-potable uses, school education programs, implementation of commercial, industrial, and institutional water conservation programs, assignment of a water conservation coordinator, and development and enforcement of prohibitions on water wasting,

Over time, as effluent supplies increase along with development, the District anticipates that sufficient recycled water would be available for landscape irrigation and other non-potable uses as well as lake supplementation with only minimal or occasional use of well water from a basin already experiencing falling water levels.

The City must realize that continued overdraft of the Elsinore Basin is not an acceptable situation, regardless of the use of the groundwater. Even without any pumping of the Island Wells, pumping from the basin appears to be approximately double the basin's natural recharge. Adding 5,000 acre-ft/yr of Island Well pumping will significantly add to that deficit. Beside recycled water, the only other water source that can offset this overdraft is imported water. Whether imported water is used to replenish the basin, or to offset pumping, the effect and the

costs are essentially the same. In an overdrafted basin, any increased pumping for lake replenishment is the equivalent of purchasing imported water. The District recognizes that the current recycled water supply is not adequate to maintain the lake levels long term, and that some temporary groundwater pumping is needed. However, this must be considered an interim or occasional solution, as it will only add to basin overdraft.

Advisory Committee

The District agrees that the Advisory Committee should be made up of stakeholders in the Elsinore Basin. The District Board of Directors will decide the committee's composition at the time of its formation.

Table G-1
Summary of Potential Water Quality Issues

No.	Potential Management Issue	Assessment Summary	Recommendation
	Identified under AB3030		
1	The control of saline water intrusion	• Not an issue due to the location of the basin	• Not to be addressed
2	Identification and management of wellhead protection areas and recharge areas	• Wellhead protection plan completed for EVMWD's production wells only. • No assessment made for remaining 200+ wells	• Conduct a well canvass (house by house survey) • Expand Well Head Protection Plan • Identify potential contamination paths
3	Regulation of the migration of contaminated groundwater	• No contamination recorded by RWQCB	• Conduct an EDR (environmental data regulation) search • Implement a contamination prevention plan
4	Identification of well construction policies	• The EVWMD wells are constructed in compliance with the DWR Guidelines • The construction policies used for the remaining 200+ wells is unknown	• Include the evaluation of construction methods used in the well canvas • Implement procedures for well construction from this point
5	Administration of a well abandonment and well destruction program	• The basin contains many wells that have an unknown status. • Improper well abandonment is present in the basin	• Include the evaluation of well status and type of abandonment in the well canvas • Implement a Well Abandonment Program
6	The construction and operation of: • Contamination cleanup projects • Storage projects • Recharge projects • Extraction projects • Conservation projects • Water recycling projects	• No current contamination recorded by RWQCB • Strategies are developed for storage, recharge and extraction projects • Conservation can result in reduced return flows • Recycling water is used for lake level maintenance	• Develop Strategies for Basin Storage, Recharge, and Extraction • Evaluate Strategies with groundwater model and cost-benefit analysis. • Evaluate Water Conservation Potential and Impact
7	Activities listed in land use plans which create a risk of groundwater contamination	• Sensitive development areas are the southern part of the Basin and the Canyons where water infiltrates to the basin • The remainder of the basin is protected from contamination by fingering clay layers	• Implement procedures to prevent groundwater pollution from new developments
	Identified for Existing Basin Conditions		
8	Meeting drinking water quality regulations for EVMWD's potable wells	• Water quality information is not available on a consistent basis throughout the basin • Natural occurring Arsenic exists (primarily in the Cereal Wells) • Contamination by bacteria exists in the Olive Street Well (possibly due to septic tanks).	• Develop and implement a water quality monitoring plan • Evaluate the location of the natural occurring Arsenic in more detail to determine actions required
	Identified for Future Basin Conditions		
9	Water quality of imported may not comply with Basin Plan Objectives when injected	• Imported water quality from Skinner (Auld Valley) and Mills (TVP) connection fluctuate, which may lead to exceeding of the Basin Plan Objectives for TDS, Sulfate, and Chloride • Increasing salt concentration as a result of long-term injection • The injectability of Mills water is unknown as the use of this water has not been tested a pilot study	• Compliance with Basin Objective: Action TBD • Perform water quality analysis of the compatibility of Mills water and groundwater • Conduct a pilot test for injecting Mills water when this is part of the recommended strategy.

Table G-2
Summary of Potential Water Quantity Issues

No.	Potential Management Issue	Assessment	Recommendation/Action
	Identified under AB3030		
10	Mitigation of conditions of overdraft	• No groundwater level information was available for the EWD Wells • Declining groundwater levels in the southern part of the Basin.	• Gather water level data from EWD • Declining Levels Back Basin: To be determined in this GWMP
11	Replenishment of groundwater extracted by water producers	• Groundwater is not replenished in the back basin as levels are declining • Groundwater is replenished in the area north of the lake as levels are stable	• Declining Levels the southern part of the basin: To be determined in this GWMP • Maintain levels in the area north of the lake • Include basin level maintenance as an objective in the management strategies
12	Monitoring of groundwater production, levels, and storage.	• Groundwater production is monitored recorded on a regular basis by EVMWD and EWD only • Water levels and production records for remaining 200+ wells are reported inconsistently or not available. • Water level information at production wells has a poor reliability due to unknown stabilization time of production wells	• Include the evaluation of well status, water use, and production recording method in the well canvas • Determine number of active wells in the basin • Develop a monitoring program for water production and water level measurements • Implement a production recording system with the basin pumpers • Measure water levels at non-production wells
13	Facilitating conjunctive use operations	• This is the purpose of the GWMP (not a management issue)	• Evaluate various conjunctive use strategies
	Identified for Existing Basin Conditions		
14	A doubling of water demands in 20 years leads to a water supply shortfall	• Water Demands are projected to exceed the supplies in Year 2011 • Additional water supplies are required • The use of available reclaimed water for water conservation is limited due to the need of lake level replenishment with reclaimed water	• Promote water conservation • Implement conjuctive use operations • Identify additional new sources of supply • Evaluate the cost-effectiveness of using untreated imported water through the Canyon Lake Spills for surface recharge
15	Increasing dependence on imported water supplies	• Imported water will be 80 percent of the water supply in 2020 • Decreasing water supply reliability • Cost of imported water are estimated to be higher than implementing conjunctive use	• Develop strategies that increase water supply reliability • Implement conjunctive use operations
16	Groundwater is required for lake replenishment	• It is uncertain whether reclaimed water is acceptable for replenishment • The need for lake replenishment water from the basin increases when runoff water is used for surface recharge	• Include the groundwater needs for lake replenishment in the strategy evaluation • Evaluate the cost-effectiveness of increasing the use of untreated imported through the Canyon Lake Spill for lake replenishment
17	Reduced groundwater recharge as a result of increasing urbanization	• Urbanization potential in the basin area is limited due to topography and flood plain • Reduced recharge does not negatively impact the basin storage as the runoff will reach the lake, reducing the need for level maintenance water from the basin	• Not to be addressed
	Identified for Future Basin Conditions		
18	Impact of groundwater management activities on hotspring wells	• Not anticipated to be an issue as the hotspring wells are located north of the Glen Ivy Fault (north of the basin)	• No action
19	Groundwater storage may lead to a groundwater outflow.	• Groundwater outflows at the southeastern end of the basin may occur if groundwater levels will rise above the saddle height.	• Evaluate potential of groundwater outflows with groundwater model. • Prevent outflows by adjusting water storage levels

Table G-3
Summary of Other Potential Management Issues

No.	Potential Management Issue	Assessment	Recommendation/Action
	Identified under AB3030		
20	Development of relationships with State and Federal Regulatory Agencies	• The District is evaluating the benefit of including Regulatory Agencies in the Stakeholders Process	• Pending and further recommendations follow in this GWMP
	Identified for Existing Basin Conditions		
21	Limited information on recharge characteristics	• The "Sedco Cone" location is unknown • Recharge capacities in the canyons are unknown	• Evaluate the "Sedco Cone' location with the groundwater model • Conduct pilot testing for recharge locations in preferred strategy
	Identified for Future Basin Conditions		
22	Risk of subsidence	• Decreasing groundwater levels as a result of ASR operations may lead to subsidence when clay layers are dewatered • The basin's storage capacity will decrease as a result of subsidence.	• Include surface level measurements in the monitoring program • Determine the water level operating range conservatively. • Evaluate the subsidence potential for the preferred alternative.
23	Risk of liquefaction	• Liquefaction may occur in perched areas due to increased groundwater levels in combination of an earthquake. • Potential areas for liquefaction are located in the northern portion of the back basin	• Conduct Cone Penetrometer Testing (CPT) in the back basin area to determine the potential of liquefaction.

APPENDIX H– DETAILS ON WATER CONSERVATION PROGRAMS

Low Water Use Landscaping

Low water use landscaping can be created by adhering to the following key principals:

- Plan and design comprehensively with the consideration of aesthetics, soil type, sloping, intended land use, and native plants.
- Evaluate soil for plant selection and improve if necessary with amendments, such as, spaghnum peat moss or compost to improve root development, water penetration and retention.
- Select the size and location of turf areas based on the purpose and function in the landscape. A reduction of turf areas, and locating them separately, can result in significant reductions in water use due to more efficient watering.
- Use appropriate plants and group according to their water needs and a focus on varieties that have low water needs.
- Water efficiently with properly designed irrigation systems.
- Use organic mulches to reduce evaporation and weed growth, slow erosion, and help prevent soil temperature fluctuations.
- Practice appropriate maintenance: proper pruning, weeding and fertilization, plus attention to the irrigation system, will preserve and enhance the quality of the low water use landscaping.

Water Conservation Program of LADWP

The following strategies for implementing water conservation in households are recommended by the Los Angeles Department of Water and Power (LADWP):

- Check for household leaks
- Displace water in toilet tank or buy an ultra-low-flush toilet
- Water saving shower heads, and take shorter showers
- Turn off the water while brushing teeth, shaving, cleaning vegetables, washing dishes, or washing your car.
- Use appliances such as dishwater and washing machine only when full
- Water lawns deeply and less frequently, early in the morning or late in the evening. Change watering frequency based on season and time of day.
- Use a broom instead of a hose.

The ten recommended steps to conserving water for businesses are:

1. Start with a desire to eliminate waste
2. Appoint a Conservation Manager
3. Determine where your water is used
4. Check your system for leaks
5. Set a conservation goal

6. Apply common sense
7. Involve your employees
8. Install low flow devices
9. Be aware of water efficient equipment
10. Monitor your results

Examples of Rebate Programs

Based on an evaluation of rebate programs of other agencies, including LADWP and MWD, rebates commonly offered are:

- A $150 rebate for residential customers who purchase qualifying high efficiency clothes washers.
- A $250 rebate for commercial customers who purchase qualifying high efficiency clothes washers.
- A $100 for residential customers who replace a toilet in a single family residence and a $75 rebate for each toilet replaced in a multi-family residence.
- A $50 rebate for commercial customers who purchase pre-rinse kitchen sprayers.

In addition, MWD will pay as much as $154 for every acre-foot of water that is saved from industrial process changes done to increase water efficiency. MWD will provide payment for up to five years as long as the process change is expected to save at least 10 acre-feet of water per year (MWD, 2003).

Implementation of Rebate Programs

Implementing a financial incentives program for water conservation would involve the following tasks:

1. Acquiring funds
2. Informing the community about the available rebates and benefits
3. Carrying out the rebate program
4. Tracking participation rates to evaluate the effectiveness of the programs

There are existing programs in California already in place to provide assistance to agencies in both of these capacities. For example, MWD's Innovative Conservation Program portion is designed to provide grants to explore the water savings potential and practicality of new water conserving technologies. Similarly, the Bureau of Reclamation has the Water Conservation Field Services Program (WCFSP) to assist water agencies in developing and implementing effective water management and conservation plans. One of the WCFSP's areas of emphasis is conservation education, and this program could be particularly useful in formulating an outreach effort to accomplish Task 2 above.

