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Hydrologic and Modeling Analysis for Zone 40 Water Supply Master Plan

Prepared for:

Sacramento County
Department of Environmental
Review and Assessment

Prepared by:

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September 2003

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Zone 40 Water Supply Master Plan

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SECTION 1 INTRODUCTION

Sacramento County Water Agency (SCWA) is preparing the 2002 Zone 40 Water Supply Master Plan (Master Plan) (with the Water Forum Agreement as its foundation) to provide a flexible program of water management alternatives that can be implemented and revised as availability and feasibility of water supply sources change in the future. The Master Plan also reflects changes from the 1987 Water Supply Master Plan (James M. Montgomery, 1987) in the pattern of water demand growth, treatment for water quality, expansion of original service area, and in the availability of potential sources of surface water. The details of the Master Plan are currently presented in the SCWA Draft Zone 40 Water Supply Master Plan (MWH, 2002).

SACRAMENTO AREA WATER FORUM

The Sacramento Area Water Forum (Water Forum) was initiated in the early 1990s because of concerns about the ability to meet increasing water demands in the Sacramento area while simultaneously protecting the Lower American River and its habitat. The coequal objectives of the Water Forum are to:

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and
- Preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

Development of the Water Forum Plan (WFP) to meet the coequal objectives involved substantial scientific study, environmental analysis, and consensus-building with various stakeholders. The WFP includes a comprehensive package of linked actions which, when implemented, are intended to successfully achieve the coequal objectives. These linked actions will require the support of each stakeholder in the public policy decision making process and through implementation in order to successfully achieve the coequal objectives.

These actions include adherence to an agreed upon long-term average annual limit (defined as the "sustainable yield") for each of the three geographic sub areas of the groundwater basin underlying Sacramento County: 131,000 acre-feet (AF) for the North Area (north of the American River); 273,000 AF for the Central Area (between the American and Cosumnes Rivers); and 115,000 AF for the Galt, or South, Area (south of the Cosumnes River). Any proposed water supply project must satisfy the groundwater conditions specified in the *Water Forum Agreement* for the 2030 projected level of development.

2002 ZONE 40 WATER SUPPLY MASTER PLAN

The Zone 40 assessment area (Zone 40) was created by Sacramento County Water Agency (Agency) in 1985 to provide drinking water for expanding urbanizing areas in the Laguna, Elk Grove, and Vineyard communities in the unincorporated areas of Sacramento County. Zone 40 provides for the construction of major water supply facilities through revenues generated by fees collected at the time of development and utility charges.

The 2030 Study Area (Study Area) for the Master Plan includes those areas within Zone 40 that have been identified as existing or developing industrial, commercial, office, and residential land uses as shown in Figure 1.1. These areas will be served with wholesale and/or retail water by SCWA. The Study Area includes approximately 46,620 acres (shown as the shaded area in Figure 1.1). Zone 40 has historically relied on the underlying groundwater basin for agricultural, industrial, and residential water supplies.

REPORT OUTLINE

The purpose of this report is to document the hydrologic analysis completed as part of the 2002 Zone 40 Water Supply Master Plan.

Section 1 Introduction provides some background to the 2002 Zone 40 Water Supply Master Plan.

Section 2 Sacramento County IGSM provides some background information of the Sacramento County Integrated Groundwater and Surface water Model used in this analysis.

Section 3 Description of Alternatives provides a description of the water supply scenarios analyzed in this study.

Section 4 Land and Water Use Conditions provides land and water use information for the 2000 and 2030 conditions.

Section 5 Water Supply Availability provides information the future water supply availability for Zone 40.

Section 6 Baseline and Alternatives Analysis presents the model results for the water supply alternatives described in Section 3.

Section 7 Summary presents a summary of the report findings.

Section 8 References lists the sources of information used in this analysis.

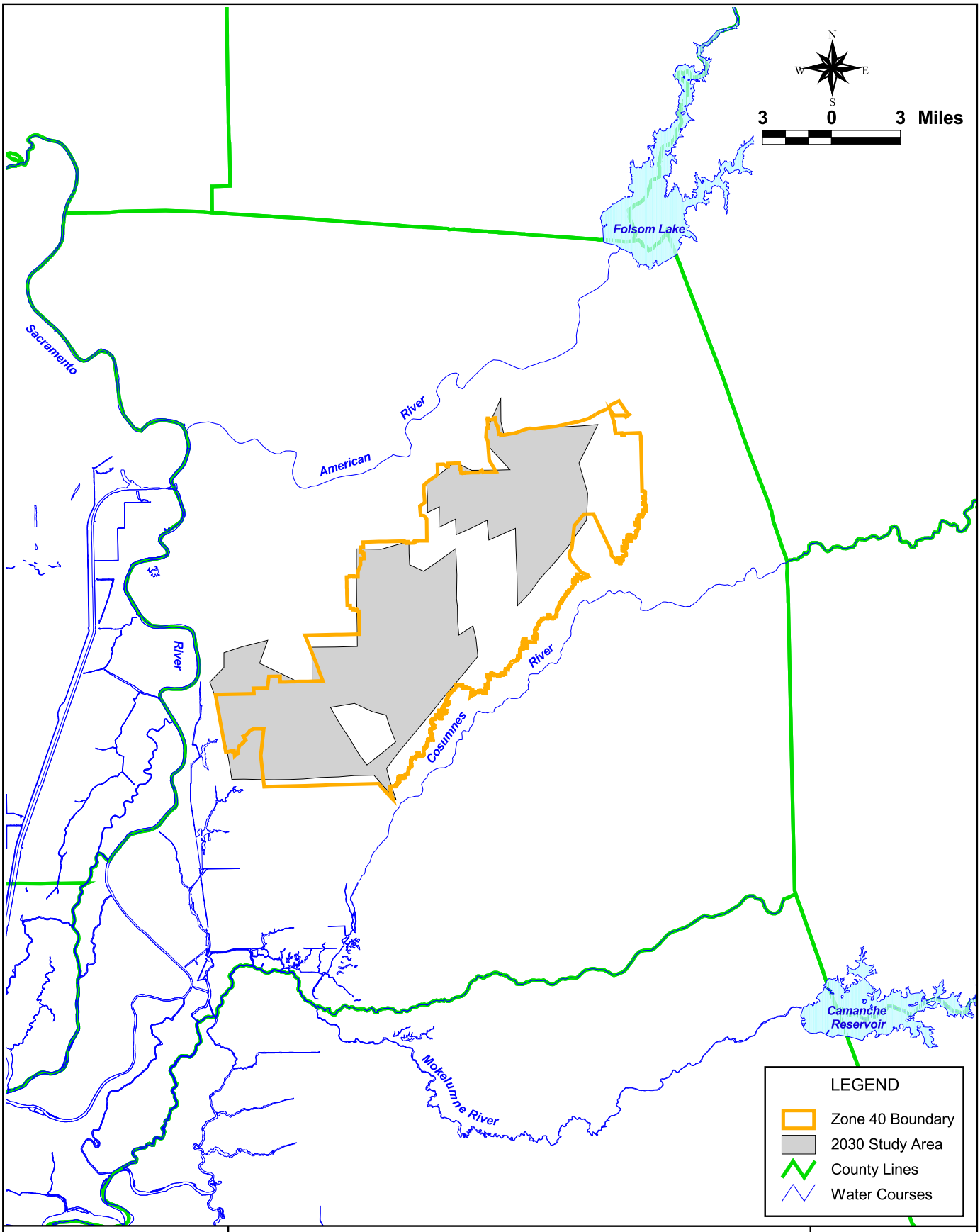
Appendix A Water Balance Summary Tables.

Appendix B Hydrographs for Zone 40 Groundwater Pumping Analysis.

Appendix C Hydrographs for Zone 40 Water Supply Analysis.

Appendix D Hydrographs for Groundwater Remediation Analysis.

Appendix E Sacramento County IGSM Suitability Technical Memorandum.



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **2030 Study Area** **DRAFT**	SEPTEMBER 2003 FIGURE 1.1

SECTION 2 SACRAMENTO COUNTY IGSM

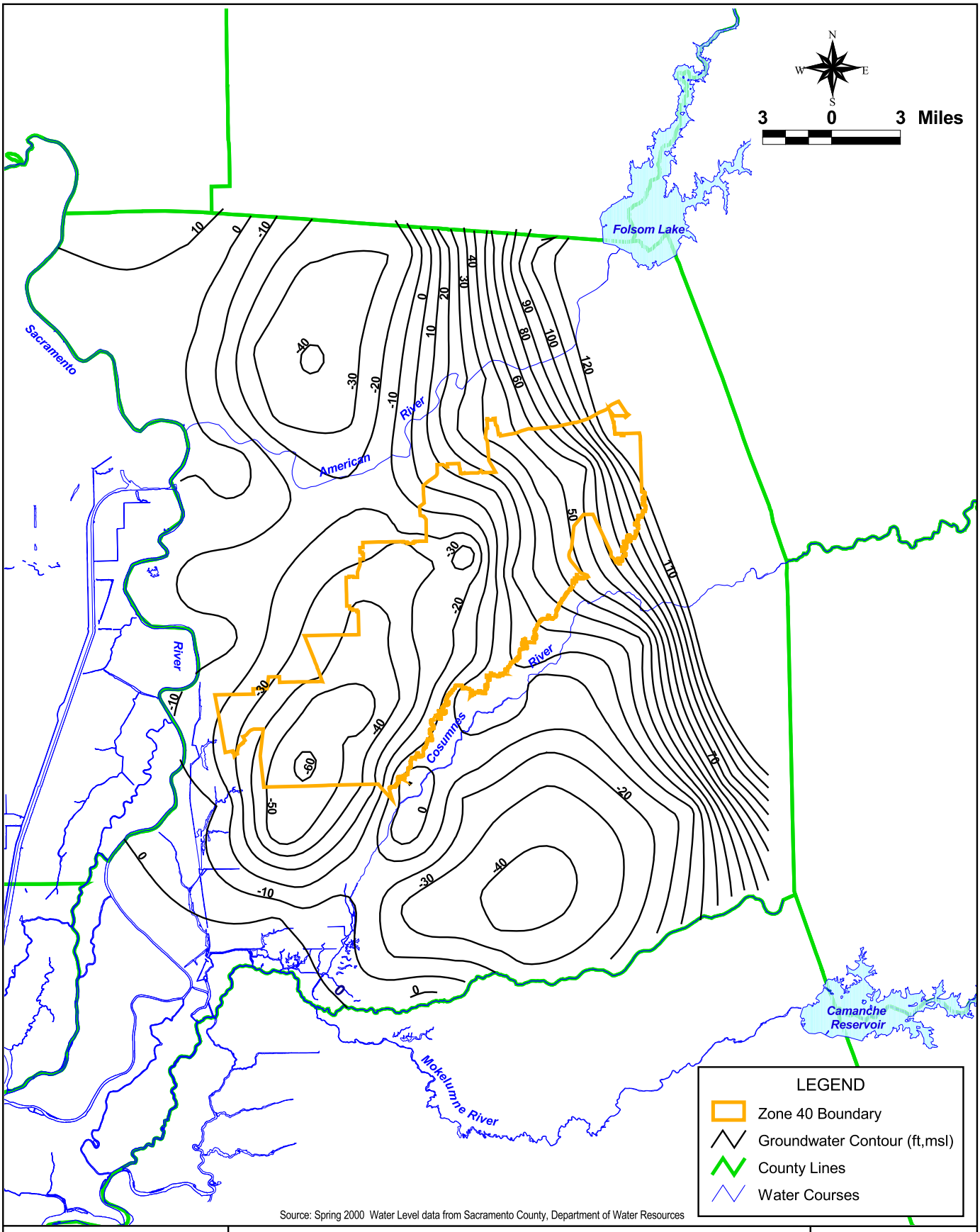
The Sacramento County groundwater system is part of the larger Sacramento Valley groundwater basin. Within Sacramento County three separate groundwater sub basins have been identified: the North Area (area north of the American River), the Central Area (roughly the area between the American and Cosumnes Rivers), and the South Area (generally the area south of the Cosumnes River). Historical groundwater use in each sub basin has resulted in the development of three regional cones of depression. The Spring 2000 groundwater elevations shown in Figure 2.1 show the location of the cones of depression in each sub basin.

SACRAMENTO COUNTY IGSM APPLICATIONS

The Sacramento County Integrated Groundwater Surface water Model (Sacramento County IGSM) was developed for the SCWA in the early 1990s to analyze the impacts of different water supply planning scenarios on the groundwater resources of Sacramento County. The details of the original Sacramento County IGSM were documented in *County Groundwater Model – Model Development and Basin Groundwater Yield* (Montgomery Watson, 1993). Since that time there have been numerous applications of the Sacramento County IGSM as shown on Table 2.1.

The appropriateness of the using the Sacramento County IGSM for this analysis was documented in *Technical Memorandum (TM) on Application of Existing Sacramento County IGSM to Hydrologic Analysis of Zone 40 Master Water Supply Plan Update* (WRIME, 2002). This TM (included in Appendix E of this report) concluded that the IGSM is an appropriate analytical tool for use in the analysis of hydrologic effects of alternatives considered under the Master Plan for the following reasons:

- The IGSM model has a history of successful field application in Sacramento County as well as in many other basins in California.
- IGSM code has been reviewed by various agencies, including the U.S. Bureau of Reclamation (Reclamation), the California Department of Water Resources (DWR), and the U.S. Geological Survey (USGS), as well as independent consultants and researchers.
- IGSM uses a unique, locally iterative technique to address the non-linearities associated with stream-aquifer interaction. The literature of non-linear, numerical mathematics abounds in different iterative and non-iterative techniques to approximate non-linear problems. The method used in IGSM did not result in any divergence as shown in the calibration of wells near the streams.



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Spring 2000 Groundwater Elevation** **DRAFT**	SEPTEMBER 2003 FIGURE 2.1

Table 2.1

Applications of Sacramento County Integrated Groundwater Surface Water Model

Sacramento County IGSM Application	Year	Study Name	Study Area	Basin Management	Stream/Lake Impact Analysis	Groundwater Recharge	Conjunctive Use	Groundwater Availability	Water Quality Analysis
1	1992	City of Sacramento IGSM	City of Sacramento POU	X	X		X	X	
2	1993	Sacramento County IGSM	Sacramento County	X	X		X	X	
3	1996	American River Water Resources Investigation	Western Placer County, Sutter County, Sacramento County, San Joaquin County	X	X		X	X	X
4	1996	Northridge WD Conjunctive Use Study	North American River Basin		X		X		
5	1996	Rio Linda Water Supply Analysis	North American River Basin				X	X	
6	1997	Sacramento Water Forum	Sacramento County	X	X	X	X	X	
7	1998	Sunrise Douglas Water Supply Analysis	Sacramento County Central Basin		X			X	X
8	1999	Sunrise Douglas Water Supply Analysis	Sacramento County Central Basin		X			X	X
9	1999	Zone 40 (North Vineyard Well Field)	Sacramento County Central Basin		X		X	X	
10	2000	American River Basin Cooperating Agencies (ARBCA)	North American River Basin	X	X		X		
11	2002	Zone 40 Water Supply Master Plan	Sacramento County Central Basin		X	X	X		

- The model represents the historical hydrologic response of the groundwater basin, as well as the streamflow conditions in the American and Cosumnes Rivers in Sacramento County appropriately based on the results of calibration to historical physical conditions.
- The results of the sensitivity analysis of pumping at wells near the American and Cosumnes Rivers also indicate that IGSM is appropriately simulating the stream-aquifer responses.

SACRAMENTO COUNTY IGSM CHARACTERISTICS

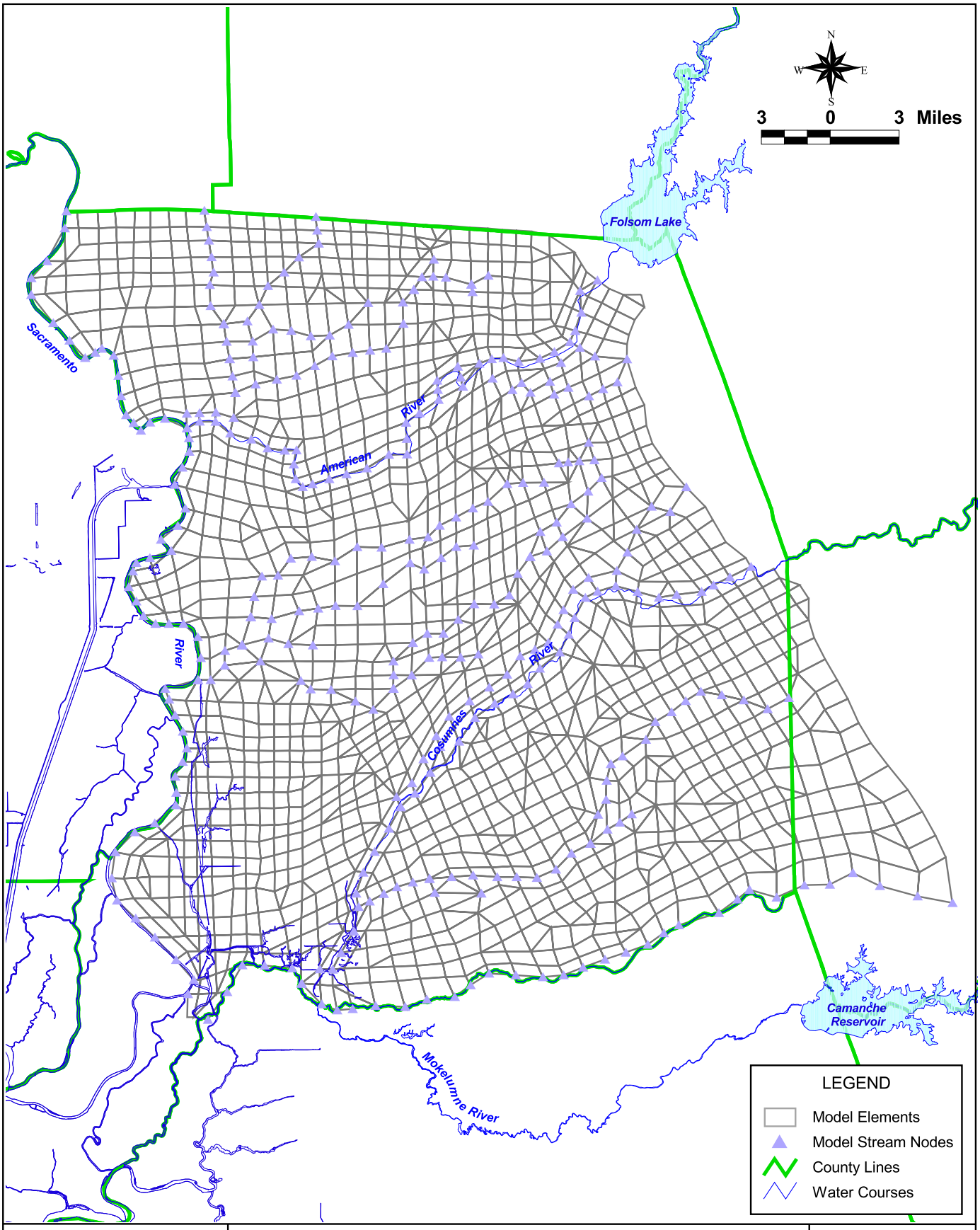
Previous reports (identified in the references) provide information on the Sacramento County IGSM model background and characteristics. Some information on the Sacramento County IGSM model grid, model subregions, and relationship to the groundwater sub basins are briefly described below.

MODEL GRID

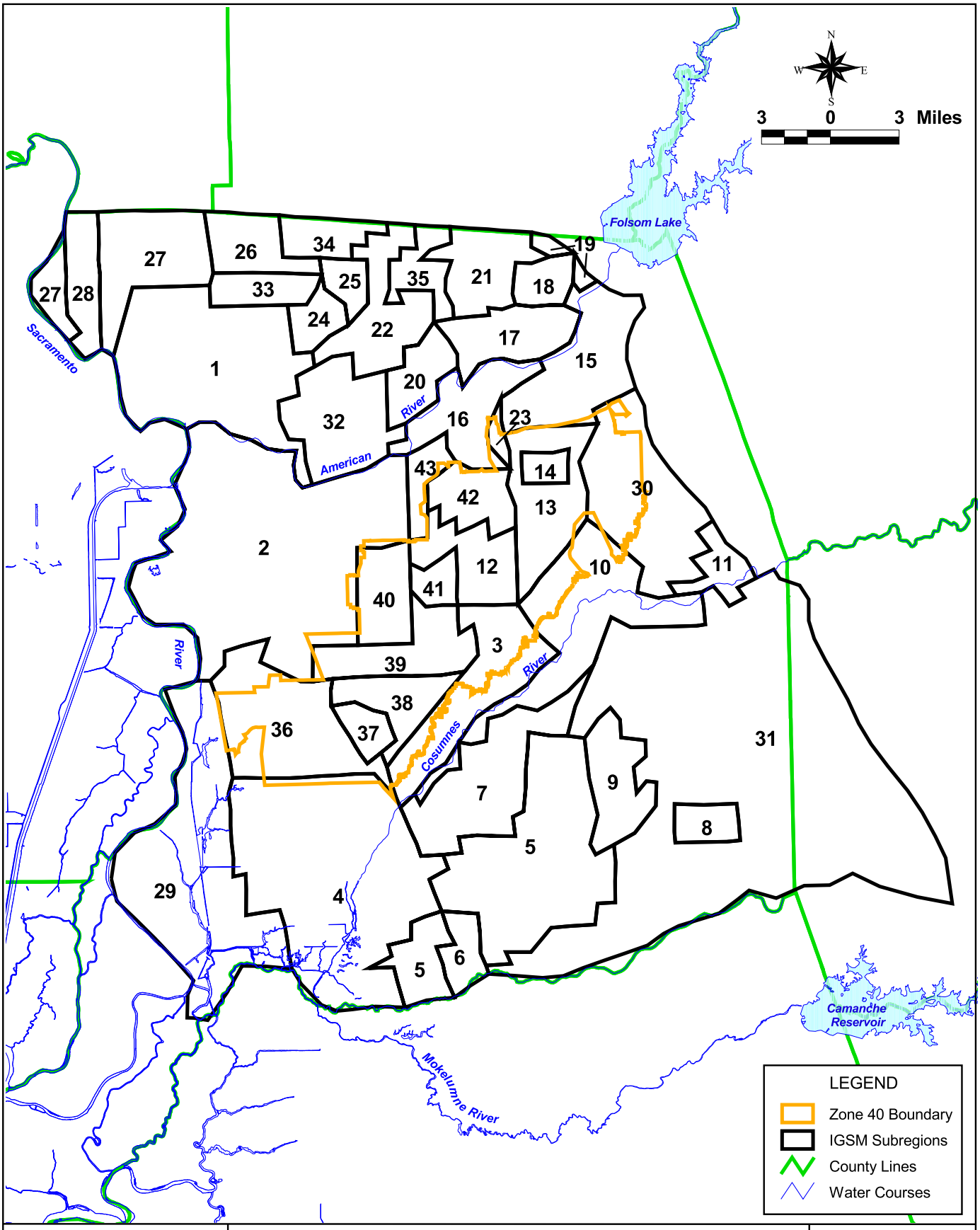
The Sacramento County IGSM model grid shown in Figure 2.2 consists of 1,637 elements and 1,552 nodes. It covers an area of about 900 square miles. The average element size is about 0.6 square miles (approximately 380 acres). The current version of the Sacramento County IGSM includes 43 model subregions and 12 modeled streams as described below.

MODEL SUBREGIONS

Much of the input data and output data are incorporated into the Sacramento County IGSM on a subregional basis. The original model included 31 subregions. Four additional model subregions were added to the Sacramento County IGSM in the North Area as part of the work completed for the American River Basin Cooperating Agencies (ARBCA) Regional Water Master Plan. The current version of the Sacramento County IGSM has been updated to include a total of 43 subregions as shown in Figure 2.3. Sacramento County IGSM subregions 36 through 43 (eight model subregions) were refined from the model subregion 3 (Zone 40) to provide better resolution to the water balance accounting in the Zone 40 area. The Sacramento County IGSM subregions are listed in Table 2.2.



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Sacramento County IGSM Model Grid** **DRAFT**	SEPTEMBER 2003 FIGURE 2.2



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Sacramento County IGSM Subregions** **DRAFT**	SEPTEMBER 2003 FIGURE 2.3

Table 2.2

Sacramento County IGSM Subregion Names

Subregion Number	Subregion Name
1	North Sacramento
2	South Sacramento
3	Omochumne-Hartnell North
4	Southwest
5	Galt ID
6	City Of Galt
7	OFSCU
8	SMUD
9	Clay WD
10	Omochumne-Hartnell
11	Rancho Murieta
12	Sunrise "A" - SCWA
13	Sunrise Douglas - SCWA
14	Security Park - Cal Am
15	City Of Folsom
16	Arden Cordova
17	Fair Oaks
18	Orangevale
19	San Juan
20	Carmichael
21	Citrus Heights
22	Northridge
23	Sunrise - SCWA
24	McClellan Air Force Base
25	Arcade
26	Rio Linda North
27	Natomas Mutual
28	Metro Airport
29	Courtland Area
30	Foothills North
31	Foothills South
32	Arcade WD - T&C
33	Rio Linda South
34	Antelope - Cal Am
35	Lincoln/RO - Cal Am
36	Laguna/Franklin - SCWA
37	EGWS
38	SCWA/EGWS Retail
39	Vineyard - SCWA
40	N. Vineyard In POU - SCWA
41	N. Vineyard Out POU - SCWA
42	Mather
43	Rosemont - Cal Am

GROUNDWATER AREAS

As mentioned, there are three separate groundwater sub basins identified in Sacramento County. The Water Forum refers to these sub basins as groundwater areas and uses the groundwater area delineations for purposes of summarizing model results. The Sacramento County IGSM model subregions have been aggregated to the groundwater areas as shown in Figure 2.4. Each of the groundwater areas is described below:

North Area

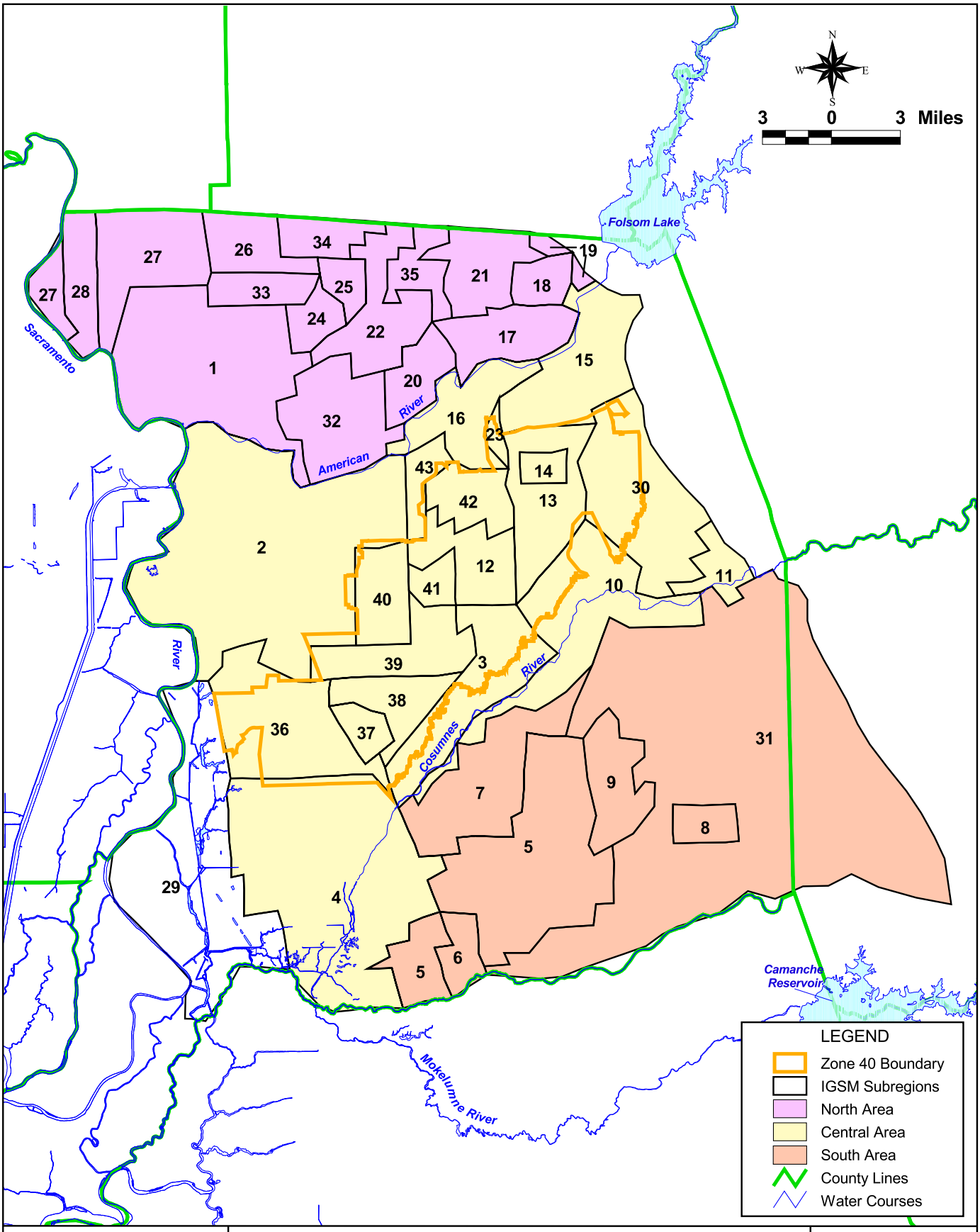
The North Area corresponds to that portion of the North American Sub Basin (DWR Basin Number 5-21.64) that is located within Sacramento County. Basin 5-21.64 extends north into Placer and Sutter Counties. In the Sacramento County IGSM, the North Area is bounded on the west by the Sacramento River, on the east by the boundary of the groundwater basin, on the north by the Sacramento-Placer/Sutter County line, and on the south by the American River.

Central Area

The Central Area corresponds to the South American Sub Basin (DWR Basin Number 5-21.65). The Sacramento County IGSM subregions representing the Central Area are shown in Figure 2.4. This sub basin is located between the American and the Cosumnes Rivers. For modeling purposes, the southern boundary of the Central Area corresponds to the Southern Boundary of Omochumne-Hartnell Water District, which is located just south of the Cosumnes River. It should be noted that the Water Forum did not include the Courtland Subregion (Subregion 29) as part of either the Central Area or South Area due to its proximity to the Sacramento–San Joaquin Delta and the corresponding high groundwater elevations.

South Area

The South Area (Galt Area) corresponds to that portion of the Cosumnes Sub Basin (DWR Basin Number 5-22.16) located within Sacramento County. In the Sacramento County IGSM, the South Area is bounded on the north and west by the Cosumnes River, on the east by the boundary of the groundwater basin, and on the south by the Sacramento County line. Subregion 8 (Sacramento Municipal Utility District [SMUD]) represents the Rancho Seco Powerplant. It is not included as part of the South Area, because its historically high industrial demand is not representative of typical agricultural or urban land uses and may mask model results for this area.



2002 ZONE 40 WATER SUPPLY MASTER PLAN

Sacramento County IGSM of Groundwater Basins

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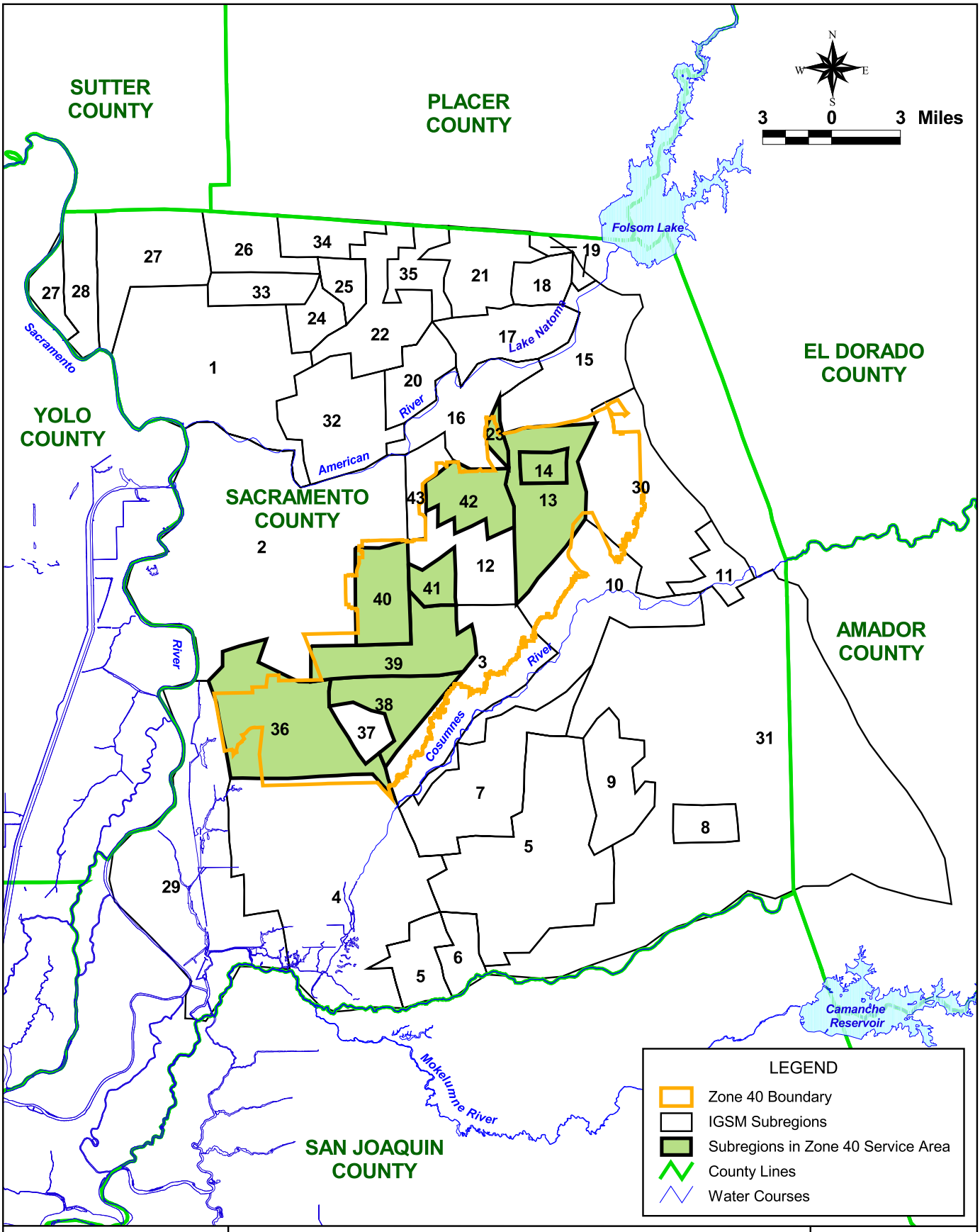
FIGURE 2.4

2030 STUDY AREA

Zone 40 is located within the Central Area as shown in Figure 2.4. For modeling purposes, the Study Area includes the selected areas within Zone 40, shown in Figure 1.1, which correspond to those Sacramento County IGSM model subregions identified in Figure 2.5. Table 2.3 presents the Sacramento County IGSM subregions grouped by the groundwater sub basin and Study Area.

As shown in Table 2.3, the 2030 Study Area includes nine subregions. These nine subregions are further divided into three areas as follows:

- **Sunrise Area –** This area includes model subregions 13, 14, and 23. The groundwater resources in this area are not considered useable for municipal supply because of existing groundwater contamination located to the northeast (at the Aerojet/Boeing site) and to the west (at the Mather Business Park).
- **Northern Zone 40 –** This area includes subregions 40, 41, and 42. These subregions are grouped together to represent the northern portion of the 2030 Study Area.
- **Southern Zone 40 –** This area includes subregions 36, 38, and 39. These subregions are grouped together to represent the southern portion of the 2030 Study Area.



2002 ZONE 40 WATER SUPPLY MASTER PLAN

Subregions in Zone 40 Service Area

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FIGURE 2.5

Table 2.3

Subregions Grouped by Groundwater Areas

Subregion Number	Subregion Name
North Area	
1	North Sacramento
17	Fair Oaks
18	Orangevale
19	San Juan
20	Carmichael
21	Citrus Heights
22	Northridge
24	McClellan AFB
25	Arcade
26	Rio Linda North
27	Natomas Mutual
28	Metro Airport
32	Arcade WD - T&C
33	Rio Linda South
34	Antelope - Cal Am
35	Lincoln/RO - Cal Am
Central Area	
2	South Sacramento
3	Omochumne-Hartnell North
4	Southwest
10	Omochumne-Hartnell
11	Rancho Murieta
12	Sunrise "A" - SCWA
15	City Of Folsom
16	Arden Cordova
30	Foothills North
37	EGWS
43	Rosemont - Cal Am
Zone 40	
13	Sunrise Douglas - SCWA
14	Security Park - Cal Am
23	Sunrise - SCWA
36	Laguna/Franklin - SCWA
38	SCWA/EGWS Retail
39	Vineyard - SCWA
40	N. Vineyard In POU - SCWA
41	N. Vineyard Out POU - SCWA
42	Mather
South (Galt)Area	
5	Galt ID
6	City Of Galt
7	OFSCU
9	Clay WD
31	Foothills South
Other	
8	SMUD
29	Courtland Area

SECTION 3 DESCRIPTION OF ALTERNATIVES

This section describes the alternatives developed and analyzed as part of the Zone 40 hydrologic analysis. The effects of water management alternatives are compared to specific baseline conditions. Two baseline conditions, 2000 and 2030 levels of development, reflecting existing conditions and ultimate buildout conditions, respectively, are developed and described below.

2000 BASELINE CONDITION

The 2000 Baseline represents the long-term effect of water supply and demand if conditions are held constant at the 2000 level of development. This means no changes in the current level of urban and agricultural demands (no new development), and no new surface water supplies or use of recycled water. The 2000 Baseline Condition within Zone 40 is based on the following:

- Land use (urban and agricultural acreage) is based on the DWR 2000 land use survey.
- Urban demands are estimated based on the 2000 land use survey, Boyle (1995) unit water use factors adjusted to reflect more recent water use data, and a 12 percent level of conservation.
- Agricultural demands are estimated based on crop type and the DWR 2000 crop acreages.
- Surface water supplies are limited to those currently in place, and are estimated based on CALSIM II 2000 Baseline Condition simulations.
- Groundwater pumping is used to meet most of the demands in Zone 40.
- There is no reuse of remediated water as a source of water supply. At the 2000 Baseline, there is about 20,000 acre-feet per year (AFY) of remediation groundwater pumping. Approximately 18,600 AFY occurs in the Central Area, mostly at the Aerojet/Boeing site (12,774 AFY) and at Mather Business Park (about 2,100 AFY). Within the Central Area, about 3,300 AFY of the treated groundwater is reinjected into the groundwater basin. The rest is discharged into small creeks or rivers.

2030 BASELINE CONDITION

The 2030 Baseline represents the long-term effect of buildout of the 2030 Study Area, with associated reductions in agricultural demands, and increases in surface water supplies to meet increased urban demand. Groundwater pumping would supplement surface water supplies for urban areas and would continue to meet agricultural demands. The 2030 Baseline Condition includes the following:

- Land use (urban and agricultural acreage) is based on projected 2030 land use, which includes buildout of the 2030 Study Area.
- Urban demands are estimated based on projected 2030 land use, Boyle (1995) unit water use factors adjusted to reflect more recent water use data, and a 25.6 percent level of conservation.
- Agricultural demands are estimated based on crop type and estimated 2030 crop acreage.
- Surface water supplies are increased to include 'firm water' supplies, including up to 4,400 AFY of reclaimed water from the Sacramento Regional County Sanitation District (SRCSD). The surface water supplies will be discussed in more detail in Section 5.
- Groundwater for urban uses is maintained within a long-term sustainable yield due to the provision of additional surface water supplies. Groundwater use for agricultural demands is less caused by reductions in irrigated acreage. Each subregion pumps groundwater to meet its water demands that are not satisfied by other sources; this includes groundwater pumping in the Sunrise Area to meet urban water demands.
- Total groundwater remediation pumping at Aerojet/Boeing is increased to 30,000 AFY. Of this amount, 9,400 AFY is treated and used as a source of water supply within Zone 40, 6,200 AFY is reinjected, and 5,000 AFY provided to augment Cosumnes River flows. This is the 'most likely' reuse option for the 2030 Baseline Condition.