Appendix I
Cost Estimate

Table I-1
Cost of Surface Spreading Basins

Location	Size (acres)	Net cut (CY)	Rock Excavation (CY)	Landscaping (ft2)	Construction Cost	Capital Cost
McVicker Canyon	6	83,000	8,300	27,000	$ 1,189,000	$ 1,940,000
Leach Canyon Bottom	14	165,000	16,500	61,000	$ 2,371,000	$ 3,860,000
Leach Canyon Top	11	95,000	9,500	48,000	$ 1,378,000	$ 2,240,000

Appendix J
Model Results

Figure J-1
Baseline B Groundwater Results

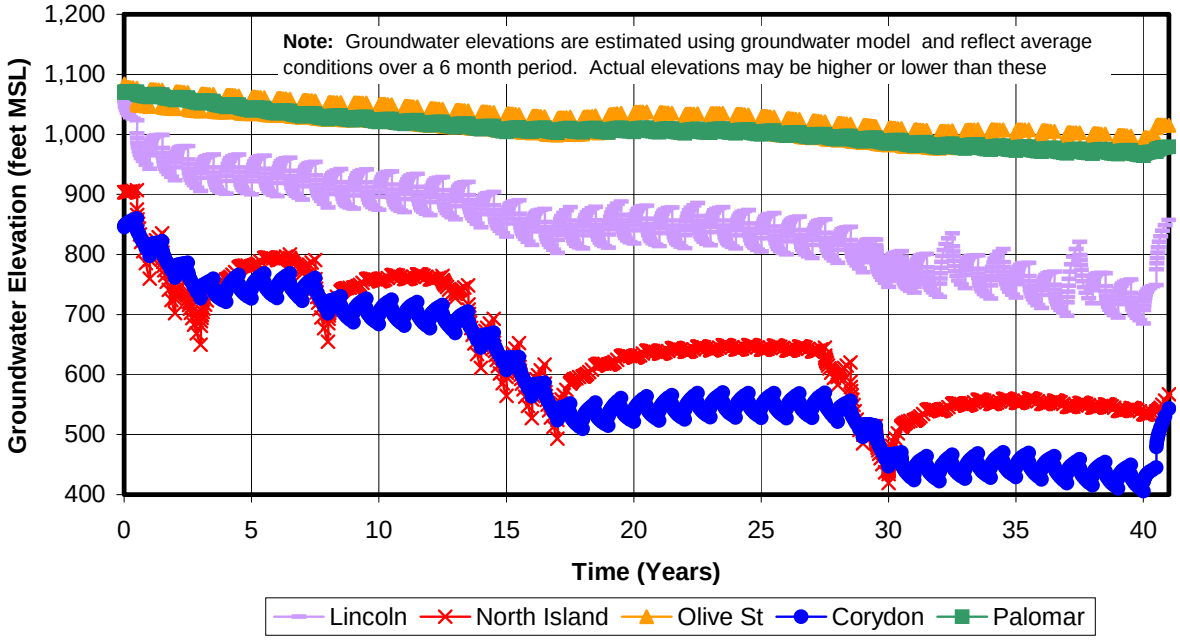


Figure J-2
Alternative 1 Groundwater Results

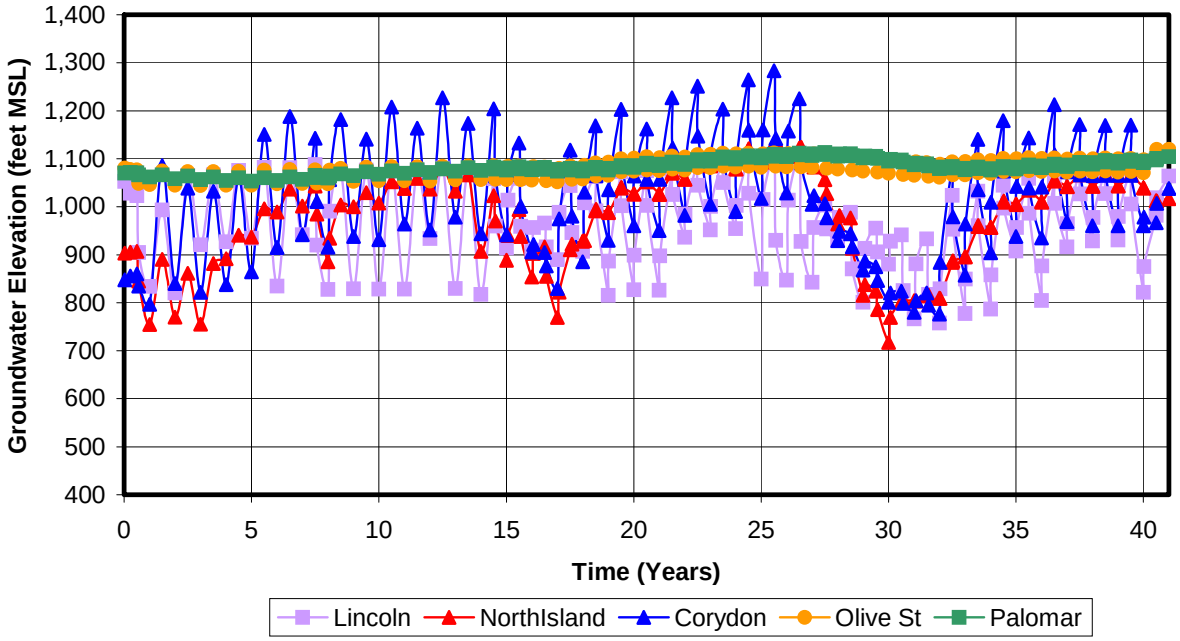


Figure J-3
Alternative 2 Groundwater Results

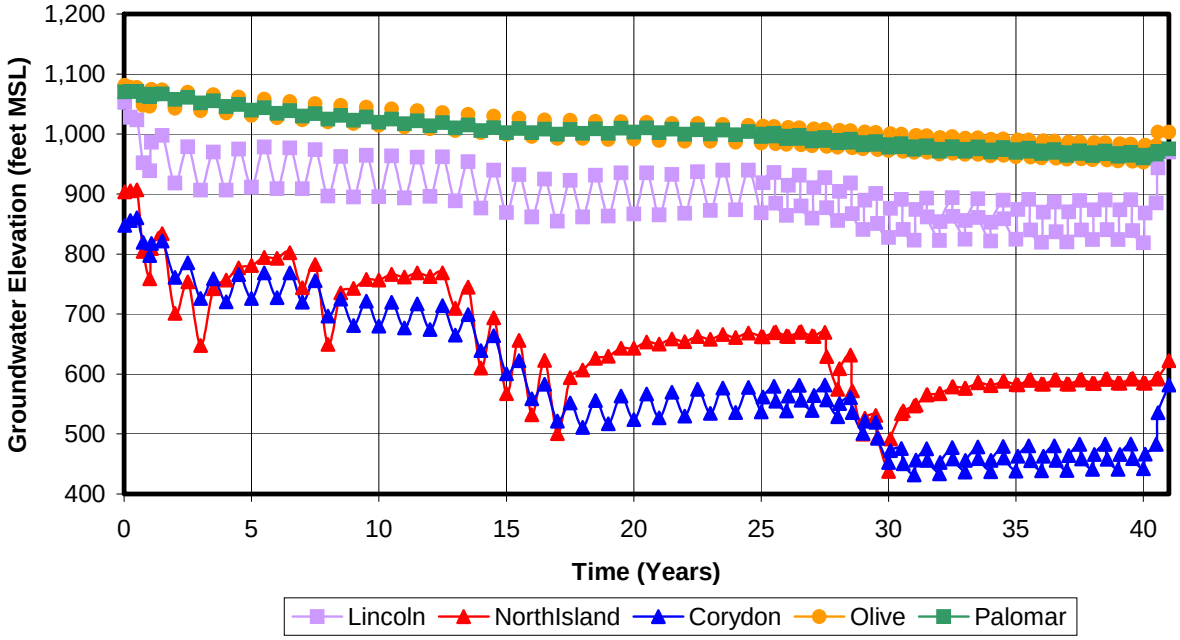


Figure J-4
Alternative 3 Groundwater Results

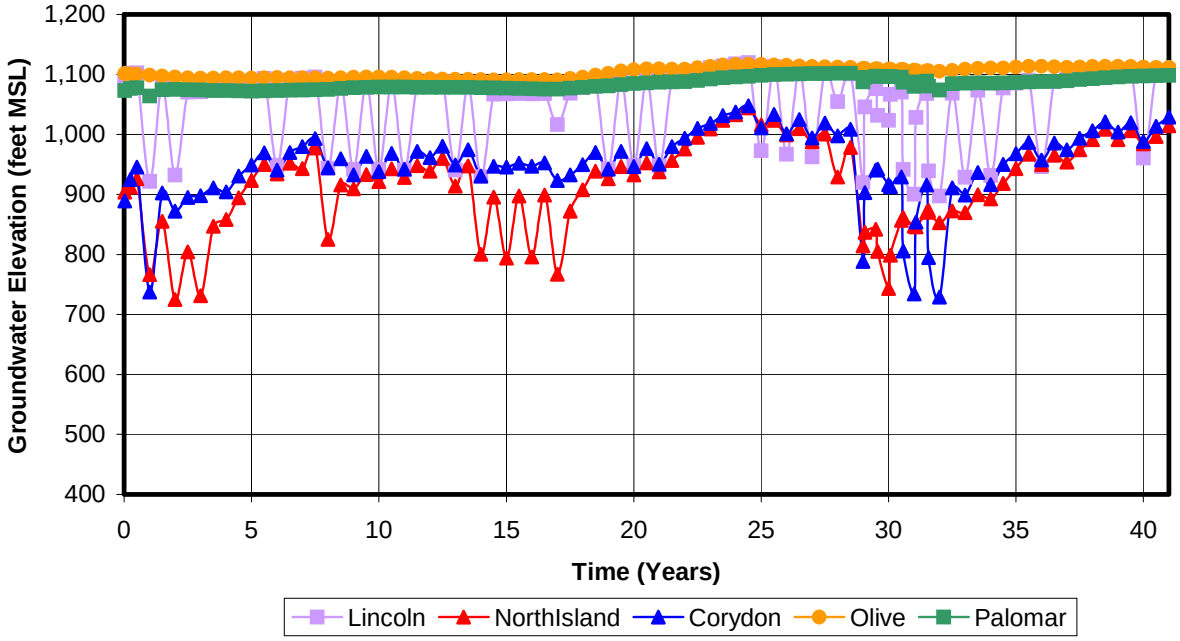
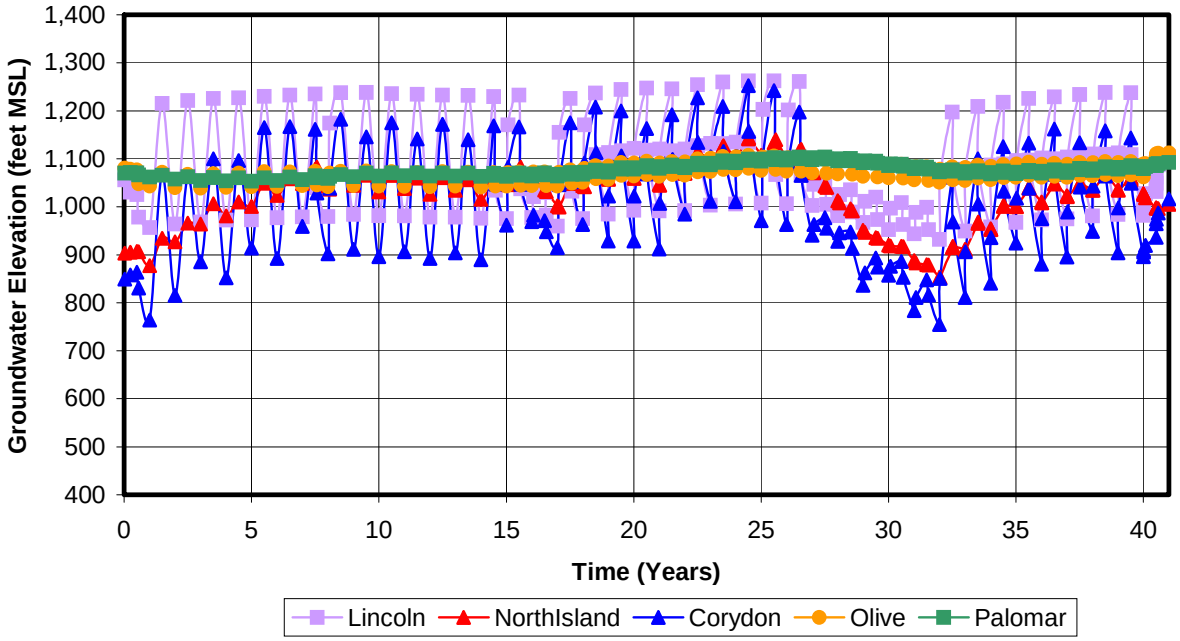


Figure J-5
Alternative 4 Groundwater Results



Appendix K
Groundwater Monitoring Plan

INTRODUCTION

The following report provides the framework for the groundwater monitoring plan for the Elsinore Basin. This report includes a summary of the:

- hydrogeologic setting
- current groundwater monitoring program
- data assessment and
- recommendations for future monitoring in the basin

The activities presented herein will be used in the development of the Groundwater Management Plan for the Elsinore Basin.

Purpose of the Monitoring Program

The primary objective of the monitoring program is to guide the collection of groundwater information in the Elsinore Basin. This task includes an inventory of existing wells within the Basin to determine suitability for use as monitoring points. The monitoring plan will identify existing and new wells to be used to monitor groundwater conditions beneath and adjacent to the proposed groundwater recharge and injection facilities. Recommendations will be made regarding the additional data to be collected and the frequency of monitoring.