In order to analyze the potential impacts of the water management options identified in the Master Plan on hydrologic conditions within the basin, three categories of alternatives were considered, as follows:

- Zone 40 Groundwater Pumping Distribution Alternatives
- Zone 40 Water Supply Availability Alternatives
- Groundwater Remediation/Reuse Alternatives

The details of these alternatives are described below and summarized in Table 3.1.

Table 3.1

Water Supply Alternatives for 2000 and 2030 Levels of Development

Alternative	2000 Level		2030 Level		Additional Supply Areas				Remediation/Reuse	
	General Plan	Zone 40	General Plan	Z40	North Vineyard	Zone 40 Uniform	Zone 40 North	Zone 40 South	2000	2030
Zone 40 Groundwater Pumping Distribution										
2000 Baseline Condition	X	X							With Existing Reuse	
Alternative 1A- Firm Surface Water Supply with Uniform Pumping	X			X	X	X			With Existing Reuse	Most Likely Reuse
Alternative 1B- Firm Surface Water Supply with Northern Zone 40 Pumping	X			X	X		X		With Existing Reuse	Most Likely Reuse
Alternative 1C- Firm Surface Water Supply with Southern Zone 40 Pumping	X			X	X			X	With Existing Reuse	Most Likely Reuse
Zone 40 Supply Availability										
2030 Baseline Condition			X	X					With Existing Reuse	Most likely Reuse
Alternative 2A- Firm Surface Water Supply with Most Likely Remediation Reuse			X	X	X	X			With Existing Reuse	Most Likely Reuse
Alternative 3 - Full Surface Water Supply with Most Likely Remediation Reuse			X	X	X	X			With Existing Reuse	Most Likely Reuse
Groundwater Remediation										
Alternative 2B- Firm Surface Water Supply with No Remediation Reuse			X	X	X	X			With Existing Reuse	W/O Reuse
Alternative 2C- Firm Surface Water Supply with Full Remediation Reuse			X	X	X	X			With Existing Reuse	100% Reuse
Alternative 4A -2000 Level with No Remediation Reuse	X	X							No Remediation	
Alternative 4B- 2000 Level with Additional Remediation Reuse	X	X							Increased Level of Reuse	

ZONE 40 GROUNDWATER PUMPING DISTRIBUTION ALTERNATIVES

The purpose of the pumping alternatives is to determine the effects of the distribution of groundwater pumping by SCWA on hydrologic conditions within the Central area. The key discriminator is the effects the location of future pumping has on flow conditions in the Cosumnes River. Three Sacramento County IGSM model runs are compared to the Baseline to assess various pumping distribution scenarios. They include:

- **Alternative 1A –** Firm Surface Water Supply with Uniform Pumping
- **Alternative 1B –** Firm Surface Water Supply with Northern Zone 40 Pumping
- **Alternative 1C –** Firm Surface Water Supply with Southern Zone 40 Pumping

Under Alternative 1, land and water use conditions in the areas located outside of Zone 40 are assumed to be the same as those described in the 2000 Baseline Condition. The differences between Alternative 1 scenarios and the 2000 Baseline Condition, within Zone 40, are listed below:

- Zone 40 land use (urban and agricultural acreage) is based on projected 2030 land use, which includes buildout of the 2030 Study Area.
- Zone 40 urban demands are estimated based on projected 2030 land use, Boyle (1995) unit water use factors adjusted to reflect more recent water use data, and a 25.6 percent level of conservation.
- Zone 40 agricultural demands are estimated based on crop type and estimated 2030 crop acreage.
- Surface water supplies are increased to include 'firm water' supplies to be available, including up to 4,400 AFY of reclaimed water from the SRCSD. The surface water supplies will be discussed in more detail in the next section.
- Groundwater for urban uses is maintained within a long-term sustainable yield due to the provision of additional surface water supplies. Groundwater use for agricultural demands is less caused by reductions in irrigated acreage. Groundwater supplies are used to meet water demands that are not satisfied by other sources.
- There is no reuse of remediated water as a source of water supply.

The various scenarios of Alternative 1 are based on the distribution of groundwater pumping within the 2030 Study Area. The three different variations of Alternative 1 (1A, 1B, and 1C) are described below.

ALTERNATIVE 1A – FIRM SURFACE WATER SUPPLY WITH UNIFORM PUMPING

Alternative 1A represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area. Much of the increased demand is met by additional surface water supplies. Additional groundwater demand will be met with pumping facilities uniformly distributed throughout the northern and southern portion of Zone 40 (shown in Figure 2.5). There is no groundwater pumping for water supply purposes in the Sunrise Area (located between the Aerojet/Boeing and Mather groundwater remediation operations) in this alternative.

ALTERNATIVE 1B – FIRM SURFACE WATER SUPPLY WITH NORTHERN ZONE 40 PUMPING

Alternative 1B represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area. Much of the increased demand will be met by additional surface water supplies. Additional groundwater needs will be met with pumping facilities focused in the northern portion of Zone 40 (shown in Figure 2.5).

ALTERNATIVE 1C – FIRM SURFACE WATER SUPPLY WITH SOUTHERN ZONE 40 PUMPING

Alternative 1C represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area. Much of the increased demand will be met by additional surface water supplies. Additional groundwater needs will be met with pumping facilities focused in the southern portion of Zone 40 (shown in Figure 2.5).

ZONE 40 WATER SUPPLY AVAILABILITY ALTERNATIVES

These alternatives identify the impacts associated with different surface water supply availability within Zone 40. The following three Sacramento County IGSM model runs are compared:

- 2030 Baseline Condition (described above)
- Alternative 2 – Firm Surface Water Supply Availability
- Alternative 3 – Full Surface Water Supply with Most Likely Remediation Reuse

Alternatives 2 and 3 are described below.

ALTERNATIVE 2 – FIRM SURFACE WATER SUPPLY AVAILABILITY

The purpose of Alternative 2 is to determine the impacts of groundwater remediation reuse on the buildout of the 2030 Study Area. The source of the remediated water is the Aerojet/Boeing groundwater remediation program in the northeast corner of the Central Basin. It is assumed that by 2030, the Aerojet/Boeing remediation pumping will total 30,000 AFY. Three different versions of Alternative 2 were analyzed based on different levels of reuse. Table 3.2 below lists the remediation reuse for Alternative 2.

Table 3.2
Reuse Alternatives of Aerojet/Boeing Groundwater Remediation Pumping

	Reinjection (AFY)	Cosumnes River Flow Enhancement (AFY)	Remediation Reuse (AFY)
Alternative 2A	6,200	5,000	9,400
Alternative 2B	6,200	0	0
Alternative 2C	6,200	5,000	18,800

Reinjection is assumed to occur at a constant rate of 517 AF per month. The Cosumnes River Flow Enhancement is assumed to occur at a rate of 1,667 AF per month (28 cubic feet per second [cfs]) during a three-month period beginning in September.

ALTERNATIVE 2A – FIRM SURFACE WATER SUPPLY WITH MOST LIKELY REMEDIATION REUSE

Alternative 2A represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area and uses 9,400 AFY of remediate water as a source of water supply for Zone 40.

Alternative 2A differs from the 2030 Baseline Condition because groundwater pumping is uniformly distributed over the 2030 Study Area.

ALTERNATIVE 2B – FIRM SURFACE WATER SUPPLY WITH NO REMEDIATION REUSE

Alternative 2B represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area with no reuse of remediated water.

ALTERNATIVE 2C – FIRM SURFACE WATER SUPPLY WITH FULL REMEDIATION REUSE

Alternative 2C represents the long-term effect of water demand and supply resulting from the buildout of the 2030 Study Area with full reuse of remediated water (totaling 18,800 AFY).

ALTERNATIVE 3 – FULL SURFACE WATER SUPPLY WITH MOST LIKELY REMEDIATION REUSE

Alternative 3 represents the long-term effect resulting from the buildout of the 2030 Study Area. Surface water supplies would be provided to satisfy increased urban demand. Groundwater pumping would be used to supplement surface water supplies for urban areas and to meet agricultural demands. Year 2030 Full Project Conditions are as follows:

- Land use (urban and agricultural acreage) is based on projected 2030 land use, which includes buildout of the 2030 Study Area.
- Urban demands are estimated based on projected 2030 land use, Boyle (1995) unit water use factors adjusted to reflect more recent water use data, and a 25.6 percent level of conservation.
- Agricultural demands are estimated based on crop type and estimated 2030 crop acreage.
- Surface water supplies are increased to include 'firm water' supplies, up to 4,400 AFY of reclaimed water from the SRCSD, and appropriative water.
- Groundwater for urban uses is maintained within a long-term sustainable yield due to the provision of additional surface water supplies. Groundwater use for agricultural demands is less caused by reductions in irrigated acreage.
- Reuse of remediated water extraction is available as source of water supply. The 'most likely' reuse option is currently assumed.

Alternative 3 differs from Alternative 2a by increasing available surface water supply by an estimated 14,600 AFY through the use of appropriative water.

GROUNDWATER REMEDIATION/REUSE ALTERNATIVES

The alternatives included in this group identify the impacts associated with different groundwater remediation and reuse options within the Central Basin. The following four Sacramento County IGSM model runs are compared:

- Alternative 2B – Firm Surface Water Supply with No Remediation Reuse

- Alternative 2C – Firm Surface Water Supply with Full Remediation Reuse
- Alternative 4A – 2000 Level with No Remediation Reuse
- Alternative 4B – 2000 Level with Additional Remediation Reuse

ALTERNATIVE 2B – FIRM SURFACE WATER SUPPLY WITH NO REMEDIATION REUSE

Alternative 2B was described above. It is presented here to identify the effects of groundwater remediation on groundwater levels in the Central Basin.

ALTERNATIVE 2C – FIRM SURFACE WATER SUPPLY WITH FULL REMEDIATION REUSE

Alternative 2C was described above. It is presented here to identify the effects of groundwater remediation on groundwater levels in the Central Basin.

ALTERNATIVE 4A – 2000 LEVEL WITH NO REMEDIATION REUSE

Alternative 4A represents the long-term effect of water demand and supply conditions at the 2000 level of development if there were no groundwater remediation in the Sacramento County IGSM model area. All other assumptions are the same as the 2000 Baseline Condition.

ALTERNATIVE 4B – 2000 LEVEL WITH ADDITIONAL REMEDIATION REUSE

Alternative 4B represents the long-term effect of water demand and supply conditions, at the 2000 level of development, with existing groundwater remediation efforts and increased injection rates. It is assumed that reinjection of treated groundwater at Aerojet/Boeing would increase from 1,460 AFY (2000 Baseline Conditions) to 6,390 AFY. All other assumptions remain the same as the 2000 Baseline Condition.

SECTION 4 LAND AND WATER USE CONDITIONS

This section provides the land and water use information used to define the 2000 and 2030 Baseline conditions. The 2030 Study Area and the Central Basin are the primary focus areas for this analysis, so this section addresses the changes in land and water use conditions in these areas for the 2000 and 2030 levels of development.

LAND USE CONDITIONS

General land use directly affects water use, but it also impacts the amount of surface runoff and infiltration into soil resulting from rainfall and applied irrigation water. In order to estimate agricultural water use and simulate various amounts of applied water (associated consumptive use, field runoff, and percolation), annual crop acreage must be defined.

DWR conducts land use surveys by county in California in order to estimate changing water demands. These surveys are completed about every five to ten years for an individual county. The Standard Land Use Legend (DWR, 1999) includes the list of land uses mapped in the survey process. Land Use surveys are available for Sacramento County for 1976, 1984, 1993, and 2000.

BASELINE LAND USE CONDITIONS

The planning assumptions for the 2000 and 2030 Baseline land use are presented below. In this analysis, the land use data presented for the 2000 and projected 2030 conditions represent land use trends within Sacramento County. For modeling purposes, land use data includes both a definition of the general land use (to identify infiltration and runoff characteristics), and crop acreage (to identify water use). The background information and assumptions for general land use and crop acreage used in the Sacramento County IGSM are described below.

General Land Use

General land use classification identifies lands with similar water use, infiltration, and runoff characteristics. The following five classes of general land use conditions have been identified in the Sacramento County IGSM:

- Agricultural land (AG), generally consisting of areas greater than 5 acres and currently used for agriculture;

- Agricultural-Residential (Ag-Res), generally consisting of 2- to 5-acre parcels zoned for agricultural and residential use;
- Urban (Urban), consisting of different types of municipal, commercial, or industrial development;
- Native Vegetation/Undeveloped (NV), consisting of areas that have not been developed. These areas may be used for dryland grazing; and
- Riparian Vegetation (RV), generally consisting of areas along water ways.

Typically, agricultural land, ag-residential land, and urban land received applied water while native vegetation/undeveloped and riparian lands do not receive any water except rainfall. The estimated acreage for each of these land use classes was developed from a geographic information system (GIS) analysis of the available land use data and is presented by basin area on Table 4.1.

2000 Land Use

The 2000 land use data was developed based on a GIS analysis of the 2000 DWR land use survey for Sacramento County. The 2030 Study Area general land use data for the 2000 Baseline is presented on Table 4.2 and shown in Figure 4.1.

2030 Land Use

The 2030 land use data was developed based on a GIS analysis of the following data sources:

- 2000 DWR land use survey for Sacramento County;
- DWR Detailed Analysis Unit (DAU) crop acreage estimates;
- Sacramento County General Plan land use mapping; and
- 2002 Zone 40 Water Supply Master Plan (for 2030 Study Area only).

The general land use data for the 2030 Baseline is presented on Table 4.3 and shown in Figure 4.2.

Difference in 2030 Study Area

Comparison of the general land use for the 2030 Study Area between the 2000 Baseline and 2030 Baseline is summarized below.

Table 4.1

Estimated Acreage of Land Use (All Values in Acres)

North Basin						
	Agriculture	**Urban**	**Agriculture-Resdential [a]**	**Riparian Vegetation**	**Undeveloped/ Native Vegetation**	**Total**
2000	20,736	76,473	2,376	1,395	20,224	121,204
2030	7,078	84,526	5,297	0 [b]	24,303	121,204
Central Basin						
	Agriculture	**Urban**	**Agriculture-Resdential [a]**	**Riparian Vegetation**	**Undeveloped/ Native Vegetation**	**Total**
2000	51,126	80,387	7,572	6,409	101,692	247,186
2030	39,492	132,263	10,486	6,363	58,582	247,186
South Basin						
	Agriculture	**Urban**	**Agriculture-Resdential [a]**	**Riparian Vegetation**	**Undeveloped/ Native Vegetation**	**Total**
2000	34,315	9,151	4,709	1,609	108,528	158,311
2030	21,934	8,942	19,647	1,609	106,178	158,311
Other						
	Agriculture	**Urban**	**Agriculture-Resdential [a]**	**Riparian Vegetation**	**Undeveloped/ Native Vegetation**	**Total**
2000	22,019	847	23	2,293	9,996	35,178
2030	21,876	2,332	23	2,293	8,654	35,178
Total						
	Agriculture	**Urban**	**Agriculture-Resdential [a]**	**Riparian Vegetation**	**Undeveloped/ Native Vegetation**	**Total**
2000	128,196	166,858	14,679	11,706	240,440	561,879
2030	90,380	228,063	35,453	10,265	197,717	561,879

Source: ARBCA, WRIME GIS, MWH, DWR

Note:

(a) Agricultural Residential land use represents a mixture of urban and agricultural areas.

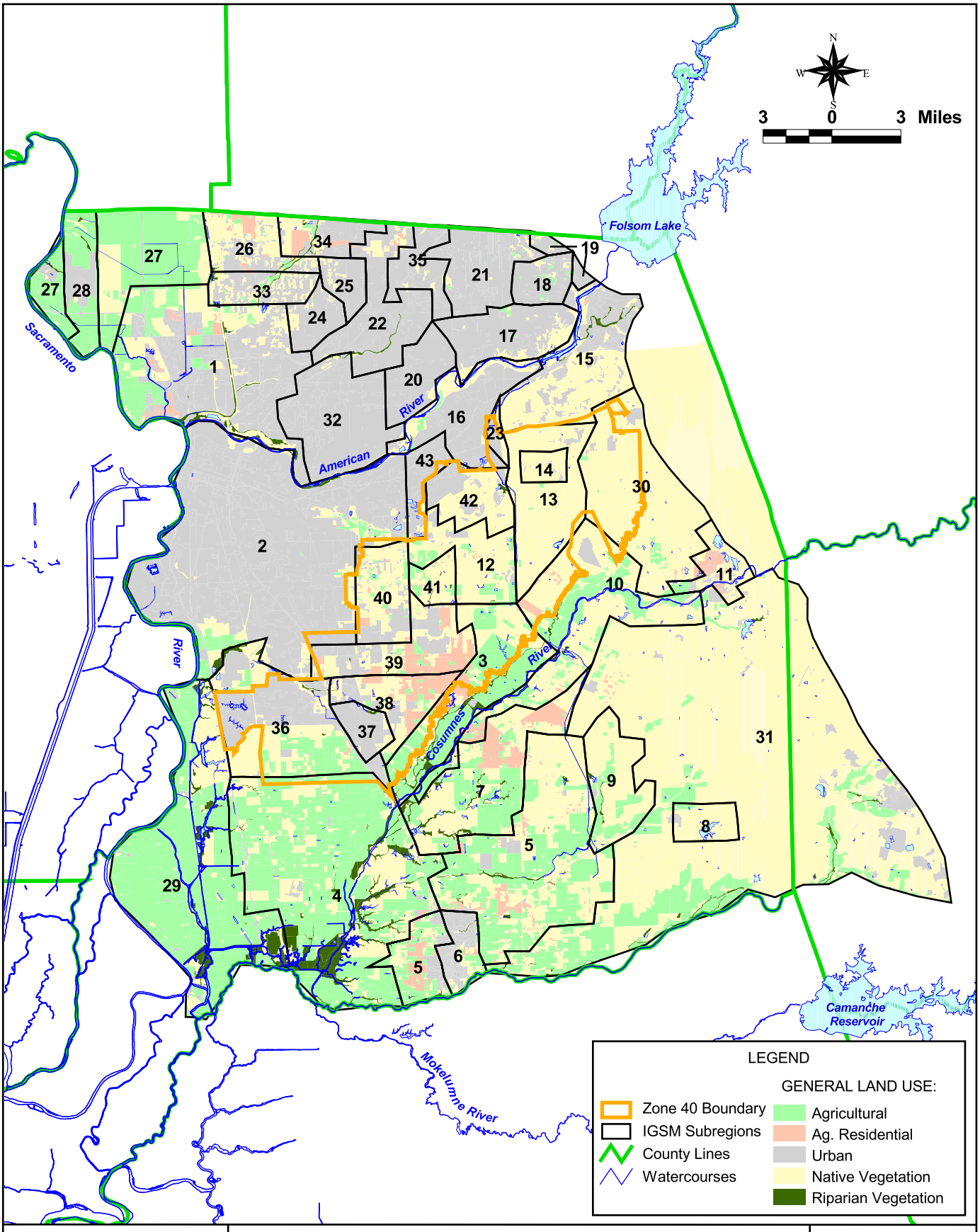
(b) The ARBCA Water Supply Master Plan did not identify the number of acres associated with Riparian Vegetation north of American River.

Table 4.2

2000 Baseline Land Use in Study Area (All Values in Acres)

Subregion Number	Subregion Name	Agriculture	Urban	Agriculture-Resdential [a]	Riparian Vegetation	Native Vegetation	Total Subregion Area
13	Sunrise Douglas - SCWA	96	221	9	27	10,271	10,624
14	Security Park - Cal Am	1	84	2	0	1,662	1,749
23	Sunrise - SCWA	0	525	0	0	389	914
36	Laguna/Franklin - SCWA	3,323	7,608	50	271	5,901	17,153
38	SCWA/EGWS Retail	582	783	1,953	33	2,646	5,997
39	Vineyard - SCWA	1,603	976	2,419	20	3,765	8,783
40	N. Vineyard In POU - SCWA	540	1,677	301	0	3,919	6,437
41	N. Vineyard Out POU - SCWA	473	38	87	27	1,753	2,378
42	Mather	7	2,167	28	47	3,507	5,756
Total		**6,625**	**14,079**	**4,849**	**425**	**33,813**	**59,791**

(a) Agriculture-Residential land use represents a mixture of urban and agricultural areas.



2002 ZONE 40 WATER SUPPLY MASTER PLAN

Year 2000 General Land Use

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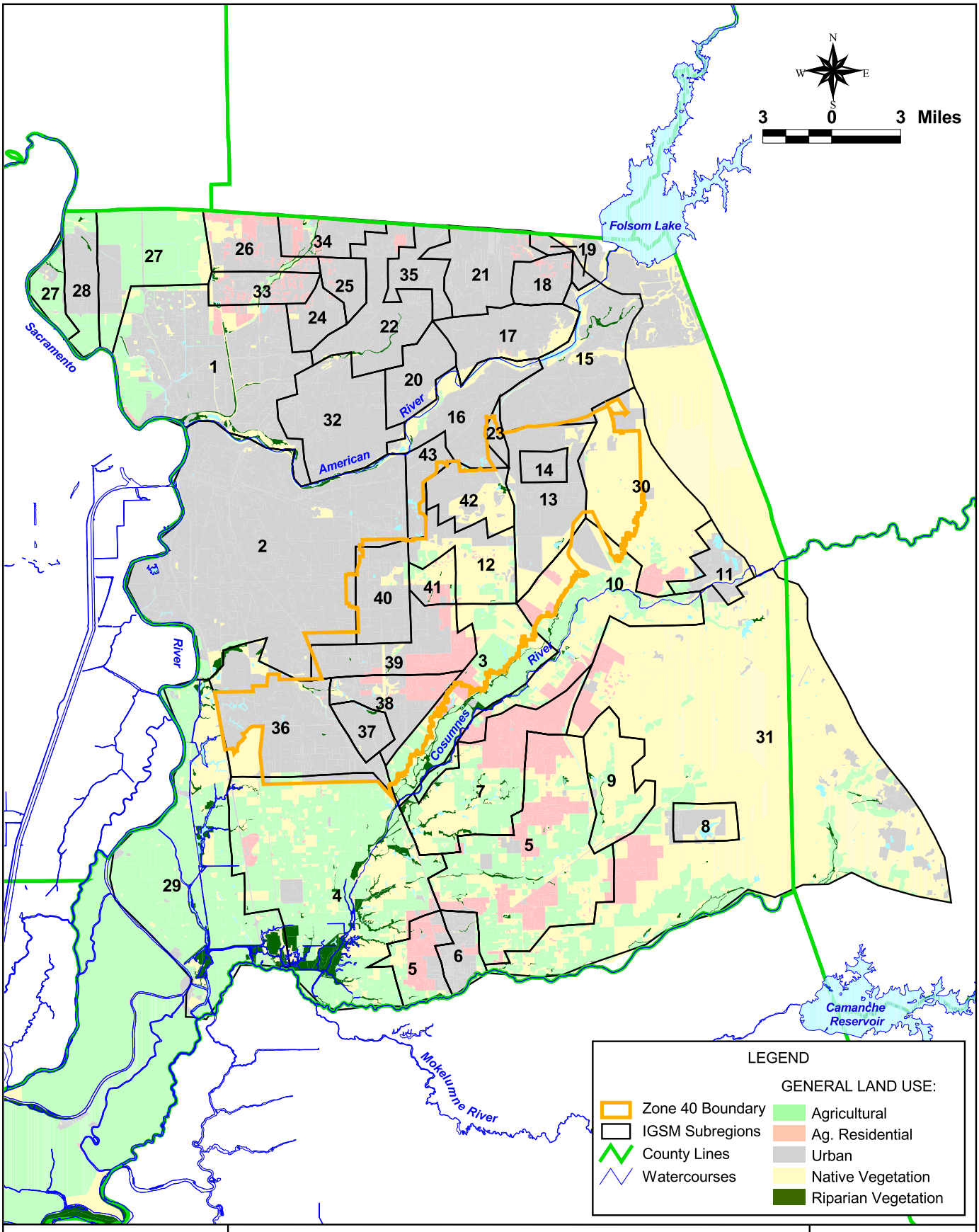
FIGURE 4.1

Table 4.3

2030 Baseline Land Use in Study Area (All Values in Acres)

Subregion Number	Subregion Name	Agriculture	Urban	Agriculture-Resdential [a]	Riparian Vegetation	Native Vegetation	Total Subregion Area
13	Sunrise Douglas - SCWA	713	8,556	0	27	1,328	10,624
14	Security Park - Cal Am	11	1,736	1	0	1	1,749
23	Sunrise - SCWA	0	912	0	0	2	914
36	Laguna/Franklin - SCWA	50	14,203	25	271	2,604	17,153
38	SCWA/EGWS Retail	53	4,151	1,736	33	24	5,997
39	Vineyard - SCWA	322	4,902	2,637	20	902	8,783
40	N. Vineyard In POU - SCWA	0	5,592	8	0	837	6,437
41	N. Vineyard Out POU - SCWA	0	1,840	511	27	0	2,378
42	Mather	0	5,755	0	1	0	5,756
Total		**1,149**	**47,647**	**4,918**	**379**	**5,698**	**59,791**

(a) Agriculture-Residential land use represents a mixture of urban and agricultural areas.



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2002 ZONE 40 WATER SUPPLY MASTER PLAN

Year 2030 General Land Use

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SEPTEMBER 2003

FIGURE 4.2

- Agricultural land use will decrease from about 7,700 acres in 2000 to about 1,150 acres in 2030.
- Urban land use will increase from about 18,000 acres in 2000 to about 52,400 acres in 2030.
- Native Vegetation/Undeveloped land will decrease from about 33,800 acres in 2000 to about 6,400 acres in 2030.
- There will be no change in the riparian land use between 2000 and 2030.

CROP ACREAGE

The crop acreage data is used to estimate agricultural water demands. While there are many different crops grown in Sacramento County, they are aggregated into 11 crop categories for purposes of water demand calculations. These categories are listed below:

- Pasture
- Alfalfa
- Sugar Beets
- Field Crops
- Rice
- Truck Crops
- Tomato
- Orchard
- Grain
- Vineyards
- Citrus/Olives

The 2000 Baseline crop acreage is shown on Table 4.4, and the distribution of crops is shown in Figure 4.3.

The 2030 Baseline crop acreage is shown on Table 4.5. While the crop acreage estimates are available for 2030 by groundwater subregion, the actual distribution of crops is not known.

In the 2030 Study Area, much of the agricultural acreage present in 2000 is replaced by urbanization by 2030 (see Tables 4.4 and 4.5). Agricultural acreage decreases from about 7,700 acres to about 1,150 acres within the 2030 Study Area.

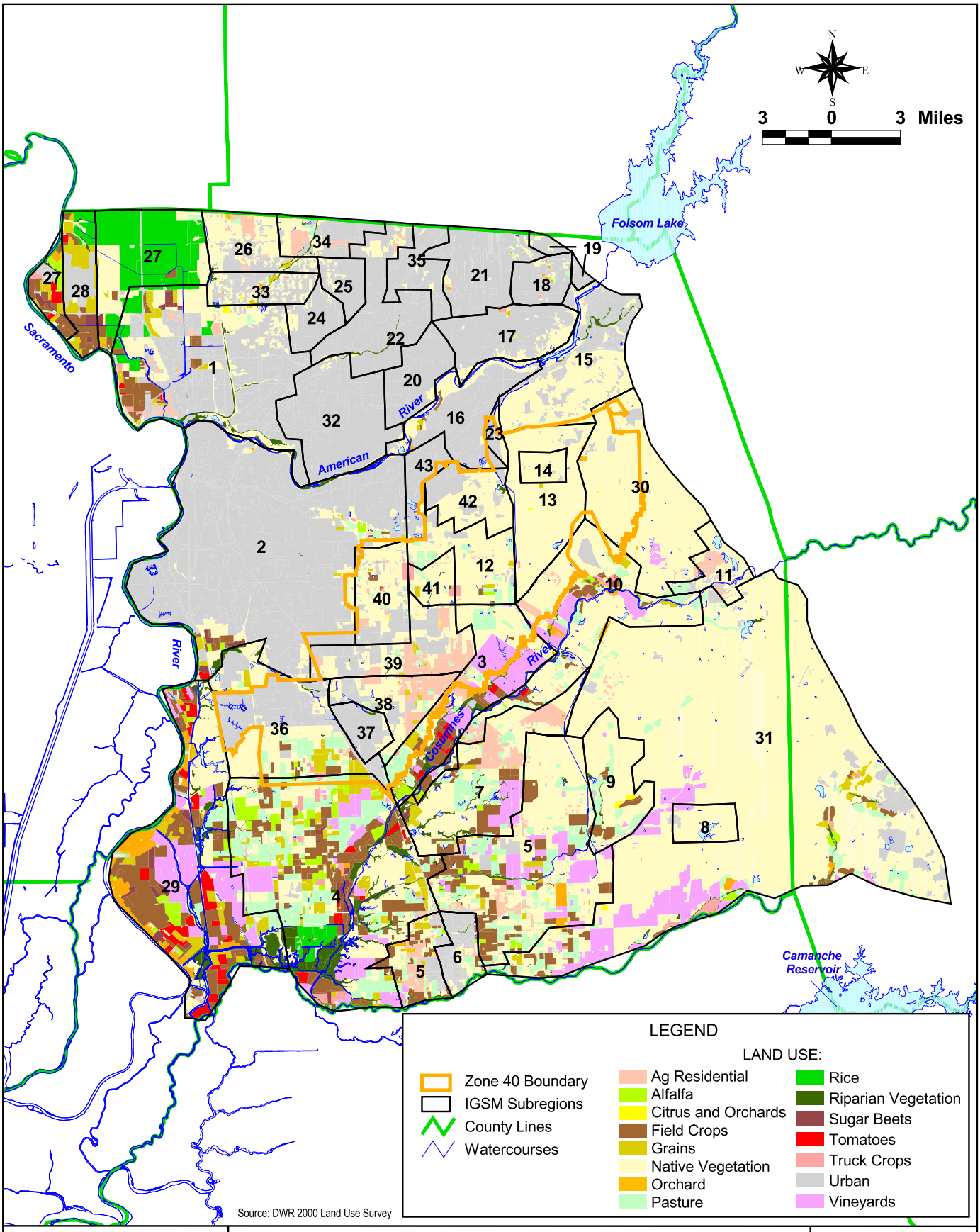
Urban acreage in the 2030 Study Area increased from about 17,900 acres in 2000 to 52,400 acres in 2030. This increase in urban acreage resulted from the conversion of agricultural land and the development of previously undeveloped land.

Table 4.4

2000 Baseline Land Use and Crop Acreage (All Values in Acres)

IGSM Subregion	Subregion Name	Subregion Area	Pasture	Alfalfa	Sugar Beets	Field Crops	Rice	Truck Crops	Tomatoes	Orchard	Grain	Vineyard	Citrus/ Olives	Agricultural Subtotal [a]	Urban [a]	Total Developed Acreage	Undeveloped/ Native Vegetation	Riparian Vegetation	Total Land Use Acreage
North Area																			
1	North Sacramento	28,854	288	0	292	1,679	1,414	189	30	50	740	0	4	4,686	16,681	21,367	6,773	714	28,854
17	Fair Oaks	7,838	7	0	0	0	0	44	0	8	20	0	12	91	6,385	6,476	1,362	0	7,838
18	Orangevale	3,238	126	0	0	0	0	14	0	48	0	0	9	197	2,849	3,046	192	0	3,238
19	San Juan	1,203	116	0	0	0	0	8	0	0	8	0	0	132	832	964	239	0	1,203
20	Carmichael	5,095	0	0	0	0	0	0	0	0	0	0	0	0	4,966	4,966	129	0	5,095
21	Citrus Heights	7,852	72	0	0	0	0	14	0	24	0	0	0	110	7,295	7,405	447	0	7,852
22	Northridge	10,146	15	0	0	0	0	0	0	0	0	0	0	15	9,354	9,369	645	132	10,146
24	McClellan AFB	3,165	6	0	0	0	0	0	0	0	0	0	0	6	2,807	2,813	352	0	3,165
25	Arcade	2,543	0	0	0	0	0	3	0	0	0	0	0	3	2,301	2,304	239	0	2,543
26	Rio Linda North	5,993	239	0	0	0	28	16	0	12	89	0	8	392	2,057	2,449	3,473	71	5,993
27	Natomas Mutual	14,851	199	324	201	1,232	8,175	106	260	148	502	2	0	11,149	517	11,666	3,075	110	14,851
28	Metro Airport	5,453	45	34	187	1,035	707	0	50	38	1,490	0	0	3,586	1,543	5,129	244	80	5,453
32	Arcade WD - T&C	12,396	0	0	0	0	0	0	0	0	0	0	0	0	12,072	12,072	243	81	12,396
33	Rio Linda South	4,120	73	0	0	0	0	32	0	25	97	0	14	241	2,361	2,602	1,420	98	4,120
34	Antelope - Cal Am	4,208	154	0	0	0	0	2	0	0	12	0	0	168	2,782	2,950	1,149	109	4,208
35	Lincoln/RO - Cal Am	4,249	0	0	0	0	0	0	0	0	0	0	0	0	4,007	4,007	242	0	4,249
Total		**121,204**	**1,340**	**358**	**680**	**3,946**	**10,324**	**428**	**340**	**353**	**2,958**	**2**	**47**	**20,776**	**78,809**	**99,585**	**20,224**	**1,395**	**121,204**
Central Area (Outside Zone 40)																			
2	South Sacramento	53,020	202	177	257	400	0	43	81	9	271	0	0	1,440	46,525	47,965	4,534	521	53,020
3	Omochumne-Hartnell North	13,823	2,372	183	29	1,328	0	23	415	11	472	3,628	0	8,461	260	8,721	4,287	815	13,823
4	Southwest	42,394	8,142	2,095	351	7,090	1,032	810	571	88	3,022	3,924	7	27,132	1,048	28,180	10,332	3,882	42,394
10	Omochumne-Hartnell	19,678	2,467	173	0	1,177	0	250	87	237	289	1,452	0	6,132	720	6,852	12,335	491	19,678
11	Rancho Murieta	3,641	274	0	0	0	0	0	0	0	0	0	0	274	1,007	1,281	2,360	0	3,641
12	Sunrise "A" - SCWA	7,541	1,032	53	0	60	0	99	0	0	97	0	0	1,341	721	2,062	5,468	11	7,541
15	City Of Folsom	13,858	2	0	0	0	0	0	0	0	0	0	0	2	5,312	5,314	8,299	245	13,858
16	Arden Cordova	9,251	0	0	0	117	0	0	0	24	61	0	0	202	6,600	6,802	2,430	19	9,251
30	Foothills North	18,469	237	0	0	0	0	0	0	68	7	296	10	618	669	1,287	17,182	0	18,469
37	EGWS	2,625	0	0	0	0	0	0	0	0	0	0	0	0	2,307	2,307	318	0	2,625
43	Rosemont - Cal Am	3,095	3	0	0	0	0	0	0	6	0	0	0	9	2,752	2,761	334	0	3,095
Total		**187,395**	**14,731**	**2,681**	**637**	**10,172**	**1,032**	**1,225**	**1,154**	**443**	**4,219**	**9,300**	**17**	**45,611**	**67,921**	**113,532**	**67,879**	**5,984**	**187,395**
Zone 40																			
13	Sunrise Douglas - SCWA	10,624	12	0	0	0	0	24	0	11	34	0	15	96	230	326	10,271	27	10,624
14	Security Park - Cal Am	1,749	1	0	0	0	0	0	0	0	0	0	0	1	86	87	1,662	0	1,749
23	Sunrise - SCWA	914	0	0	0	0	0	0	0	0	0	0	0	0	525	525	389	0	914
36	Laguna/Franklin - SCWA	17,153	1,631	58	2	490	0	144	0	25	973	0	0	3,323	7,658	10,981	5,901	271	17,153
38	SCWA/EGWS Retail	5,997	1,406	0	0	0	0	24	0	9	119	0	0	1,558	1,760	3,318	2,646	33	5,997
39	Vineyard - SCWA	8,783	1,458	0	0	0	0	8	0	7	111	2	17	1,603	3,395	4,998	3,765	20	8,783
40	N. Vineyard In POU - SCWA	6,437	249	0	0	76	0	178	0	0	20	0	17	540	1,978	2,518	3,919	0	6,437
41	N. Vineyard Out POU - SCWA	2,378	262	0	0	0	0	177	0	0	77	0	0	516	82	598	1,753	27	2,378
42	Mather	5,756	21	0	0	0	0	0	0	0	0	0	0	21	2,181	2,202	3,507	47	5,756
Total		**59,791**	**5,040**	**58**	**2**	**566**	**0**	**555**	**0**	**52**	**1,334**	**2**	**49**	**7,658**	**17,895**	**25,553**	**33,813**	**425**	**59,791**
Total Central Basin		**247,186**	**19,771**	**2,739**	**639**	**10,738**	**1,032**	**1,780**	**1,154**	**495**	**5,553**	**9,302**	**66**	**53,269**	**85,816**	**139,085**	**101,692**	**6,409**	**247,186**
South Area																			
5	Galt ID	32,797	6,529	482	0	4,941	0	38	0	528	767	3,050	16	16,351	2,415	18,766	13,694	337	32,797
6	City Of Galt	3,357	192	35	0	143	0	0	0	0	0	4	7	381	2,258	2,639	668	50	3,357
7	OFSCU	15,053	3,365	57	94	1,486	0	0	0	10	444	1,131	4	6,591	490	7,081	7,368	604	15,053
9	Clay WD	7,668	1,022	0	0	535	0	0	0	0	0	134	107	1,798	132	1,930	5,654	84	7,668
31	Foothills South	99,436	4,002	265	0	1,403	0	538	0	302	742	6,501	40	13,793	3,965	17,758	81,144	534	99,436
Total		**158,311**	**15,110**	**839**	**94**	**8,508**	**0**	**576**	**0**	**840**	**1,953**	**10,820**	**174**	**38,914**	**9,260**	**48,174**	**108,528**	**1,609**	**158,311**
Other																			
8	SMUD	2,934	0	0	0	0	0	0	0	0	0	150	0	150	131	281	2,653	0	2,934
29	Courtland Area	32,244	1,129	847	659	7,694	0	22	2,438	2,544	1,761	4,798	0	21,892	716	22,608	7,343	2,293	32,244
Total		**35,178**	**1,129**	**847**	**659**	**7,694**	**0**	**22**	**2,438**	**2,544**	**1,761**	**4,948**	**0**	**22,042**	**847**	**22,889**	**9,996**	**2,293**	**35,178**
Grand Total		**561,879**	**37,350**	**4,783**	**2,072**	**30,886**	**11,356**	**2,806**	**3,932**	**4,232**	**12,225**	**25,072**	**287**	**135,001**	**174,732**	**309,733**	**240,440**	**11,706**	**561,879**

(a) Average Values for Agriculture and Urban may include some Agriculture-Residential acreage



2002 ZONE 40 WATER SUPPLY MASTER PLAN

Year 2000 Crop Distribution

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FIGURE 4.3

Table 4.5

2030 Baseline Land Use and Crop Acreage (All Values in Acres)

IGSM Subregion	Subregion Name	Subregion Area	Pasture	Alfalfa	Sugar Beets	Field Crops	Rice	Truck Crops	Tomatoes	Orchard	Grain	Vineyard	Citrus/ Olives	Agricultural Subtotal [a]	Urban [a]	Total Developed Acreage	Undeveloped/ Native Vegetation	Riparian Vegetation	Total Land Use Acreage
North Area																			
1	North Sacramento	28,854	84	14	57	126	323	0	57	57	281	0	0	999	27,374	28,373	481	0	28,854
17	Fair Oaks	7,838	0	0	0	0	0	0	0	0	0	0	0	0	6,300	6,300	1,538	0	7,838
18	Orangevale	3,238	0	0	0	0	0	0	0	0	0	0	0	0	2,376	2,376	862	0	3,238
19	San Juan	1,203	0	0	0	0	0	0	0	0	0	0	0	0	650	650	553	0	1,203
20	Carmichael	5,095	0	0	0	0	0	0	0	0	0	0	0	0	4,690	4,690	405	0	5,095
21	Citrus Heights	7,852	0	0	0	0	0	0	0	0	0	0	0	0	7,164	7,164	688	0	7,852
22	Northridge	10,146	0	0	0	0	0	0	0	0	0	0	0	0	5,500	5,500	4,646	0	10,146
24	McClellan AFB	3,165	0	0	0	0	0	0	0	0	0	0	0	0	1,880	1,880	1,285	0	3,165
25	Arcade	2,543	0	0	0	0	0	0	0	0	0	0	0	0	2,447	2,447	96	0	2,543
26	Rio Linda North	5,993	9	2	7	14	37	0	7	7	32	0	0	115	3,822	3,937	2,056	0	5,993
27	Natomas Mutual	14,851	413	69	276	620	1,584	0	276	276	1,378	0	0	4,892	4,044	8,936	5,915	0	14,851
28	Metro Airport	5,453	87	15	58	131	334	0	58	58	291	0	0	1,032	3,299	4,331	1,122	0	5,453
32	Arcade WD - T&C	12,396	0	0	0	0	0	0	0	0	0	0	0	0	11,605	11,605	791	0	12,396
33	Rio Linda South	4,120	7	1	5	10	25	0	5	5	22	0	0	80	2,640	2,720	1,400	0	4,120
34	Antelope - Cal Am	4,208	0	0	0	0	0	0	0	0	0	0	0	0	2,042	2,042	2,166	0	4,208
35	Lincoln/RO - Cal Am	4,249	0	0	0	0	0	0	0	0	0	0	0	0	3,950	3,950	299	0	4,249
Total		**121,204**	**600**	**101**	**403**	**901**	**2,303**	**0**	**403**	**403**	**2,004**	**0**	**0**	**7,118**	**89,783**	**96,901**	**24,303**	**0**	**121,204**
Central Area (Outside Zone 40)																			
2	South Sacramento	53,020	0	23	155	33	0	0	81	0	94	0	0	386	50,234	50,620	1,879	521	53,020
3	Omochumne-Hartnell North	13,823	2,399	183	29	1,328	0	23	416	11	447	3,552	0	8,388	137	8,525	4,483	815	13,823
4	Southwest	42,394	7,862	2,092	351	6,997	1,032	753	571	78	2,681	3,923	7	26,348	2,284	28,632	9,880	3,882	42,394
10	Omochumne-Hartnell	19,678	2,714	173	0	1,159	0	236	87	237	267	1,427	0	6,301	1,277	7,578	11,609	491	19,678
11	Rancho Murieta	3,641	216	0	0	0	0	0	0	0	0	0	0	216	2,178	2,394	1,247	0	3,641
12	Sunrise "A" - SCWA	7,541	850	53	0	60	0	98	0	0	97	0	0	1,158	2,482	3,640	3,890	11	7,541
15	City Of Folsom	13,858	0	0	0	0	0	0	0	0	0	0	0	0	11,697	11,697	1,916	245	13,858
16	Arden Cordova	9,251	0	0	0	105	0	0	0	7	61	0	0	173	6,929	7,102	2,130	19	9,251
30	Foothills North	18,469	590	0	0	0	0	0	0	33	7	295	10	935	1,825	2,760	15,709	0	18,469
37	EGWS	2,625	0	0	0	0	0	0	0	0	0	0	0	0	2,590	2,590	35	0	2,625
43	Rosemont - Cal Am	3,095	0	0	0	0	0	0	0	0	0	0	0	0	2,990	2,990	105	0	3,095
Total		**187,395**	**14,633**	**2,525**	**535**	**9,683**	**1,032**	**1,110**	**1,155**	**367**	**3,654**	**9,196**	**16**	**43,905**	**84,621**	**128,527**	**52,884**	**5,984**	**187,395**
Zone 40																			
13	Sunrise Douglas - SCWA	10,624	548	28	0	32	0	53	0	0	52	0	0	713	8,556	9,269	1,328	27	10,624
14	Security Park - Cal Am	1,749	11	0	0	0	0	0	0	0	0	0	0	11	1,737	1,748	1	0	1,749
23	Sunrise - SCWA	914	0	0	0	0	0	0	0	0	0	0	0	0	912	912	2	0	914
36	Laguna/Franklin - SCWA	17,153	25	1	0	7	0	2	0	0	15	0	0	50	14,228	14,278	2,604	271	17,153
38	SCWA/EGWS Retail	5,997	48	0	0	0	0	1	0	0	4	0	0	53	5,887	5,940	24	33	5,997
39	Vineyard - SCWA	8,783	294	0	0	0	0	2	0	1	22	0	3	322	7,539	7,861	902	20	8,783
40	N. Vineyard In POU - SCWA	6,437	0	0	0	0	0	0	0	0	0	0	0	0	5,600	5,600	837	0	6,437
41	N. Vineyard Out POU - SCWA	2,378	0	0	0	0	0	0	0	0	0	0	0	0	2,351	2,351	0	27	2,378
42	Mather	5,756	0	0	0	0	0	0	0	0	0	0	0	0	5,755	5,755	0	1	5,756
Total		**59,791**	**926**	**29**	**0**	**39**	**0**	**58**	**0**	**1**	**93**	**0**	**3**	**1,149**	**52,565**	**53,714**	**5,698**	**379**	**59,791**
Total Central Basin		**247,186**	**15,559**	**2,554**	**535**	**9,722**	**1,032**	**1,168**	**1,155**	**368**	**3,747**	**9,196**	**19**	**45,054**	**137,186**	**182,241**	**58,582**	**6,363**	**247,186**
South Area																			
5	Galt ID	32,797	8,507	452	0	4,515	0	22	0	471	413	2,995	0	17,375	1,965	19,340	13,120	337	32,797
6	City Of Galt	3,357	40	35	0	124	0	0	0	0	0	0	0	199	2,918	3,117	190	50	3,357
7	OFSCU	15,053	3,911	53	94	1,464	0	0	0	0	422	1,129	0	7,073	65	7,138	7,311	604	15,053
9	Clay WD	7,668	1,038	0	0	535	0	0	0	0	0	134	107	1,814	126	1,940	5,644	84	7,668
31	Foothills South	99,436	5,165	265	0	1,404	0	538	0	296	742	6,479	40	14,929	4,060	18,989	79,913	534	99,436
Total		**158,311**	**18,661**	**805**	**94**	**8,042**	**0**	**560**	**0**	**767**	**1,577**	**10,737**	**147**	**41,390**	**9,134**	**50,524**	**106,178**	**1,609**	**158,311**
Other																			
8	SMUD	2,934	0	0	0	0	0	0	0	0	0	149	0	149	1,391	1,540	1,394	0	2,934
29	Courtland Area	32,244	1,116	841	659	7,663	0	22	2,439	2,452	1,758	4,800	0	21,750	941	22,691	7,260	2,293	32,244
Total		**35,178**	**1,116**	**841**	**659**	**7,663**	**0**	**22**	**2,439**	**2,452**	**1,758**	**4,949**	**0**	**21,899**	**2,332**	**24,231**	**8,654**	**2,293**	**35,178**
Grand Total		**561,879**	**35,936**	**4,301**	**1,691**	**26,328**	**3,335**	**1,750**	**3,997**	**3,990**	**9,086**	**24,882**	**166**	**115,461**	**238,435**	**353,897**	**197,717**	**10,265**	**561,879**

(a) Average Values for Agriculture and Urban may include some Agriculture-Residential acreage

WATER USE CONDITIONS

Water use estimates are based on the land use data described above. For modeling purposes, water use is divided into two categories: urban and agricultural. Water use for these two categories is calculated separately because of differences in land use, the amount of deep percolation, and runoff; for example, agricultural water is applied directly to the soil surface and results in a high level of infiltration, whereas urban water use includes both an indoor and outdoor component.

Urban Water Use

Urban water use includes both indoor and outdoor water use. Once used, water used indoors is discharged to the Sacramento Regional Wastewater Treatment Plant (SRWTP). Because this water is treated and discharged to the Sacramento River, there is no infiltration into the groundwater basin. In more rural areas, water used indoors is disposed of through septic systems, which provides infiltration to the groundwater basin. The portion of water used outdoors irrigates lawns, trees, and shrubs. Water that is not consumed by the plants either evaporates or infiltrates back into the groundwater basin.

2000 Baseline Urban Water Use

The 2000 Baseline urban water use data was developed by MWH (Montgomery Watson Harza) based on the land use criteria described above. Urban water use was estimated by assigning different water duties to individual urban land uses as described in *Estimate of Annual Water Demand Within Sacramento County Wide Area* (Boyle, 1995). The water duties used were then modified to reflect more recent water use data and include a 12 percent level of conservation. The 12 percent conservation value is prorated from the Water Forum's 25.6 percent level of conservation goal for 2030. The 2000 Study Area water demands in Sacramento County IGSM model subregions reflect the geographic distribution identified in the 2002 Master Plan. The 2000 urban water demand for each model subregion is presented on Table 4.6.

2030 Baseline Urban Water Use

The 2030 Baseline urban water use data for the 2030 Study Area was developed as part of the 2002 Zone 40 Water Supply Master Plan. Urban water use was estimated by assigning different water duties to individual urban land uses as done for the 2000 urban water use estimates. The 2030 water duties were modified to reflect a 25.6 percent level of conservation which represents full

Table 4.6

2000 Baseline Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
	North Area								GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772	21,364		21,364	4,332		4,332		25,696	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475	20,348		20,348	1,155		1,155		21,503	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169	4		4	20,165		20,165		20,169	12,774	1,462	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711	10,740		10,740	3,971		3,971		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**188,803**	**0**	**188,803**	**121,566**	**0**	**121,566**	**0**	**310,369**	**15,633**	**1,502**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	96	230	145	1.5	115	0.5	259	260		260	0		0		260			
14	Security Park - Cal Am	1	86	5	5.3	381	4.4	384	386		386	0		0		386			
23	Sunrise - SCWA	0	525	0	4.9	2,059	3.8	2,058	0		0	2,066		2,066		2,066			
36	Laguna/Franklin - SCWA	3,323	7,655	10,265	1.9	14,422	2.2	24,687	20,263		20,263	4,500		4,500		24,763	966		
38	SCWA/EGWS Retail	1,558	1,760	7,209	1.6	6,185	2.1	13,394	13,394		13,394	0		0		13,394			
39	Vineyard - SCWA	1,603	3,389	7,425	4.0	7,646	2.3	15,071	15,071		15,071	0		0		15,071			
40	N. Vineyard In POU - SCWA	540	1,978	1,644	4.5	4,444	4.4	6,088	6,088		6,088	0		0		6,088			
41	N. Vineyard Out POU - SCWA	516	82	1,620	3.1	261	2.6	1,880	1,881		1,881	0		0		1,881			
42	Mather	21	2,181	105	4.1	2,303	2.6	2,410	2,408		2,408	0		0		2,408	2,065	1,774	
	Total Zone 40 [4]	**7,658**	**17,886**	**28,418**	**N/A**	**37,816**	**N/A**	**66,233**	**59,751**	**0**	**59,751**	**6,566**	**0**	**6,566**	**0**	**66,317**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**53,269**	**85,807**	**171,632**	**N/A**	**205,018**	**N/A**	**376,649**	**248,554**	**0**	**248,554**	**128,132**	**0**	**128,132**	**0**	**376,686**	**18,664**	**3,276**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.3	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	3.9	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.7	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	1.1	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54633	2.5	666	0.9	55,300	13,611		13,611	41,689		41,689		55,300			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,989**	**0**	**50,989**	**0**	**64,915**	**0**	**0**	**0**
	Grand Total	**135,001**	**174,721**	**440,813**	**N/A**	**408,726**	**N/A**	**849,539**	**516,678**	**0**	**516,678**	**342,526**	**0**	**342,526**	**0**	**859,204**	**19,874**	**3,276**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 15,000 AF/yr from Folsom South Canal.
(4) In the Sacramento County IGSM, the Zone 40 Service Area includes embedded areas that are not served by the Sacramento County Water Agency: Model output includes these embedded areas in the Zone 40 Service Area, so some values may be different from the 2002 Master Plan.

implementation of the Water Forum's conservation estimate. The 2030 urban water demand for each model subregion is presented on Table 4.7.

In the 2030 Study Area, the urban water demand increases significantly from about 38,000 AF in 2000 to about 120,000 AF in 2030.

Agricultural Water Use

While there are no precise records of agricultural water use in the area, there are ways to estimate that use. The Sacramento County IGSM can estimate the consumptive use of a crop, which is the amount of water required to satisfy evapotranspirative demand, including the evaporative loss from crop foliage and adjacent soils.

The portion of consumptive use that is met by irrigation water is called the consumptive use of applied water (CUAW). Using precipitation, crop acreage, and evapotranspiration, and irrigation efficiency data the Sacramento County IGSM can determine the CUAW and the total agricultural water demand.

2000 Baseline Agricultural Water Use

The 2000 Baseline agricultural water use data was estimated by the Sacramento County IGSM using the 2000 land use and crop acreage (see Table 4.4). The 2000 agricultural water demand for each model subregion is presented on Table 4.6. In the 2030 Study Area, the average annual agricultural demand totals about 28,400 AFY.

2030 Baseline Agricultural Water Use

The 2030 Baseline agricultural water use data was estimated by the Sacramento County IGSM using the 2030 land use and crop acreage (see Table 4.5). The 2030 agricultural water demand for each model subregion is presented on Table 4.7. In the 2030 Study Area, the average annual agricultural demand totals about 5,000 AFY.

Agricultural–Residential Water Use

Agricultural Residential (Ag-Res) water use reflects a combination of urban and agricultural uses. Ag-Res areas are typically 2- to 5-acre parcels that consist of residential homes in a rural setting, or larger 2- to 5-acre rural estates in the urbanized areas that include larger landscape areas (Rural Estates). While the residence occupies only a small portion of the parcel, the

Table 4.7

2030 Baseline Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
	North Area								GW Pumping	Project	Total	SW Supply (4)	Remediation Reuse	Total	GW Supply				R. Enhance.
1	North Sacramento	999	27336	3,512	3.5	71,199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14,210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6,700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5,041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11,990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16,390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19,502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1,432	0.8	1,432	639		639	833		833		1,472	1210		
25	Arcade	0	2447	0	N/A	5,199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11,100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3,407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2,436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27,399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7,600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6,801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13,101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116,006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2,181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1,796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2,093		5,000
11	Rancho Murieta	216	2178	1,091	5.1	5,011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2,659	1.1	7,456	7,463		7,463	0		0		7,463			
15	City Of Folsom	0	11697	0	N/A	32,904	2.8	32,904	0		0	32,823		32,823		32,823	30,000	6,200	
16	Arden Cordova	173	6929	297	1.7	12,534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1,202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2,552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5,610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,347**	**0**	**179,347**	**143,386**	**0**	**143,386**	**0**	**322,733**	**32,859**	**6,240**	**5,000**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17,429	2.1	20,454	12,455		12,455	6,504	1,537	8,041		20,496			
14	Security Park - Cal Am	11	1736	54	4.9	1,455	0.8	1,509	841		841	543	128	671		1,512			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	1,112		1,112	768	182	950		2,062			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35,752	2.5	35,907	17,628		17,628	15,763	2,761	18,524		36,152	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14,308	2.4	14,553	8,091		8,091	5,210	1,261	6,471		14,562			
39	Vineyard - SCWA	322	7485	1,497	4.6	21,988	2.9	23,485	13,519		13,519	8,006	1,938	9,944		23,463			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9,929	1.8	9,929	701		701	9,212	55	9,267		9,968			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7,038	3.0	7,038	4,196		4,196	2,284	553	2,837		7,033			
42	Mather	0	5755	0	N/A	11,168	1.9	11,168	6,159		6,159	4,067	985	5,052		11,211	2,065	1,774	
	Total Zone 40 [5]	**1,149**	**52,388**	**4,976**	**N/A**	**121126**	**N/A**	**126,102**	**64,702**	**0**	**64,702**	**52,357**	**9,400**	**61,757**	**0**	**126,459**	**3,031**	1,774	0
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303956**	**N/A**	**448,556**	**244,049**	**0**	**244,049**	**195,743**	**9,400**	**205,143**	**0**	**449,192**	**35,890**	**8,014**	**5,000**
	South (Galt)Area																		
5	Galt ID (2)	17375	1954	60522	3.5	3,921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5,488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3,802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121.0**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD (3)	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**494,699**	**0**	**494,699**	**434,053**	**9,400**	**443,453**	**0**	**938,152**	**37,100**	**8,014**	**5,000**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).
(5) In the Sacramento County IGSM, the Zone 40 Service Area includes embedded areas that are not served by the Sacramento County Water Agency: Model output includes these embedded areas in the Zone 40 Service Area, so some values may be different from the 2002 Master Plan.

remaining area is available for other uses, which range from undeveloped/native vegetation to fully cultivated and irrigated land. Because of the wide range of potential water use rates and wastewater disposal (sewer vs. septic systems) associated with Ag-Res lands, they were separated into two groups called rural estates and rural agricultural as described below.

Rural Estates

Typically, rural estates are areas that are served by a water purveyor and have more extensive landscaping and/or agricultural development than equivalent rural areas served by a private well. Overall water use and water disposal is more typical of an urban land use than an agricultural area.

Rural Agricultural

In contrast to the Rural Estates, the Ag-Res areas served by a private well are referred to as rural agricultural. The rural agricultural areas are typically farther from communities which could provide water and sewer services. Overall water use for rural agricultural areas tends to be less than that of rural estates, and these areas are typically on septic systems. Overall water use and water disposal is more typical of a agricultural land use than urban land use.

Because there are differences in water usage between rural estates and rural agricultural areas, they are incorporated into the Sacramento County IGSM to account for these differences.

The land use and crop summary tables in this report reflect this distribution of rural agricultural lands to agricultural land use and of the rural estates to urban land use for purposes of estimating water use requirements.

SECTION 5 WATER SUPPLY AVAILABILITY

This section defines the water supply conditions included in the various baseline and alternative conditions. The baseline and alternative conditions were developed to reflect several different potential water supply scenarios within the Study Area in order to quantify their impacts to the groundwater system. The framework was developed through a series of meetings with the Zone 40 study team.

The different water supply scenarios are based on the water supply availability from the following four sources:

- Surface Water Supplies
- Recycled Water
- Groundwater Supplies
- Groundwater Remediation and Reuse Options

Each of these available supplies is discussed below, and Table 5.1 presents the average annual water supplies for each baseline and alternative condition in the 2030 Study Area.

SURFACE WATER SUPPLIES

The availability of surface water to the 2030 Study Area was determined by:

- Identifying the potential available surface water supplies for use in Zone 40; and
- Determining the availability (timing and volume) of each supply.

The process of identifying and developing surface water supplies for the 2030 Study Area is briefly described below.

POTENTIAL SURFACE WATER SUPPLIES FOR 2030 STUDY AREA

Based on work completed for the 2002 Zone 40 Water Supply Master Plan, there are six potential surface water supplies available to the 2030 Study Area. The contract amounts and long-term average supply from each potential surface water source is listed on Table 5.2 and described below.

Table 5.1

Water Demands and Available Water Supplies for Zone 40

	Zone 40 Groundwater Pumping Distribution		Zone 40 Water Supply Availibility			Groundwater Remediation/Opeartions			
	Baseline 2000	Alternative 1A,1B,1C [A]	Baseline 2030	Alternative 2A	Alternative 3	Alternative 4A [B]	Alternative 4B [C]	Alternative 2B	Alternative 2C
Zone 40 Water Demand									
Agricultural Demand	28,418	4,976	4,976	4,976	4,976	28,418	28,418	4,976	4,976
Urban Demand	37,816	121,126	121,126	121,126	121,126	37,816	37,816	121,126	121,126
Total Demand	**66,234**	**126,102**	**126,102**	**126,102**	**126,102**	**66,234**	**66,234**	**126,102**	**126,102**
Zone 40 Water Supply									
Surface Water Supply									
Fazio (PL 101-514)	4,500	13,551	13,551	13,551	13,551	4,500	4,500	13,551	13,551
SMUD 1 Assignment	0	13,000	13,000	13,000	13,000	0	0	13,000	13,000
SMUD 2 Assignment	0	13,000	13,000	13,000	13,000	0	0	13,000	13,000
Sacramento City POU Water	0	9,300	9,300	9,300	9,300	0	0	9,300	9,300
Appropriative Water (Excess Water)	0	0	0	0	14,586	0	0	0	0
Other Supply (Purchase or Transfer)	2,066	0	0	0	0	2,066	2,066	0	0
Total Surface Supply	6,566	48,851	48,851	48,851	63,437	6,566	6,566	48,851	48,851
Other Water Supply									
Reclaimed Water	0	4,400	4,400	4,400	4,400	0	0	4,400	4,400
Remediation Reuse	0	0	9,400	9,400	9,400	0	0	0	18,800
Total Other Supply	0	4,400	13,800	13,800	13,800	0	0	4,400	23,200
Groundwater Supply	59,751	73,856	64,702	64,618	53,646	59,751	59,751	73,784	55,758
Total Water Supply	**66,317**	**127,107**	**127,353**	**127,269**	**130,883**	**66,317**	**66,317**	**127,035**	**127,809**

A) The location of groundwater pumping within Zone 40 varies in Alternatives 1A, 1B, 1C.
B) Includes no remediation operation in the model area.
C) Includes increased injection of remediation groundwater at Aerojet / Boeing site compared to 2000 Baseline condition.

Table 5.2
Zone 40 Surface Water Supply Scenarios

Surface Supply	Contract Amount (AFY)	2000 Baseline Supply (AFY)	2030 *Firm* Supply (AFY)	2030 *Full Project* Supply (AFY)
CVP Water Public Law 101-514 ("Fazio Water")	15,000	4,500	13,551	13,551
SMUD 1 Surface Water Assignment	15,000	0	13,000	13,000
SMUD 2 Surface Water Assignment	15,000	0	13,000	13,000
Purchase of City of Sacramento Water for use in City Place of Use (POU)	9,300	0	9,300	9,300
Appropriative Water	Undetermined	0	0	14,600
Other Water Supplies	Undetermined	2,066[1]	0	0
Total		6,566	48,851	63,451

[1]Water purchased from American States Water Company as a replacement to groundwater sources lost due to groundwater contamination.

CVP Water Public Law 101-514 ("Fazio Water")

In April 1999, SCWA obtained a CVP water service contract pursuant to PL 101-514 that provides a permanent water supply to Zone 40 of 15,000 AFY.

At the 2000 level of development, "Fazio Water" provides about 4,500 AF of surface water to the 2030 Study Area. At the buildout level of development, "Fazio Water" provides 13,551 AFY of surface water.

SMUD 1 Surface Water Assignment

Under the terms of a three party agreement (SCWA, SMUD, and the City of Sacramento [City]) and in accordance with SMUD's Purveyor Specific Agreement (PSA) in the Water Forum Agreement, the City provides water to SMUD for use at two of SMUD's cogeneration facilities. SMUD, in turn, will assign 15,000 AFY of its Reclamation Central Valley Project (CVP) contract

water to SCWA for Municipal and Industrial (M&I) use. A CVP contract amendment is currently in the environmental review process.

There is no SMUD 1 water available at the 2000 level of development. At buildout level of development, the SMUD 1 supply provides about 13,000 AFY to the 2030 Study Area.

SMUD 2 Surface Water Assignment

SMUD's PSA includes a second assignment of 15,000 AFY to SCWA. In return for this water, Zone 40 would be required to construct groundwater facilities necessary to meet SMUD's dry year water shortages of up to 10,000 AFY.

There is no SMUD 2 water available at the 2000 level of development. At the buildout level of development, the SMUD 2 supply provides approximately 13,000 AFY to the 2030 Study Area. The average annual supply needed to meet SMUD's dry year water shortage requirements totals about 890 AFY.

Purchase of City of Sacramento Water for use in City Place of Use

The PSA for the City of Sacramento includes providing surface water to areas within the City's American River Place of Use (POU). SCWA proposes to enter into an agreement with the City whereby the City will sell surface water to SCWA for use in the portion of the 2030 Study Area within the City's American River POU. The total contract amount is 9,300 AFY. This is a firm water supply that is anticipated to be utilized the most in drier years when other supplies may experience shortages.

At the 2000 level of development, City POU water is not utilized as a water supply. At the buildout level of development, City POU water provides 9,300 AFY of surface water to the 2030 Study Area.

Appropriative Water

SCWA has submitted an application to the State Water Resources Control Board (SWRCB) in 1995 for the appropriation of water from the American and Sacramento Rivers. This water is considered intermittent water that typically would be available during winter months of normal or wet years.

At the 2030 level, the availability of appropriative water ranges from 0 AFY (in the firm surface water supply scenarios) to about 38,700 AFY (full use of appropriative water), and averages about 14,600 AFY.

Other Water Supplies

SCWA enters into purchase and transfer agreements with other entities that currently hold surface water rights in the north Sacramento River basin.

At the 2000 level of development, the 'other supplies' provide about 2,066 AFY of surface water to the 2030 Study Area in the Sunrise SCWA Service Area from the Arden Cordova to replace groundwater supplies that have been impacted by local contamination. At the buildout level of development, 'other supplies' are not utilized because no information is available to document the availability of this supply.

SURFACE WATER SUPPLY AVAILABILITY

The availability of the surface water supplies to 2030 Study Area was developed based on information in the Zone 40 Water Supply Master Plan (MWH, 2002). The available surface water supplies for the 2030 Study Area were developed based on results provided by CALSIM II analysis. CALSIM II is a California statewide surface water operations model used by local, state, and federal agencies for water supply planning studies. CALSIM II results are available at an aggregate level at various points in the County, which were disaggregated into the appropriate annual water supplies to the purveyors.

SURFACE WATER SUPPLY SCENARIOS

The 2002 Master Plan identified the long-term surface water supply delivery of 68,500 AFY. This is slightly less than the 71,000 AFY supply identified in the Freeport Regional Water Project.

As part of the hydrologic analysis completed for the 2002 Master Plan, three different surface water supply scenarios were developed:

- 2000 Baseline Supply,
- 2030 Firm Supply, and
- 2030 Full Project Supply.

The different water supply scenarios are described below.

2000 Baseline Supply

The 2000 Baseline surface water supplies presented on Table 5.2 reflects current (Year 2000) surface water use in Zone 40. Total surface water use is about 6,600 AFY. Only the Baseline 2000 Condition Alternative uses this surface water supply scenario.

2030 Firm Supply

The 2030 'Firm' surface water supplies presented on Table 5.2 reflect the firm surface water supplies available to Zone 40 at buildout. Water supply development efforts completed to date have identified these supply sources and have a high assurance that they will be available to meet future Zone 40 water needs. Most of the alternatives (all but the Baseline 2000 Condition and the Full Project Condition) are based on the availability of these surface water supplies which total about 48,900 AFY.

2030 Full Project Supply

The 2030 'Full Project' surface water supplies add Appropriative Water to the Firm surface supply availability scenario, as shown on Table 5.2. The appropriative water supply has less certainty than the previously identified surface water supplies, and so it is added as an additional increment of potential supply. Only the Full Project Condition uses this surface water supply scenario, which totals about 63,500 AFY.

The 2002 Master Plan has identified an additional supply of 'other' water from the American and Sacramento Rivers to supplement these other supplies to meet the total project demand of 68,500 AFY. The 'other' water was not included in the hydrologic analysis at this time because limited information is available about the availability of this supply.

RECYCLED WATER

Recycled water is considered an additional supply to extend the available water resources in Sacramento County. SRCSD's Wastewater Treatment Plant located near Freeport along the Sacramento River is the source of recycled water. It is anticipated that the use of reclaimed water will become a reliable source of non-potable water use such as landscape irrigation of parks, schools, and rights-of way for the 2030 Study Area in the future.

For modeling purposes, it is assumed that there is no recycled water available at the 2000 level. At the 2030 level, 4,400 AFY of recycled water will be available for use.

GROUNDWATER SUPPLIES

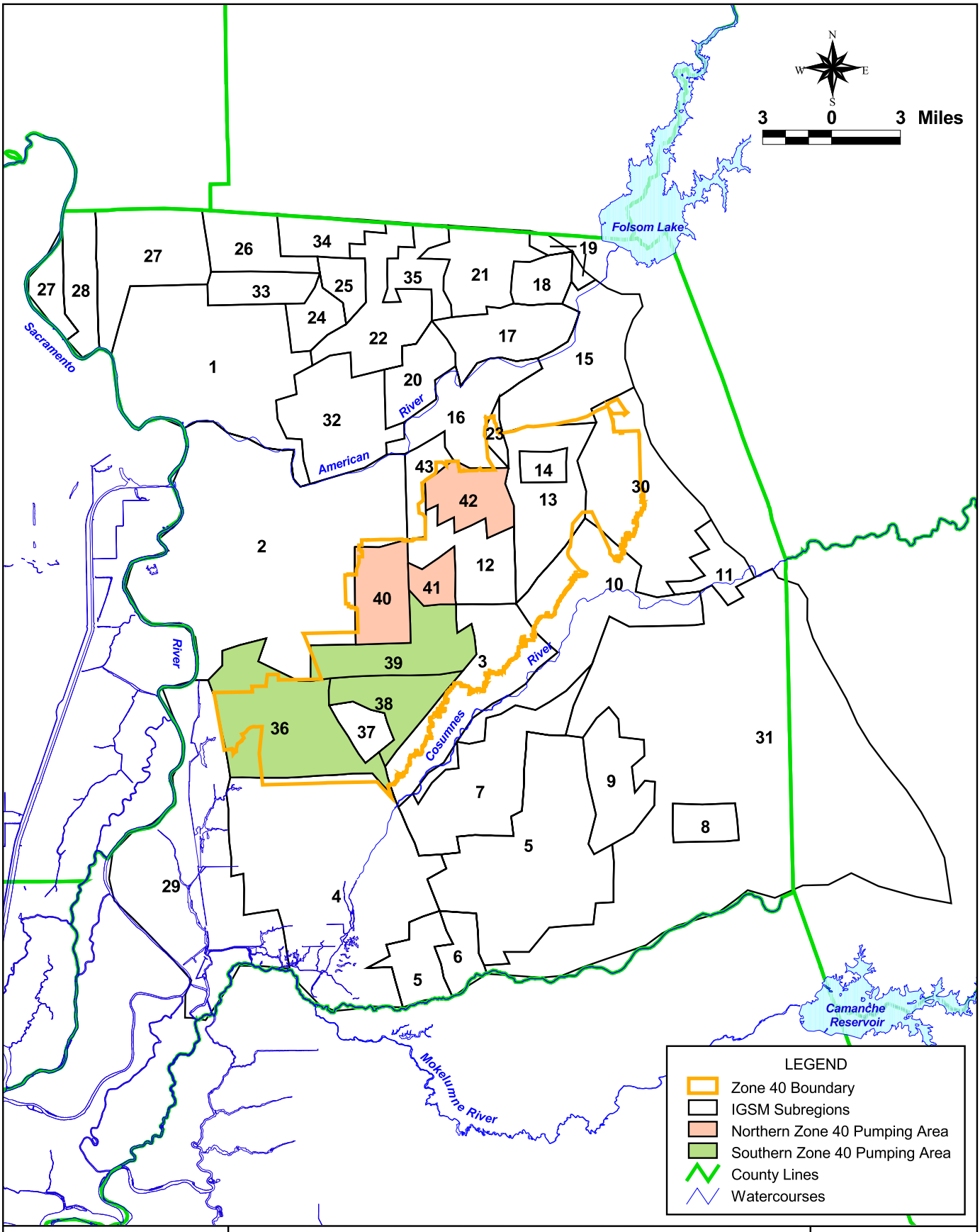
Historically, groundwater has been used to meet water demands in much of Sacramento County, either to supplement surface water supplies in dry years, or to provide water to areas without access to surface water. The water supply areas below represent the locations within Zone 40 where future groundwater pumping would be located to meet increased demands. The four separate water supply areas identified as part of this analysis are shown in Figure 5.1 and listed below:

- **North Vineyard –** The North Vineyard represents the future well field in the North Vineyard Area. This area corresponds to Subregion 41 in the Sacramento County IGSM. Groundwater pumping in the North Vineyard area is included in each of the 2030 level water supply alternatives.
- **Zone 40 Uniform Pumping –** This pumping configuration assumes that increased groundwater pumping would be distributed throughout the entire 2030 Study Area except for Sacramento County IGSM subregions 13, 14, and 23.
- **Northern Zone 40 Pumping –** This pumping configuration would locate additional groundwater pumping in the northern portions of the 2030 Study Area. Increased groundwater pumping would be focused in Sacramento County IGSM subregions 40, 41, and 42.
- **Southern Zone 40 Pumping –** This pumping configuration would locate additional groundwater pumping in the southern portions of the 2030 Study Area. Increased groundwater pumping would be focused in Sacramento County IGSM subregions 36, 38, and 39.

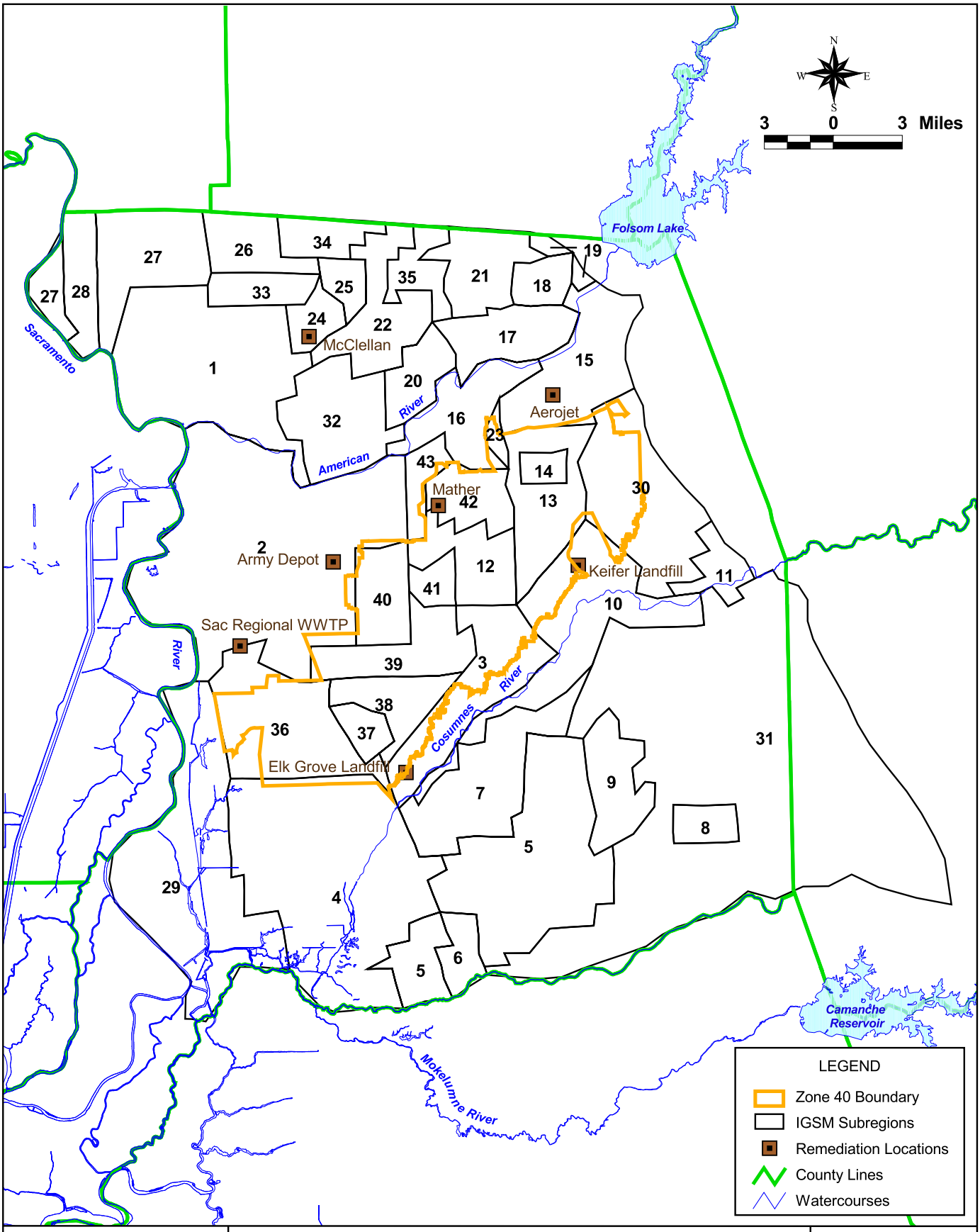
GROUNDWATER REMEDIATION AND REUSE OPTIONS

There are seven groundwater remediation sites with long-term groundwater pumping requirements located within Sacramento County. Each site has specified use for the remediated water, including discharge to streams, injection, stream flow augmentation, and treatment and reuse of the water for urban needs. These seven sites were identified and included in the Sacramento County IGSM to determine their potential impact on overall groundwater availability. The location of the groundwater remediation sites shown in Figure 5.2 are listed below:

- McClellan Business Park (formerly McClellan Air Force Base) (North Basin)
- Aerojet/Boeing (Central Basin)
- Mather (Central Basin)



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Zone 40 Groundwater Supply Area** **DRAFT**	SEPTEMBER 2003 FIGURE 5.1



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Remediation Locations** **DRAFT**	SEPTEMBER 2003 FIGURE 5.2

- Army Depot (Central Basin)
- Sacramento Regional WWTP (Central Basin)
- Keifer Landfill (Central Basin)
- Elk Grove Landfill (Central Basin)

The largest groundwater remediation operation (in terms of volume of extracted water) is at Aerojet/Boeing in the northeast Central Basin. Reuse of remediated water is being considered as a potential source of supply for several different uses as described in Section 3.

At the 2000 level of development, reuse of remediation water is not considered a water supply. At the 2030 level of development reuse of remediated water ranges from 0 to 18,800 AFY. At this time, the 'most likely' reuse option assumes that 9,400 AFY would be available for use.

SECTION 6 BASELINE AND ALTERNATIVE ANALYSIS

This section describes results of the Sacramento County IGSM model runs completed for the Zone 40 Hydrologic Analysis. This is section is organized as follows:

- Hydrologic Conditions
- Baseline Condition and Impact Areas
- Impact Assessment

HYDROLOGIC CONDITIONS

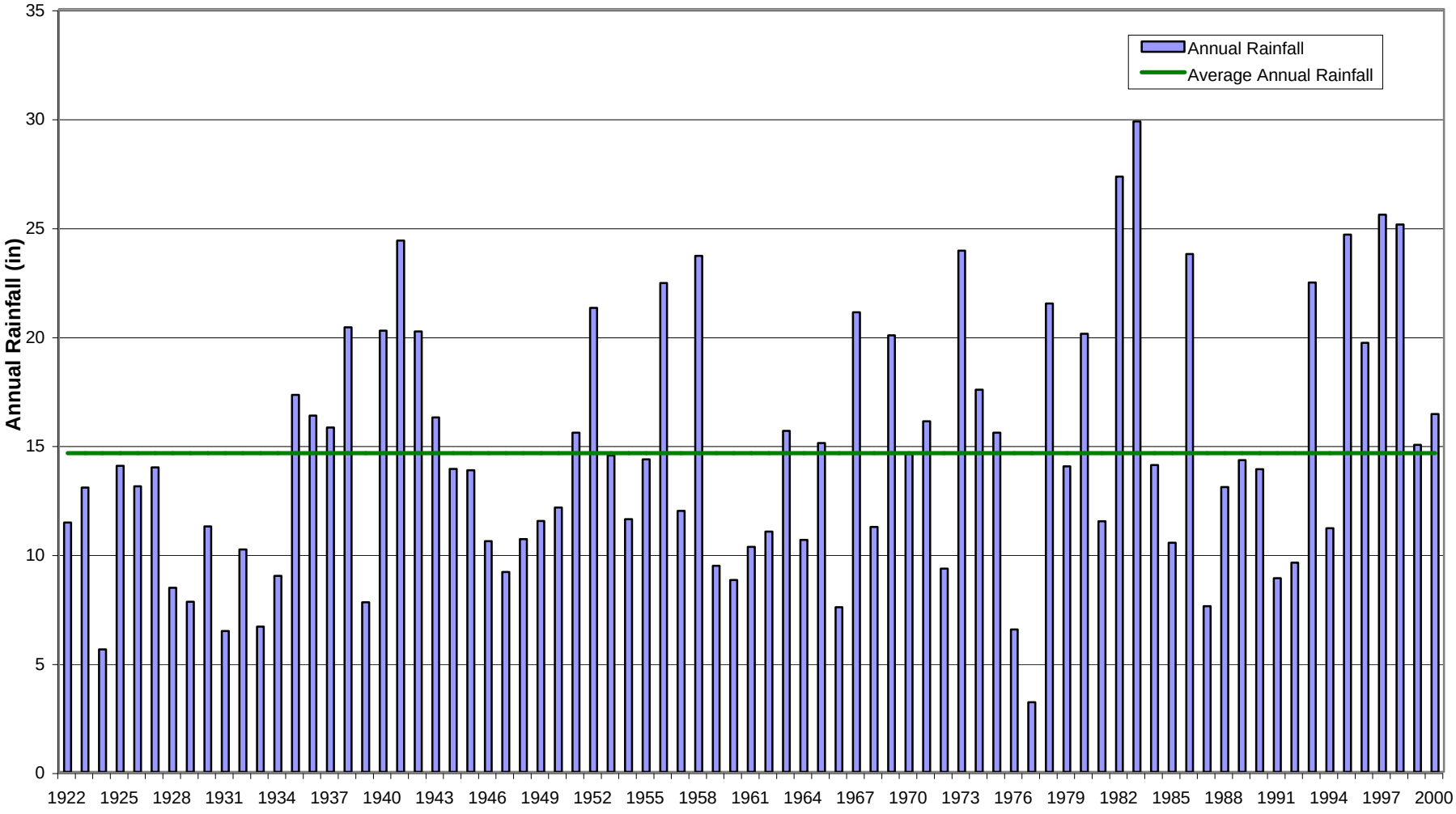
Hydrologic conditions (i.e., rainfall and river inflow) are an important consideration in the modeling of alternative water supply scenarios. The amount of rainfall and stream flow has a direct impact on groundwater recharge. Therefore, it is important to use a hydrologic period that includes both wet and dry periods. The hydrologic conditions affecting the simulation period and initial conditions used in the groundwater analysis are described below.