This plan also describes the current groundwater monitoring activities in the basin and identifies additional data that are needed to evaluate the groundwater conditions in the basin. The purpose of the data collection is to compile information to:

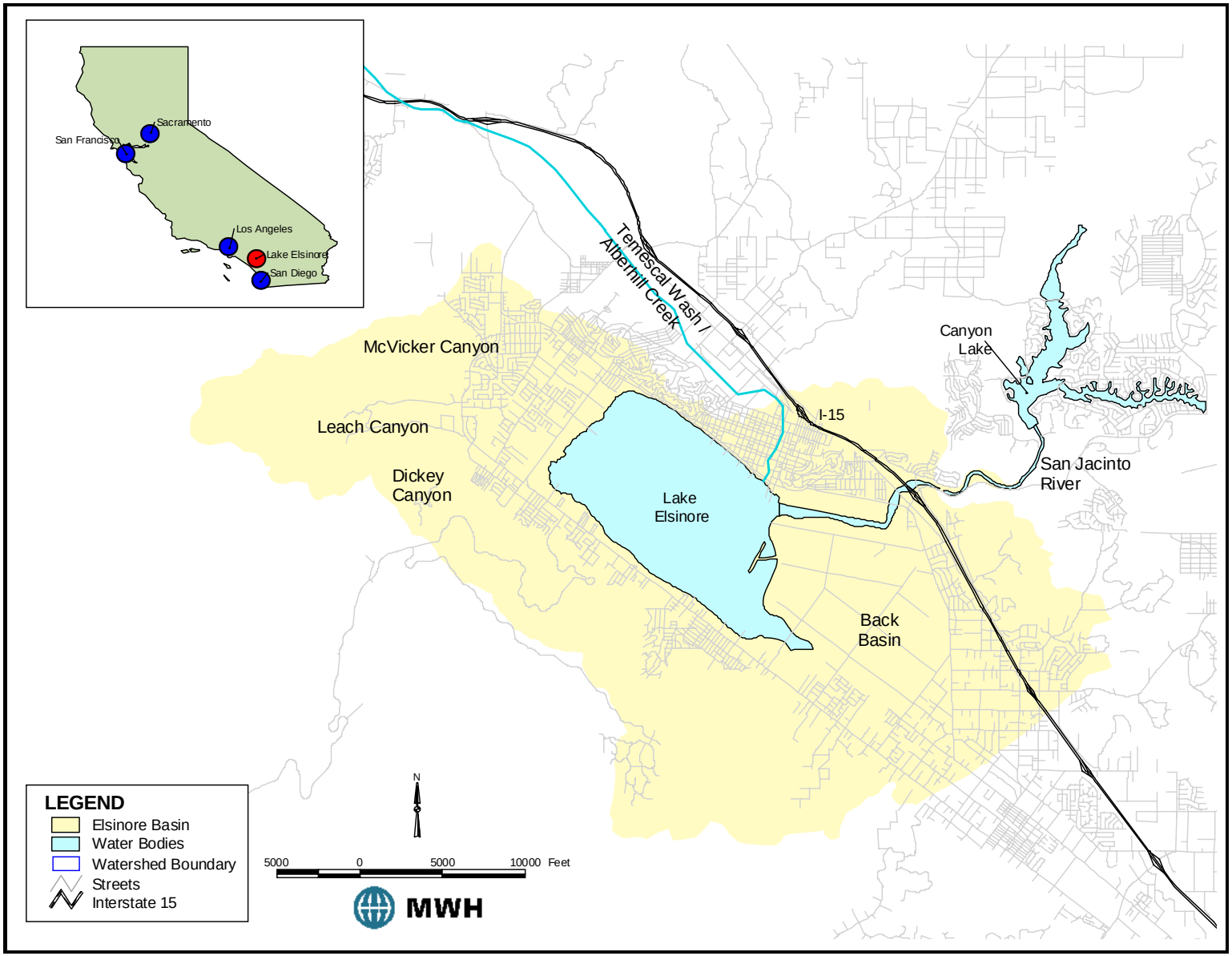
- characterize existing and future vertical and horizontal groundwater flow conditions throughout the basin
- evaluate the influence of faulting on groundwater flow particularly in the area of Leach and McVicker Canyons, which recharge groundwater northeast of Lake Elsinore
- identify and evaluate vertical and horizontal variations in water quality particularly with respect to constituents of concern (TDS, sulfate, nitrate and arsenic)
- quantify sources of groundwater recharge to the basin particularly in the area of Leach and McVicker Canyon and
- provide the framework for evaluating future groundwater management actions in the basin

The remainder of this section describes the area of interest and existing conditions within the Elsinore Basin.

Area of Interest

The area of interest for the monitoring program is the Elsinore Basin as shown in **Figure 1**. The surface drainage area shown on this figure includes approximately 42 square miles, of which

Figure 1
Study Area



about 25 square miles are located within the basin floor and Lake Elsinore. The remaining portions of the Elsinore Basin include the surrounding highlands and associated streams and canyons. In general, the surface water in the study area drains toward Lake Elsinore. Major surface water canyons and rivers include McVicker, Leach and Dickey Canyons along the western margin of Lake Elsinore and the San Jacinto River from the north and east. During periods of high lake levels, water in Lake Elsinore flows into the lake outlet channel, which discharges to Temescal Wash. The area southeast of the lake, referred to as the Back Basin, is part of the flood plain for Lake Elsinore and the San Jacinto River. The boundary of the groundwater basin is approximately coincident with the surface drainage boundary shown on **Figure 1**.

EXISTING CONDITIONS IN THE BASIN

Hydrogeologic Setting

The following provides a brief description of the hydrogeologic setting for the Elsinore Basin. A complete description of the hydrogeology is provided in the Groundwater Management Plan (MWH, 2003). This information provides the framework for the development of the monitoring program. **Figure 2** shows the general hydrostratigraphy of the Elsinore Basin.

The principal water-bearing units in the Elsinore Basin from top to bottom are the Recent and Older alluvium (referred to as “alluvium” throughout this memorandum) and the Fernando Group. Although some wells are screened in the Bedford Canyon Formation, this formation does not generally yield high-producing wells.

The Elsinore Basin is dominated by the Elsinore graben, a downdropped block between the Glen Ivy fault zone and the Wildomar fault zone located to the north and south of Lake Elsinore, respectively. Major faults zones in the Elsinore Basin include the Glen Ivy fault zone, which includes the Glen Ivy fault, the Freeway fault and the Sedco fault, and the Wildomar fault zone, which includes the Wildomar fault, the Rome Hill fault, and the Willard fault. These faults are shown on **Figure 3**.

Other faults identified by DWR (1981), which subdivided the Elsinore Basin into additional hydrogeologic compartments, appear to be limited to the basement rocks and do not appear to provide barriers or restriction to groundwater flow.

Groundwater Levels

An evaluation of current groundwater levels is important to understanding the behavior of the groundwater basin. Recent groundwater data from wells other than those owned by EVMWD is limited. Therefore, most of the groundwater level data available comes from wells that are located between the Glen Ivy fault and the Wildomar fault (see Figure 3) in the Back Basin and in the area northwest of Lake Elsinore.

Figure 2
Hydrostratigraphy in the Elsinore Basin

Formation	Symbol	Graphic	Description
Recent Alluvium	Qal		Interfingering sands and clays
			Perched groundwater conditions present
Older Alluvium	Qt		Interfingering sands and clays
			Slightly more consolidated than above
Fernando Group	TQf		Poorly sorted, subangular granitic sands, cobbles, and boulders
			Most produced groundwater comes from this zone
Bedford Canyon Formation	bcb		Blue to black slate and sandstone
			Relatively low groundwater production rates in this zone
Undifferentiated Basement	bct		Granitic basement rocks
			Limited groundwater production except in fractures

A detailed discussion of the groundwater conditions within the basin is provided in the Groundwater Management Plan. A groundwater contour map for the Fernando Group, the principal water-producing aquifer, is shown in **Figure 4**. As shown in this figure, groundwater generally flows from the northwest to the southeast across the basin and the gradient appears to steepen toward the Corydon Street well as a result of pumping within the Back Basin. In the summer of 2002, the groundwater elevation in the Olive Street well, which is on the upthrown side of the Glen Ivy fault, is 1,156 feet above MSL, more than 400 feet higher than water levels in the Corydon Street well about a mile away. This suggests that the Glen Ivy fault provides a barrier to groundwater flow. However, observed offsets in the bedrock associated with Glen Ivy fault may also cause fluctuations in water level.

Figure 5 shows groundwater levels for wells that penetrate the alluvium. Because there are few wells screened exclusively in the alluvium, it is not possible to generate a contour map with existing data. Water levels in monitoring wells MW-1 and MW-2, which have piezometers screened exclusively in the Lower alluvium, are about 100 to 150 feet higher than wells (e.g. Cereal-1 and Cereal-3) that are also screened in the Fernando Group. This appears to suggest a hydrogeologic separation between the alluvium and the underlying Fernando Group.

Figure 3
Faults of the Elsinore Basin

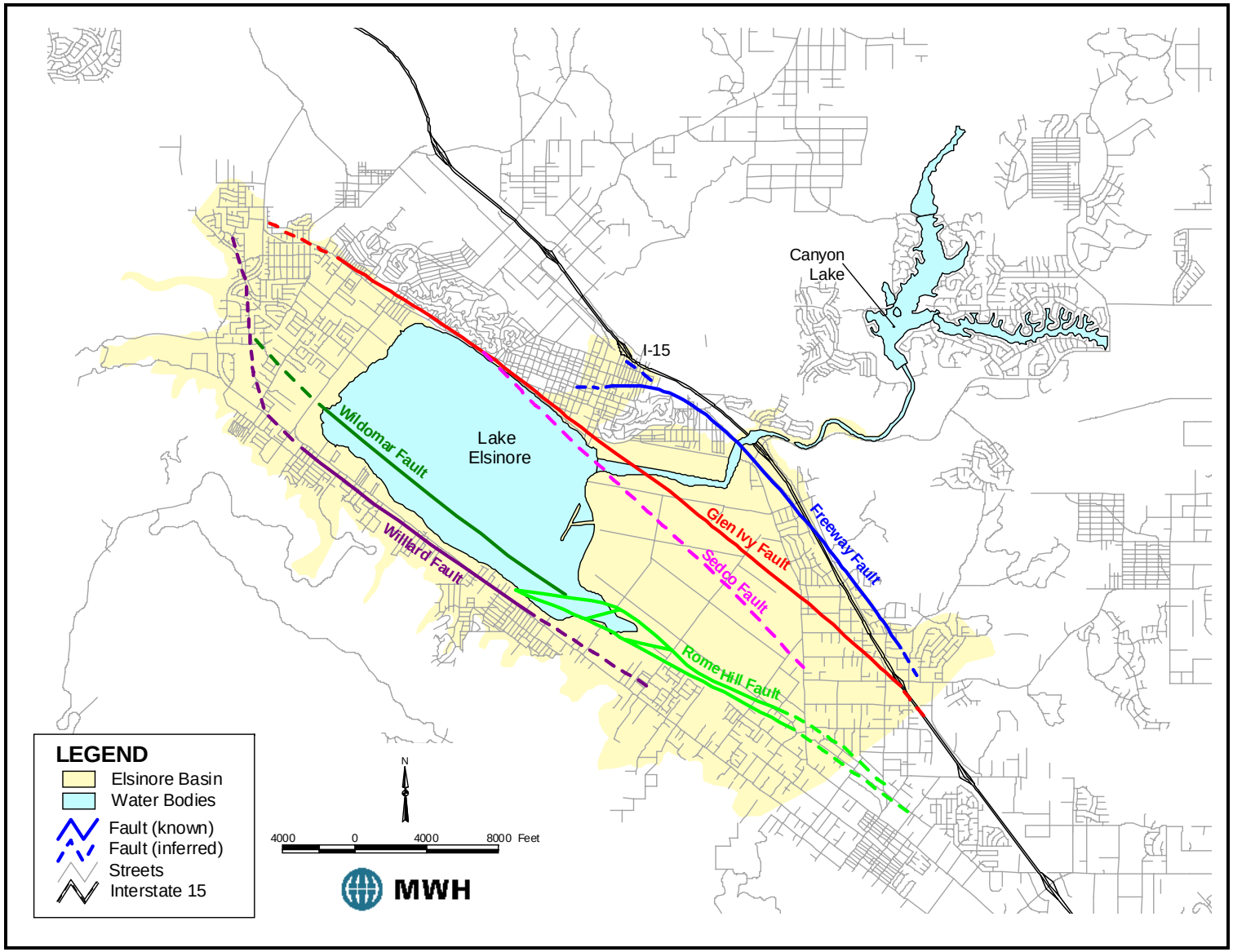


Figure 4
Groundwater Contour Map of the Fernando Group (Summer 2002)

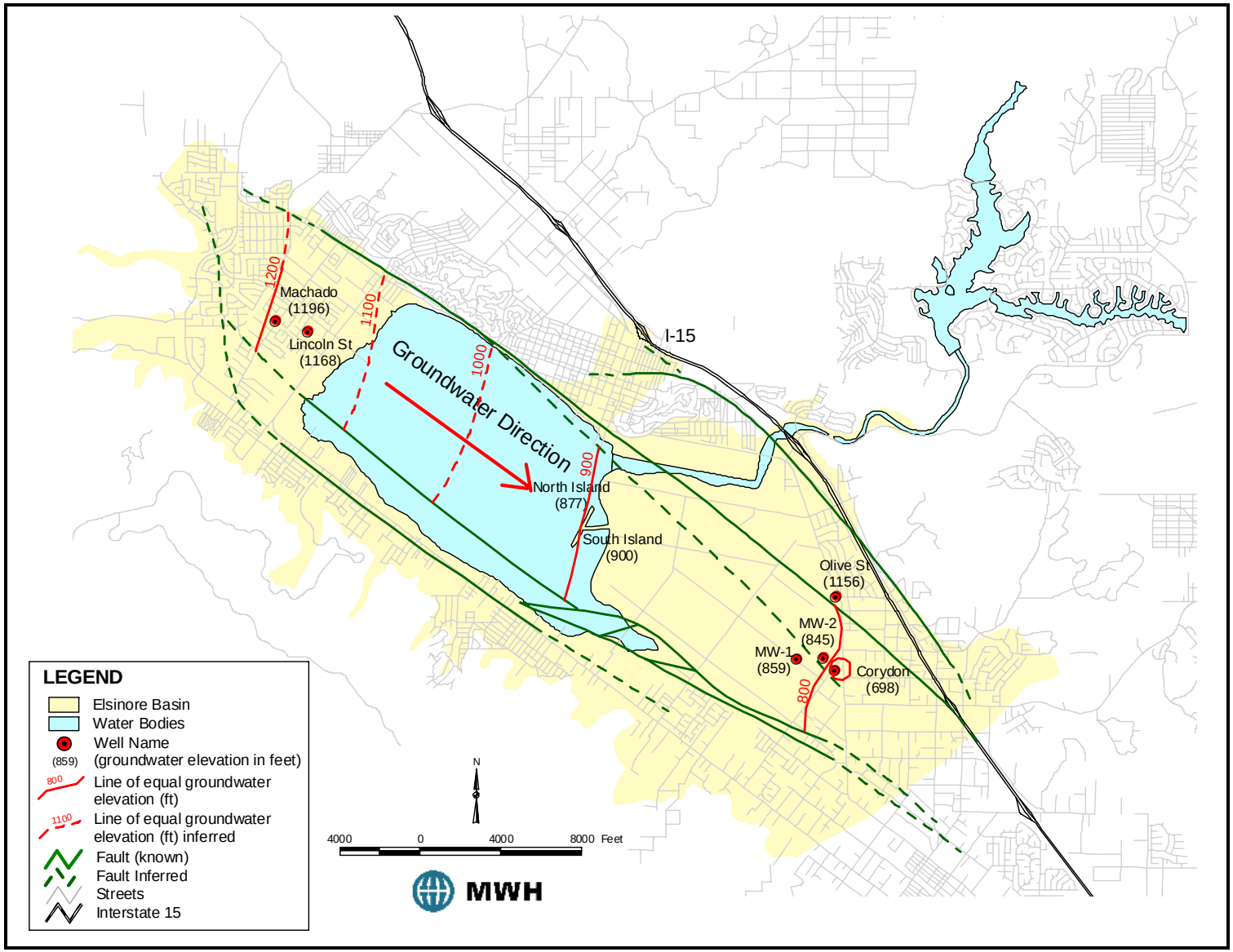
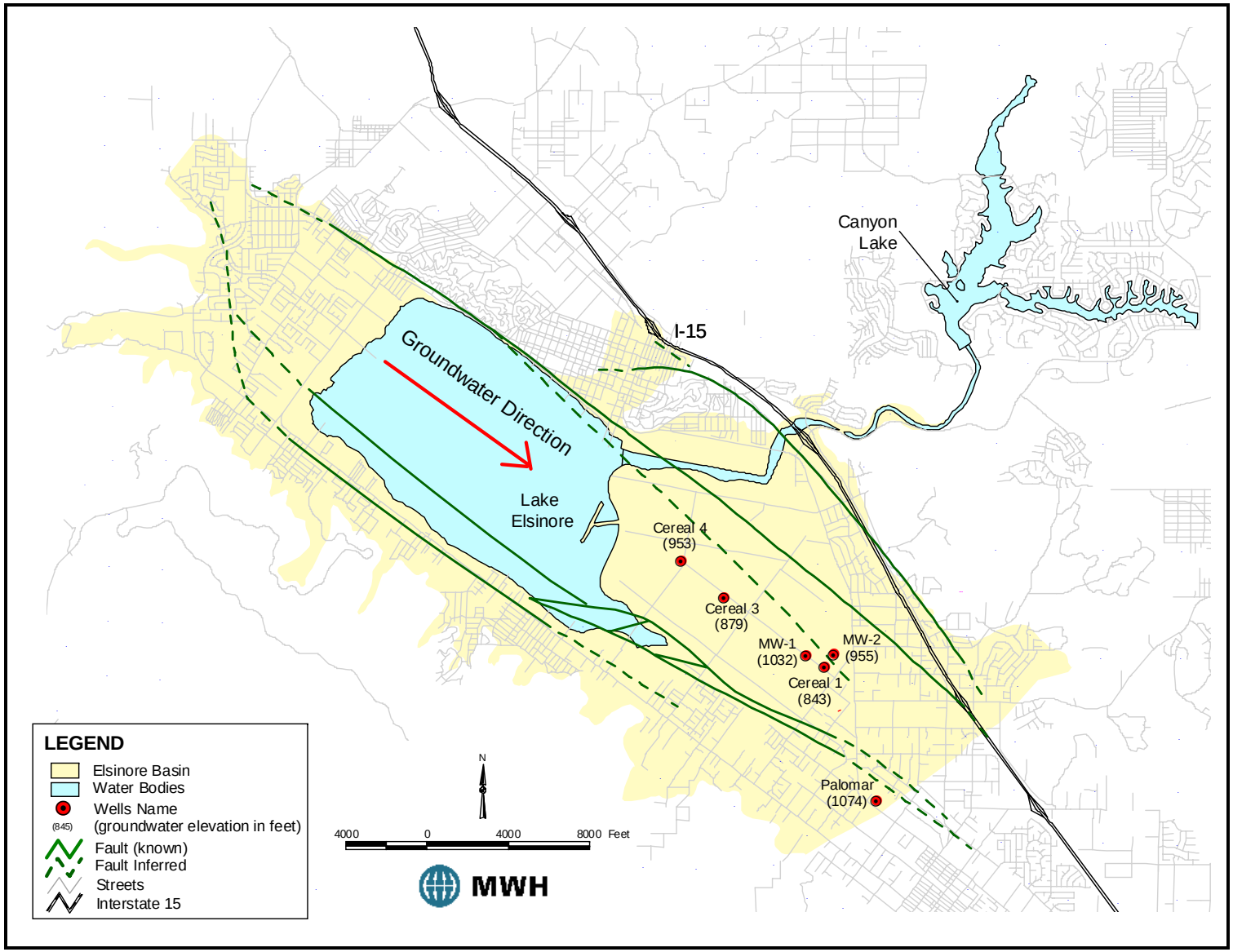


Figure 5
Groundwater Levels in the Alluvium and Fernando Group (Summer 2002)



The Palomar well, located on the south side of the Wildomar Fault Zone, has a water elevation of 1,074 feet above MSL. Because no other water level data are available for the area near the Palomar well during 2002, it is impossible to contour water levels in this area for this time period. Based upon the available data, more shallow monitoring points are necessary to characterize the groundwater flow conditions within the alluvium.

Groundwater Quality

An understanding of the existing water quality is also an important aspect of the groundwater monitoring plan. The following section provides a description of the current groundwater quality within the basin.

General

Piper diagrams are often used to observe differences in general water quality from various sources. A Piper diagram plots various cation and anion concentrations on the same graph as a relative percentage, which allows for identification of water quality similarities and differences among various water sources that may not be detected simply by comparing bulk concentrations. A Piper diagram representing groundwater quality during Summer 2002 for the Elsinore Basin is provided in **Figure 6**.

These data suggest various water quality signatures throughout the basin and vertical and horizontal differences in water quality. For example, the Cereal-1 well, which is screened across the alluvium and the Fernando Group, has intermediate quality between the Corydon Well (which is screened only in the Fernando Group) and the monitoring wells (MW-1 and MW-2) that are screened in the Lower Alluvium. Similarly, the Lincoln Street Well and the Machado Well, which are screened in the Fernando Group and the Bedford Canyon Formation, appear to have similar water quality.

Time-series plots for total dissolved solids (TDS), nitrate, sulfate and arsenic in select wells are presented in **Figure 7** through **Figure 10**. These constituents are often used to identify changes in water quality. General observations made from these data include:

- TDS (caused by higher nitrate and sulfate) is generally higher in the area north of the lake and along basin margins than in the Back Basin
- Highest concentrations of TDS, sulfate and nitrate are found at the Lincoln Street Well
- Lowest concentrations of TDS and sulfate are found in the Olive Street Well
- Concentrations of TDS have exceeded the secondary standard of 500 mg/L historically in the Lincoln Street Well and Cereal-4
- Concentrations of nitrate and sulfate, although higher in some locations, have not exceeded applicable standards in any EVMWD well
- Nitrate (as nitrate) concentrations in the Palomar Well appear to be increasing
- Concentrations of arsenic are below the current standard of 50 μg/L, however, they have exceeded the proposed new (effective 2006) maximum contaminant level of 10 μg/L in the Back Basin wells (Cereal-1, Cereal-3, Cereal-4 and Corydon Street)
- Highest concentrations of arsenic are found in deeper wells such as Cereal-1, Cereal-3 and Cereal-4

Figure 6
Piper Diagram in the Elsinore Basin

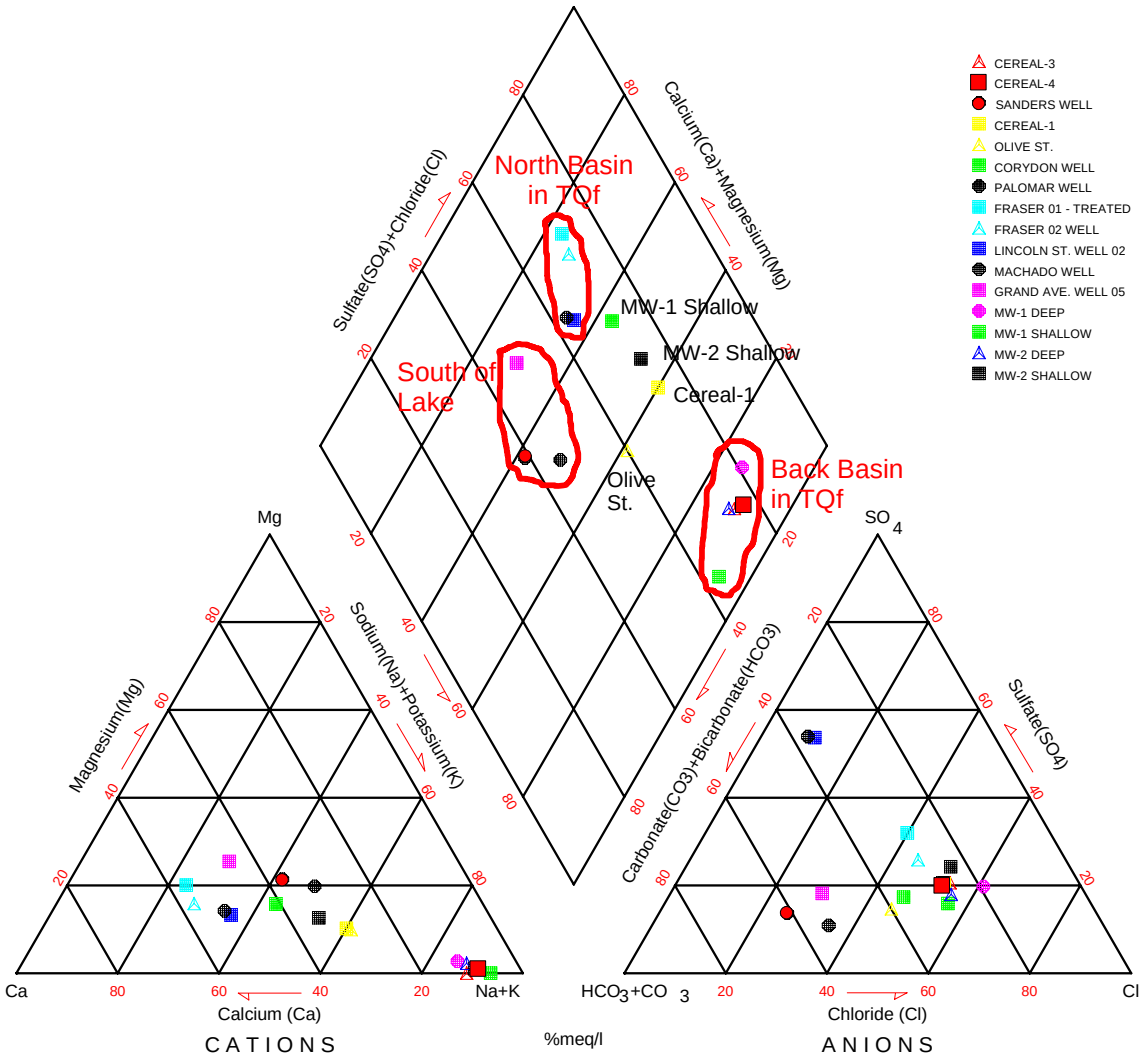


Figure 7
Historical Total Dissolved Solids Concentrations in Wells in the Elsinore Basin