SIMULATION PERIOD

The simulation period for the baseline and alternative model runs represents the historical 74-year hydrologic period from 1922 to 1995. This simulation period is commonly used in California statewide water supply planning efforts. The surface water operations model CALSIM II uses this hydrologic period to estimate surface water supply availability for the project. This period is used because it represents a long-term time frame that includes wet and dry periods, as well as short-term and prolonged drought conditions, that are often used in planning water supplies for drought conditions. Figure 6.1 presents the long-term rainfall in Sacramento for the 1922 to 2000 period (which includes the 1922 to 1995 simulation period).

Changes in groundwater levels can be analyzed over this period of various hydrologic conditions at different levels of development (described below). Because the hydrologic period is the same for each analysis, the response in groundwater levels is a result of different levels of development. It is important to note that planning analyses using models such as IGSM should consider the impacts of a project in a relative sense with respect to Baseline Conditions during the same hydrologic period, not compared to conditions at one instant in time.

Figure 6.1
Annual Rainfall at Sacramento Metro Airport (SMF)
For Water Year 1922 to 2000



INITIAL CONDITIONS

The initial conditions (groundwater levels) represent the current state of the groundwater basin as the starting point for the baseline and alternative analysis. The initial conditions are developed from measured groundwater levels, and reflect the changes in water use and hydrologic conditions over time. The long-term hydrologic conditions shown in Figure 6.1 show that the period following the 1976 drought has generally been wetter than average. Except for the 1987 to 1992 period, which consisted of six consecutive years of below-average precipitation, the hydrologic conditions have included average or above average rainfall. During 1995 to 2000, rainfall conditions have been above normal.

The fluctuations in the recent hydrologic conditions are reflected in the groundwater levels of the Central Basin. Groundwater levels in parts of the Central Basin were at their lowest in the mid-1990s in response to the below-average rainfall conditions. Since then, groundwater elevations in the Central Basin have increased by up to 10 feet. Thus, the 2000 groundwater elevations used as initial conditions for the groundwater analysis represent slightly higher groundwater elevations than earlier years due in part to the wetter hydrologic conditions over the last several years.

In contrast to the wetter conditions which define the initial conditions for the groundwater analysis, the first 13 years (representing years 1922 to 1934) of the 74-year simulation period (1922 to 1995) used for the baseline and alternative analysis consist of below-average rainfall conditions. The decreased rainfall during these years results in increased groundwater pumping and reduced infiltration of rainfall which may result in declining groundwater elevations during the first portion of the groundwater simulation as the basin adjusts to a new state of quasi-equilibrium.

BASELINE CONDITION AND IMPACT AREAS

The Baseline Condition is defined as the state of the groundwater basin during a predefined hydrologic period and at specific level of development. The level of development is defined based on a set of land use, water use, and water supply/demand conditions. Two levels of development are used in the planning studies for SCWA water management scenarios: an existing condition (2000 level of development) and a buildout condition (2030 level of development). The Baseline Conditions provide a frame of reference for comparison of hydrologic impacts of action alternatives, such as the various water management alternatives. The changes resulting from different water management alternatives will, therefore, be

analyzed against the Baseline Conditions on a comparative basis to determine the relative impacts of the alternatives on the groundwater and surface water resources in the model area.

The Sacramento County IGSM Baseline Conditions will be used to establish the benchmark for:

- Groundwater levels at various locations in the 2030 Study Area and the Central Basin; and
- Streamflows in the Cosumnes River.

GROUNDWATER IMPACT AREAS

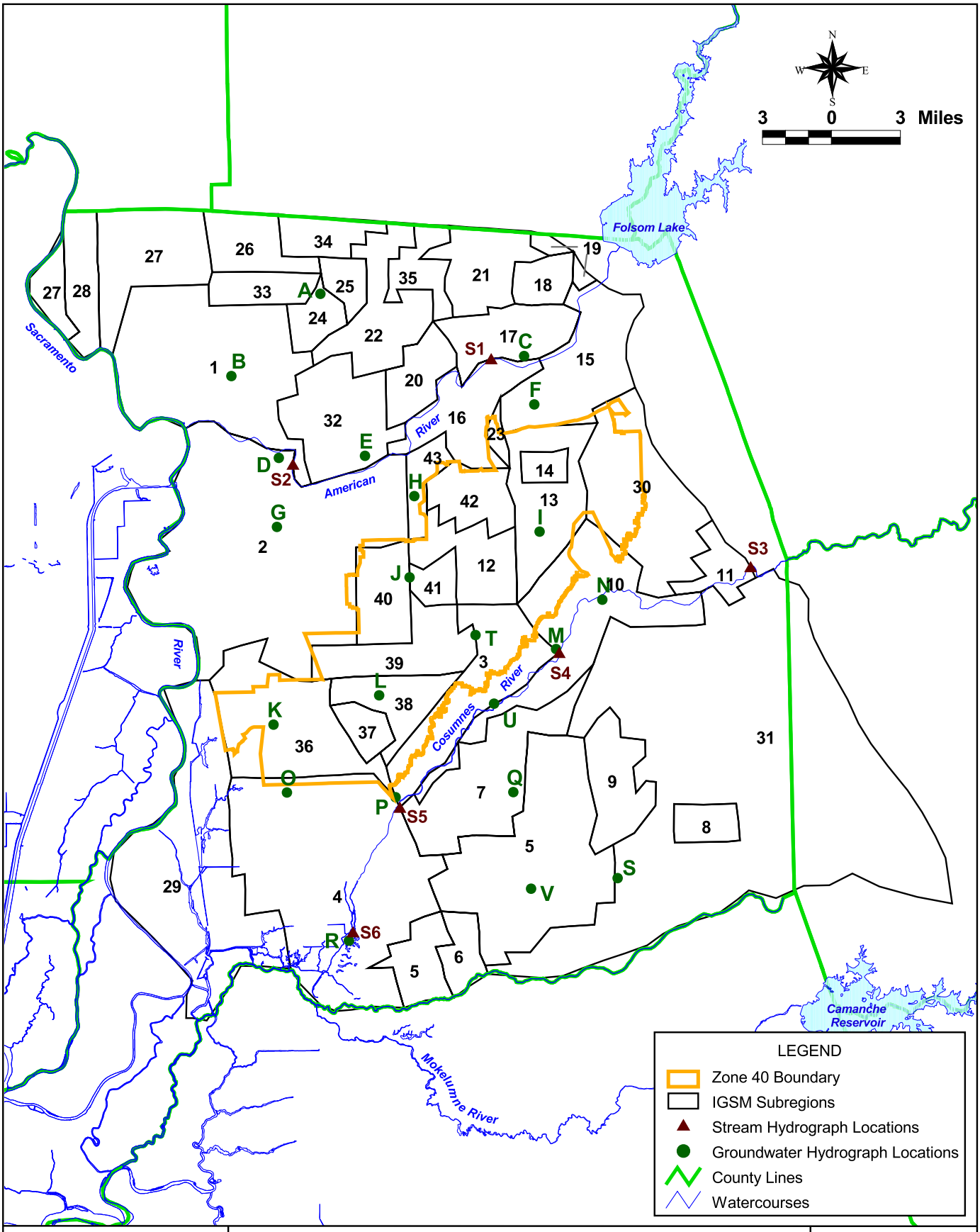
The groundwater storage and corresponding groundwater levels in the model area fluctuate every month in response to changes in demand and variations in hydrologic conditions. The baseline groundwater conditions are defined by change in groundwater levels at various locations throughout the model area. There are currently 22 locations that are selected to compare the groundwater levels for the 74-year simulation period. The groundwater hydrograph locations are shown in Figure 6.2 and listed on Table 6.1.

Table 6.1
Summary Table of Groundwater Hydrograph Locations

Area of Interest		Hydrograph Location(s)*
1.	North Area	A, B
2.	American River	C, D, E
3.	City of Sacramento South	G
4.	Sunrise Area	F, I
5.	Northern 2030 Study Area	H, J, T
6.	Southern 2030 Study Area	K, L, O, P
7.	Cosumnes River	M, N, R, U
8.	South Area	Q, S, V

* For location map, see Figure 6.2

The groundwater hydrograph locations listed in Table 6.1 represent locations of Sacramento County IGSM model output throughout the model area. For purposes of the analysis of groundwater impacts due to the water management scenarios in Zone 40, the impacts to groundwater elevations will be analyzed for Northern Zone 40, Southern Zone 40, and along the Cosumnes River.



ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Selected Hydrograph Locations** **DRAFT**	SEPTEMBER 2003 FIGURE 6.2

STREAMFLOW CONDITIONS

Streamflow conditions in the Sacramento County IGSM are represented by streamflow hydrographs at different locations within the model area. In order to compare the differences in streamflow conditions caused by various water management scenarios, six streamflow hydrograph locations have been identified in the Sacramento County IGSM. The locations are shown in Figure 6.2 and listed on Table 6.2.

The impacts of Zone 40 water management alternatives on monthly streamflows will be compared at the two selected locations along the Cosumnes River (streamflow hydrographs S4 and S5). The annual streamflow in the Cosumnes River will be evaluated at Highway 99 (hydrograph location S5).

Table 6.2
Summary Table of Streamflow Hydrograph Locations

Area of Interest	Hydrograph Location(s)*
American River near Fair Oaks	S1
American River near H Street Bridge	S2
Cosumnes River near Michigan Bar	S3
Cosumnes River near Folsom South Canal	S4
Cosumnes River near Highway 99	S5
Cosumnes River near Twin Cities Road	S6

*For location map, see Figure 6.2

IMPACT ASSESSMENT

The analysis of the model results are grouped by the

- Zone 40 Groundwater Pumping Distribution Alternatives,
- Effects of Buildout Conditions,
- Zone 40 Water Supply Availability Alternatives, and
- Groundwater Remediation/Reuse Alternatives.

Table 6.3 provides a summary of the water supply/demand assumptions for the 2030 Study Area and Central Basin, and summary of results for each alternative. These results are described below in more detail.

ZONE 40 GROUNDWATER PUMPING DISTRIBUTION ALTERNATIVES

The groundwater and streamflow hydrographs for the Zone 40 Groundwater Pumping Distribution Alternatives are included in Appendix B. Groundwater and streamflow impacts are discussed below.

Groundwater Impacts

The monthly groundwater elevations resulting from change in the location of groundwater pumping within Zone 40 are shown in Figures 6.3 a, b, and c for the Northern Zone 40, Southern Zone 40, and along the Cosumnes River, respectively. The complete set of groundwater hydrographs located throughout the model area are presented in Appendix B (Figures B.1 to B.22).

1. As expected, pumping in the north (Alt. 1B) impacts groundwater levels in the north the most, and groundwater levels in the south the least. This is observed in hydrographs H, I (Figure 6.3a), and J in the north; and K (Figure 6.3b), O, and P in the south.

2. Pumping in the south (Alt. 1C) impacts groundwater levels in the south the most, and groundwater levels in the north the least. This is seen in hydrographs H, I, and J in the north, and K, O, and P in the south.

3. Analysis of the results of the pumping distribution scenarios suggests that the uniform pumping alternative (Alt. 1A) has the least overall impact on groundwater levels relative to Baseline Conditions. The area that is impacted most by the uniform pumping alternative is in the vicinity of the cone of depression (hydrographs K, L, and O). Based on these hydrographs, only the northern pumping alternative would reduce impacts in the cone of depression area.

Table 6.3

Summary of Hydrologic Impacts of the Alternatives

	Zone 40						Central Basin			Impact Summary			
Alternatives	**Agricultural Water Use (AF)**	**Urban Water Use (AF)**	**Surface Water Supply [A] (AF)**	**Groundwater Supply (AF)**	**Remediation Reuse In-Lieu of Urban Pumping (AF)**	**Total Groundwater Pumping [B] (AF)**	**Extraction (AF)**	**Reinjection (AF)**	**Cosumnes Flow Enhancement [C] (AF)**	**Average Groundwater Level (Northern Z40) [D] (ft above msl)**	**Average Groundwater Level (Southern Z40) [E] (ft above msl)**	**Average Annual Cosumnes River Flow at Highway 99 (AF)**	**Average Monthly Cosumnes River Flow September-November at Highway 99 (cfs)**
Zone 40 Groundwater Pumping Distribution													
Baseline 2000	28,418	37,816	6,566	59,751	N/A	248,554	18,664	3,276	N/A	-22.2	-70.6	318,800	40.7
Alternative 1a	4,976	121,126	52,357	73,856	N/A	261,702	18,664	3,276	N/A	-30.4	-83.8	319,400	41.1
Alternative 1b	4,976	121,126	52,357	73,847	N/A	261,671	18,664	3,276	N/A	-57.9	-50.1	319,000	41.0
Alternative 1c	4,976	121,126	52,357	73,855	N/A	261,701	18,664	3,276	N/A	-27.1	-91.8	319,500	41.1
Zone 40 Water Supply Availibility													
Baseline 2030	4,976	121,126	52,357	64,702	9,400	244,049	35,890	8,014	5,000	-25.4	-60.9	323,300	48.4
Alternative 2a	4,976	121,126	52,357	64,618	9,400	244,046	35,890	8,014	5,000	-27.3	-67.6	323,600	48.5
Alternative 3	4,976	121,126	66,929	53,646	9,400	233,055	35,890	8,014	5,000	-19.3	-60.5	323,900	48.6
Groundwater Remediation/ Reuse Operations													
Alternative 2b	4,976	121,126	52,357	73,784	0	253,225	35,890	8,014	0	-34.5	-75.3	322,500	44.5
Alternative 2c	4,976	121,126	52,357	55,758	18,800	235,173	35,890	8,014	5,000	-21.9	-61.8	323,900	48.6
Alternative 4a	28,418	37,816	6,566	59,751	N/A	248,563	0	0	N/A	-18.8	-69.2	319,200	40.8
Alternative 4b	28,418	37,816	6,566	59,751	N/A	248,554	18,664	8,201	N/A	-21.6	-70.6	318,800	40.7

Note:

(A) Surface Water values for 2030 level conditions reduced by 894 AF/yr to reflect Dry Year Demand for SMUD

(B) Does not include groundwater remediation pumping

(C) Flow enhancement totals 5,000 AFY equally distributed through September, October, and November

(D) Average monthly groundwater elevation of hydrograph H,J,T for the 74 years simulation period

(E) Average monthly groundwater elevation of hydrograph K,L,O,P for the 74 years simulation period

Figure 6.3a
Groundwater Hydrograph at Sunrise Area (Location I)
for Zone 40 Groundwater Pumping Distribution Alternatives

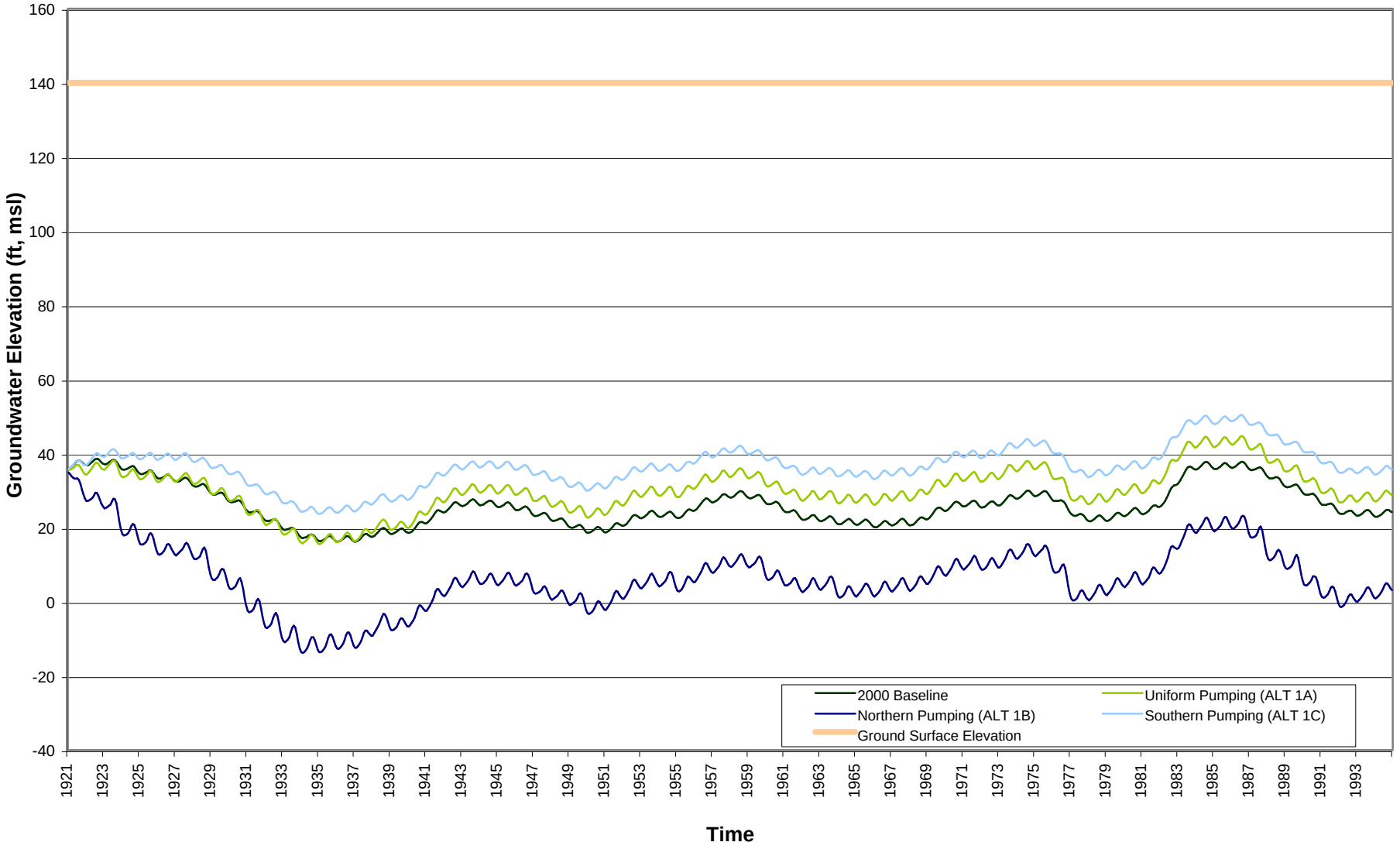


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Figure 6.3b
Groundwater Hydrograph at Central Area Groundwater Depression (Location K)
for Zone 40 Groundwater Pumping Distribution Alternatives

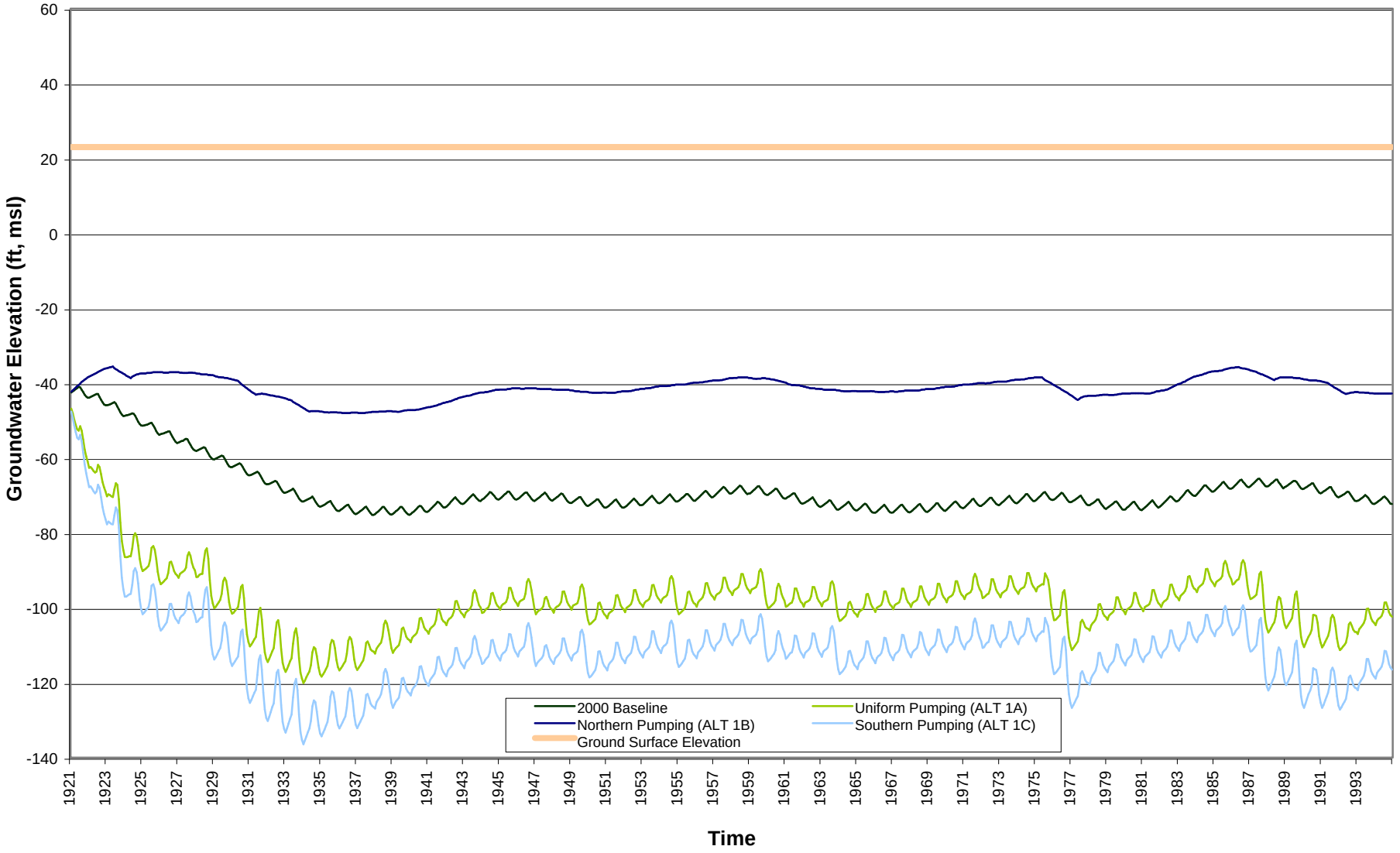

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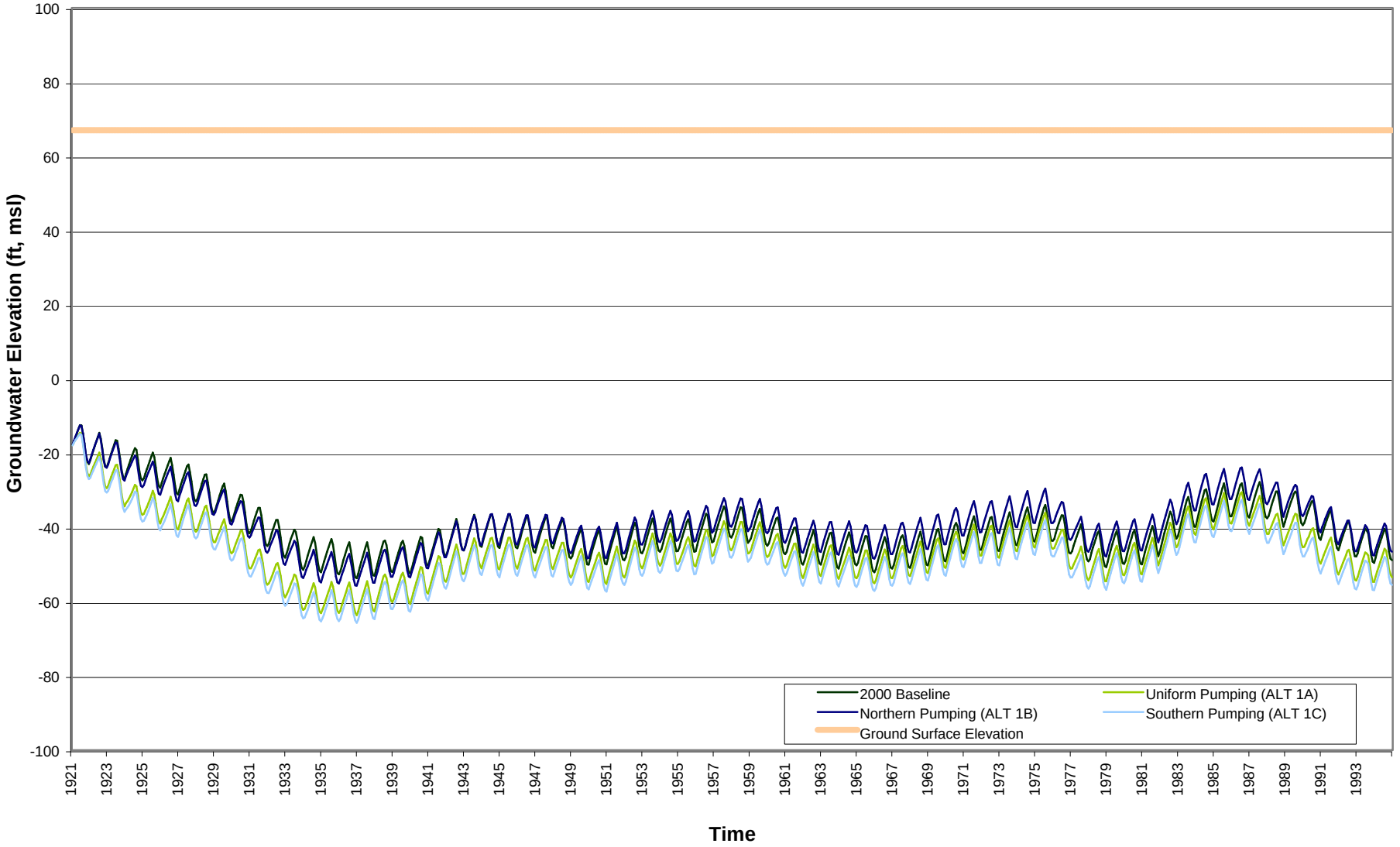
Figure 6.3c
Groundwater Hydrograph at Middle of Cosumnes River (Location U)
for Zone 40 Groundwater Pumping Distribution Alternatives



Streamflow Impacts

The effects of pumping distribution alternatives on streamflows in the Cosumnes River are shown in Appendix B (Figures B.23 to B.38). These figures indicate that, although the different pumping distribution alternatives affect groundwater levels in the vicinity of the Cosumnes River, streamflows in the Cosumnes River are not significantly impacted. As presented in Table 6.3, the average annual flows in the Cosumnes River may be due in part to the hydraulic connection between the Cosumnes River and the main aquifer system. It is noteworthy that recent studies by UC Davis have indicated that the Cosumnes River is in hydraulic connection with perched aquifers located under the river. However, these are seasonal conditions that only occur when groundwater levels are high in the perched zones. As the Sacramento County IGSM simulates groundwater operations in the main aquifer system, including groundwater pumping and flow fields, and the interaction between streams and the main aquifer system, perched conditions are not directly taken into consideration.

Impacts Summary

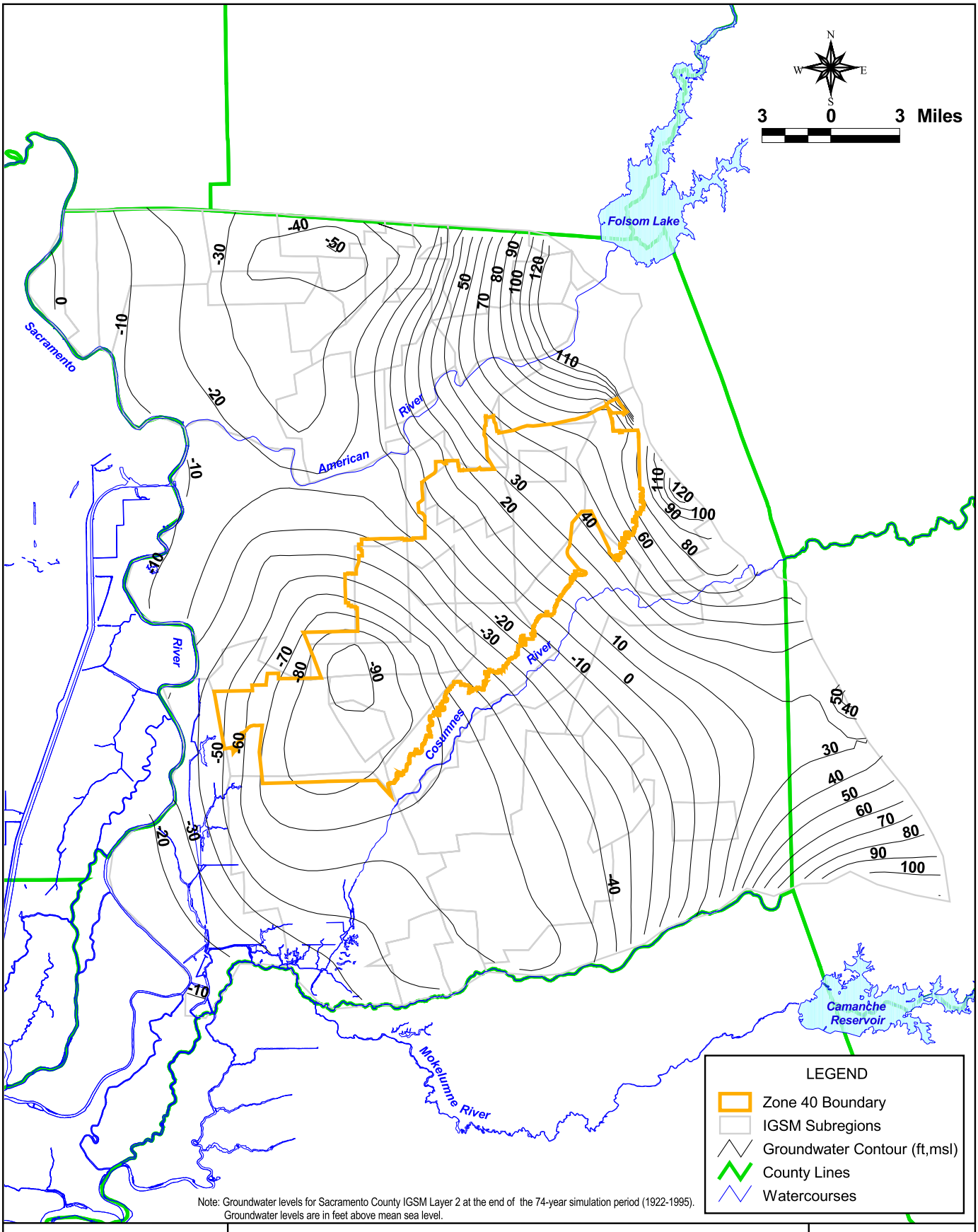
Based on the groundwater and streamflow impacts of these alternatives, it was determined that uniform groundwater pumping within Zone 40 distributed the effects of pumping operations on groundwater elevations to a larger area and resulted in smaller impacts at a specific location relative to the northern or southern emphasis of pumping. Uniform pumping within Zone 40 is, therefore, used for analysis of the remaining alternatives.

EFFECTS OF BUILDOUT CONDITIONS

Before discussing the analysis of water supply alternatives, the effects of 2030 buildout conditions based on the General Plan and Specific Community Plans, and the projected water supplies available to Zone 40, based on firm water supply availability, and most likely remediation reuse option, are presented.

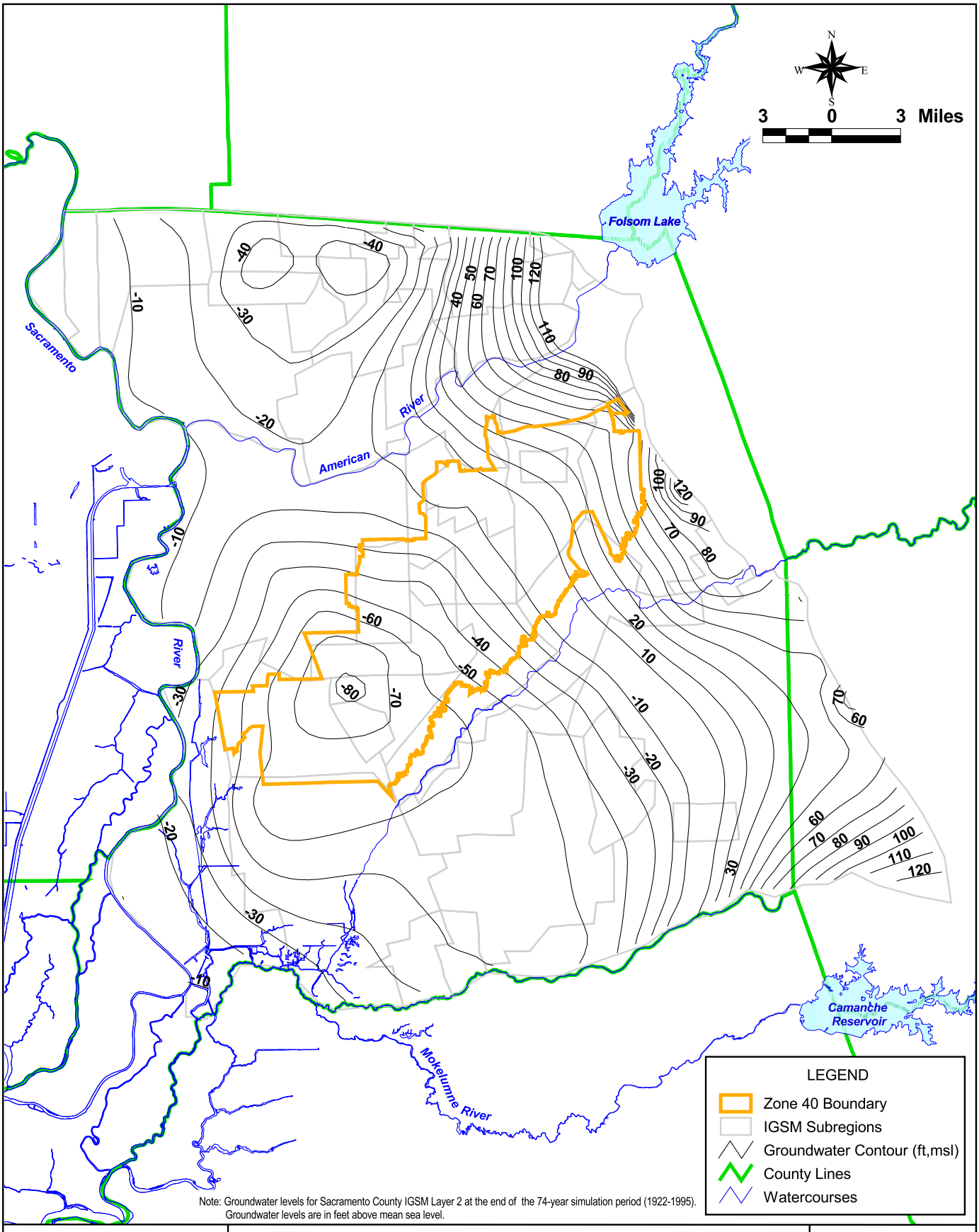
GROUNDWATER IMPACTS

Figures 6.4 and 6.5 show contours of simulated groundwater levels in the County for the 2000 and 2030 Baseline conditions, respectively. These figures indicate that, in general, groundwater levels near the cone of depression in the Central Basin are at a higher elevation in 2030 when



Note: Groundwater levels for Sacramento County IGSM Layer 2 at the end of the 74-year simulation period (1922-1995). Groundwater levels are in feet above mean sea level.

ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Baseline 2000 Groundwater Levels** **DRAFT**	SEPTEMBER 2003 FIGURE 6.4



Note: Groundwater levels for Sacramento County IGSM Layer 2 at the end of the 74-year simulation period (1922-1995). Groundwater levels are in feet above mean sea level.

ORIME	2002 ZONE 40 WATER SUPPLY MASTER PLAN **Baseline 2030 Groundwater Levels** **DRAFT**	SEPTEMBER 2003 FIGURE 6.5

compared to the 2000 Baseline. Table 6.3 indicates that although the average 2030 Baseline groundwater levels in northern Zone 40 are about 3 feet lower than the 2000 Baseline, average 2030 Baseline groundwater levels in the southern Zone 40 area are about 10 feet higher than 2000 Baseline conditions. In fact, the minimum 2030 Baseline groundwater elevation in the cone of depression is approximately 10 feet higher than the 2000 Baseline conditions. These higher groundwater level conditions are primarily due to changes in land and water use conditions, introduction of additional sources of surface water supply, and reuse of remediated groundwater. The lower groundwater levels in the northern part of Zone 40 are primarily due to groundwater remediation operations and local water supply pumping included in the 2030 Baseline. The effects of remediation operations on the groundwater levels and streamflows is discussed in the subsequent section of this report.

STREAMFLOW IMPACTS

The average monthly stream flow for the 2000 and 2030 Baseline Conditions ranges from near zero in the August and September to about 1,100 cfs in March as shown in Figure 6.6. The higher flows in September, October, and November for the 2030 Baseline Condition are primarily due to the delivery of 5,000 AFY (1,666 AF per month) of remediated groundwater into Cosumnes River as part of the reuse program. The remediated water and other changes between the 2000 and 2030 levels of development result in the average annual 2030 Baseline Cosumnes River flows at Highway 99 are approximately 5,500 AFY higher than the 2000 Baseline conditions.

The average fall flows (represented as the monthly average of September, October, and November) for the 2030 Baseline Condition are approximately 8 cfs higher than the 2000 Baseline Condition (Table 6.3). The difference in Cosumnes River flows at the Folsom South Canal and the Highway 99 is shown in Figures 6.7 and 6.8 respectively. For the 2000 Baseline, the monthly Cosumnes River streamflow near the Folsom South Canal (Figure 6.7) is greater than 10 cfs about 65 percent of the time. For the 2030 Baseline, which includes the Cosumnes River flow enhancement, the monthly flows are greater than 10 cfs about 85 percent of the time. Near Highway 99 (Figure 6.8), the 2000 Baseline streamflow is greater than 10 cfs only 58 percent of the time, while the 2030 Baseline is about 62 percent. These figures show the benefit of the Cosumnes River flow enhancement during summer conditions (low flow periods) is the greatest near the Folsom South Canal resulting from where the reuse water is delivered to the river. At Highway 99, the difference in flows to the flow enhancement has diminished as much of that water infiltrated into the streambed.

Figure 6.6
Cosumnes River Average Flow
Near Folsom South Canal Crossing

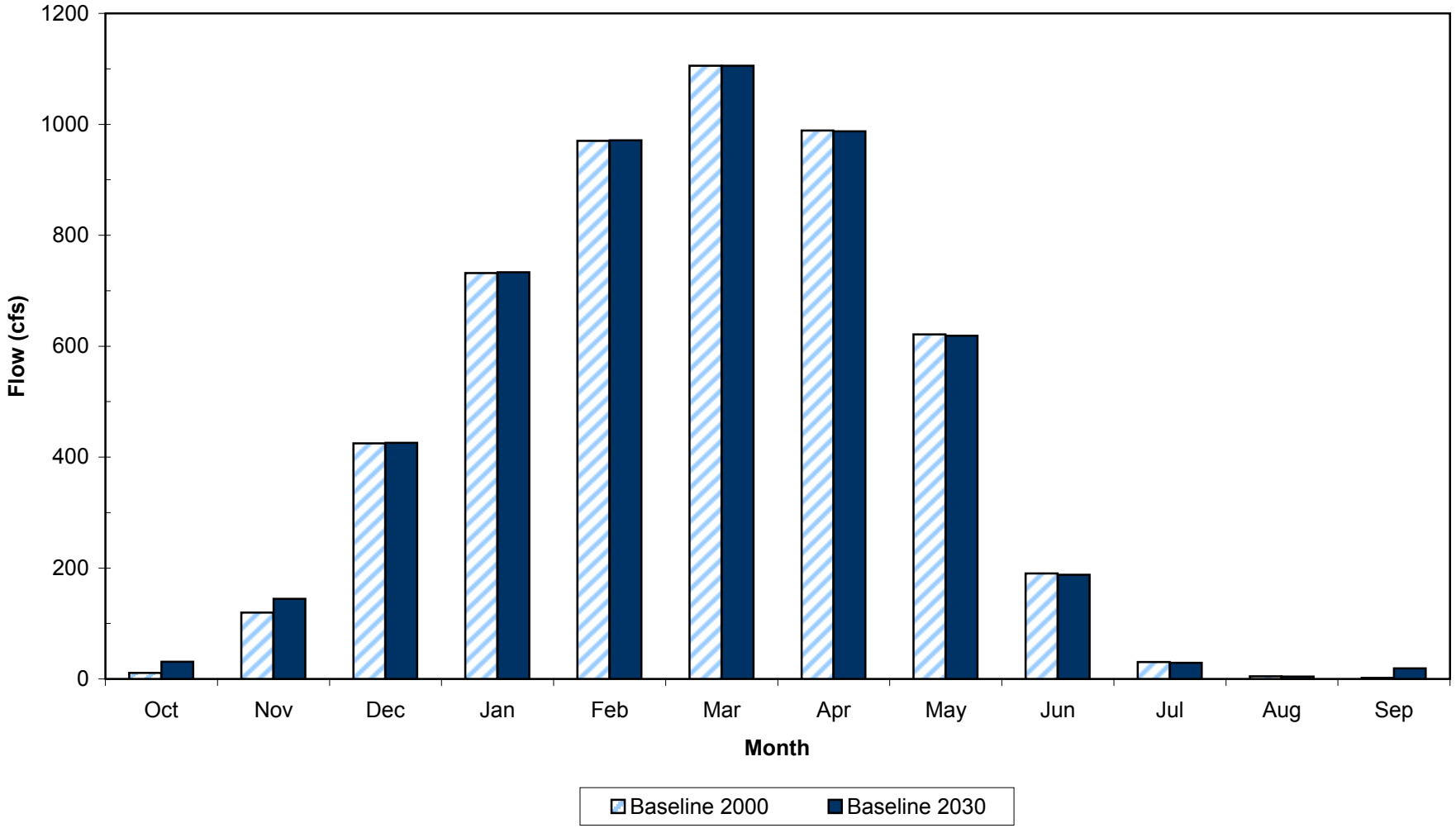


Figure 6.7
Monthly Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

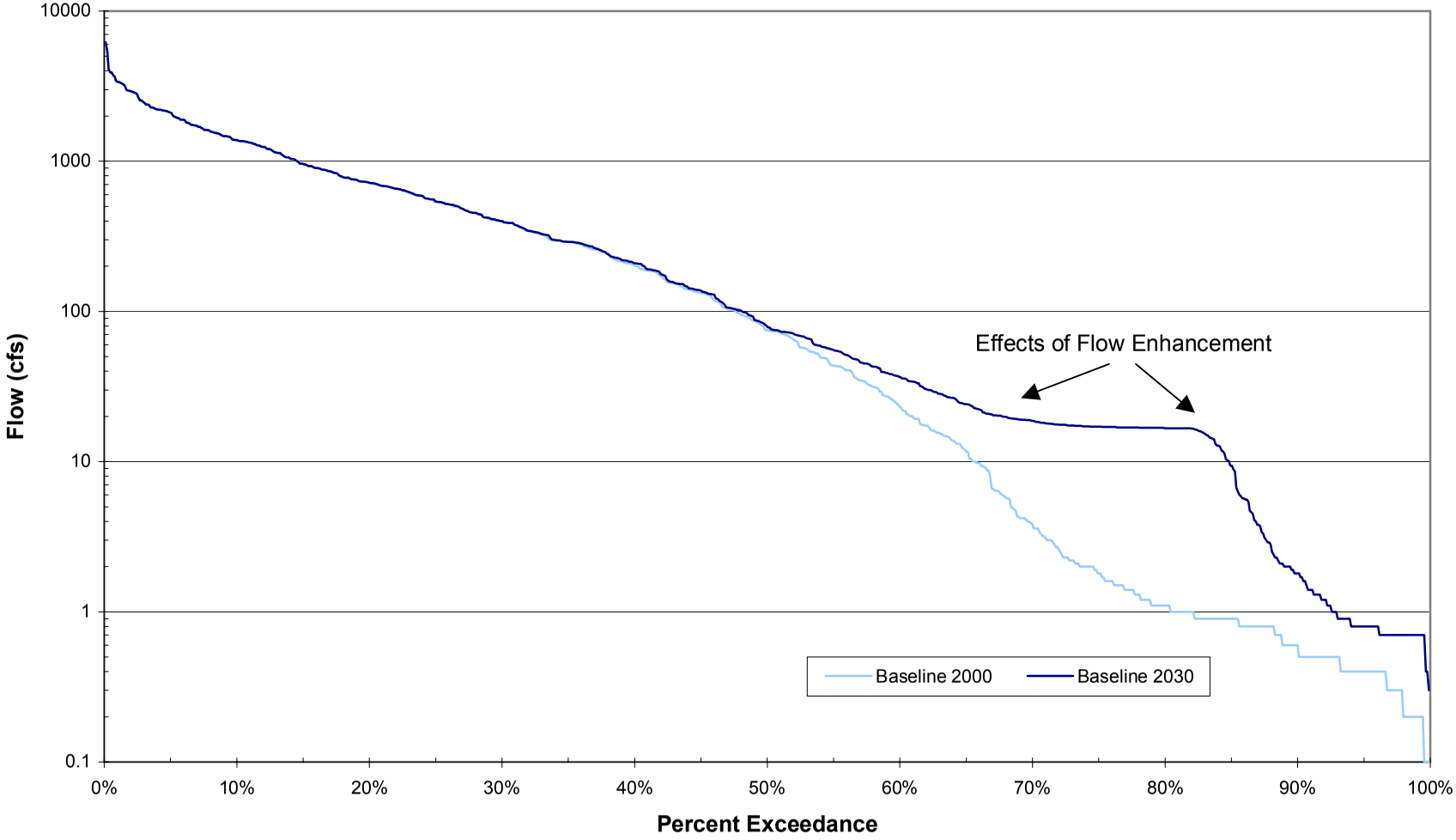
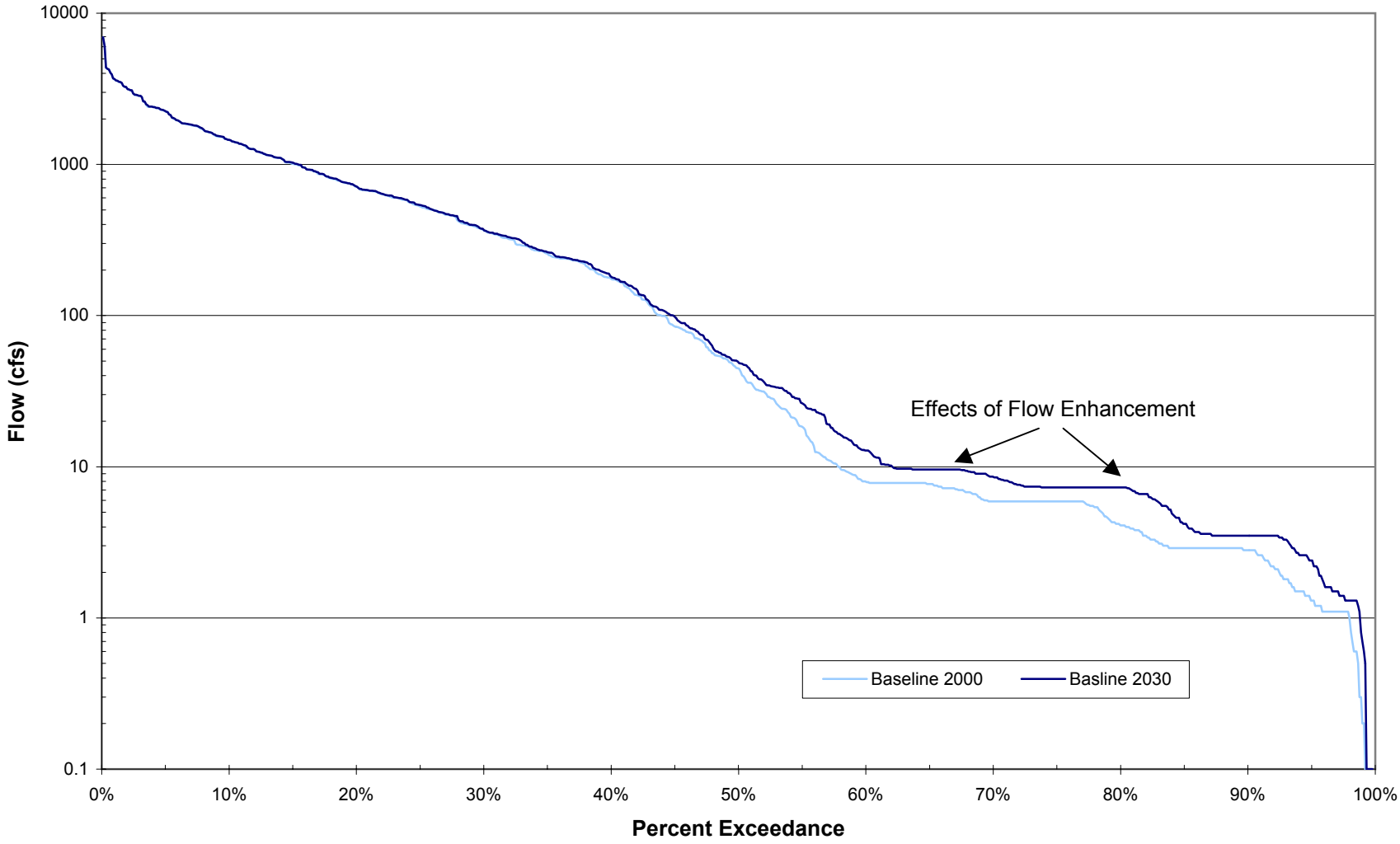


Figure 6.8
Monthly Cosumnes River Flow Exceedance Probability
Near Highway 99



ZONE 40 WATER SUPPLY AVAILABILITY ALTERNATIVES

The groundwater and streamflow hydrographs for Zone 40 Water Supply Availability alternatives are included in Appendix C. The groundwater and streamflow impacts related to this alternative are discussed below. Two alternatives are analyzed for effects on water supply conditions; Alternative 2A (Zone 40 uniform pumping at buildout level of development, with firm surface water supply and, most likely, remediation reuse) and Alternative 3 (Zone 40 uniform pumping at buildout level of development, with full surface water availability [firm and intermittent water supplies] and most likely remediation/reuse). Both these alternatives are compared with the Baseline conditions at buildout (2030 level of development). The main difference between Alternative 2A and the Baseline 2030 is that under the 2030 Baseline condition, additional groundwater pumping occurs in the area where the water is needed, whereas, in Alternative 2A, additional pumping is distributed uniformly at several project wells throughout the 2030 Study Area. Alternative 3 is similar to Alternative 2A, except it defines the proposed Master Plan project and includes an additional appropriative source of water supply on an intermittent basis.

Groundwater Impacts

Table 6.3 indicates that the average groundwater levels in northern and southern Zone 40 under Alternative 2A would be approximately 2 and 7 feet lower, respectively, than the 2030 Baseline conditions. However, average groundwater levels under Alternative 3 (the proposed project) would be approximately 6 feet higher in northern Zone 40, and almost the same in southern Zone 40. The details of changes in groundwater levels in various parts of Zone 40 can be seen in the groundwater level hydrographs presented in Appendix C (Figures C.1 to C.22).

Streamflow Impacts

The three alternatives (2030 Baseline, Alternative 2A, and Alternative 3) include the Cosumnes River flow enhancement during September, October, and November. The effects of operation of the basin under Alternatives 2A and proposed project (Alternative 3) are also summarized in Table 6.3. Based on this Table, the average annual flows in the Cosumnes River at Highway 99 are approximately the same for each Alternative. The average fall flows at Highway 99 are also about the same under the alternatives. The effects of the water supply alternatives on streamflows in the Cosumnes River are shown in Appendix C (Figures C.23 to C.38). For these alternatives, the monthly Cosumnes River flows near the Folsom South Canal and Highway 99 are greater than 10 cfs about 85 and 63 percent of the time, respectively.

GROUNDWATER REMEDIATION/REUSE OPTIONS ALTERNATIVES

The effects of remediation operations are analyzed under two Baseline conditions:

1. Alternatives 4A and 4B are under the 2000 level of development; Alternative 4A presents the effects of no remediation, while Alternative 4B presents the effects of additional reuse.

2. Alternatives 2A–2C are analyzed under the 2030 level of development, representing the most likely remediation reuse, no remediation reuse, and full remediation reuse options, respectively.

The discussion of the effects of remediation is presented at two levels of development:

2000 Conditions

Groundwater Impacts

To evaluate the effects of remediation operations at the 2000 level of development, the remediation extraction and reuse operations are removed from the model; this constitutes Alternative 4A. Based on the results summarized in Table 6.3, remediation operations lower average groundwater levels in the northern part of Zone 40 by approximately 3.5 feet, while average groundwater levels in the southern Zone 40 are affected at a minimum level.

To evaluate the effects of additional reuse on groundwater levels in the basin, Alternative 4B assumes that the level of reuse is increased to 50 percent of extracted water. Reuse is assumed to be in the form of reinjection of treated, remediated water back into the groundwater basin. Based on the results summarized in Table 6.3, remediation operations lower average groundwater levels in the northern part of Zone 40, and the southern Zone 40 are affected at a minimum level. Detailed impacts at each location are presented in the groundwater level hydrographs presented in Appendix D (Figures D.1 to D.22).

Streamflow Impacts

Table 6.3 shows the summary of the effects of remediation operations on Cosumnes River flows. Based on this table, if there were no remediation operations in the basin, the average annual Cosumnes River flows at Highway 99 would increase slightly compared to the 2000 Baseline Condition. In the fall, there is no significant difference in average streamflows.

Table 6.3 also shows that increasing the use of remediated water to approximately 50 percent has very minimal effect on Cosumnes River streamflows at Highway 99. Detailed impacts at

each location are presented in the streamflow hydrographs presented in Appendix D (Figures D.23 to D.38). For Alternatives 4A and 4B the monthly Cosumnes River flows near the Folsom South Canal and at Highway 99 are greater than 10 cfs 66 and 58 percent of the time, respectively.

2030 Conditions

Groundwater Impacts

The effects of the partial reuse option, no reuse, and complete reuse of remediated groundwater are presented in summary Table 6.3, as well as in the hydrographs presented in Appendix D. Based on the summary table, if the partial reuse option (Alt. 2A) is implemented, the average groundwater levels would be lower than the 2030 Baseline by about 2 to 7 feet. If no reuse option is implemented (Alt. 2B), the average groundwater levels would be approximately 9 to 14 feet lower. However, if the reuse of remediated groundwater is increased to the full level (Alt. 2C), the average groundwater levels in northern Zone 40 would increase by about 4 feet, while those in southern Zone 40 area would decrease by about 1 foot.

Streamflow Impacts

Table 6.3 also presents the effects of Alternatives 2A–2C on Cosumnes River streamflows at Highway 99. Based on these results, the average annual Cosumnes River flows would be about the same for the partial reuse alternative (Alt. 2A) and full reuse alternative (Alt. 2C). However, if no reuse of remediated groundwater takes place, average annual flows in the Cosumnes River would be reduced slightly at Highway 99 due to no flow enhancement. During the September to November period, this corresponds to a decrease in the average monthly flow of about 4 cfs at Highway 99. For Alt. 2B, the average monthly Cosumnes River flow at Folsom South Canal and Highway 99 exceeds 10 cfs about 66 and 62 percent of the time, respectively. For Alt. 2C, the average monthly Cosumnes River flow at Folsom South Canal and Highway 99 exceeds 10 cfs about 85 and 62 percent of the time, respectively.

SECTION 7 SUMMARY

This report presents the results of the analysis of hydrologic impacts of the alternative water management scenarios required to support the documentation of the Environmental Impact Report for the Zone 40 Water Supply Master Plan.

The report presented the following sections:

Section 1 Introduction provides background to the Zone 40 Water Supply Master Plan, and to the need to perform hydrologic analysis of the impacts of the project and associated alternative water management options.

Section 2 Sacramento County IGSM provides some background information on the Sacramento County Integrated Groundwater and Surface Water Model used in this analysis. In addition, Appendix E contains a Technical Memorandum that documents the suitability of the Sacramento County IGSM as an analytical tool to evaluate the hydrologic impacts of the water management alternatives on the groundwater and streamflows in the area.

Section 3 Description of Alternatives provides a description of the water supply alternatives analyzed in this study. These alternatives are briefly outlined in Table 3.1, with corresponding assumptions on the level of development, pumping location, and remediation operations. The alternative water management scenarios are categorized into the following:

- 2000 Baseline Condition
- 2030 Baseline Condition
- Zone 40 Groundwater Pumping Distributions Alternatives
- Zone 40 Water Supply Availability Alternatives
- Groundwater Remediation/Reuse Alternatives

The results of the analysis of these alternatives are presented in Section 6.

Section 4 Land and Water Use Conditions provides land and water use information for 2000 and 2030 Baseline conditions. The land use data for the 2000 and 2030 levels of development are collected and analyzed based on data from DWR, the County of Sacramento, the County Agricultural Commissioner Office, the General Plan, and Specific Plans. Agricultural water use data was developed based on land use and crop acreages, along with irrigation practices data and parameters. The urban water use data was developed based on land use and unit water demand factors from the Boyle (1995) study modified to reflect more recent water use data,

assuming 12 and 25.6 percent conservation for the 2000 and 2030 levels of development, respectively. Tables 4.1 through 4.3 are key tables presenting information on land use acreage. Tables 4.4 and 4.5 present acreage by individual crops per the 2000 land use survey as well as the projections for 2030 level of development.

Section 5 Water Supply Availability provides information on future water supply availability for Zone 40. Water supplies available to meet future Zone 40 water needs are surface water, recycled water, groundwater, and remediated groundwater. Table 5.1 shows the combination of water supplies available to meet the Zone 40 needs. Table 5.2 provides a breakdown of the surface water evaluated in this study.

Section 6 Baseline and Alternatives Analysis presents the model results for the water management alternatives described in Section 3. The impacts analysis are grouped into the following three categories:

- Zone 40 Groundwater Pumping Distribution Alternatives
- Zone 40 Water Supply Availability Alternatives
- Groundwater Remediation/Reuse Alternatives

Table 6.3 presents the summary of results of the impact assessment on average groundwater levels in northern and southern Zone 40, as well as the average annual and average Fall streamflows in the Cosumnes River near Highway 99.

SECTION 8 REFERENCES

Boyle Engineering Corporation, Estimate of Annual Water Demand Within the Sacramento County-Wide Area, May 1995.

California Department of Water Resources, Standard Land Use Legend, March 1999.

James M. Montgomery, Sacramento County Water Agency, *Zone 40 Master Water Supply Plan,* 1987.

Montgomery Watson, Sacramento County Water Agency, *County Groundwater Model, Model Development and Basin Groundwater Yield*, June 1993.

Montgomery Watson, Sacramento County Water Agency, *Baseline Conditions for Groundwater Yield Analysis*, 1997.

MWH, Sacramento County Water Agency, *Zone 40 Water Supply Master Plan* (Draft), December 2002.

MWH, American River Basin Cooperating Agencies – Regional Water Master Plan Phase I Final Report, 2002.

WRIME, Inc., *Technical Memorandum on Application of Existing Sacramento County IGSM to Hydrologic Analysis of Zone 40 Master Water Supply Plan Update*, October 2002.

APPENDIX A WATER BALANCE SUMMARY TABLES

Table A.1

2000 Baseline Condition

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
									Groundwater Pumping			Surface Water Supply			Project	Total Supply			
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply		Extraction	Injection	Cosum.
	North Area																		R. Enhance.
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772	21,364		21,364	4,332		4,332		25,696	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475	20,348		20,348	1,155		1,155		21,503	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169	4		4	20,165		20,165		20,169	12,774	1,462	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711	10,740		10,740	3,971		3,971		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**188,803**	**0**	**188,803**	**121,566**	**0**	**121,566**	**0**	**310,369**	**15,633**	**1,502**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	96	230	145	1.5	115	0.5	259	260		260	0		0		260			
14	Security Park - Cal Am	1	86	5	5.3	381	4.4	384	386		386	0		0		386			
23	Sunrise - SCWA	0	525	0	4.9	2,059	3.8	2,058	0		0	2,066		2,066		2,066			
36	Laguna/Franklin - SCWA	3,323	7,655	10,265	1.9	14,422	2.2	24,687	20,263		20,263	4,500		4,500		24,763	966		
38	SCWA/EGWS Retail	1,558	1,760	7,209	1.6	6,185	2.1	13,394	13,394		13,394	0		0		13,394			
39	Vineyard - SCWA	1,603	3,389	7,425	4.0	7,646	2.3	15,071	15,071		15,071	0		0		15,071			
40	N. Vineyard In POU - SCWA	540	1,978	1,644	4.5	4,444	4.4	6,088	6,088		6,088	0		0		6,088			
41	N. Vineyard Out POU - SCWA	516	82	1,620	3.1	261	2.6	1,880	1,881		1,881	0		0		1,881			
42	Mather	21	2,181	105	4.1	2,303	2.6	2,410	2,408		2,408	0		0		2,408	2,065	1,774	
	Total Zone 40	**7,658**	**17,886**	**28,418**	**N/A**	**37,816**	**N/A**	**66,233**	**59,751**	**0**	**59,751**	**6,566**	**0**	**6,566**	**0**	**66,317**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**53,269**	**85,807**	**171,632**	**N/A**	**205,018**	**N/A**	**376,649**	**248,554**	**0**	**248,554**	**128,132**	**0**	**128,132**	**0**	**376,686**	**18,664**	**3,276**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.3	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	3.9	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.7	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	1.1	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD (3)	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54633	2.5	666	0.9	55,300	13,611		13,611	41,689		41,689		55,300			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,989**	**0**	**50,989**	**0**	**64,915**	**0**	**0**	**0**
	Grand Total	**135,001**	**174,721**	**440,813**	**N/A**	**408,726**	**N/A**	**849,539**	**516,678**	**0**	**516,678**	**342,526**	**0**	**342,526**	**0**	**859,204**	**19,874**	**3,276**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).

(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.

(3) SMUD diverts 15,000 AF/yr from Folsom South Canal.

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Table A.2

Alternative 1A-Firm Surface Water Supply with Uniform Pumping

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208.0	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772.0	21,440		21,440	4,328		4,328		25,768	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824.0	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475.0	20,348		20,348	1,155		1,155		21,503	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163.0	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642.0	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169.0	4		4	20,165		20,165		20,169	12,774	1,462	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711.0	9,707		9,707	5,004		5,004		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510.0	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710.0	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232.0	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**187,846**	**0**	**187,846**	**122,595**	**0**	**122,595**	**0**	**310,441**	**15,633**	**1,502**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8,451	3,025	4.2	17,429	2.1	20,454	3,025		3,025	6,504		6,504	10,929	20,458			
14	Security Park - Cal Am	11	1,736	54	4.9	1,455	0.8	1,509	54		54	543		543	913	1,510			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0		0	768		768	1,292	2,060			
36	Laguna/Franklin - SCWA	50	14,225	155	3.1	35,752	2.5	35,907	20,234	4,385	24,619	15,763		15,763		35,997	966		
38	SCWA/EGWS Retail	53	5,873	245	4.6	14,308	2.4	14,553	9,346	1,899	11,245	5,210		5,210		14,556			
39	Vineyard - SCWA	322	7,485	1,497	4.6	21,988	2.9	23,485	15,477	2,432	17,909	8,006		8,006		23,483			
40	N. Vineyard In POU - SCWA	0	5,600	0	N/A	9,929	1.8	9,929	725	1,807	2,532	9,212		9,212		9,937			
41	N. Vineyard Out POU - SCWA	0	2,351	0	N/A	7,038	3.0	7,038	4,753	759	5,512	2,284		2,284		7,037			
42	Mather	0	5,755	0	N/A	11,168	1.9	11,168	7,105	1,855	8,960	4,067		4,067		11,172	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121,126**	**N/A**	**126,102**	**60,719**	**13,137**	**73,856**	**52,357**	**0**	**52,357**	**13,134**	**126,210**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**46,760**	**120,309**	**148,190**	**N/A**	**288,328**	**N/A**	**436,518**	**248,565**	**13,137**	**261,702**	**174,952**	**0**	**174,952**	**13,134**	**436,651**	**18,664**	**3,548**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.3	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	3.9	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.7	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	1.1	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54,633	2.5	666	0.9	55,300	13,611		13,611	41,690		41,690		55,301			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,990**	**0**	**50,990**	**0**	**64,916**	**0**	**0**	**0**
	Grand Total	**128,492**	**209,223**	**417,371**	**N/A**	**492,036**	**N/A**	**909,408**	**516,689**	**13,137**	**529,826**	**389,347**	**0**	**389,347**	**13,134**	**919,170**	**19,874**	**3,276**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.3

Alternative 1B- Firm Surface Water Supply with Northern Zone 40 Pumping

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208.0	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772.0	21,440		21,440	4,328		4,328		25,768	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824.0	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475.0	20,326		20,326	1,134		1,134		21,460	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163.0	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642.0	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169.0	4		4	20,165		20,165		20,169	12,774	1,462	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711.0	9,707		9,707	5,004		5,004		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510.0	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710.0	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232.0	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**187,824**	**0**	**187,824**	**122,574**	**0**	**122,574**	**0**	**310,398**	**15,633**	**1,502**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8,451	3,025	4.2	17,429	2.1	20,454	3,025		3,025	6,504		6,504	10,920	20,449			
14	Security Park - Cal Am	11	1,736	54	4.9	1,455	0.8	1,509	54		54	543		543	912	1,509			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0		0	768		768	1,290	2,058			
36	Laguna/Franklin - SCWA	50	14,225	155	3.1	35,752	2.5	35,907	480		480	15,763		15,763	19,744	35,987	966		
38	SCWA/EGWS Retail	53	5,873	245	4.6	14,308	2.4	14,553	374		374	5,210		5,210	8,963	14,547			
39	Vineyard - SCWA	322	7,485	1,497	4.6	21,988	2.9	23,485	1,695		1,695	8,006		8,006	13,772	23,473			
40	N. Vineyard In POU - SCWA	0	5,600	0	N/A	9,929	1.8	9,929	725	22,733	23,458	9,212		9,212		9,937			
41	N. Vineyard Out POU - SCWA	0	2,351	0	N/A	7,038	3.0	7,038	4,753	9,544	14,297	2,284		2,284		7,037			
42	Mather	0	5,755	0	N/A	11,168	1.9	11,168	7,104	23,360	30,464	4,067		4,067		11,171	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121,126**	**N/A**	**126,102**	**18,210**	**55,637**	**73,847**	**52,357**	**0**	**52,357**	**55,601**	**126,168**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**46,760**	**120,309**	**148,190**	**N/A**	**288,328**	**N/A**	**436,518**	**206,034**	**55,637**	**261,671**	**174,931**	**0**	**174,931**	**55,601**	**436,566**	**18,664**	**3,548**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.4	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	2.4	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.4	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	2.4	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54,633	2.5	666	0.9	55,300	13,611		13,611	41,690		41,690		55,301			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,990**	**0**	**50,990**	**0**	**64,916**	**0**	**0**	**0**
	Grand Total	**128,492**	**209,223**	**417,371**	**N/A**	**492,036**	**N/A**	**909,408**	**474,158**	**55,637**	**529,795**	**389,326**	**0**	**389,326**	**55,601**	**919,085**	**19,874**	**3,276**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.4

Alternative 1C- Firm Surface Water Supply with Southern Zone 40 Pumping

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208.0	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772.0	21,440		21,440	4,328		4,328		25,768	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824.0	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475.0	20,348		20,348	1,155		1,155		21,503	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163.0	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642.0	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169.0	4		4	20,165		20,165		20,169	12,774	1,462	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711.0	9,707		9,707	5,004		5,004		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510.0	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710.0	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232.0	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**187,846**	**0**	**187,846**	**122,595**	**0**	**122,595**	**0**	**310,441**	**15,633**	**1,502**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8,451	3,025	4.2	17,429	2.1	20,454	3,025		3,025	6,504		6,504	11,006	20,535			
14	Security Park - Cal Am	11	1,736	54	4.9	1,455	0.8	1,509	54		54	543		543	831	1,428			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0		0	768		768	1,246	2,014			
36	Laguna/Franklin - SCWA	50	14,225	155	3.1	35,752	2.5	35,907	20,234	9,694	29,928	15,763		15,763		35,997	966		
38	SCWA/EGWS Retail	53	5,873	245	4.6	14,308	2.4	14,553	9,346	4,135	13,481	5,210		5,210		14,556			
39	Vineyard - SCWA	322	7,485	1,497	4.6	21,988	2.9	23,485	15,477	5,296	20,773	8,006		8,006		23,483			
40	N. Vineyard In POU - SCWA	0	5,600	0	N/A	9,929	1.8	9,929	89		89	9,212		9,212	623	9,924			
41	N. Vineyard Out POU - SCWA	0	2,351	0	N/A	7,038	3.0	7,038	4,753	1,652	6,405	2,284		2,284		7,037			
42	Mather	0	5,755	0	N/A	11,168	1.9	11,168	100		100	4,067		4,067	7,060	11,227	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121,126**	**N/A**	**126,102**	**53,078**	**20,777**	**73,855**	**52,357**	**0**	**52,357**	**20,766**	**126,201**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**46,760**	**120,309**	**148,190**	**N/A**	**288,328**	**N/A**	**436,518**	**240,924**	**20,777**	**261,701**	**174,952**	**0**	**174,952**	**20,766**	**436,642**	**18,664**	**3,548**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.4	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	2.4	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.4	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	2.4	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54,633	2.5	666	0.9	55,300	13,611		13,611	41,690		41,690		55,301			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,990**	**0**	**50,990**	**0**	**64,916**	**0**	**0**	**0**
	Grand Total	**128,492**	**209,223**	**417,371**	**N/A**	**492,036**	**N/A**	**909,408**	**509,048**	**20,777**	**529,825**	**389,347**	**0**	**389,347**	**20,766**	**919,161**	**19,874**	**3,276**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.5

2030 Level Baseline Condition

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	999	27336	3,512	3.5	71,199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14,210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6,700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5,041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11,990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16,390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19,502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1,432	0.8	1,432	639		639	833		833		1,472	1210		
25	Arcade	0	2447	0	N/A	5,199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11,100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3,407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2,436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27,399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7,600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6,801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13,101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116,006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2,181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1,796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2,093		5,000
11	Rancho Murieta	216	2178	1,091	5.1	5,011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2,659	1.1	7,456	7,463		7,463	0		0		7,463			
15	City Of Folsom	0	11697	0	N/A	32,904	2.8	32,904	0		0	32,823		32,823		32,823	30,000	6,200	
16	Arden Cordova	173	6929	297	1.7	12,534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1,202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2,552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5,610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,347**	**0**	**179,347**	**143,386**	**0**	**143,386**	**0**	**322,733**	**32,859**	**6,240**	**5,000**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17,429	2.1	20,454	12,455		12,455	6,504	1,537	8,041		20,496			
14	Security Park - Cal Am	11	1736	54	4.9	1,455	0.8	1,509	841		841	543	128	671		1,512			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	1,112		1,112	768	182	950		2,062			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35,752	2.5	35,907	17,628		17,628	15,763	2,761	18,524		36,152	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14,308	2.4	14,553	8,091		8,091	5,210	1,261	6,471		14,562			
39	Vineyard - SCWA	322	7485	1,497	4.6	21,988	2.9	23,485	13,519		13,519	8,006	1,938	9,944		23,463			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9,929	1.8	9,929	701		701	9,212	55	9,267		9,968			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7,038	3.0	7,038	4,196		4,196	2,284	553	2,837		7,033			
42	Mather	0	5755	0	N/A	11,168	1.9	11,168	6,159		6,159	4,067	985	5,052		11,211	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121126**	**N/A**	**126,102**	**64,702**	**0**	**64,702**	**52,357**	**9,400**	**61,757**	**0**	**126,459**	**3,031**	1,774	0
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303956**	**N/A**	**448,556**	**244,049**	**0**	**244,049**	**195,743**	**9,400**	**205,143**	**0**	**449,192**	**35,890**	**8,014**	**5,000**
	South (Galt)Area																		
5	Galt ID [2]	17375	1954	60522	3.5	3,921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5,488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3,802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121.0**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**494,699**	**0**	**494,699**	**434,053**	**9,400**	**443,453**	**0**	**938,152**	**37,100**	**8,014**	**5,000**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.6

Alternative 2A- Firm Surface Water Supply with Most Likely Remediation Reuse

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	999	27336	3,512	3.5	71,199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14,210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6,700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5,041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11,990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16,390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19,502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1,432	0.8	1,432	639		639	833		833		1,472	1,210		
25	Arcade	0	2447	0	N/A	5,199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11,100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3,407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2,436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27,399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7,600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6,801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13,101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116,006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2,181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1,796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2,093		5,000
11	Rancho Murieta	216	2178	1,091	5.1	5,011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2,659	1.1	7,456	7,544		7,544	0		0		7,544			
15	City Of Folsom	0	11697	0	N/A	32,904	2.8	32,904	0		0	32,897		32,897		32,897	30,000	6,200	
16	Arden Cordova	173	6929	297	1.7	12,534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1,202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2,552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5,610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,428**	**0**	**179,428**	**143,460**	**0**	**143,460**	**0**	**322,888**	**32,859**	**6,240**	**5,000**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17,429	2.1	20,454	3,025	0	3,025	6,504	1,537	8,041	9,401	20,467			
14	Security Park - Cal Am	11	1736	54	4.9	1,455	0.8	1,509	54	0	54	543	128	671	793	1,518			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0	0	0	768	182	950	1,133	2,083			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35,752	2.5	35,907	17,621	3,787	21,408	15,763	2,761	18,524		36,145	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14,308	2.4	14,553	8,090	1,620	9,710	5,210	1,261	6,471		14,561			
39	Vineyard - SCWA	322	7485	1,497	4.6	21,988	2.9	23,485	13,520	2,064	15,584	8,006	1,938	9,944		23,464			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9,929	1.8	9,929	700	1,545	2,245	9,212	55	9,267		9,967			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7,038	3.0	7,038	4,196	649	4,845	2,284	553	2,837		7,033			
42	Mather	0	5755	0	N/A	11,168	1.9	11,168	6,161	1,586	7,747	4,067	985	5,052		11,213	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121126**	**N/A**	**126,102**	**53,367**	**11,251**	**64,618**	**52,357**	**9,400**	**61,757**	**11,328**	**126,452**	**3,031**	1,774	0
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303956**	**N/A**	**448,556**	**232,795**	**11,251**	**244,046**	**195,817**	**9,400**	**205,217**	**11,328**	**449,340**	**35,890**	**8,014**	**5,000**
	South (Galt)Area																		
5	Galt ID [2]	17375	1954	60522	3.5	3,921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5,488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3,802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**483,445**	**11,251**	**494,696**	**434,127**	**9,400**	**443,527**	**11,328**	**938,300**	**37,100**	**8,014**	**5,000**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.7

Alternative 3 - Full Surface Water Supply with Most Likely Remediation Reuse

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
	North Area								GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
1	North Sacramento	999	27336	3,512	3.5	71,199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14,210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6,700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5,041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11,990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16,390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19,502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1,432	0.8	1,432	639		639	833		833		1,472	1210		
25	Arcade	0	2447	0	N/A	5,199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11,100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3,407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2,436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27,399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7,600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6,801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13,101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116,006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2,181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1,796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2093		5000
11	Rancho Murieta	216	2178	1,091	5.1	5,011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2,659	1.1	7,456	7,525		7,525	0		0		7,525			
15	City Of Folsom	0	11697	0	N/A	32,904	2.8	32,904	0		0	32,897		32,897		32,897	30000	6200	
16	Arden Cordova	173	6929	297	1.7	12,534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1,202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2,552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5,610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,409**	**0**	**179,409**	**143,460**	**0**	**143,460**	**0**	**322,869**	**32,859**	**6,240**	**5,000**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17,429	2.1	20,454	3,025	0	3,025	9,728	1,537	11,264	7,190	21,479			
14	Security Park - Cal Am	11	1736	54	4.9	1,455	0.8	1,509	54	0	54	806	128	934	606	1,594			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0	0	0	1,147	182	1,329	866	2,195			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35,752	2.5	35,907	17,073	2,897	19,970	16,346	2,761	19,107		36,180	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14,308	2.4	14,553	6,019	1,239	7,258	7,850	1,261	9,112		15,131			
39	Vineyard - SCWA	322	7485	1,497	4.6	21,988	2.9	23,485	10,342	1,578	11,920	12,061	1,938	13,999		24,341			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9,929	1.8	9,929	573	1,181	1,754	9,402	55	9,457		10,030			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7,038	3.0	7,038	3,203	496	3,699	3,451	553	4,004		7,207			
42	Mather	0	5755	0	N/A	11,168	1.9	11,168	4,754	1,212	5,966	6,138	985	7,123		11,877	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121126**	**N/A**	**126,102**	**45,043**	**8,603**	**53,646**	**66,929**	**9,400**	**76,329**	**8,662**	**130,034**	**3,031**	1,774	0
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303956**	**N/A**	**448,556**	**224,452**	**8,603**	**233,055**	**210,389**	**9,400**	**219,789**	**8,662**	**452,903**	**35,890**	**8,014**	**5,000**
	South (Galt)Area																		
5	Galt ID [2]	17375	1954	60522	3.5	3,921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5,488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3,802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**475,102**	**8,603**	**483,705**	**448,699**	**9,400**	**458,099**	**8,662**	**941,863**	**37,100**	**8,014**	**5,000**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.8

Alternative 2B- Firm Surface Water Supply with No Remediation Reuse

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
									GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	999	27336	3,512	3.5	71,199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14,210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6,700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5,041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11,990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16,390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19,502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1,432	0.8	1,432	639		639	833		833		1,472	1210		
25	Arcade	0	2447	0	N/A	5,199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11,100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3,407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2,436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27,399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7,600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6,801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13,101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116,006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2,181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1,796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2,093		0
11	Rancho Murieta	216	2178	1,091	5.1	5,011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2,659	1.1	7,456	7,557		7,557	0		0		7,557			
15	City Of Folsom	0	11697	0	N/A	32,904	2.8	32,904	0		0	32,890		32,890		32,890	30,000	6,200	
16	Arden Cordova	173	6929	297	1.7	12,534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1,202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2,552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5,610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,441**	**0**	**179,441**	**143,453**	**0**	**143,453**	**0**	**322,894**	**32,859**	**6,240**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17,429	2.1	20,454	3,025	0	3,025	6,504		6,504	10,900	20,429			
14	Security Park - Cal Am	11	1736	54	4.9	1,455	0.8	1,509	54	0	54	543		543	919	1,516			
23	Sunrise - SCWA	0	912	0	N/A	2,059	2.3	2,059	0	0	0	768		768	1,314	2,082			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35,752	2.5	35,907	20,241	4,390	24,631	15,763		15,763		36,004	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14,308	2.4	14,553	9,345	1,878	11,223	5,210		5,210		14,555			
39	Vineyard - SCWA	322	7485	1,497	4.6	21,988	2.9	23,485	15,442	2,393	17,835	8,006		8,006		23,448			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9,929	1.8	9,929	757	1,791	2,548	9,212		9,212		9,969			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7,038	3.0	7,038	4,748	752	5,500	2,284		2,284		7,032			
42	Mather	0	5755	0	N/A	11,168	1.9	11,168	7,129	1,839	8,968	4,067		4,067		11,196	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121126**	**N/A**	**126,102**	**60,741**	**13,043**	**73,784**	**52,357**	**0**	**52,357**	**13,133**	**126,231**	**3,031**	1,774	0
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303956**	**N/A**	**448,556**	**240,182**	**13,043**	**253,225**	**195,810**	**0**	**195,810**	**13,133**	**449,125**	**35,890**	**8,014**	**0**
	South (Galt)Area																		
5	Galt ID [2]	17375	1954	60522	3.5	3,921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5,488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3,802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**490,832**	**13,043**	**503,875**	**434,120**	**0**	**434,120**	**13,133**	**938,085**	**37,100**	**8,014**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.9