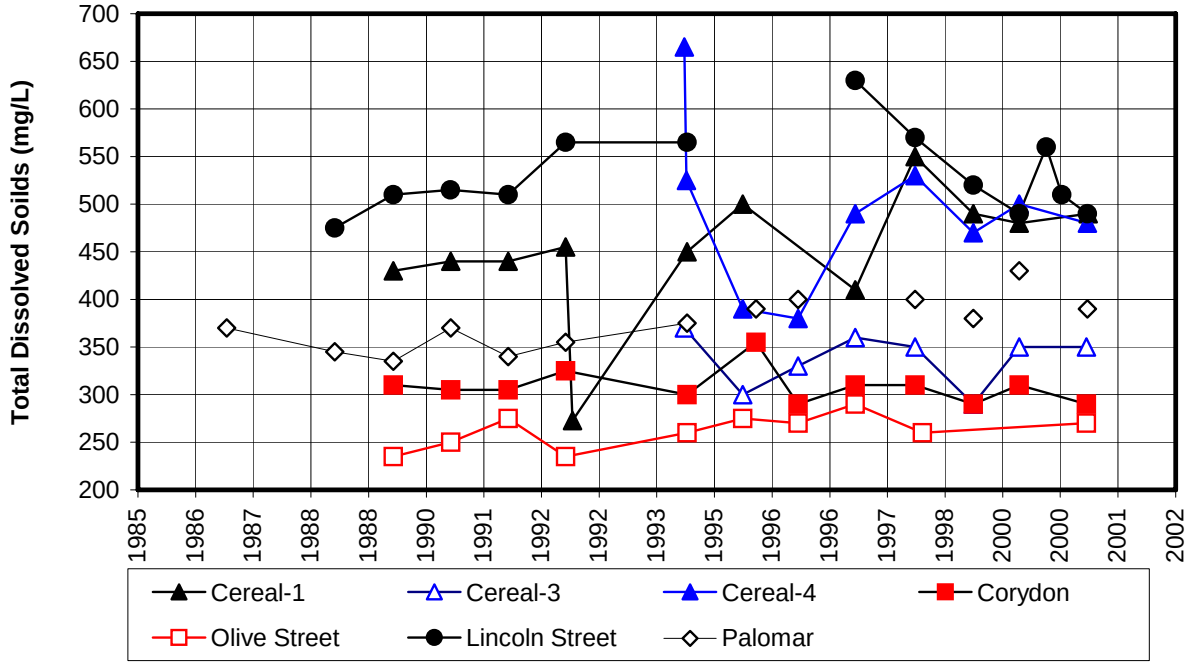


Figure 8
Historical Sulfate Concentrations in Wells in the Elsinore Basin

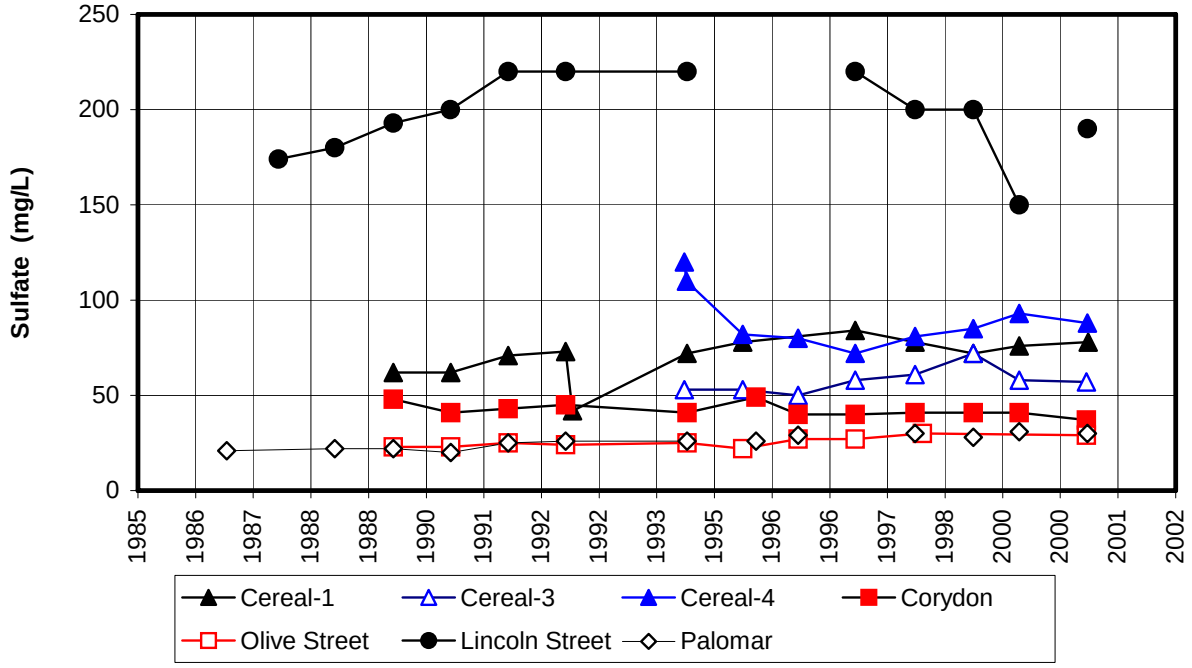


Figure 9
Historical Nitrate Concentrations in Wells in the Elsinore Basin

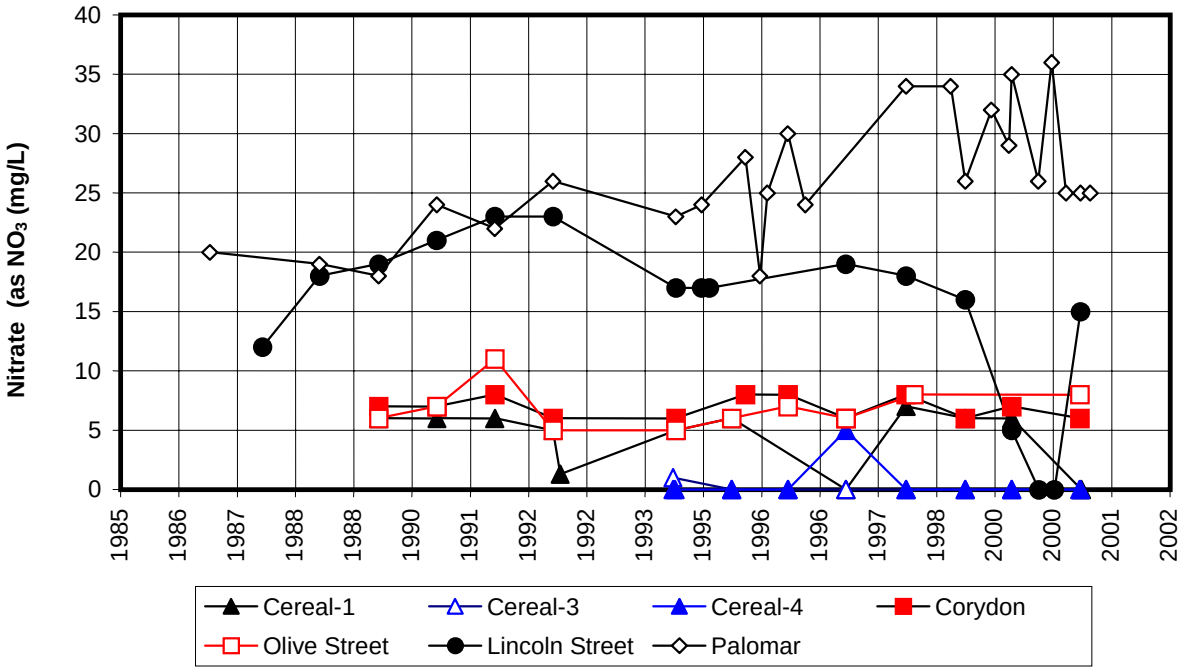
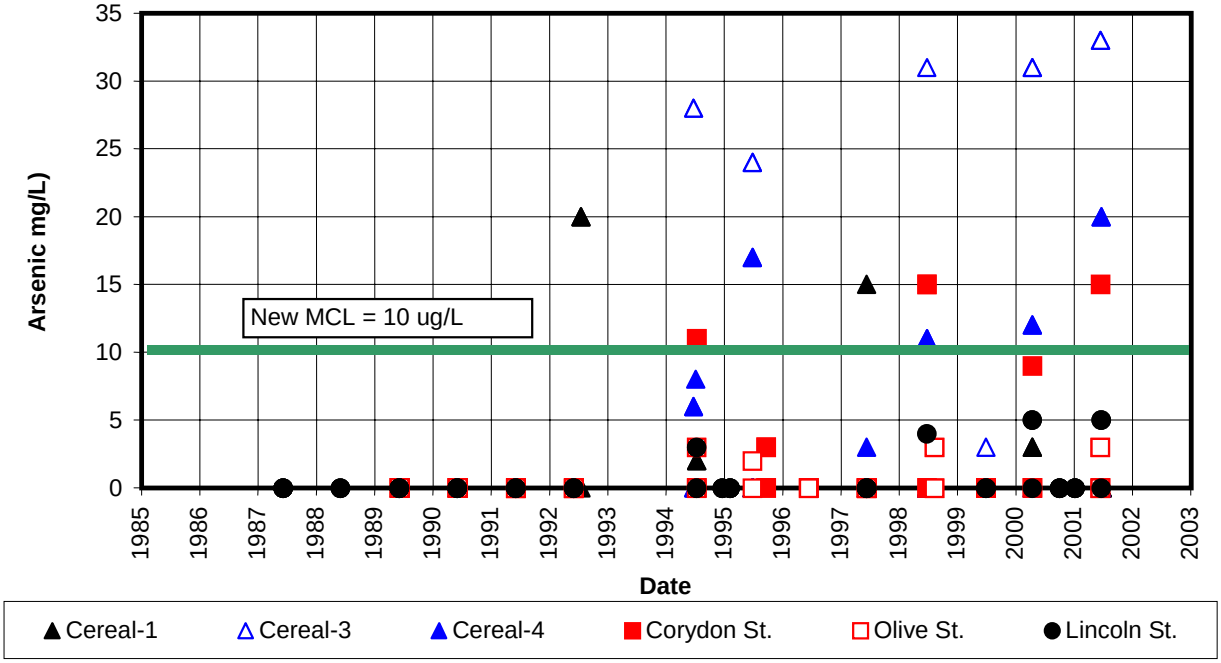


Figure 10
Historical Arsenic Concentrations in Wells in the Elsinore Basin



CURRENT MONITORING PROGRAM

The following section describes current groundwater monitoring activities within the Elsinore Basin and identifies data gaps.

Joint Groundwater Monitoring Program

In May, 2000, EVMWD and Elsinore Water District (EWD) entered into an agreement to participate in a Joint Groundwater Monitoring Program to monitor groundwater levels, quality, production and precipitation in the area of the Elsinore Basin northwest of Lake Elsinore (EWD and EVMWD, 2000). This agreement established specific groundwater trigger points for wells in the basin and developed a specific monitoring program for these wells. Inactive wells in the vicinity of active EWD wells Fraser I and Fraser II (trigger well Wisconsin well) and EVMWD's Machado well (trigger well Stewart well) were selected as "trigger wells" to monitor groundwater changes in the basin. These wells are listed in **Table 1**.

Table 1
Summary of Joint Groundwater Monitoring Program

Production Well	Non-Production Well (Trigger Well)	Trigger Point	Monitoring Analyses
Fraser I	Wisconsin (6S/4W 02B01)	1,106 feet MSL	• Water level and production monthly • Water quality annually
Fraser II			
Machado	Stewart (6S/4W 03G01)	1,057 feet MSL	

When groundwater levels in the trigger wells drop below the specified trigger point for three consecutive months (based upon historic low groundwater levels in the respective well), EVMWD agreed to pay EWD for the additional power costs and/or provide mitigation water if EWD could not produce sufficient groundwater to meet their customer needs.

EVMWD Wells

EVMWD also monitors monthly groundwater levels (both pumping and static) and production and annual groundwater quality in other wells in its distribution system. The wells included in EVMWD's current monitoring program other than those listed in Table 1 are listed in **Table 2**. MWH has recently installed four monitoring wells (MW-1 through MW-4) and a new production well (Inj-1) in the Back Basin. These wells are included in the future monitoring program.

Table 2
Summary of Current Monitoring Frequency for EVMWD Wells

Well Name	Monitoring Frequency		
	Water Level	Production	Water Quality
Cereal-1	Monthly	Monthly	Annually
Cereal-3	Monthly	Monthly	Annually
Cereal-4	Monthly	Monthly	Annually
Corydon	Monthly	Monthly	Annually
Lincoln Street	Monthly	Monthly	Annually
Machado Street	Monthly	Monthly	Annually
Olive Street	Monthly	Monthly	Annually
Palomar Street	Monthly	Monthly	Annually
North Island	Monthly	NA	NA
Middle Island	Monthly	NA	NA
South Island	Monthly	NA	NA

AREAS OF CONCERN

The following discusses areas of concern within the Elsinore Basin that should be monitored as part of the groundwater monitoring program.

Overdraft

The groundwater balance, which accounts for the inflows and outflows in the basin, is one of the components of overdraft. From 1990 through 2000, the average annual basin storage decreased by about 1,800 acre-ft/yr. It should be noted that this period was wetter than the historical average and, as such, would underestimate the actual deficit in the basin. In addition, water levels in some wells in the south portion of the basin declined more than 200 feet. Groundwater levels remained fairly constant in the northern part of the basin where most of the recharge occurs. Because of the negative groundwater balance and declining water levels, the sustainability of this condition is an issue that will need continued monitoring.