Alternative 2c - Preferred Alternative Complete Reuse option

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (Acre-feet/Year)								Remediation Operation		
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	Groundwater Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
	North Area								GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
1	North Sacramento	999	27336	3,512	3.5	71199	2.6	74,711	28,711		28,711	46,002		46,002		74,713			
17	Fair Oaks	0	6300	0	N/A	14210	2.3	14,210	263		263	14,209		14,209		14,472			
18	Orangevale	0	2376	0	N/A	6700	2.8	6,700	117		117	6,741		6,741		6,858			
19	San Juan	0	650	0	N/A	5041	7.8	5,041	3		3	6,630		6,630		6,633			
20	Carmichael	0	4690	0	N/A	11990	2.6	11,990	160		160	12,100		12,100		12,260			
21	Citrus Heights	0	7164	0	N/A	16390	2.3	16,390	301		301	16,402		16,402		16,703			
22	Northridge	0	5500	0	N/A	19502	3.5	19,502	8,633		8,633	10,869		10,869		19,502			
24	McClellan AFB	0	1880	0	N/A	1432	0.8	1,432	639		639	833		833		1,472	1210		
25	Arcade	0	2447	0	N/A	5199	2.1	5,199	2,303		2,303	2,896		2,896		5,199			
26	Rio Linda North	115	3822	415	3.6	11100	2.9	11,515	11,515		11,515	0		0		11,515			
27	Natomas Mutual	4892	4037	17,692	3.6	3407	0.8	21,099	4,144		4,144	18,063		18,063		22,207			
28	Metro Airport	1032	3297	3,749	3.6	2436	0.7	6,185	2,591		2,591	3,828		3,828		6,419			
32	Arcade WD - T&C	0	11605	0	N/A	27399	2.4	27,399	16,307		16,307	11,092		11,092		27,399			
33	Rio Linda South	80	2640	291	3.6	7600	2.9	7,891	7,891		7,891	0		0		7,891			
34	Antelope - Cal Am	0	2042	0	N/A	6801	3.3	6,801	5,365		5,365	1,437		1,437		6,802			
35	Lincoln/RO - Cal Am	0	3950	0	N/A	13101	3.3	13,101	11,664		11,664	1,437		1,437		13,101			
	Total North Area	**7,118**	**89,736**	**25,659**	**N/A**	**223,507**	**N/A**	**249,166**	**100,607**	**0**	**100,607**	**152,539**	**0**	**152,539**	**0**	**253,146**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	386	50185	972	2.5	116006	2.3	116,978	28,828		28,828	88,150		88,150		116,978	726		
3	Omochumne-Hartnell North	8388	136	24,791	3.0	375	2.8	25,166	20,800		20,800	4,332		4,332		25,132	40	40	
4	Southwest	26347	2198	82,784	3.1	2181	1.0	84,965	84,965		84,965	0		0		84,965			
10	Omochumne-Hartnell	6300	1275	21,281	3.4	1796	1.4	23,077	16,506		16,506	6,599		6,599		23,105	2,093		5,000
11	Rancho Murieta	216	2178	1,091	5.1	5011	2.3	6,102	179		179	6,282		6,282		6,461			
12	Sunrise "A" - SCWA	1158	2479	4,797	4.1	2659	1.1	7,456	7,531		7,531	-69		-69		7,462			
15	City Of Folsom	0	11697	0	N/A	32904	2.8	32,904	0		0	32,904		32,904		32,904	30,000	6,200	
16	Arden Cordova	173	6929	297	1.7	12534	1.8	12,831	7,631		7,631	5,200		5,200		12,831			
30	Foothills North	935	1825	3,611	3.9	1202	0.7	4,813	4,813		4,813	0		0		4,813			
37	EGWS	0	2590	0	N/A	2552	1.0	2,552	2,552		2,552	0		0		2,552			
43	Rosemont - Cal Am	0	2990	0	N/A	5610	1.9	5,610	5,610		5,610	0		0		5,610			
	Total Central Area	**43,903**	**84,482**	**139,624**	**N/A**	**182,830**	**N/A**	**322,454**	**179,415**	**0**	**179,415**	**143,398**	**0**	**143,398**	**0**	**322,813**	**32,859**	**6,240**	**5,000**
	Zone 40																		
13	Sunrise Douglas - SCWA	713	8451	3,025	4.2	17429	2.1	20,454	3,025		3,025	6,504	3,073	9,577	7,940	20,542			
14	Security Park - Cal Am	11	1736	54	4.9	1455	0.8	1,509	54		54	543	257	800	669	1,523			
23	Sunrise - SCWA	0	912	0	N/A	2059	2.3	2,059	0		0	768	363	1,131	957	2,088			
36	Laguna/Franklin - SCWA	50	14225	155	3.1	35752	2.5	35,907	15,144	3,199	18,343	15,763	5,522	21,285		36,429	966		
38	SCWA/EGWS Retail	53	5873	245	4.6	14308	2.4	14,553	6,869	1,368	8,237	5,210	2,523	7,733		14,602			
39	Vineyard - SCWA	322	7485	1,497	4.6	21988	2.9	23,485	11,646	1,743	13,389	8,006	3,876	11,882		23,528			
40	N. Vineyard In POU - SCWA	0	5600	0	N/A	9929	1.8	9,929	645	1,305	1,950	9,212	111	9,323		9,968			
41	N. Vineyard Out POU - SCWA	0	2351	0	N/A	7038	3.0	7,038	3,649	548	4,197	2,284	1,106	3,390		7,039			
42	Mather	0	5755	0	N/A	11168	1.9	11,168	5,224	1,339	6,563	4,067	1,969	6,036		11,260	2,065	1,774	
	Total Zone 40	**1,149**	**52,388**	**4,976**	**N/A**	**121,126**	**N/A**	**126,102**	**46,256**	**9,502**	**55,758**	**52,357**	**18,800**	**71,157**	**9,566**	**126,979**	**3,031**	1,774	**0**
	Grand Total Central Area	**45,052**	**136,870**	**144,600**	**N/A**	**303,956**	**N/A**	**448,556**	**225,671**	**9,502**	**235,173**	**195,755**	**18,800**	**214,555**	**9,566**	**449,792**	**35,890**	**8,014**	**5,000**
	South (Galt)Area																		
5	Galt ID [2]	17375	1954	60522	3.5	3921	2.0	64,443	49,744		49,744	14,700		14,700		64,444			
6	City Of Galt	199	2918	598	3.0	5488	1.9	6,086	6,086		6,086	0		0		6,086			
7	OFSCU	7073	65	25465	3.6	211	3.2	25,676	25,676		25,676	0		0		25,676			
9	Clay WD	1814	126	6383	3.5	281	2.2	6,664	6,664		6,664	0		0		6,664			
31	Foothills South	14929	4058	44519	3.0	3802	0.9	48,321	48,321		48,321	0		0		48,321			
	Total South (Galt) Area	**41,390**	**9,121**	**137,487**	**N/A**	**13,703**	**N/A**	**151,190**	**136,491**	**0**	**136,491**	**14,700**	**0**	**14,700**	**0**	**151,191**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	149	1,390	322	2.2	0	0.0	322	322		322	28,692		28,692		29,014			
29	Courtland Area	21,750	932	54186	2.5	730	0.8	54,916	13,230		13,230	42,379		42,379		55,609			
	Total Other	**21,899**	**2,322**	**54,508**	**N/A**	**730**	**N/A**	**55,238**	**13,552**	**0**	**13,552**	**71,071**	**0**	**71,071**	**0**	**84,623**			
	Grand Total	**115,459**	**238,049**	**362,254**	**N/A**	**541,896**	**N/A**	**904,150**	**476,321**	**9,502**	**485,823**	**434,065**	**18,800**	**452,865**	**9,566**	**938,752**	**37,100**	**8,014**	**5,000**

(1) Average Annual values for 74 years Simulation (1922- 1995).
(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.
(3) SMUD diverts 43,400 AF/yr from Folsom South Canal.
(4) Surface Water Supply in Zone 40 includes recycled water (4400 AF/yr).

Table A.10

Alternative 4A - 2000 Level with No Remediation Reuse

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
									Groundwater Pumping			Surface Water Supply			Project	Total Supply			
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply		Extraction	Injection	Cosum.
	North Area																		R. Enhance.
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,624		1,624	0		0		1,624	0		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,046**	**0**	**120,046**	**157,705**	**0**	**157,705**	**0**	**277,751**	**0**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208	32,423		32,423	87,786		87,786		120,209	0		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772	21,368		21,368	4,328		4,328		25,696	0	0	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475	20,353		20,353	1,150		1,150		21,503	0		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169	10		10	20,159		20,159		20,169	0	0	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711	10,740		10,740	3,971		3,971		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**188,812**	**0**	**188,812**	**121,557**	**0**	**121,557**	**0**	**310,369**	**0**	**0**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	96	230	145	1.5	115	0.5	259	260		260	0		0		260			
14	Security Park - Cal Am	1	86	5	5.3	381	4.4	384	386		386	0		0		386			
23	Sunrise - SCWA	0	525	0	4.9	2,059	3.8	2,058	0		0	2,066		2,066		2,066			
36	Laguna/Franklin - SCWA	3,323	7,655	10,265	1.9	14,422	2.2	24,687	20,263		20,263	4,500		4,500		24,763	0		
38	SCWA/EGWS Retail	1,558	1,760	7,209	1.6	6,185	2.1	13,394	13,394		13,394	0		0		13,394			
39	Vineyard - SCWA	1,603	3,389	7,425	4.0	7,646	2.3	15,071	15,071		15,071	0		0		15,071			
40	N. Vineyard In POU - SCWA	540	1,978	1,644	4.5	4,444	4.4	6,088	6,088		6,088	0		0		6,088			
41	N. Vineyard Out POU - SCWA	516	82	1,620	3.1	261	2.6	1,880	1,881		1,881	0		0		1,881			
42	Mather	21	2,181	105	4.1	2,303	2.6	2,410	2,408		2,408	0		0		2,408	0	0	
	Total Zone 40	**7,658**	**17,886**	**28,418**	**N/A**	**37,816**	**N/A**	**66,233**	**59,751**	**0**	**59,751**	**6,566**	**0**	**6,566**	**0**	**66,317**	**0**	**0**	**0**
	Grand Total Central Area	**53,269**	**85,807**	**171,632**	**N/A**	**205,018**	**N/A**	**376,649**	**248,563**	**0**	**248,563**	**128,123**	**0**	**128,123**	**0**	**376,686**	**0**	**0**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117.0	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.3	6,486.0	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	3.9	24,771.0	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.7	6,655.0	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	1.1	43,495.0	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54,633	2.5	666	0.9	55,300	13,611		13,611	41,690		41,689		55,300			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,990**	**0**	**50,989**	**0**	**64,915**	**0**	**0**	**0**
	Grand Total	**135,001**	**174,721**	**440,813**	**N/A**	**408,726**	**N/A**	**849,539**	**516,685**	**0**	**516,685**	**342,518**	**0**	**342,517**	**0**	**859,202**	**0**	**0**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).

(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.

(3) SMUD diverts 15,000 AF/yr from Folsom South Canal.

Table A.11

Alternative 4B - 2000 Level with Additional Remediation Reuse

Land and Water Use Summary Table [1]

SUBREGION		AG Acreage	Urban Acreage	AG Demand	AG Water Duty	Urban Demand	Urban Water Duty	Total Water Demand	Water Supply (AF/Year)								Remediation Operation		
									Groundwater W Pumping			Surface Water Supply			Project	Total Supply	Extraction	Injection	Cosum.
Number	Name	(A)	(A)	(AF)	(AF/A)	(AF)	(AF/A)	(AF)	GW Pumping	Project	Total	SW Supply [4]	Remediation Reuse	Total	GW Supply				R. Enhance.
	North Area																		
1	North Sacramento	4,686	16,680	15,959	3.4	41,697	2.5	57,656	30,958		30,958	26,697		26,697		57,655			
17	Fair Oaks	91	6,385	142	1.6	13,693	2.1	13,835	142		142	13,693		13,693		13,835			
18	Orangevale	197	2,849	791	4.0	6,572	2.3	7,363	791		791	6,572		6,572		7,363			
19	San Juan	132	832	592	4.5	3,685	4.4	4,277	592		592	3,685		3,685		4,277			
20	Carmichael	0	4,966	0	NA	12,702	2.6	12,702	0		0	12,702		12,702		12,702			
21	Citrus Heights	110	7,295	450	4.1	19,124	2.6	19,574	450		450	19,124		19,124		19,574			
22	Northridge	15	9,354	75	5.0	17,447	1.9	17,522	3,518		3,518	14,004		14,004		17,522			
24	McClellan AFB	6	2,807	29	4.8	1,595	0.6	1,624	1,626		1,626	0		0		1,626	1,210		
25	Arcade	3	2,301	5	1.7	5,888	2.6	5,893	5,893		5,893	0		0		5,893			
26	Rio Linda North	392	2,057	1,486	3.8	7,042	3.4	8,528	8,528		8,528	0		0		8,528			
27	Natomas Mutual	11,149	517	62,313	5.6	1,654	3.2	63,967	9,132		9,132	54,835		54,835		63,967			
28	Metro Airport	3,586	1,543	9,132	2.5	836	0.5	9,968	3,576		3,576	6,393		6,393		9,969			
32	Arcade WD - T&C	0	12,072	0	NA	26,795	2.2	26,795	26,795		26,795	0		0		26,795			
33	Rio Linda South	241	2,361	552	2.3	4,843	2.1	5,395	5,395		5,395	0		0		5,395			
34	Antelope - Cal Am	168	2,782	784	4.7	8,642	3.1	9,426	9,426		9,426	0		0		9,426			
35	Lincoln/RO - Cal Am	0	4,007	0	NA	13,226	3.3	13,226	13,226		13,226	0		0		13,226			
	Total North Area	**20,776**	**78,808**	**92,310**	**N/A**	**185,441**	**N/A**	**277,751**	**120,048**	**0**	**120,048**	**157,705**	**0**	**157,705**	**0**	**277,753**	**1,210**	**0**	**0**
	Central Area																		
2	South Sacramento	1,440	46,525	3,912	4.6	116,296	3.5	120,208	32,429		32,429	87,780		87,780		120,209	726		
3	Omochumne-Hartnell North	8,461	260	24,917	4.6	855	2.3	25,772	21,364		21,364	4,332		4,332		25,696	40	40	
4	Southwest	27,132	1,048	84,623	3.0	1,201	2.2	85,824	85,824		85,824	0		0		85,824			
10	Omochumne-Hartnell	6,132	720	20,260	3.1	1,215	3.2	21,475	20,348		20,348	1,155		1,155		21,503	2,093		
11	Rancho Murieta	274	1,007	1,382	5.0	2,781	1.1	4,163	0		0	4,163		4,163		4,163			
12	Sunrise "A" - SCWA	1,341	721	5,715	3.7	927	2.3	6,642	6,642		6,642	0		0		6,642			
15	City Of Folsom	2	5,312	10	3.3	20,159	2.4	20,169	4		4	20,165		20,165		20,169	12,774	6,387	
16	Arden Cordova	202	6,600	380	1.9	14,331	2.2	14,711	10,740		10,740	3,971		3,971		14,711			
30	Foothills North	618	669	1,981	3.2	529	0.8	2,510	2,510		2,510	0		0		2,510			
37	EGWS	0	2,307	0	N/A	2,710	1.2	2,710	2,710		2,710	0		0		2,710			
43	Rosemont - Cal Am	9	2,752	34	3.8	6,198	2.3	6,232	6,232		6,232	0		0		6,232			
	Total Central Area	**45,611**	**67,921**	**143,214**	**N/A**	**167,202**	**N/A**	**310,416**	**188,803**	**0**	**188,803**	**121,566**	**0**	**121,566**	**0**	**310,369**	**15,633**	**6,427**	**0**
	Zone 40																		
13	Sunrise Douglas - SCWA	96	230	145	1.5	115	0.5	259	260		260	0		0		260			
14	Security Park - Cal Am	1	86	5	5.3	381	4.4	384	386		386	0		0		386			
23	Sunrise - SCWA	0	525	0	4.9	2,059	3.8	2,058	0		0	2,066		2,066		2,066			
36	Laguna/Franklin - SCWA	3,323	7,655	10,265	1.9	14,422	2.2	24,687	20,263		20,263	4,500		4,500		24,763	966		
38	SCWA/EGWS Retail	1,558	1,760	7,209	1.6	6,185	2.1	13,394	13,394		13,394	0		0		13,394			
39	Vineyard - SCWA	1,603	3,389	7,425	4.0	7,646	2.3	15,071	15,071		15,071	0		0		15,071			
40	N. Vineyard In POU - SCW	540	1,978	1,644	4.5	4,444	4.4	6,088	6,088		6,088	0		0		6,088			
41	N. Vineyard Out POU - SCV	516	82	1,620	3.1	261	2.6	1,880	1,881		1,881	0		0		1,881			
42	Mather	21	2,181	105	4.1	2,303	2.6	2,410	2,408		2,408	0		0		2,408	2,065	1,774	
	Total Zone 40	**7,658**	**17,886**	**28,418**	**N/A**	**37,816**	**N/A**	**66,233**	**59,751**	**0**	**59,751**	**6,566**	**0**	**6,566**	**0**	**66,317**	**3,031**	**1,774**	**0**
	Grand Total Central Area	**53,269**	**85,807**	**171,632**	**N/A**	**205,018**	**N/A**	**376,649**	**248,554**	**0**	**248,554**	**128,132**	**0**	**128,132**	**0**	**376,686**	**18,664**	**8,201**	**0**
	South (Galt)Area																		
5	Galt ID [2]	16,351	2,415	52,336	3.2	5,781	2.4	58,117	52,743		52,743	5,700		5,700		58,443			
6	City Of Galt	381	2,258	1,387	3.6	5,099	2.3	6,486	6,486		6,486	0		0		6,486			
7	OFSCU	6,591	490	22,859	3.5	1,912	3.9	24,771	24,771		24,771	0		0		24,771			
9	Clay WD	1,798	132	6,301	2.1	354	2.7	6,655	6,655		6,655	0		0		6,655			
31	Foothills South	13,793	3,964	39,040	3.5	4,455	1.1	43,495	43,495		43,495	0		0		43,495			
	Total South (Galt) Area	**38,914**	**9,259**	**121,923**	**N/A**	**17,601**	**N/A**	**139,524**	**134,150**	**0**	**134,150**	**5,700**	**0**	**5,700**	**0**	**139,850**	**0**	**0**	**0**
	Other																		
8	SMUD [3]	150	131	315	2.1	0	0.0	315	315		315	9,300		9,300		9,615			
29	Courtland Area	21,892	716	54,633	2.5	666	0.9	55,300	13,611		13,611	41,690		41,689		55,300			
	Total Other	**22,042**	**847**	**54,948**	**N/A**	**666**	**N/A**	**55,615**	**13,926**	**0**	**13,926**	**50,990**	**0**	**50,989**	**0**	**64,915**	**0**	**0**	**0**
	Grand Total	**135,001**	**174,721**	**440,813**	**N/A**	**408,726**	**N/A**	**849,539**	**516,678**	**0**	**516,678**	**342,527**	**0**	**342,526**	**0**	**859,204**	**19,874**	**8,201**	**0**

(1) Average Annual values for 74 years Simulation (1922- 1995).

(2) SW supply is diverted from Laguna Creek. Laguna Creek flow includes releases from SMUD.

(3) SMUD diverts 15,000 AF/yr from Folsom South Canal.

APPENDIX B ZONE 40 GROUNDWATER PUMPING DISTRIBUTION ALTERNATIVES HYDROGRAPHS

Figure B.1
Groundwater Hydrograph at North Area Groundwater Depression (Location A)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

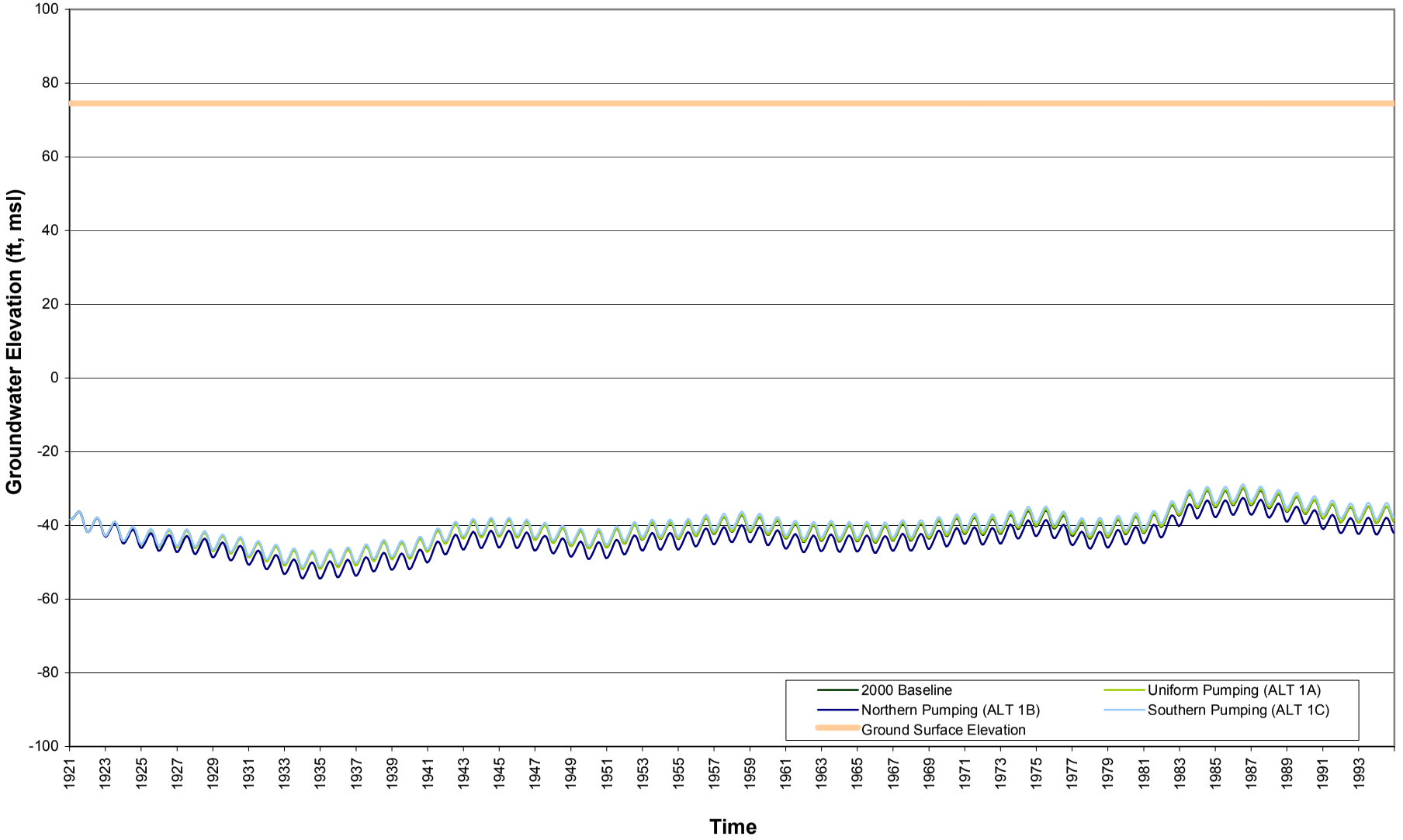

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Figure B.2
Groundwater Hydrograph at City of Sacramento North (Location B)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

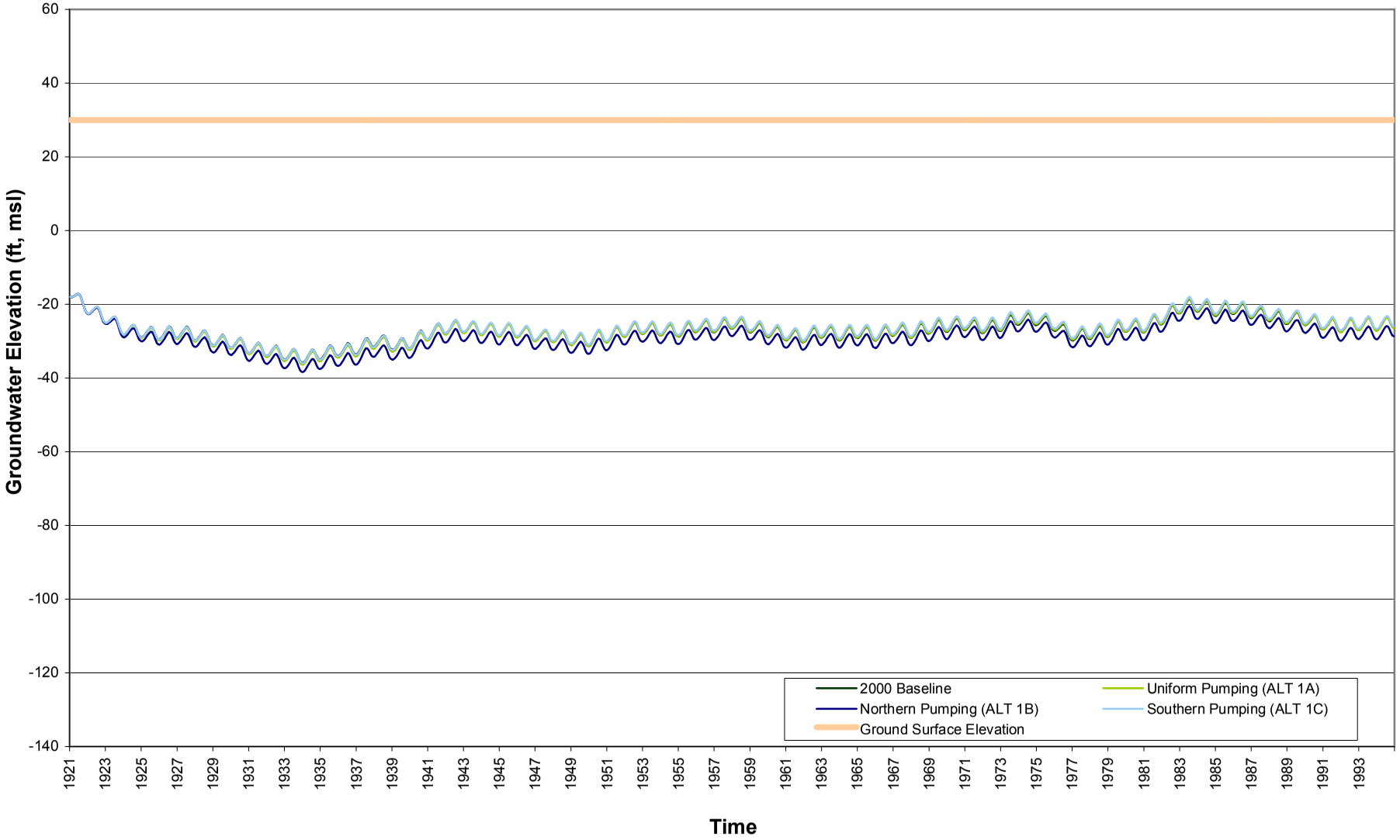

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Figure B.3
Groundwater Hydrograph near Fair Oaks along American River (Location C)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

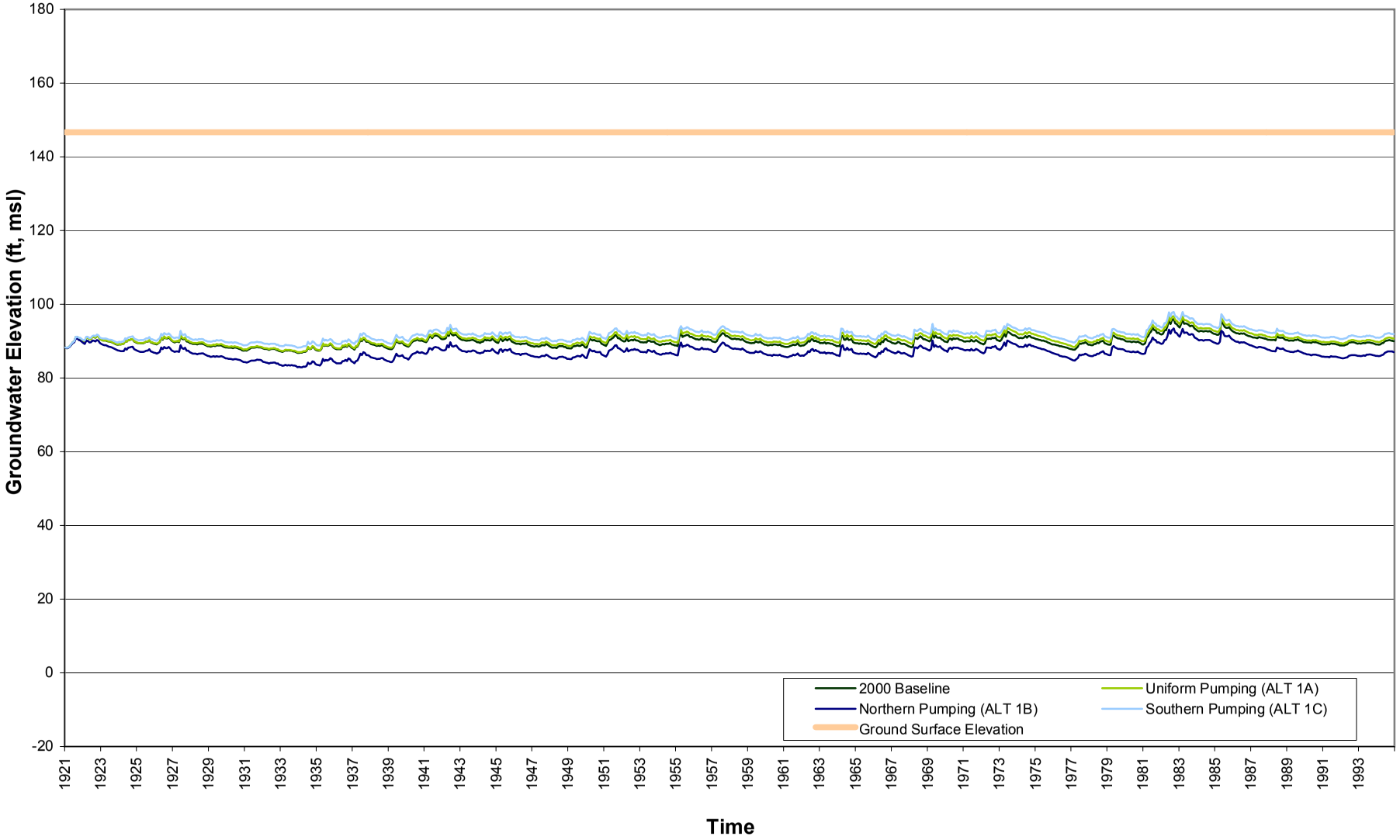

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Figure B.4
Groundwater Hydrograph near H Street along American River (Location D)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

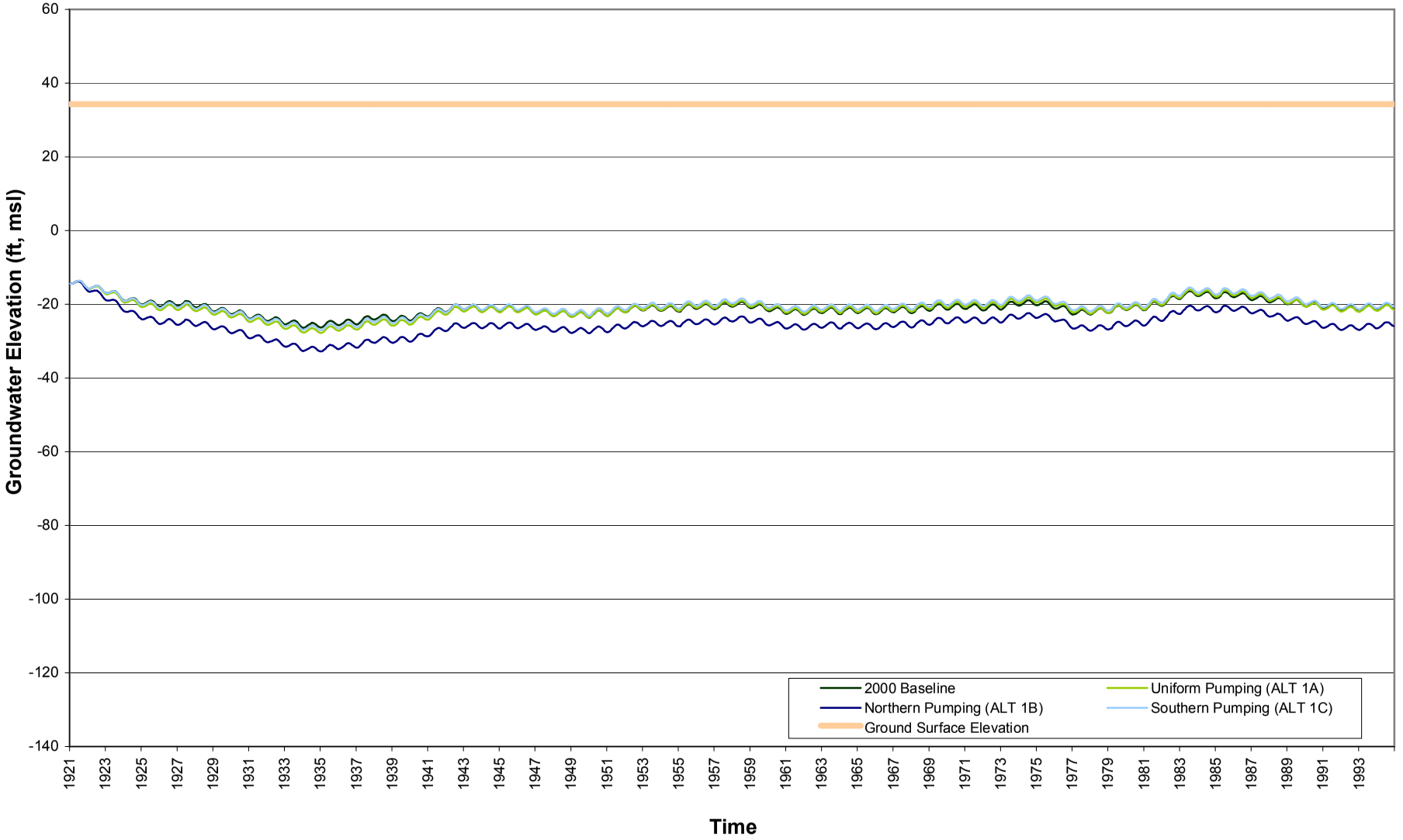

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Figure B.5
Groundwater Hydrograph near Carmichael W.D. along American River (Location E)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

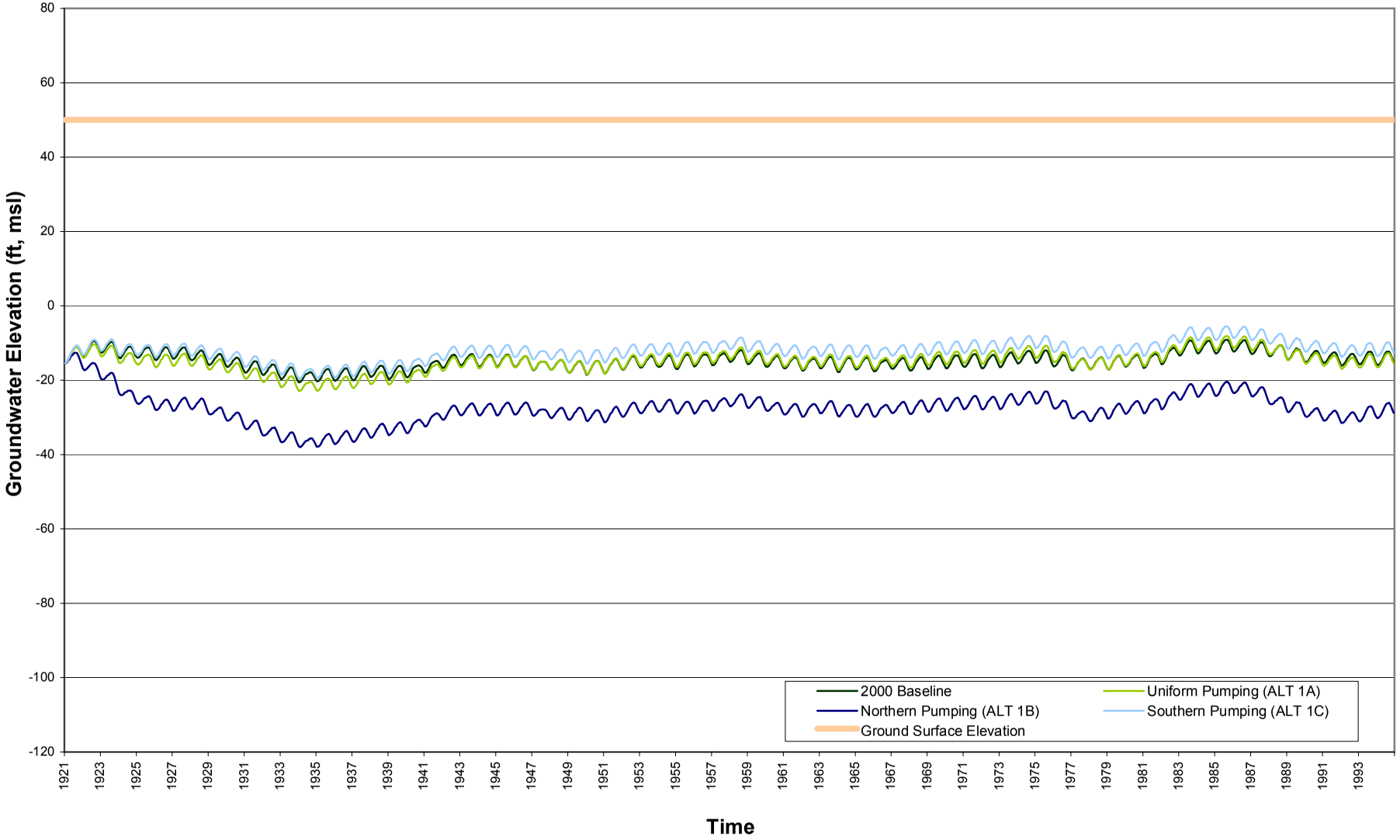

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Figure B.6
Groundwater Hydrograph at Aerojet/Boeing (Location F)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

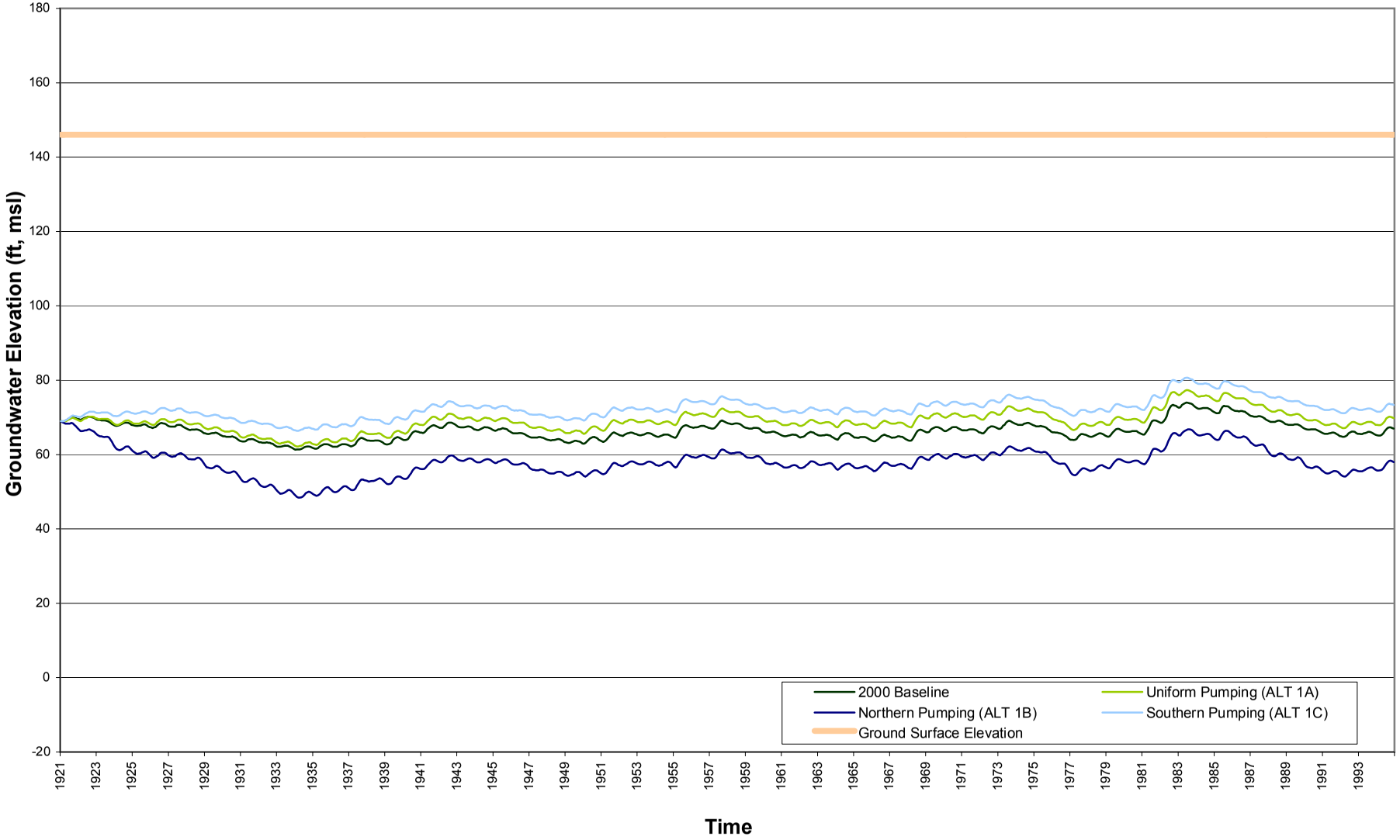

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Figure B.7
Groundwater Hydrograph at City of Sacramento South near Army Depot (Location G)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