Land subsidence is the lowering of the ground surface due to groundwater withdrawal or seismic activity. Groundwater withdrawal is the most likely mechanism or cause for land subsidence in the Elsinore Basin. Groundwater withdrawal causes the sediments of the aquifer to compact. The amount of compaction depends upon the thickness and hydrogeologic character of the aquifer, as well as the rate and amount of decrease in the water level. Fine-grained sediments (clays), such as those composing the aquitard that separates the alluvium and the Fernando Group, are more susceptible to compaction and subsidence than coarse-grained sediments (sands) when groundwater is removed from them. However, the low permeability and high specific storage of fine-grained sediments cause compaction to occur slowly, over a period of several years, rather than as an instantaneous response to water level decline. Therefore, a short-term impact might be difficult to detect and subsidence may occur years after the water level had

declined. However, once it has occurred, compaction of fine-grained sediments is permanent, due to a permanent rearrangement of soil particles. This results in a permanent loss of groundwater storage capacity and land subsidence. It is unclear whether land subsidence is actually occurring in the Elsinore Basin at this time. The groundwater monitoring plan should include identification of potential areas of land subsidence.

Groundwater Quality

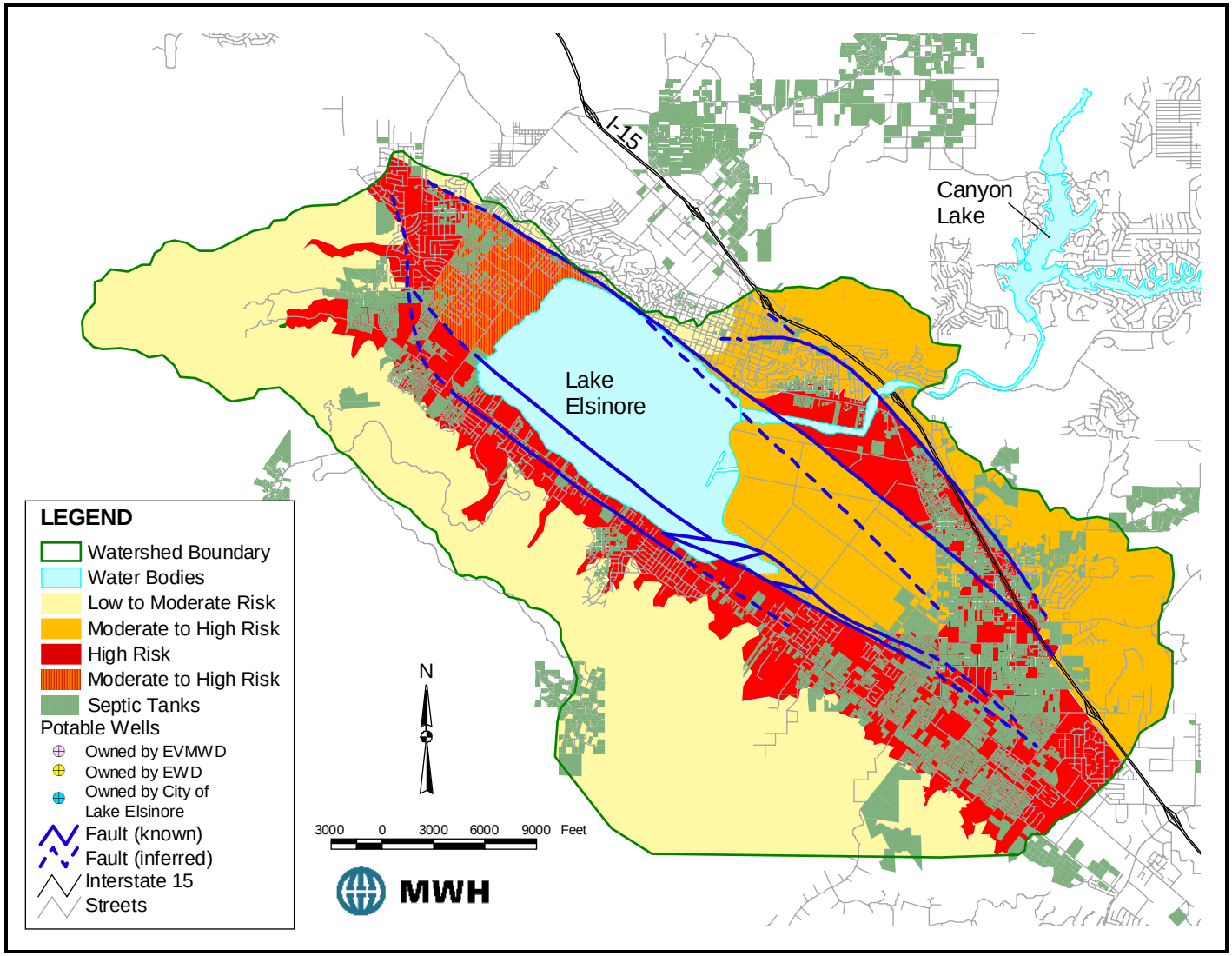
The downward seepage of sewage, agricultural, or industrial waste is a potential source of groundwater contamination. The District service area includes residential and industrial land use. Agricultural land use has greatly diminished in the last ten years. However, in some areas (e.g. the north end of the lake) where historical agricultural land use was present, there is a potential for downward migration of higher TDS and sulfate water. The higher concentrations of various constituents in the area north of the lake could be a result of historical land use practices in this area. Much of the area north of the lake historically has been an agricultural area. In addition, much of this area was on septic systems, which can result in higher nitrate concentrations in the groundwater.

In addition, approximately 4,000 parcels in the City of Lake Elsinore and surrounding areas have septic systems that are still used (see **Figure 11).** Risk zones associated with septic tank locations relative to groundwater supply are proposed based on the previously mentioned material. Generally, the level of risk is related to existing or potential future groundwater supply development and recharge potential. The categories and the basis for their selection are as follows:

- **Areas of Low to Moderate Risk:** These areas generally consist of bedrock. There is little or no potential for the development of groundwater supply projects in these areas.
- **Areas of Moderate to High Risk:** These are areas where there are existing groundwater supply facilities or the potential for the development of future groundwater supply. However, the clay content is higher in the shallow sediments which provides limited separation between septic tank effluent and the deeper water supply aquifers.
- **Areas of High Risk:** These are areas where there are existing groundwater supply facilities or the potential for future groundwater supply development. Based on the location relative to the basin boundaries, and the lack of fine-grained sediments in the shallow sediments, these areas are where most of the aquifer recharge occurs and are the most vulnerable to contamination.

One of the eight EVMWD wells (Palomar) and two of EWD's wells (Wood and Sanders) are currently located in high risk zones. The Palomar well has experienced an increase in nitrate concentrations (a indicator parameter for septic tank contamination) over the past 15 years. If nitrate concentrations in this well continue to increase, it is possible that it could exceed the MCL of45 mg/L in the near future. Sufficient data are not available to evaluate the nitrate concentrations in the Wood and Sanders wells. Although concentrations are currently below the MCL of 45 mg/L for nitrate in these well, nitrate presents an issue for groundwater quality in portions of the basin.

Figure 11
Septic Tank Risk Zones



An additional concern for contamination is from leaky underground storage tanks (LUSTs) discharging petroleum products, solvents or other organic constituents. In particular, the gasoline oxygenate known as MTBE (methyl tertiary-butyl ether) has become a major problem throughout California. According to the Regional Board (2003), MTBE has been detected in the groundwater as a result of LUSTs in four locations throughout the Elsinore Basin since 1998. In addition, 35 cases of LUSTs have been reported to the Regional Board (Regional Board, 2003). Based upon recent groundwater production well quality data, no District or EWD well has had detections of MTBE or other organic compounds attributed to these LUSTs.

Concentrations of arsenic for select wells in the basin are provided in **Table 3**. Arsenic is a naturally occurring element that is commonly found in granitic or metasedimentary source rocks. Higher concentrations of arsenic in the Back Basin area appears to be a function of the screened depth and the aquifer from which the well receives its water. Wells screened within the lower portion of the Fernando Group and/or the Bedford Canyon Formation (e.g. Cereal-3 and Cereal-4) tend to have higher concentrations than those screened shallower.

Table 3
Summary of Arsenic Concentrations in Select Wells (2000-2)

Well	Screened Interval (fbgs)	Aquifer Zone	Concentration Range (μg/L)
Cereal-1	420-1,410	Qa and TQf	1.5-2.7
Cereal-3	440-1960	Qa, TQf and bcb	33
Cereal-4	380-1,700	Qa and TQf	20
Corydon Street	340-1,260	TQf	9
Fraser-01	180-400	Qa and TQf	2-3
Lincoln Street	360-940	TQf and bcb	5
Machado Street	570-960	TQf and bcb	5
Olive Street	398-698	TQf	3-15
Palomar Street	200-900	Qa and TQf	ND
MW-1 Shallow	230-430	Qa	ND
MW-1 Deep	700-1,000	TQf	6.1
MW-2 Shallow	280-480	Qa and TQf	2.1
MW-2 Deep	700-1,000	TQf	4.6

According to EVMWD staff, the Olive Street well is not currently in production because of elevated bacteria levels. These elevated levels may be caused by a variety of environmental conditions including: influence of septic tanks and surface water and/or conditions such as vegetable oil leakage within the pump. Because the elevated bacteria levels are not associated with a corresponding increase in nitrate concentrations or other nutrients, it is unlikely to be caused by septic tanks. Further investigation will be required to address this issue.

Identification of Data Gaps

Additional data are needed in the following areas:

- Groundwater level and production data for wells other than those controlled by EVMWD throughout the basin
- Estimates of vertical distribution of flow within existing production wells with water quality issues particularly those wells with elevated TDS, sulfate, nitrate and arsenic
- Additional groundwater level and water quality data for wells screened exclusively in the alluvium
- Groundwater level and quality in the area north of the lake between Leach and McVicker Canyons and Machado Street to evaluate the effect of faulting on groundwater flow from the canyons and the feasibility of surface recharge in this area. In addition, because there is limited data in this area, background water level and water quality data are needed to evaluate future recharge impacts. These wells will also be used to monitor the recharge operations once constructed.
- Groundwater level and quality in the area southeast of the Corydon Well between the Glen Ivy fault and the Wildomar fault zone to evaluate the impact of groundwater storage activities to the area downgradient of the Corydon Well.
- Groundwater level and quality along the San Jacinto River southwest of I-15 between the Freeway fault and the Glen Ivy fault to evaluate the feasibility of surface recharge in the area where bedrock is downdropped creating a thicker alluvial section.
- Groundwater level and quality in the area south of the lake to evaluate whether the Wildomar fault zone is a barrier to groundwater flow

The groundwater monitoring plan provides the framework for obtaining these data.

GROUNDWATER MONITORING PROGRAM

The following section outlines the activities associated with the groundwater monitoring program. This includes a discussion of the wells included in the program, recommendations for new wells, a description of the water quality sampling protocol, and a description of the groundwater level monitoring for the Elsinore Basin.

The Groundwater Management Plan recommends that the EVMWD Board of Directors appoint an Advisory Committee, which is expected to include local agencies and interested stakeholders, to oversee the implementation of the plan. EVMWD should implement the groundwater monitoring program through this Advisory Committee.

Wells Included in Monitoring Program

As part of the development of the water management plan, MWH identified 235 well locations within the Elsinore Basin, of which only 147 had well log information that could be used to verify their owners and locations (MWH, 2003). However, in most cases, no additional data, other that the data provided on the DWR well log were available for private wells. The following section identifies wells within the Elsinore Basin that should be included in the groundwater monitoring program. The initial list includes 29 existing or pending production and monitoring

wells owned and operated by public agencies including EVMWD and Elsinore Water District. Specific private domestic and agricultural wells for monitoring have not been identified at this time. Recommendations for new monitoring wells are also included.

Existing Wells

Table 4 lists the existing municipal production and monitoring wells in the Elsinore Basin that are recommended for inclusion in the first phase of the groundwater monitoring program. The location of existing wells to be included in the monitoring program are included in **Figure 12**.

Table 4
Summary of Existing Municipal Wells in the Elsinore Basin

Well Name	State Well No.	Owner	Well Type	Status	Aquifer
Cereal-1	06S04W21J03	EVMWD	Production	Active	Qa and TQf
Cereal-3	06S04W17K01	EVMWD	Production	Active	Qa and TQf
Cereal-4	06S04W17L01	EVMWD	Production	Active	Qa and TQf
Corydon	06S04W22N01	EVMWD	Production	Active	TQf
North Island Well	06S04W18B01	State Parks	Production	Active	TQf
South Island Well	06S04W18K01	State Parks	Production	Active	TQf
Middle Island Well	06S04W18G02	State Parks	Production	Active	TQf
Olive Street	06S04W22D04	EVMWD	Production	Inactive	TQf
Wood	06S04W19L03	Elsinore Water District	Production	Inactive	Qa and bedrock
Sanders	06S04W19L04	Elsinore Water District	Production	Inactive	Qa and bedrock
Palomar	06S04W27P02	EVMWD	Production	Active	Qa
Grand	06S05W24A01	Elsinore Water District	Production	Active	Qa and bedrock
Showboat	06S04W19D04	Elsinore Water District	Production	Unknown	Qa and bedrock
Wisconsin	06S05W02A	Elsinore Water District	Production	Unknown	Qa and TQf
Fraser No. 1	06S05W02B02	Elsinore Water District	Production	Inactive	Qa and TQf
Fraser No. 2	06S05W02B03	Elsinore Water District	Production	Inactive	Qa and TQf

Table 4 (continued)
Summary of Existing Municipal Wells in the Elsinore Basin

Well Name	State Well No.	Owner	Well Type	Status	Aquifer
Well No. 2	06S04W06A	City of Lake Elsinore	Production	Unknown	Qa
Lincoln Street Well	06S05W02M04	EVMWD	Production	Active	TQf and bcb
Machado Well	06S05W03H01	EVMWD	Production	Active	TQf and bcb
Beecher Street Well	06S04W28A01	EVMWD	Production	Inactive	TQf and bcb
Como Well	Unknown	EVMWD	Production	Inactive	Qa
Stewart Well	06S05W03G01	EVMWD	Production	Inactive	Unknown
MW-1	Not assigned	EVMWD	Monitoring	Active	Qa and TQf
MW-2	Not assigned	EVMWD	Monitoring	Active	Qa and TQf
MW-3	Not assigned	EVMWD	Monitoring	Active	Qa and TQf
MW-4	Not assigned	EVMWD	Monitoring	Active	Qa and TQf
Inj-1	Not assigned	EVMWD	Dual Purpose	Inactive	Qa

EVMWD should perform a well canvas that includes obtaining the location (latitude and longitude) and other well information for all wells in the basin. This well canvassing task may include door-to-door interviews and evaluations with private well owners by EVMWD staff to obtain additional data. Groundwater monitoring of these wells may be included in a follow-up phase of the monitoring program at a later time if suitable wells are encountered.