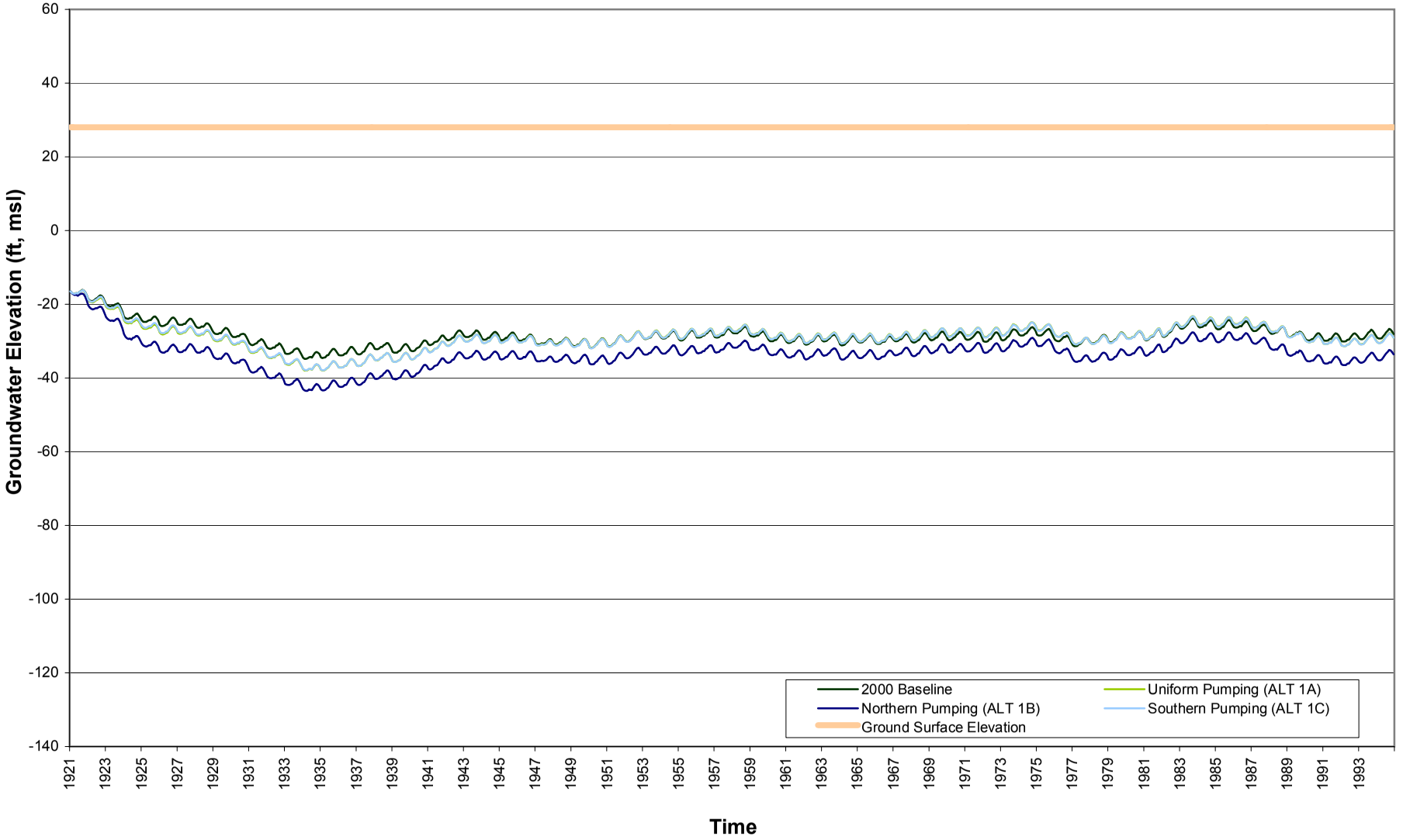

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Figure B.8
Groundwater Hydrograph near Mather Remediation Area (Location H)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

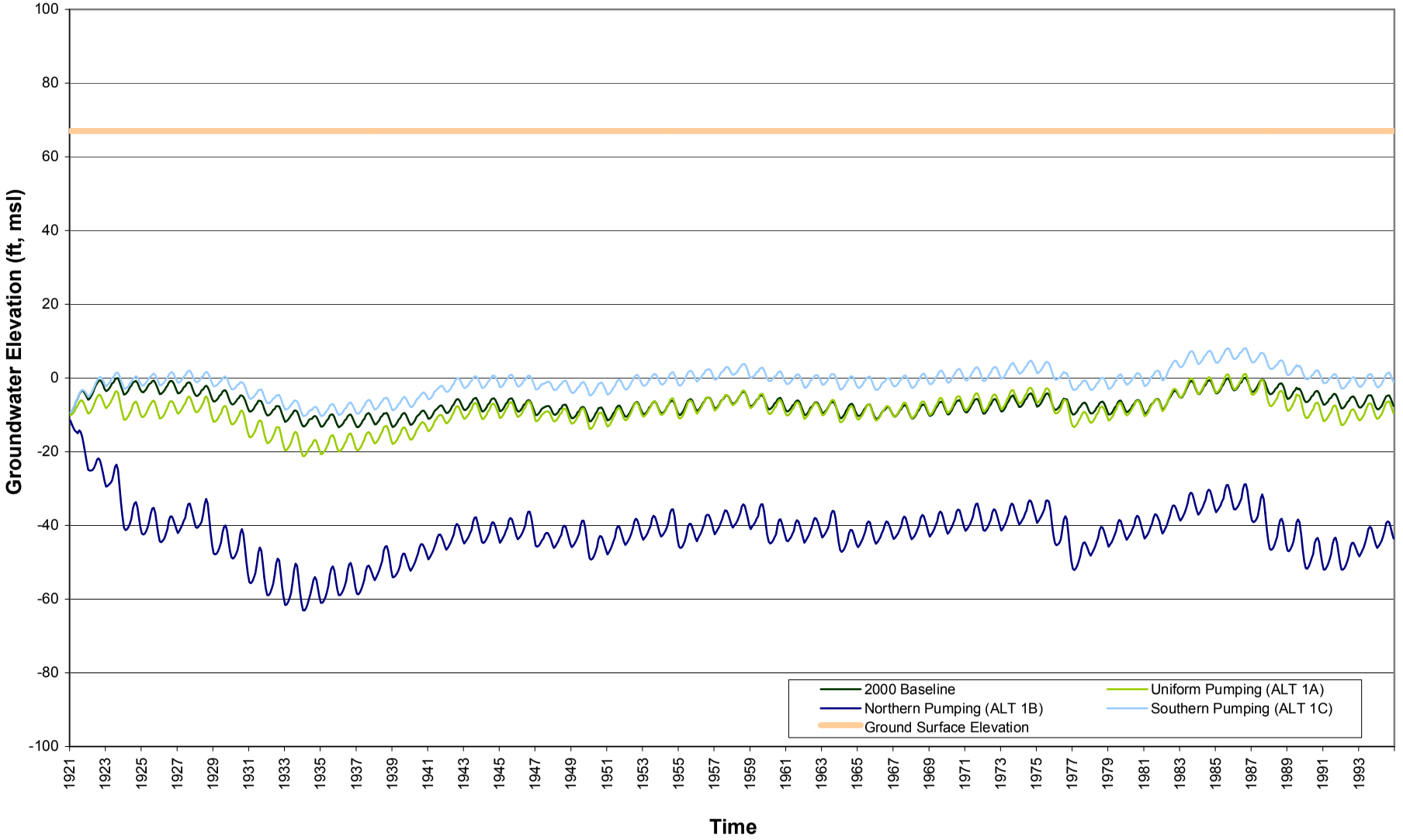

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Figure B.9
Groundwater Hydrograph at Zone 40 Sunrise Area (Location I)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

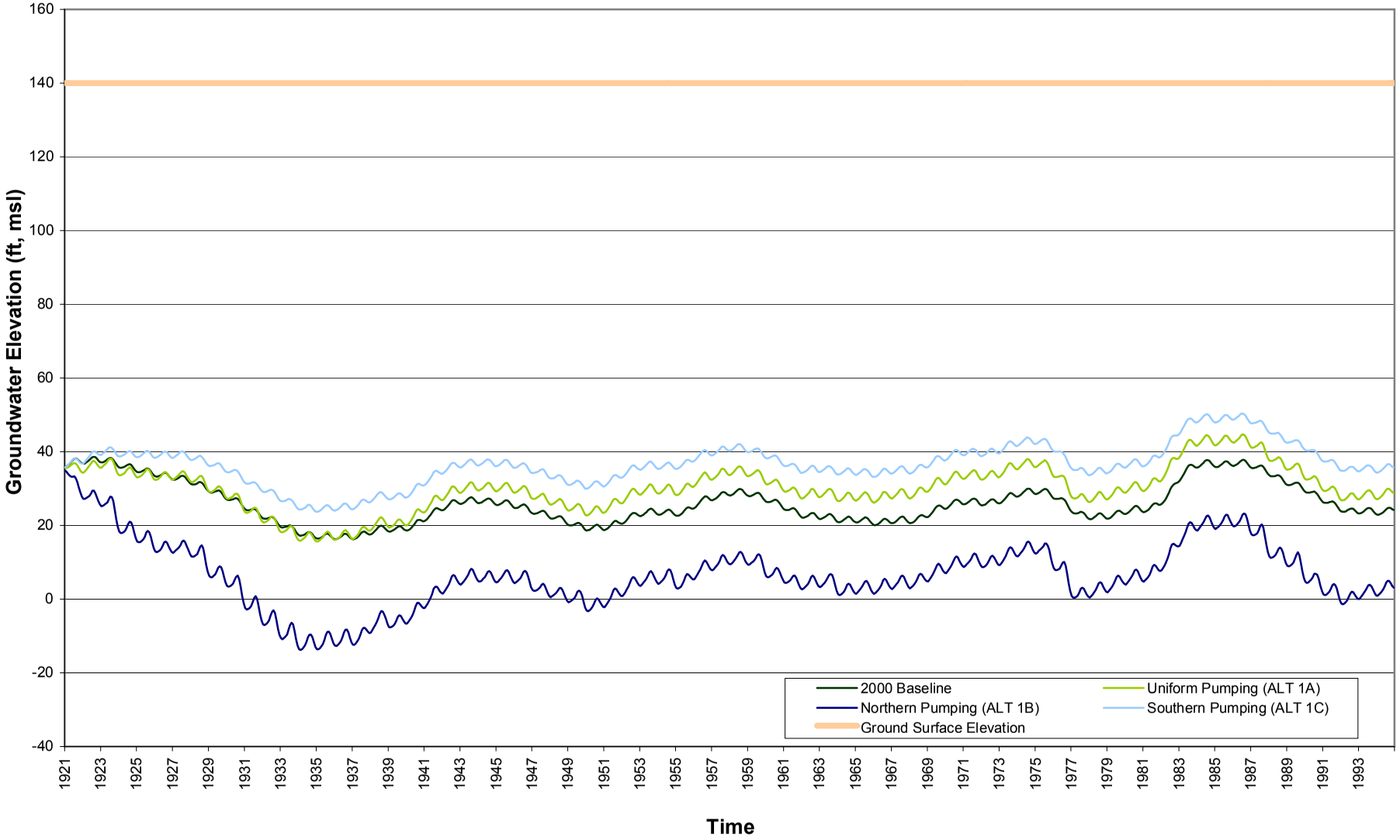

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Figure B.10
Groundwater Hydrograph at Northern Zone 40 (Location J)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

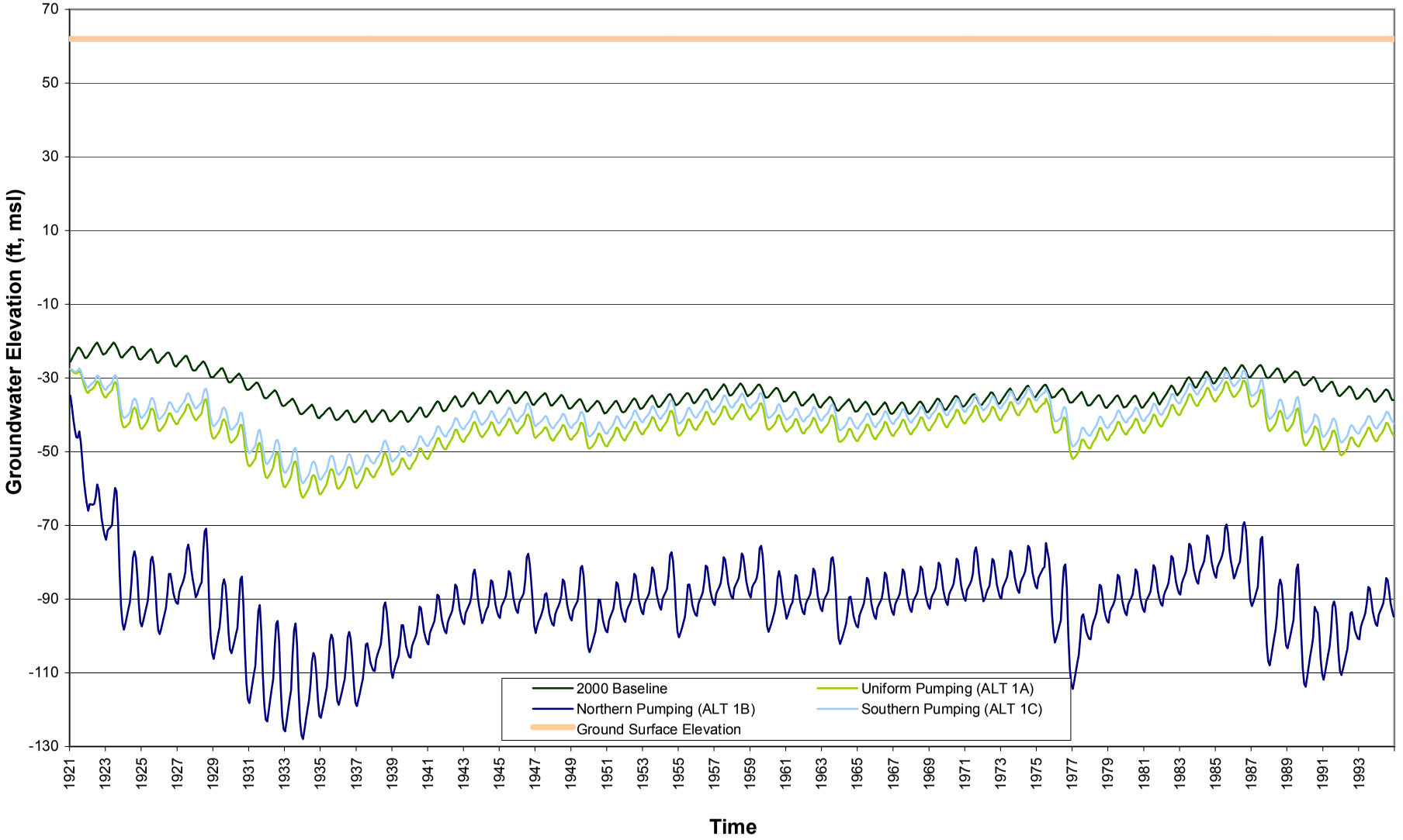

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Figure B.11
Groundwater Hydrograph at Zone 40 near Central Area Groundwater Depression (Location K)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

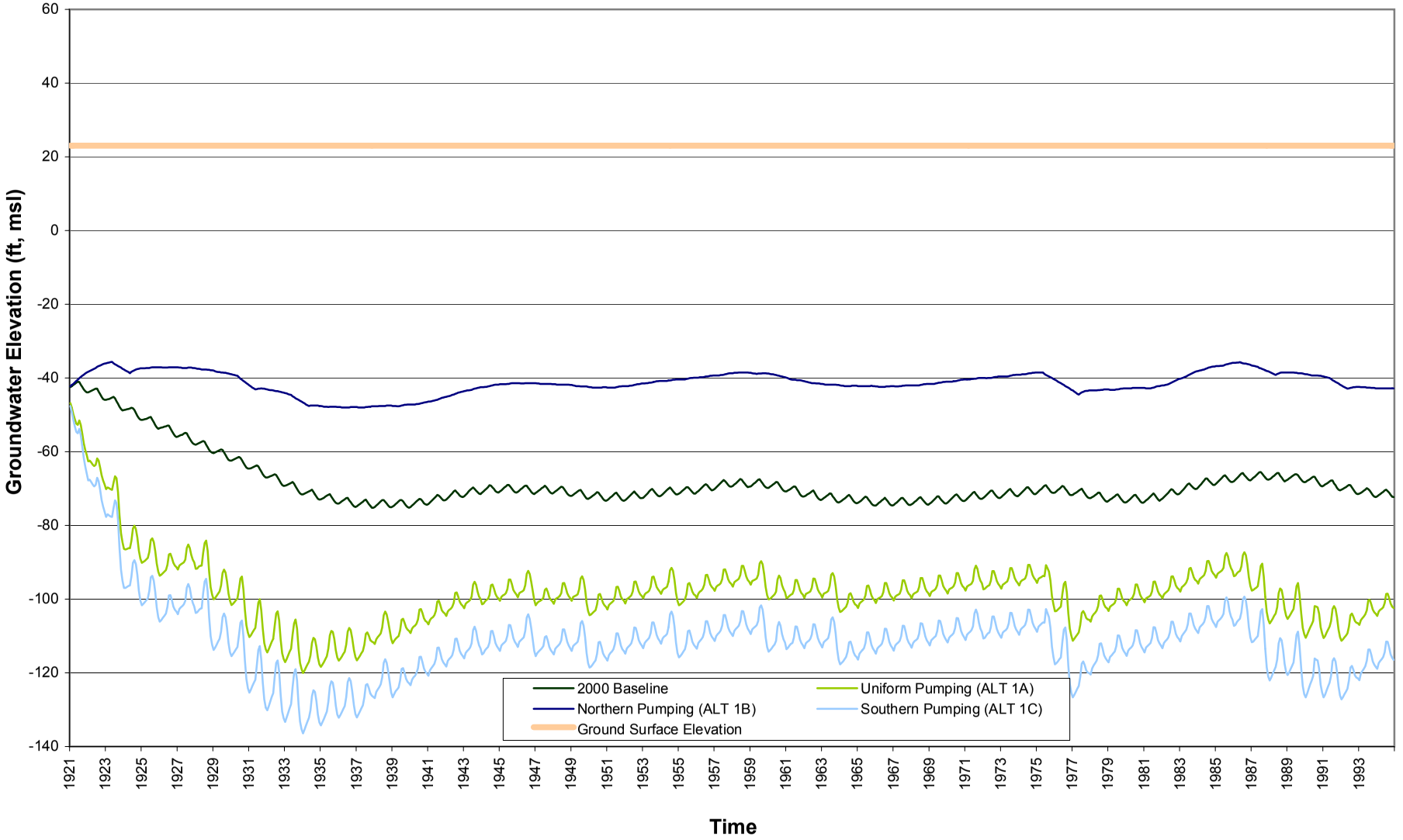

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Figure B.12
Groundwater Hydrograph at Zone 40 (Location L)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

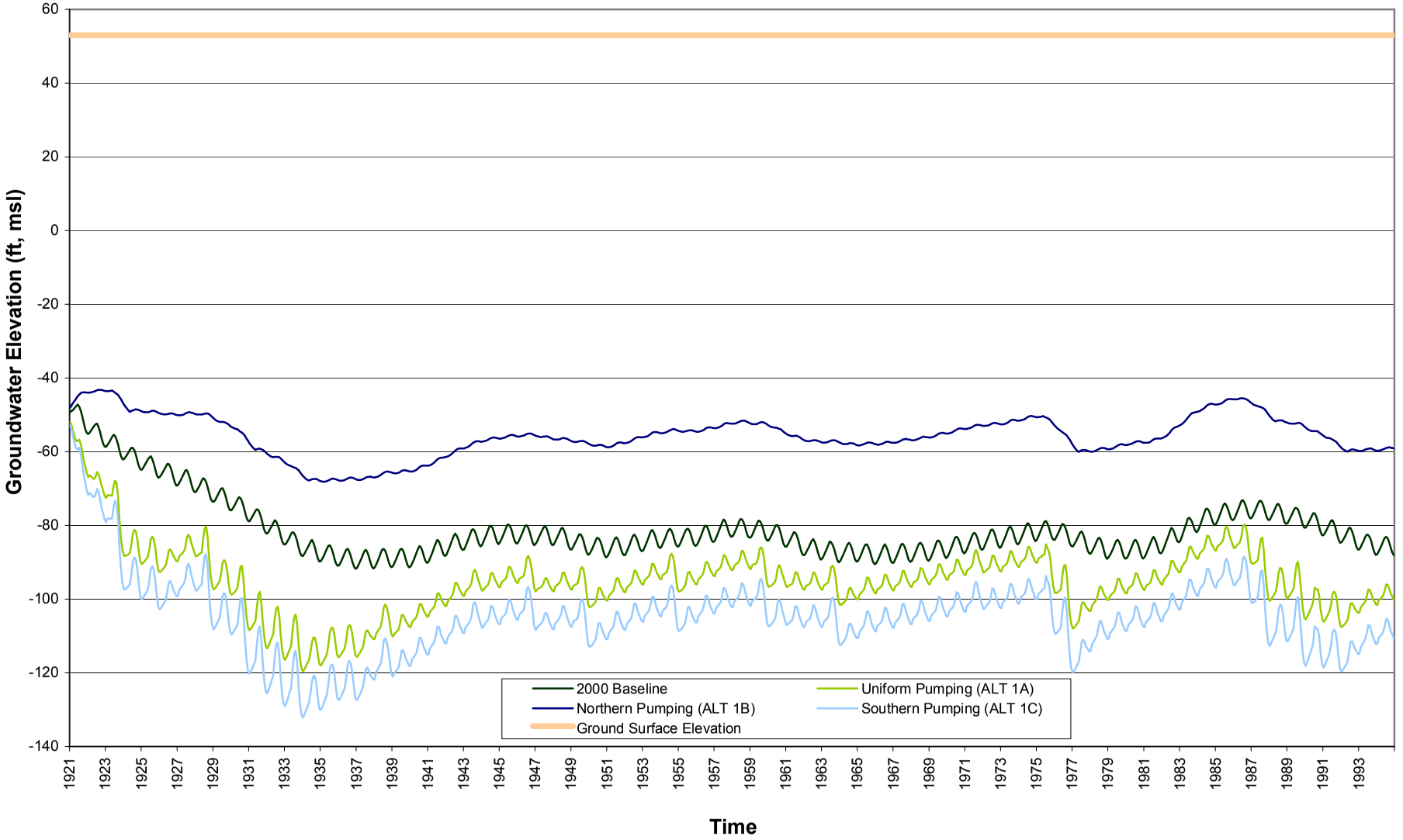

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Figure B.13
Groundwater Hydrograph near Folsom South Canal along Cosumnes River (Location M)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

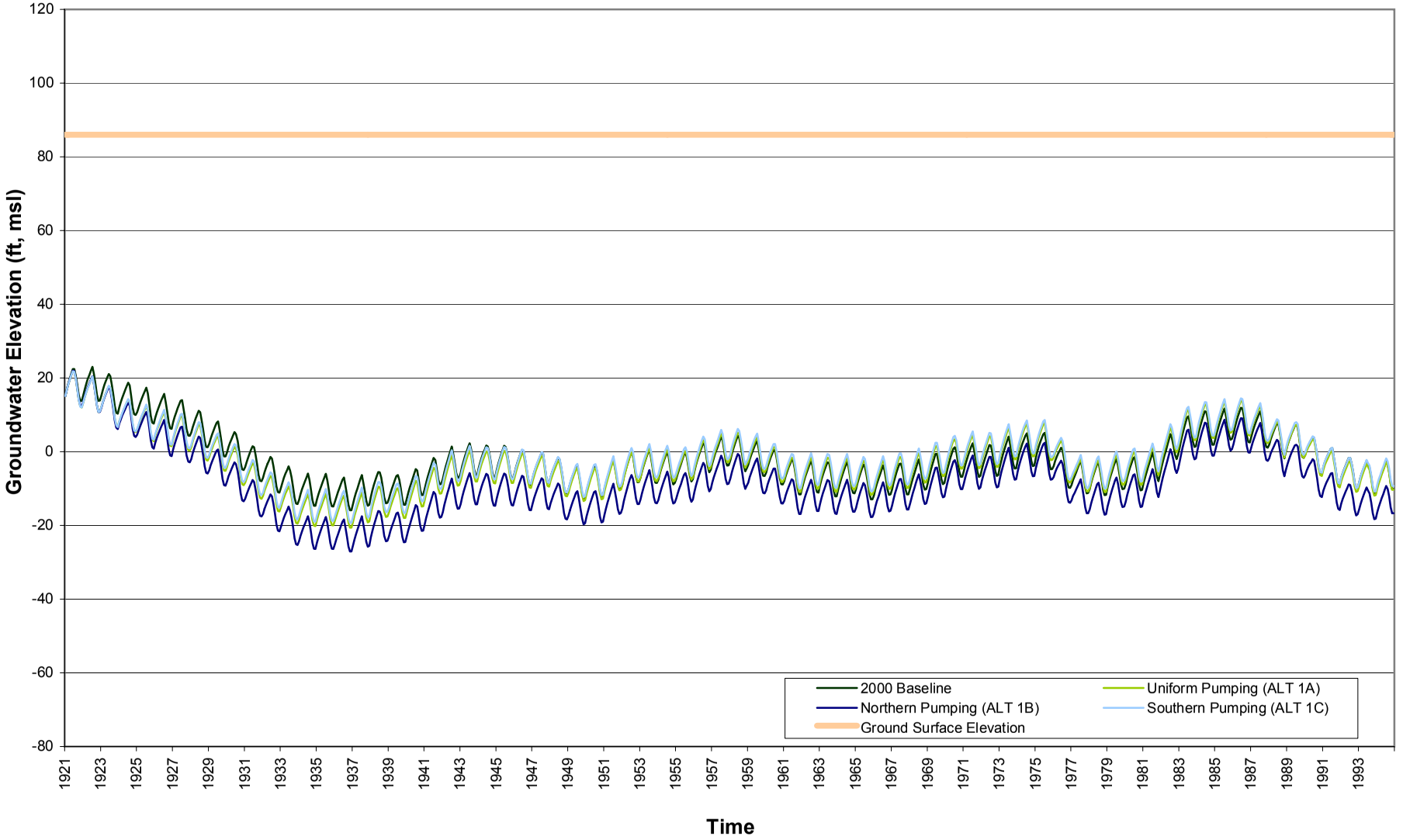

Figure B.14
Groundwater Hydrograph near Remediation Area Keifer Landfill (Location N)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

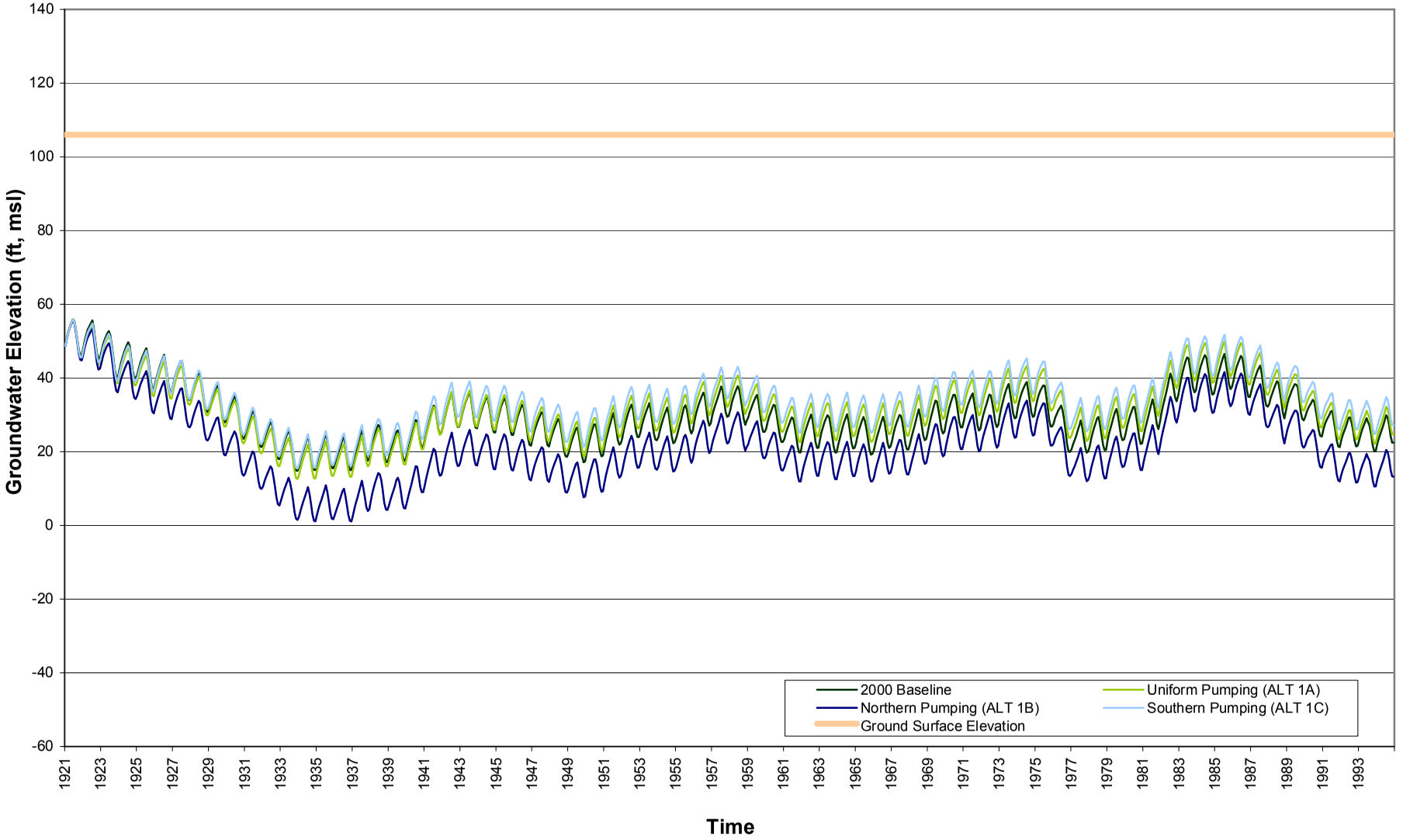

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Figure B.15
Groundwater Hydrograph at Central Area Groundwater Depression (Location O)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

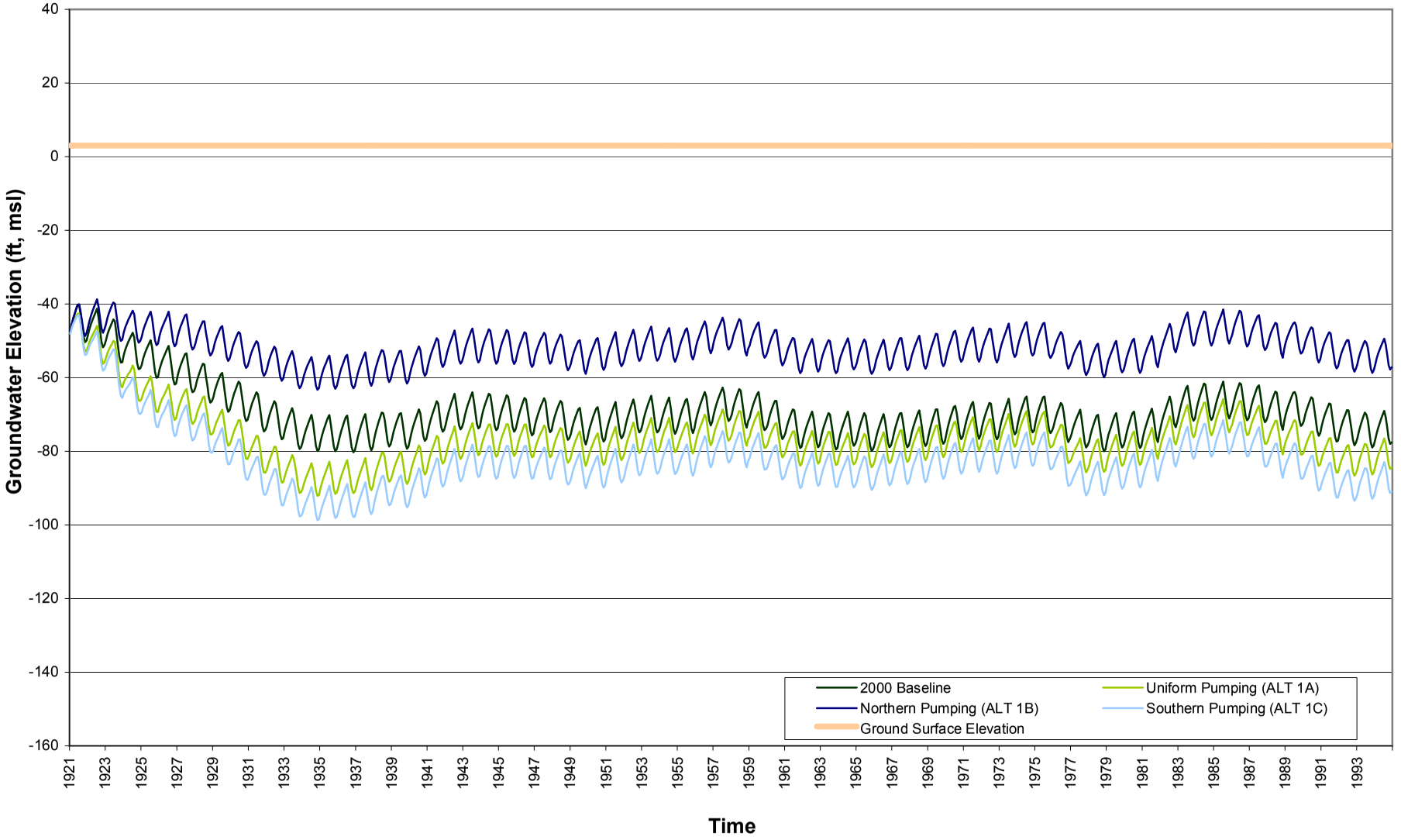

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Figure B.16
Groundwater Hydrograph near Highway 99 along Cosumnes River (Location P)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

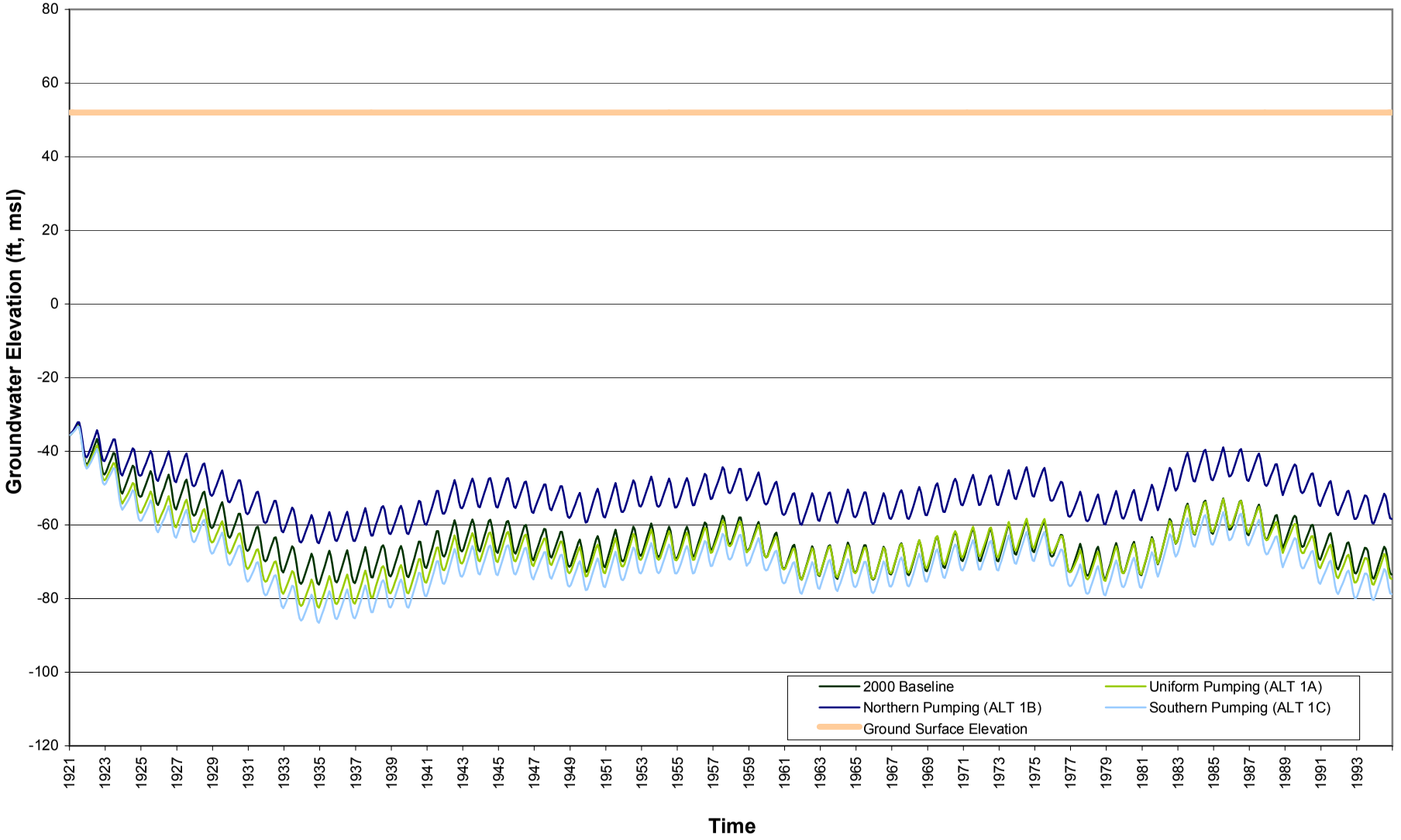

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Figure B.17
Groundwater Hydrograph near South Area Groundwater Depression (Location Q)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