Proposed New Monitoring Wells

Based on the comments from the District's Technical Review Committee meeting and our understanding of the groundwater basin, MWH recommends a total of five new monitoring well sites. The location of each new proposed monitoring well is provided in **Figure 13** and listed in **Table 5**.

The purpose of the Leach Canyon and McVicker Canyon wells is to monitor water levels and water quality from the natural recharge areas to the Elsinore Basin and to evaluate the flow conditions across the Willard and Wildomar faults. Two monitoring wells screened to bedrock are proposed for the upward side of the fault at the mouths of Leach and McVicker Canyons. One multi-level monitoring well screened in the alluvium and the Fernando Group is proposed on the basin-side of the faults.

Figure 12
Location of Proposed Wells for Monitoring Program

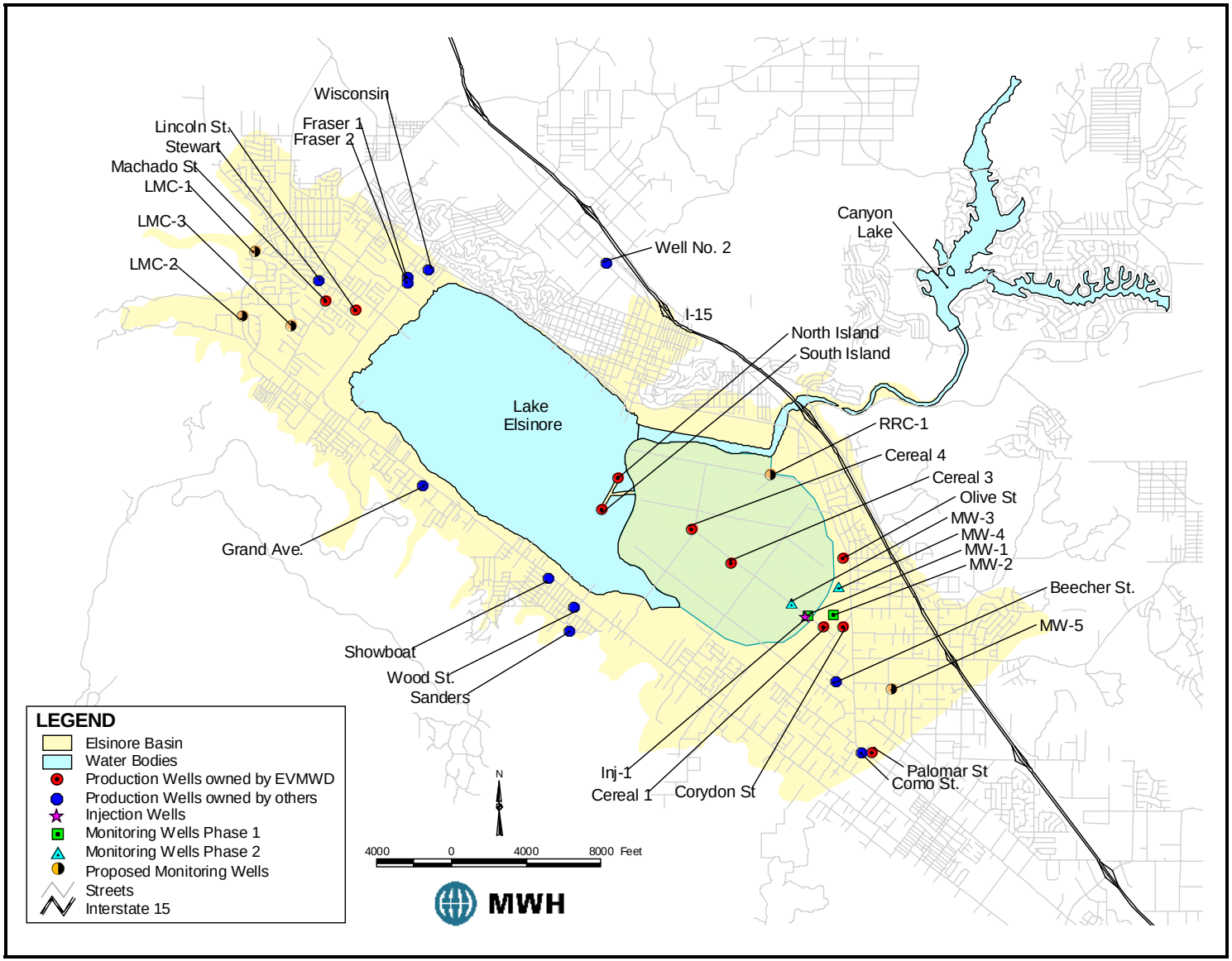
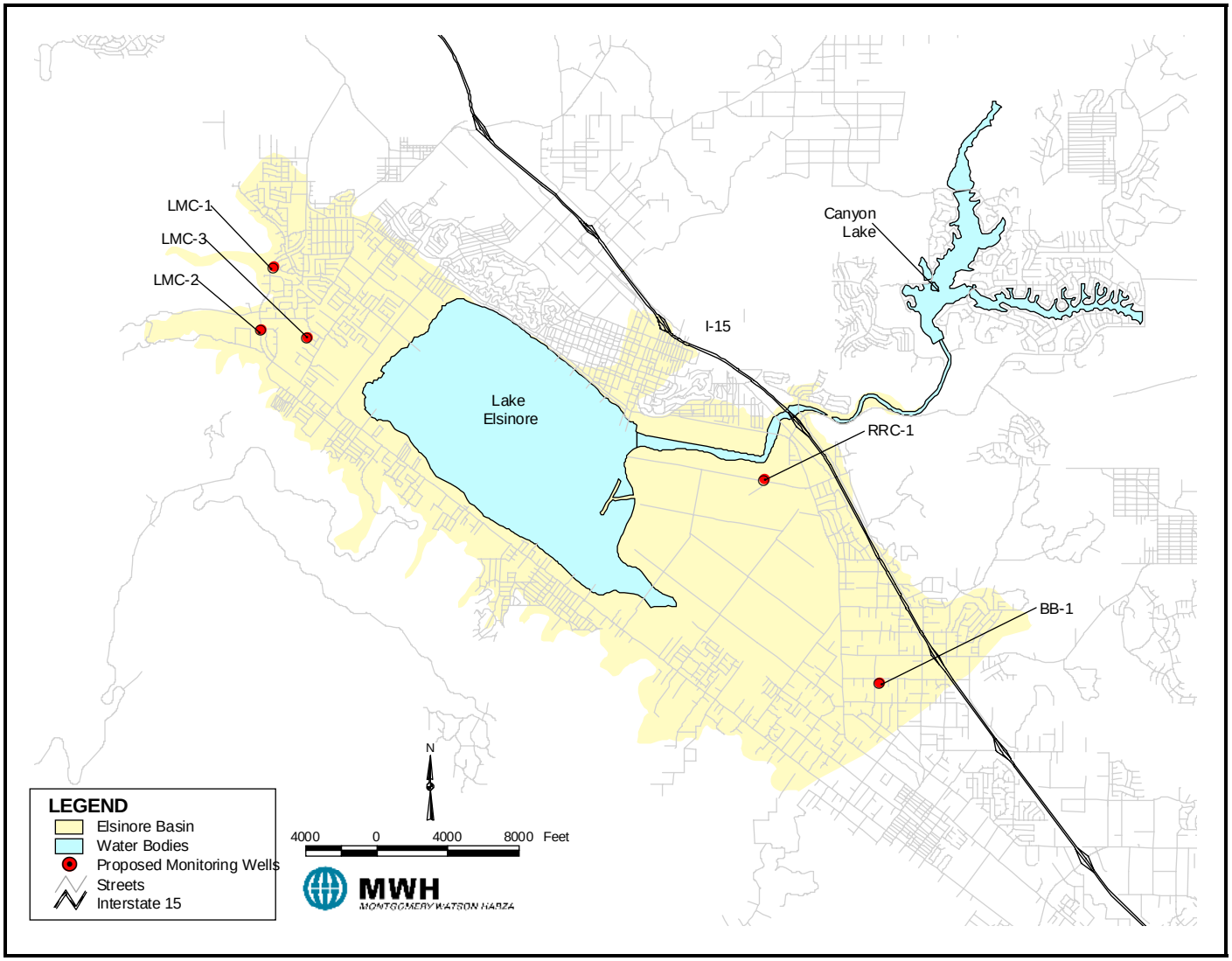


Figure 13
Location of Proposed New Monitoring Wells



Another proposed monitoring well location is near the outlet of the San Jacinto River south of I-15. The purpose of this well is to document groundwater flow and quality in the vicinity of the Sedco Cone. The compartment between the Freeway fault and the Glen Ivy fault may be a possible location for groundwater storage. In addition, this area is a source of natural recharge to the basin. This well can be used to monitor inflows into the basin. The well will be screened in both the alluvium and the Fernando Group to evaluate flow conditions in the alluvium and downward migration from the alluvium into the Fernando Group.

Table 5
Summary of Proposed New Monitoring Wells

Monitor Well Location	Symbol	Number of Piezometers	Monitoring Interval(s) (ft, bgs)
McVicker Canyon	LMC-1	1	200 to 300
Leach Canyon	LMC-2	1	200 to 300
Downgradient of Leach & McVicker Canyons	LMC-3	2	200 to 300 & 800 to 900
Railroad Canyon (San Jacinto River Outlet)	RRC-1	2	200 to 300 & 600 to 700
Fernando Group Outcrop in Wildomar	MW-5	2	200 to 300 & 800 to 900

Another proposed monitoring well site is located in the Wildomar area southeast of the Corydon well. The purpose of this well is to monitor water levels and water quality downgradient of the injection well network proposed further north. The bedrock surface rises substantially in this area and provides a barrier to groundwater flow to the southeast. This well can be used to evaluate the potential regional effects of the Corydon well and the injection well network.

In general, the proposed monitoring wells should be completed with Schedule 40, 4-inch nominal mild steel casing, and Schedule 40 Type 304 stainless steel well screen and associated dissimilar metal connectors. Under certain conditions, PVC may be substituted for the shallow wells. The slot size for the well screens is anticipated to be 0.050 inches. Monitoring wells will be completed with an 8x16 filter pack from the bottom of the borehole to 20 feet above the top of the screen, surface sand cement seals, and flush-mounted vaults fitted with steel traffic-rated lids. For multi-level wells, annular seals should be filled with sand cement. If PVC well materials are used (for the shallow wells), care should be taken during installation of the grout seal so as not to cause damage to the PVC casing from the heat of hydration. In areas of asphalt or concrete, the

surrounding area will be repaired with similar materials. The materials may be modified based upon site specific conditions.

Permits and access agreements will be needed in order to install the monitoring wells at each site. The requirements for access will vary depending on ownership, (i.e. private vs. public property). The types of issues addressed in permits and access agreements are site specific, but may include the following:

- Public notification before construction.
- Traffic controls.
- Notification of the Underground Service Alert 48 hours before the start of well construction.
- Access to the site for periodic monitoring.
- Responsibility for maintenance of monitoring facilities.
- Responsibility for abandonment of monitoring facilities at the conclusion of the monitoring period.
- Coordination with officials at the municipal, county, and state levels, before and during construction.
- Ownership of monitoring facilities.

Groundwater Level Monitoring

Water levels should be measured in each identified well on a monthly basis as described in **Table 6**.

Pumping and static water levels shall be taken with a sounding device in each active production well. Pumping rate, pumping and static water levels should be recorded. To obtain an accurate reading, the pumping well should be allowed to recover at least 2 hours prior to recording static water levels. Two hours may not be sufficient to allow complete recovery for some wells. The well should be shut off until recovery is obtained. If allowing for a full recovery period is not possible, the time allowed for recovery should be the same for each well every month. Water levels in the monitoring wells and inactive wells can be measured directly (no pumping water level or production rate can be measured, however).

Groundwater Quality Monitoring

Water quality monitoring will be an important part of the monitoring program. A list of parameters for analysis is presented in **Table 7**. Sampling frequency is provided in **Table 6**. As shown in this table, water quality sampling will not be performed every month. When both water level and water quality data are to be collected, water levels from all wells should be collected prior to collecting a water quality sample. Water quality sampling is required on an annual basis for all active municipal production wells – sampling for this monitoring plan should be performed at the same time to avoid duplicate sampling events. The groundwater sampling program should be implemented in accordance with ASTM D5903-96(2001), ASTM D4448-01 and other related standards. Details specific to this groundwater monitoring plan are discussed below.

Table 6
Monitoring Frequency for Wells in Elsinore Basin

Well Type	Activity	Recommended Monitoring Frequency
Active Production Wells	Water Quality	Annually
	Water Level	Monthly
Inactive Production Wells	Water Quality	Two times per year for 1 year Annually after 1 year
	Water Level	Monthly
Monitoring Wells	Water Quality	Two times per year for 1 year Annually after 1 year
	Water Level	Monthly

To be valid, a groundwater sample must be representative of the particular zone of the water being sampled. The physical, chemical, and bacteriological integrity of the sample must be maintained from the time of collection to the time of analysis in order to minimize changes in water quality parameters. The primary considerations in obtaining a representative sample of the groundwater are to avoid collecting stagnant (standing) water in the well, to avoid physically or chemically altering the water due to improper sampling techniques, sample handling, or transport, and to document that proper sampling procedures have been followed. For this monitoring program, it is recommended that three (3) casing and annulus volumes be evacuated from a well prior to sample collection. During well purging, the well should never be pumped dry. Rather, the flow rate should be adjusted such that flow can be maintained throughout the purge process and a subsequent groundwater sample may be collected. Water-quality parameters (pH, electrical conductivity, temperature and turbidity) should be measured during each well's purge. Purging shall continue until the indicator parameters have stabilized and three consecutive measurements are reproducible within ten percent. Other parameters to be measured in the field are included in **Table 7**.

This monitoring plan recommends the use of a Grundfos® pump for sample purging of monitoring wells. The Grundfos® pump takes in water and pushes the sample up a sample tube to the surface. The power sources for this pump is a portable generator. Pumps are available for 2-inch-diameter wells and larger, and these pumps can lift water up to several hundred feet. Production wells can be sampled from an existing sample port if available. For inactive large-

diameter wells that are not equipped with a pump, it may be necessary to install a temporary pump to purge the well.

Table 7
Water Quality Analyses for Monitoring Program

Field Parameters	Laboratory Parameters	
	General	**Trace Metals**
pH	Total Dissolved Solids	Aluminum
Turbidity	Total Suspended Solids	Arsenic
eH	Specific Conductance	Barium
Temperature	Langlier Index	Boron
Dissolved oxygen	pH	Cadmium
Specific Conductance	Total Alkalinity	Chromium
	Carbonate Alkalinity	Cobalt
	Bicarbonate Alkalinity	Copper
	Total Hardness	Iron
	Non-carbonate Hardness	Lead
	Calcium Hardness	Mercury
	Chloride	Nickel
	Sulfate	Selenium
	Nitrite	Silver
	Nitrate	Zinc
	Organic Nitrogen	
	Ammonia	
	Phosphorous	
	Calcium	
	Iron	
	Magnesium	
	Sodium	
	Manganese	
	Potassium	
	Fluoride	
	Color	
	Odor	
	MBAS	
	Oil and Grease	

Aquifer Testing

This plan recommends that aquifer testing be performed on various production wells in the basin. Aquifer testing includes relatively inexpensive methods to obtain a variety of different data that can be used to evaluate management strategies in the basin such as

- static and dynamic spinner logging
- static and dynamic temperature/fluid resistivity logging
- continuous water quality logging, which can continuously record parameters such as pH, nitrate, or fluoride
- depth-discrete water quality sampling and
- continuous pump testing

Aquifer testing can be used to identify vertical and horizontal variations in production capacity and groundwater quality in existing wells. As discussed previously, there are several wells in the basin that have water quality concerns that may eventually require some sort of wellhead treatment or blending. Based upon preliminary data compiled, it appears that some of the water quality issues in the basin are related to specific water-bearing units. Therefore, a series of aquifer tests as described below can further evaluate this hypothesis.

Static Spinner Logging

Spinner logging is used to measure fluid flow rates within either cased or uncased wells. The surveying results may be used to determine production rates from all zones to the well. The impeller-type, 3-inch diameter spinner logging tool measures the movement of water by the use of a low inertia impeller, which spins on precision carbide bearings. A small perforated disc connected to the end of the impeller shaft activates a magnetorestrictive counter in the body of the tool. As the impeller and the disc turn, these perforations cause a magnetic field fluctuation which is electronically converted to pulses and transmitted to the surface recording system for further processing (e.g., pulses or “counts” per second may be converted to flow rate in gallons per minute).

Static spinner logging (i.e., conducting spinner logging under nonpumping conditions) is typically performed to establish whether groundwater flow is occurring between shallower and deeper aquifers which may have been intersected by the well during drilling and construction. One “down run” (lowering the spinner logging tool down the well) and one “up run” (raising the spinner logging tool up the well) is usually performed at the well. Any “mirror image” divergence in the static spinner log between the “up run” and the “down run” would indicate a zone of flow in that portion of the well.

Continuous and Stop-Count Spinner Logging

Continuous spinner logging (i.e., conducting spinner logging under pumping conditions) and stop-count spinner logging (i.e., suspending the spinner logging tool at selected depths under pumping conditions) should be performed during well purging. Continuous spinner logging consisting of three “down runs” at three different “line speeds” (rate of ascent or descent of logging tool) should be performed. The continuous spinner logs can be evaluated to identify

vertical zones of flow contribution to the well. Because vertical zones showing a change in "counts per second" during the constant-rate pumping conditions may represent zones of flow contribution to the well, the subsequent stop-count spinner logging and depth-discrete sampling intervals should be selected based on these potential zones of flow contribution.

Depth Discrete Sampling

The flow information from the spinner logs and the depth-discrete groundwater analytical results can be evaluated into the method presented by Collar and Mock (1997) to calculate concentrations from each vertical zone of flow contribution to the well. When groundwater flow data and solute concentration data for a solute of interest is available above and below a zone of flow contribution to a well, the following algebraic equation may be used to solve for solute concentration from the zone of flow contribution:

$$C_i = (Q_a C_a - Q_b C_b)/(Q_a - Q_b)$$

where

C_i	=	solute concentration in zone of flow contribution
Q_a	=	groundwater flow rate above zone
C_a	=	solute concentration above zone
Q_b	=	groundwater flow rate below zone
C_b	=	solute concentration below zone

These data can be used to evaluate whether a specific zone should be sealed off to reduce the concentration of the constituent of concern in the produced water from a well without reducing production capacity. Zone sampling can be performed using a passive groundwater sampling system where a small pump is lowered to the screened section of interest and a sample is collected. Packer testing, which isolates a particular zone during pumping, may also provide zone specific samples.

Continuous Aquifer Testing

As part of the Monitoring and Mitigation Program for the Elsinore Basin, aquifer tests were to be performed at Fraser I, Fraser II, and Lincoln Street wells. In addition, a continuous aquifer test should be performed for each municipal production well in the basin. A continuous test is used to estimate aquifer parameters such as transmissivity and storativity. These parameters can be used to estimate the impact of future groundwater management activities on groundwater levels. Groundwater levels should be monitored in at least one additional non-pumping production well or monitoring well if feasible to evaluate the influence of pumping to adjacent wells.

Surface Water Monitoring

In addition to the groundwater monitoring activities discussed above, EVMWD should compile water quality and water level data from surface water bodies within the Elsinore Basin. These include:

- Water surface elevation and water quality data for Lake Elsinore
- Flow and water quality data from the San Jacinto River
- Flow and water quality data from Leach and McVicker Canyons

The monitoring frequency for surface water is provided in **Table 8**.

EVMWD currently records water surface elevation data for Lake Elsinore monthly. The USGS currently records flow data from stream gauge 11070500 on a daily basis. These data can be obtained from the USGS in real-time from their website:

http://waterdata.usgs.gov/ca/nwis/uv?11070500.

Table 8
Monitoring Frequency for Surface Water Bodies in the Elsinore Basin

Well Type	Activity	Recommended Monitoring Frequency
Lake Elsinore	Water Quality	Two times per year
	Water Level	Monthly
San Jacinto River	Water Quality	Two times per year
	Flow	Daily [1]
Leach and McVicker Canyons	Water Quality	Two times per year r
	Flow	Daily

1 – Data are currently collected by USGS (Stream Guage No. 11070500)

This plan recommends installation of stream gauges in Leach and McVicker Canyons. These stream gauges should be installed upstream of the debris dams in each canyon. Coordination with the Riverside County Flood Control District will be required to implement this recommendation.

Land Subsidence Monitoring

As discussed previously, there is a potential for land subsidence associated with declining groundwater levels in the Elsinore Basin, particularly in the area south of the Lake. It is currently unknown whether land subsidence is actually occurring in the basin. Therefore, a land subsidence monitoring program is recommended.

Options for land subsidence monitoring include:

- Performance of GPS leveling surveys
- Collection of INSAR (data
- Installation of extensometers

GPS Leveling Survey

The Global Positioning System (GPS) is a highly-accurate, satellite-based, spatial positioning technology. It is capable of providing sub-centimeter horizontal positions (coordinates) over large distances. However, because of the nature of the GPS satellite configuration and other considerations it is not able to provide equally accurate vertical positions (elevations). Generally speaking, the accuracy of GPS-derived elevations is only one-half to one-third as accurate as GPS-derived horizontal positions (latitude and longitude), and achieving this vertical accuracy requires a greater effort than that required for horizontal accuracy.

EVMWD should establish a network of benchmarks within the Elsinore Basin to measure land subsidence. Monuments should include benchmarks in areas that are not anticipated to be susceptible to subsidence as well as areas where land subsidence could be expected. Successive land survey measurements in various locations should be made semi-annually. If these data suggest land subsidence, additional analysis as described below should be performed.

InSAR Data Collection

Interferometric Synthetic Aperture Radar (InSAR) is a technology suited for detection of land surface elevation changes. The technology employs aircraft- or satellite-based sensors that monitor the ground and in successive passes can determine the change in elevation over large areas to about five centimeter accuracy. It should be noted that the technology cannot distinguish between the ground and the tops of vegetation. In an extreme case, successive passes over a field lying fallow at the first observation and with a full mature crop of corn at the second would indicate the change of perhaps a couple of meters. It should be remembered that InSAR is a change detection technology. It can record the relative differences in an area over time, but cannot measure the absolute change without some ground-truth mechanism. InSAR should be used in concert with a GPS leveling survey. The USGS is actively involved in InSAR data collection efforts throughout Southern California. If subsidence is suggested in the Elsinore Basin, a cooperative effort with the USGS is recommended.

Extensometer Installation

The installation of extensometers is the most expensive subsidence monitoring activity. If subsidence is indicated with InSAR and GPS measurements, then EVMWD should consider installing extensometers in various locations throughout the basin. A borehole extensometer, which can be constructed to measure subsidence in various depths in the aquifer, measures soil deformation at a particular location. Costs could exceed $200,000 per extensometer for installation.

SUMMARY

The groundwater monitoring program includes:

- A well canvas to obtain information from private well owners. These additional background data can be used to further characterize the basin to guide EVMWD's future groundwater supply needs.
- Construction of five new monitoring wells (three nested piezometer wells and two single wells). These wells will be used to obtain additional background water level and water quality data to characterize the basin. In addition, these wells can be used to monitor the impact of future facilities.
- Measuring of water levels in existing production and monitoring wells and the new monitoring wells on a monthly basis. Monthly data is important to understanding the seasonal variations in water levels throughout the basin and confirm the basin yield.
- Collecting water quality data from the existing wells on an annual basis and the new monitoring wells two times annually. Changes in water quality may be caused by operations throughout the basin. New monitoring wells should be monitored more frequently to obtain background data for comparison to future water quality.
- Performing spinner logging to identify where most of the production comes from in existing production wells. These data may indicate the depth to which new production wells should be drilled in the future.
- Performing water quality zone testing, in conjunction with the spinner logging. This analysis can be used to isolate which areas are causing variations in water quality. This may include continuous water quality logging or zone specific testing.
- Performing continuous aquifer testing. These data can be used to confirm transmissivity and storativity estimates that can used to estimate future drawdown and basin yield.
- Performing surface water monitoring of Lake Elsinore, the San Jacinto River and Leach and McVicker Canyons
- Perform land subsidence monitoring, which should initially consist of a GPS monument network

This monitoring plan should be implemented as quickly as possible so that data can be incorporated into future groundwater management plan activities. In addition, these data will be used to evaluate future potential pilot projects such as surface spreading, injection, and other groundwater storage projects.

REFERENCES

ASTM, 2001. ASTM Standard D5903-96 (2001) – Standard Guide for Planning and Preparing for a Groundwater Sampling Event.

ASTM, 2001. ASTM Standard D4448-01 – Standard Guide for Sampling Ground-Water Monitoring Wells.

California Department of Water Resources, 1981. Investigation of Ground Water Supply for Stabilization of Level of Lake Elsinore, Riverside County.

Elsinore Water District and Elsinore Valley Municipal Water District, 2000. Monitoring and Mitigation Program – Elsinore Valley Groundwater Basin.

Collar, Robert J. and Peter A. Mock, "Using Water-Supply Wells to Investigate Vertical Ground-Water Quality", Ground Water, September-October 1997, p. 743-750.

MWH, 2003. Elsinore Basin Groundwater Management Plan. Prepared for the Elsinore Valley Municipal Water District.