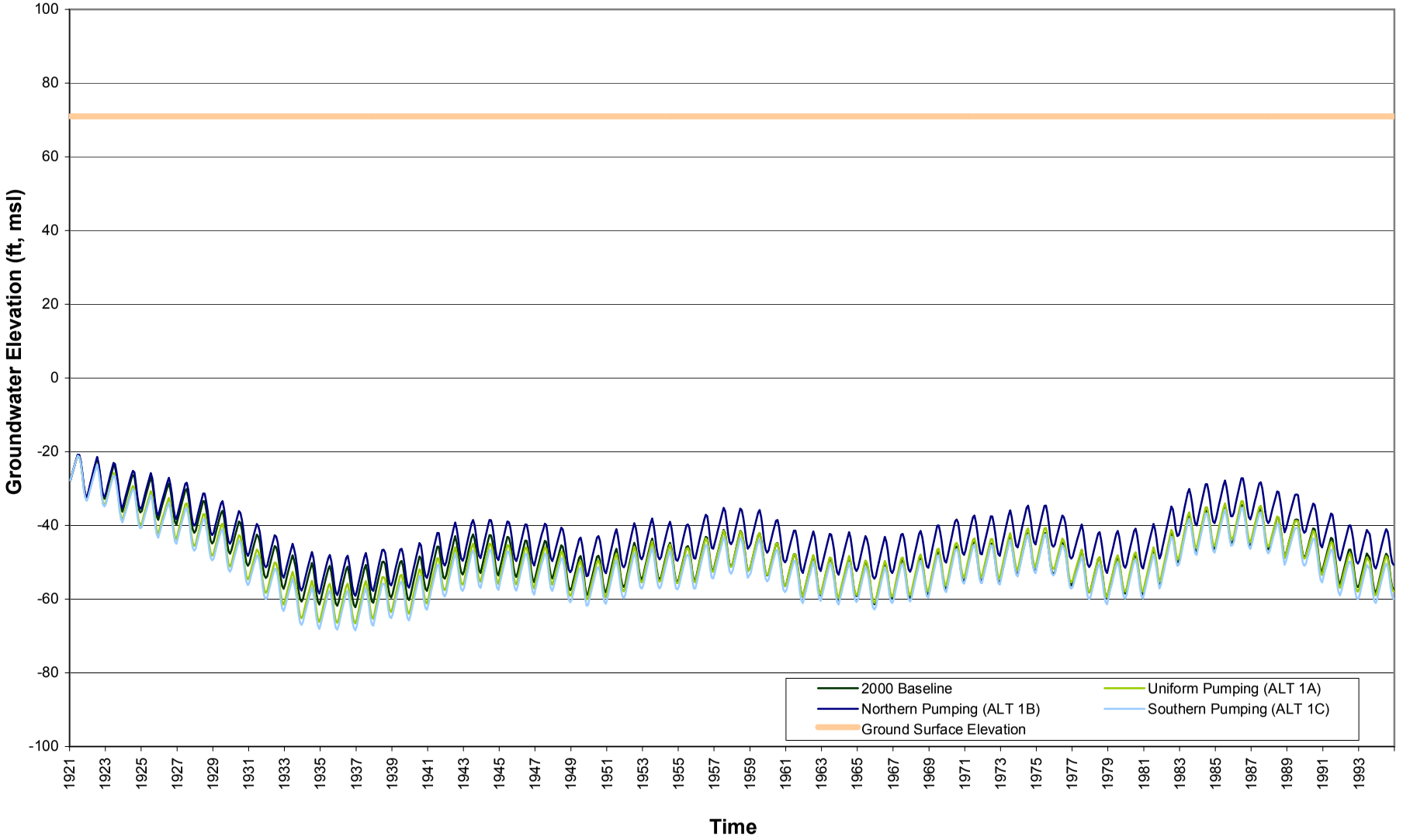

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Figure B.18
Groundwater Hydrograph near Twin Cities along Cosumnes River (Location R)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

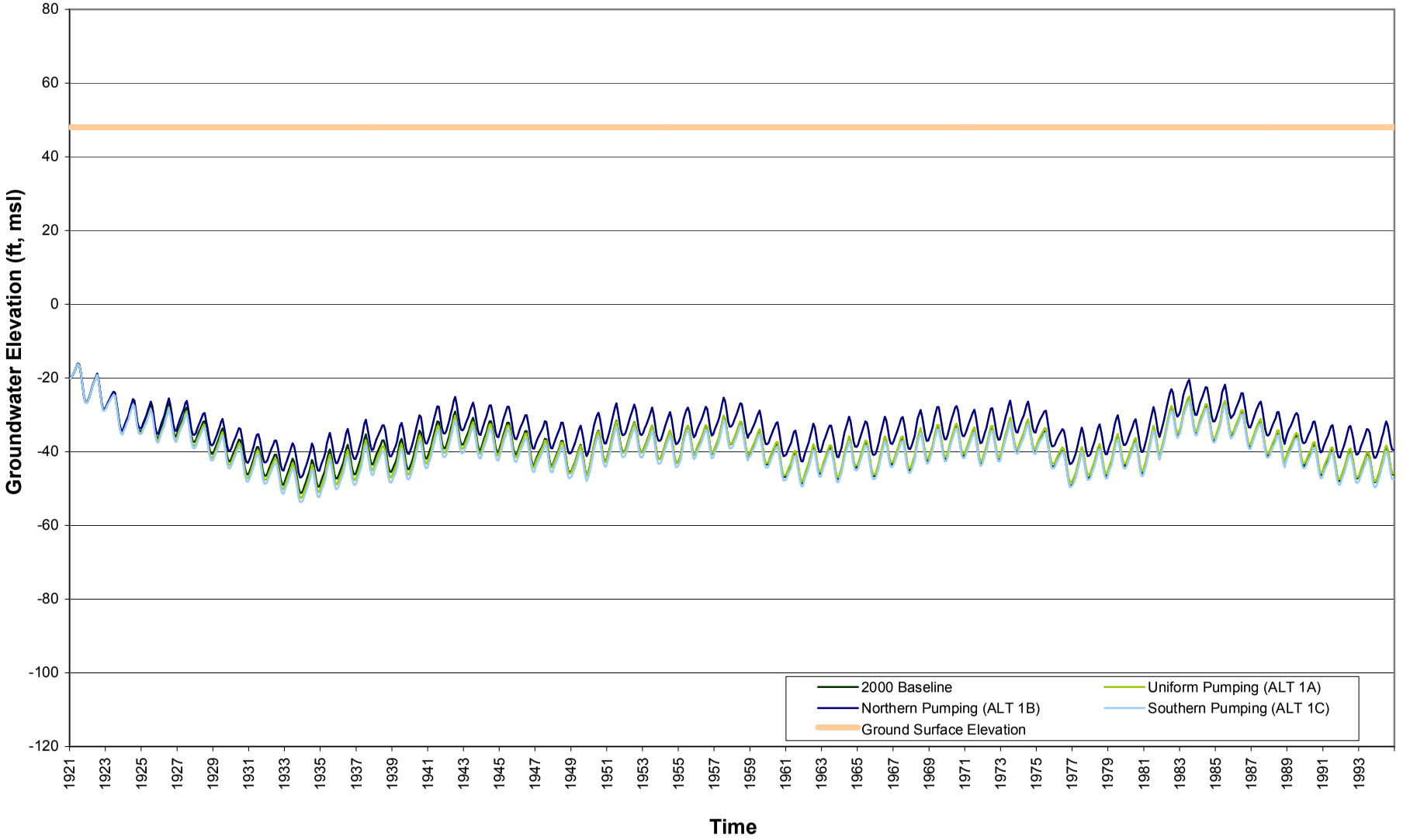

Figure B.19
Groundwater Hydrograph at Galt Area (Location S)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

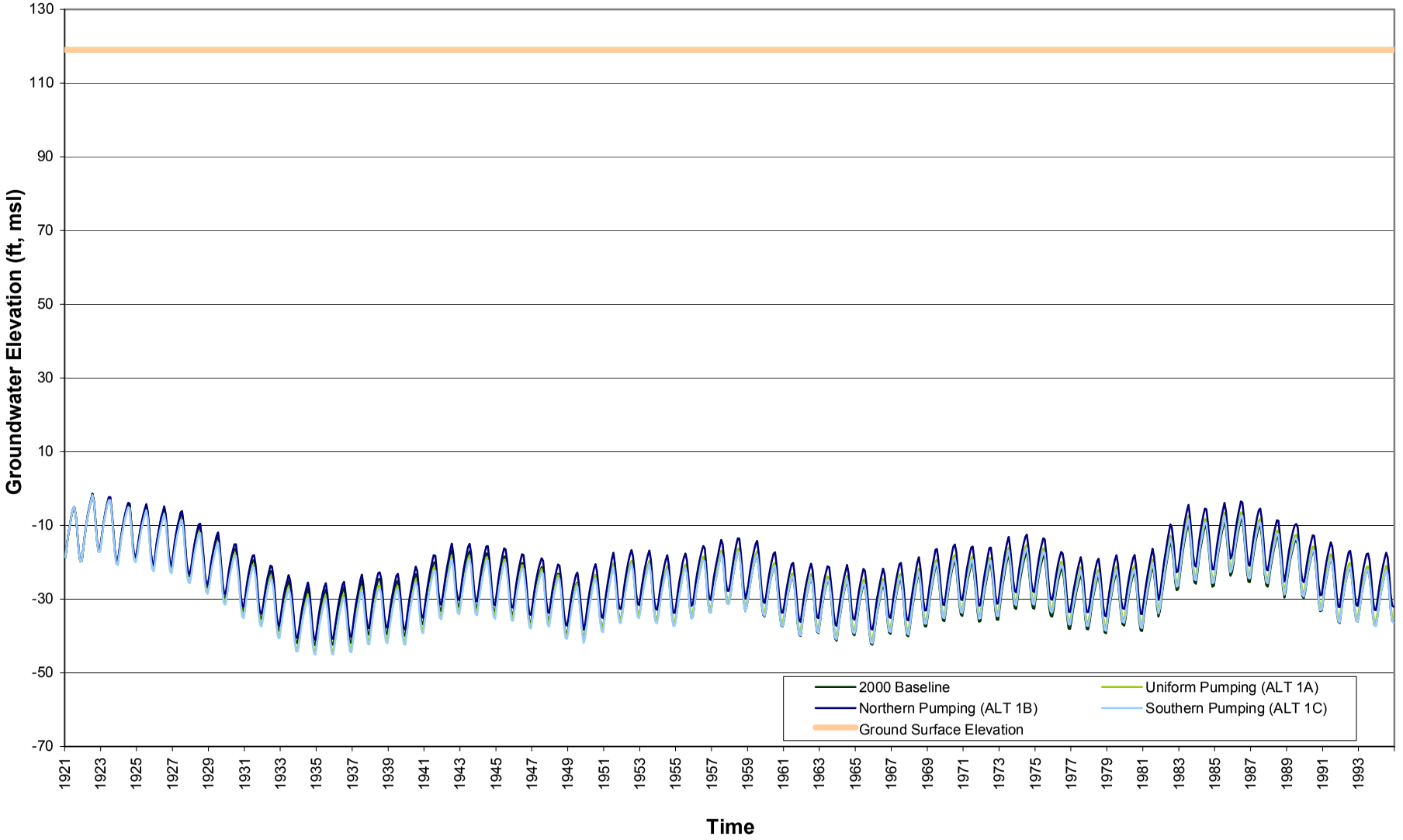

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Figure B.20
Groundwater Hydrograph at West of Grantline Road (Location T)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

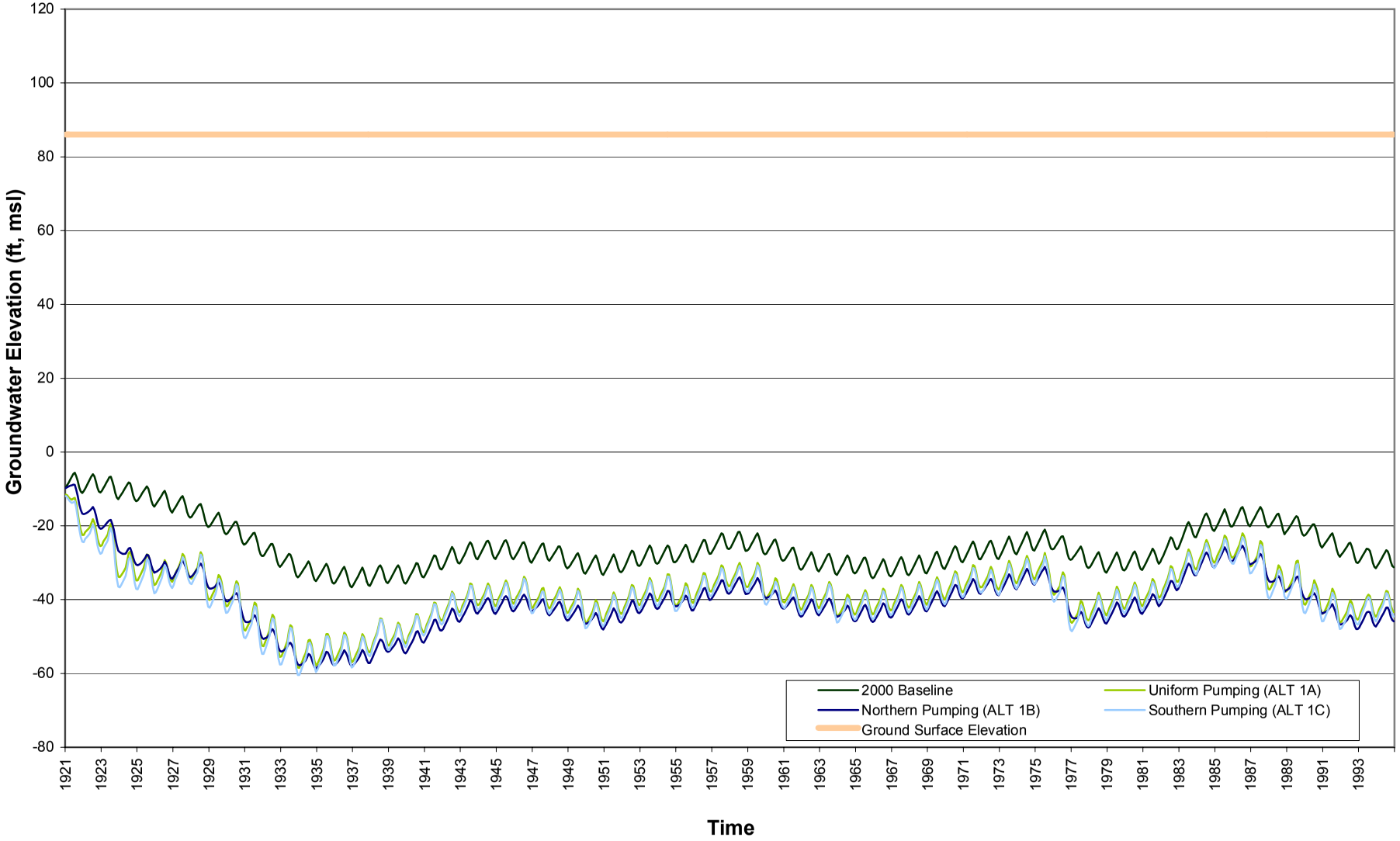

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Figure B.21
Groundwater Hydrograph at Middle of Cosumnes River (Location U)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

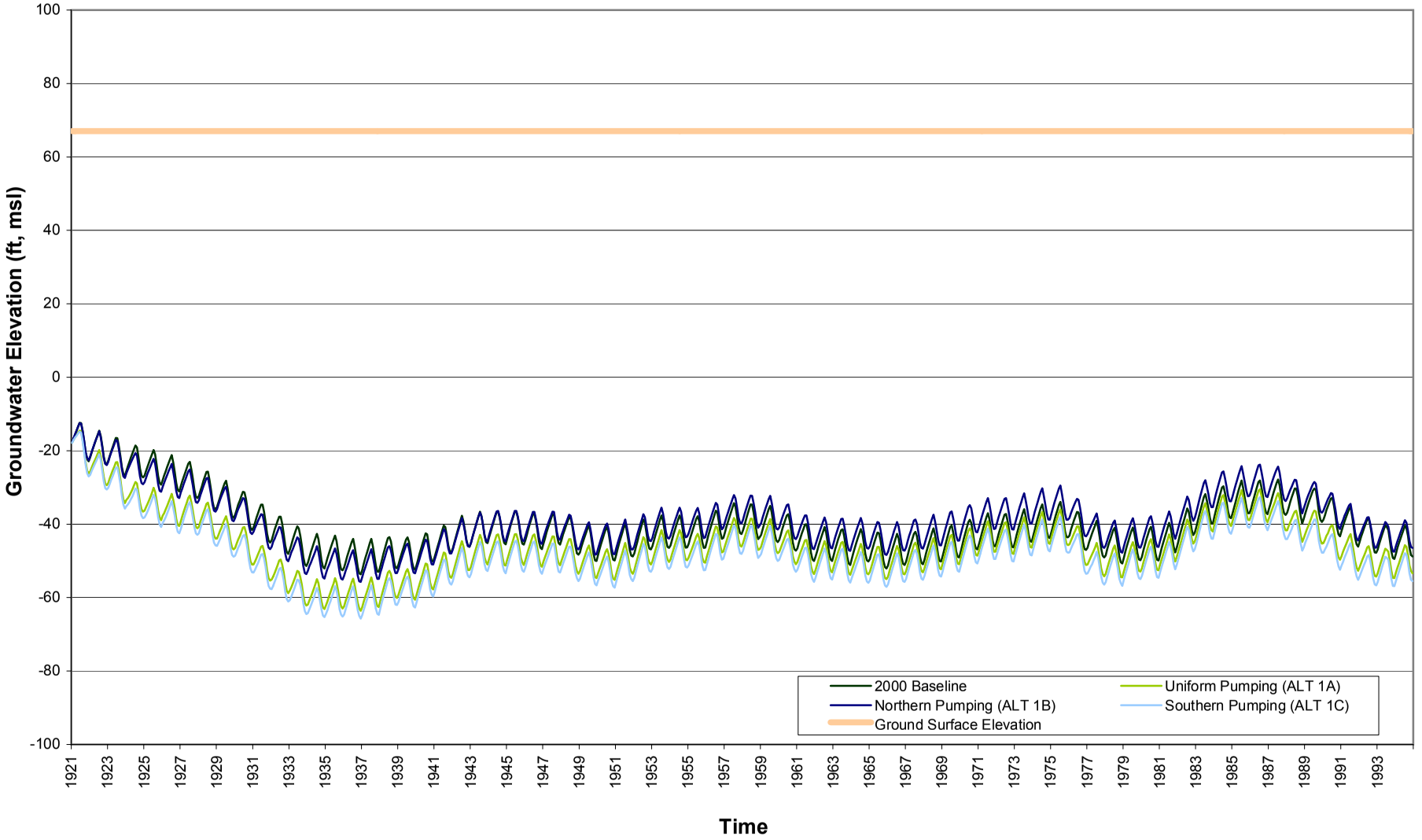

Figure B.22
Groundwater Hydrograph at Galt - Cone of Depression (Location V)
for Baseline 2000 and Alternatives 1A, 1B, and 1C Conditions

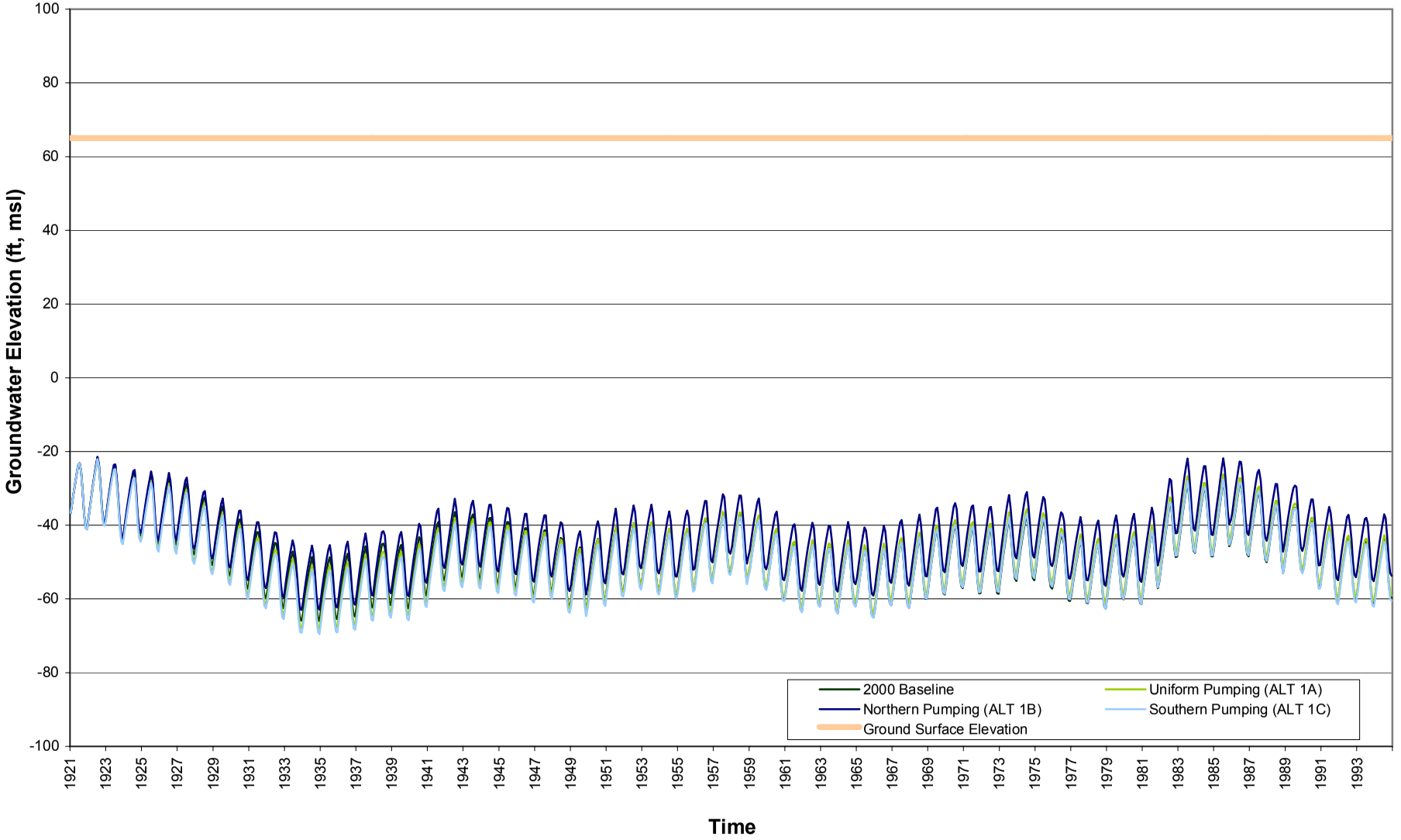

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Figure B.23
Stream Hydrograph at American River near Fair Oaks (Location S1)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

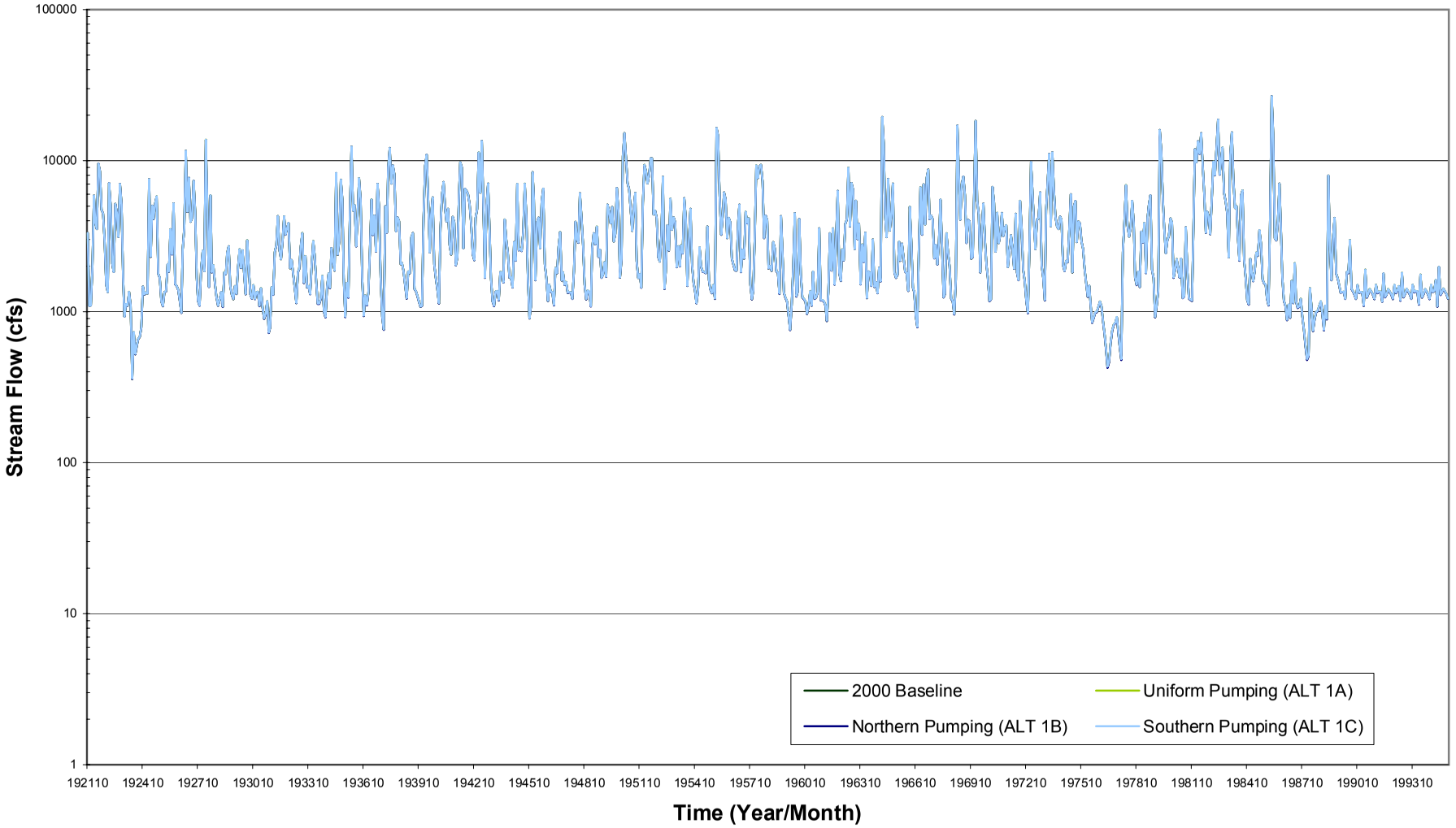

Figure B.24
Stream Hydrograph at American River near H Street (Location S2)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

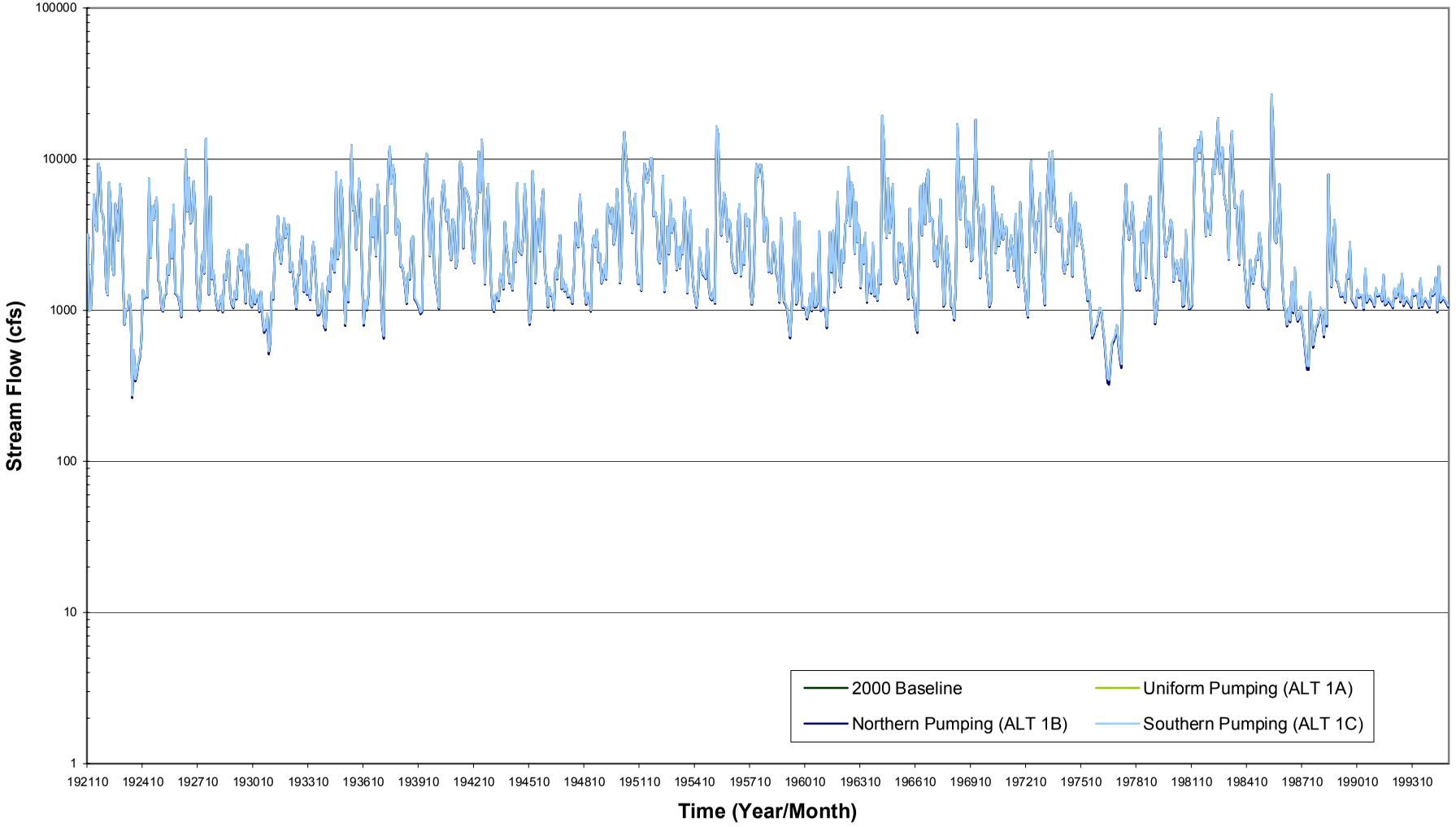

Figure B.25
Stream Hydrograph at Cosumnes River near Michigan Bar (Location S3)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

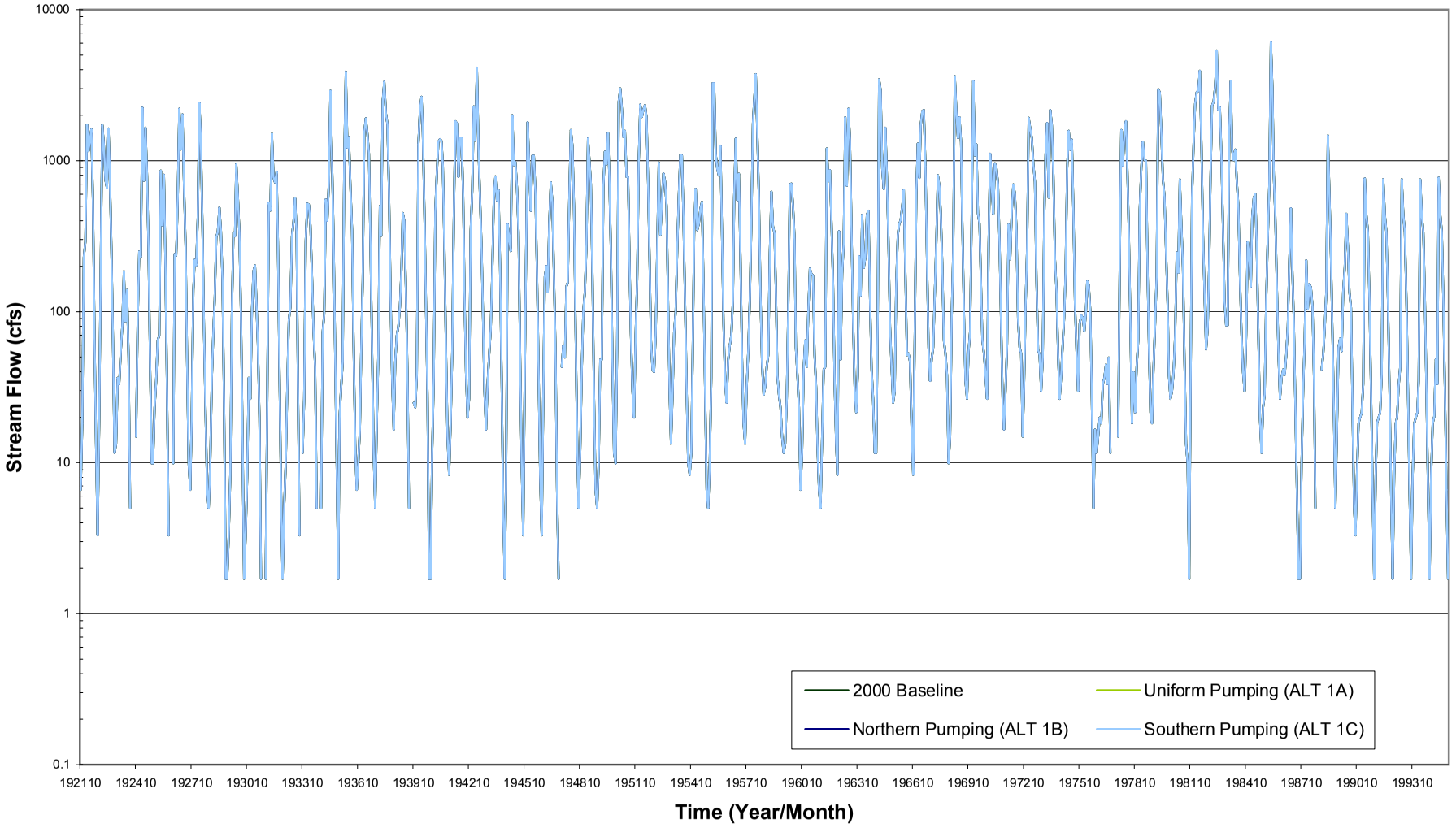

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Figure B.26
Stream Hydrograph at Cosumnes River near Folsom South Canal (Location S4)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

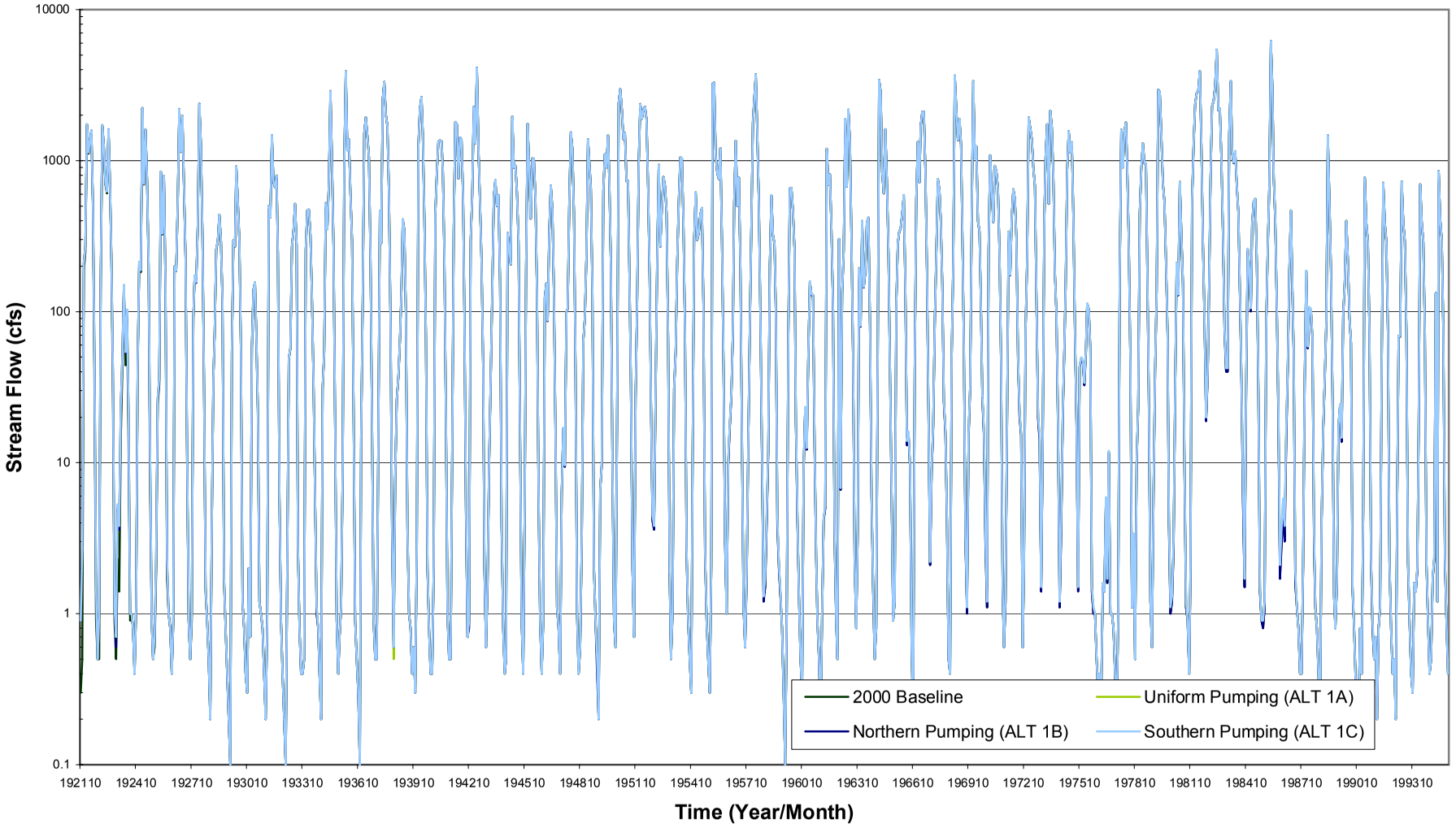

Figure B.27
Stream Hydrograph at Cosumnes River near Highway 99 (Location S5)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

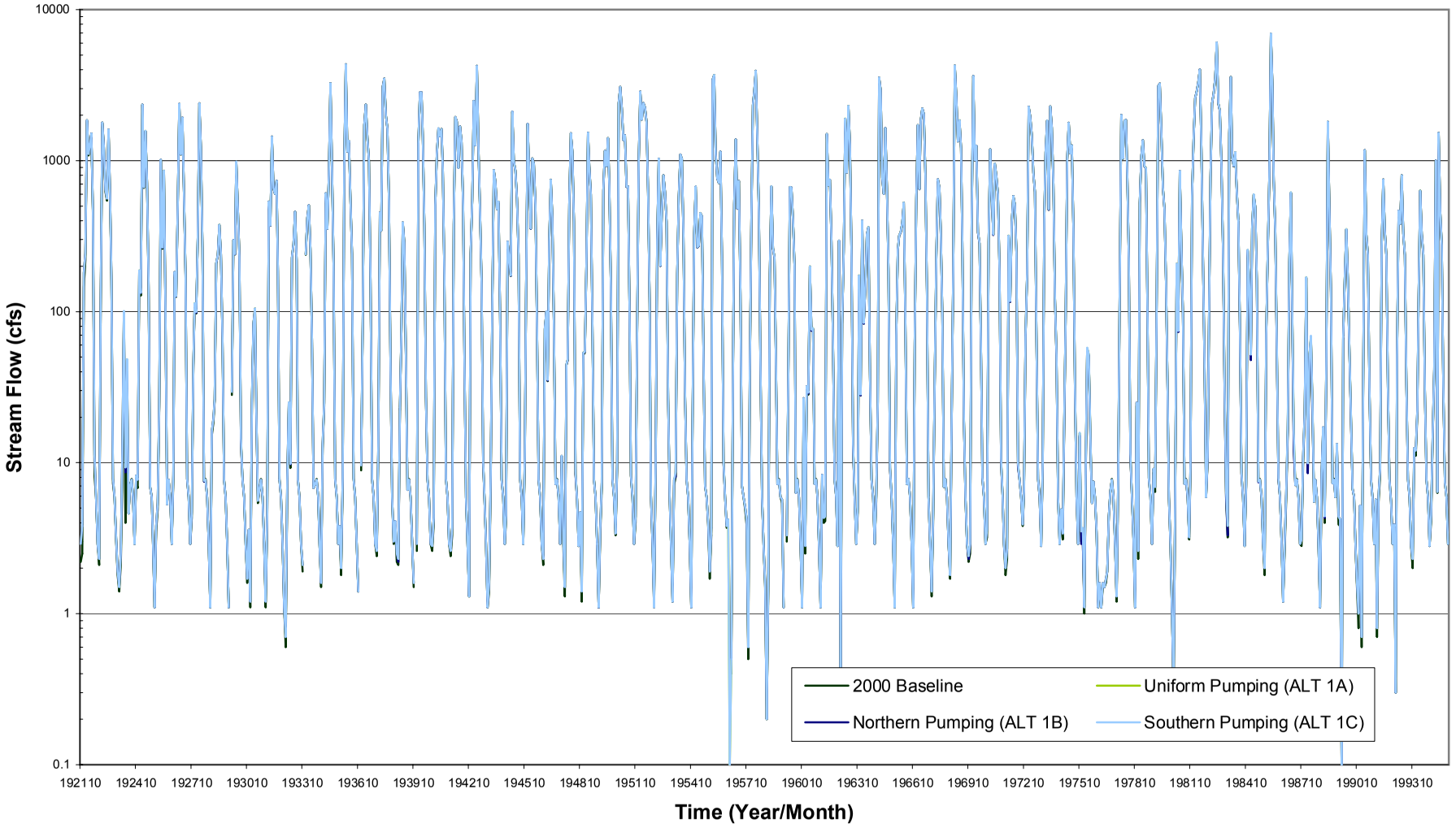

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Figure B.28
Stream Hydrograph at Cosumnes River near Twin Cities Road (Location S6)
for 2000 Baseline and Alternatives 1A, 1B, and 1C Conditions

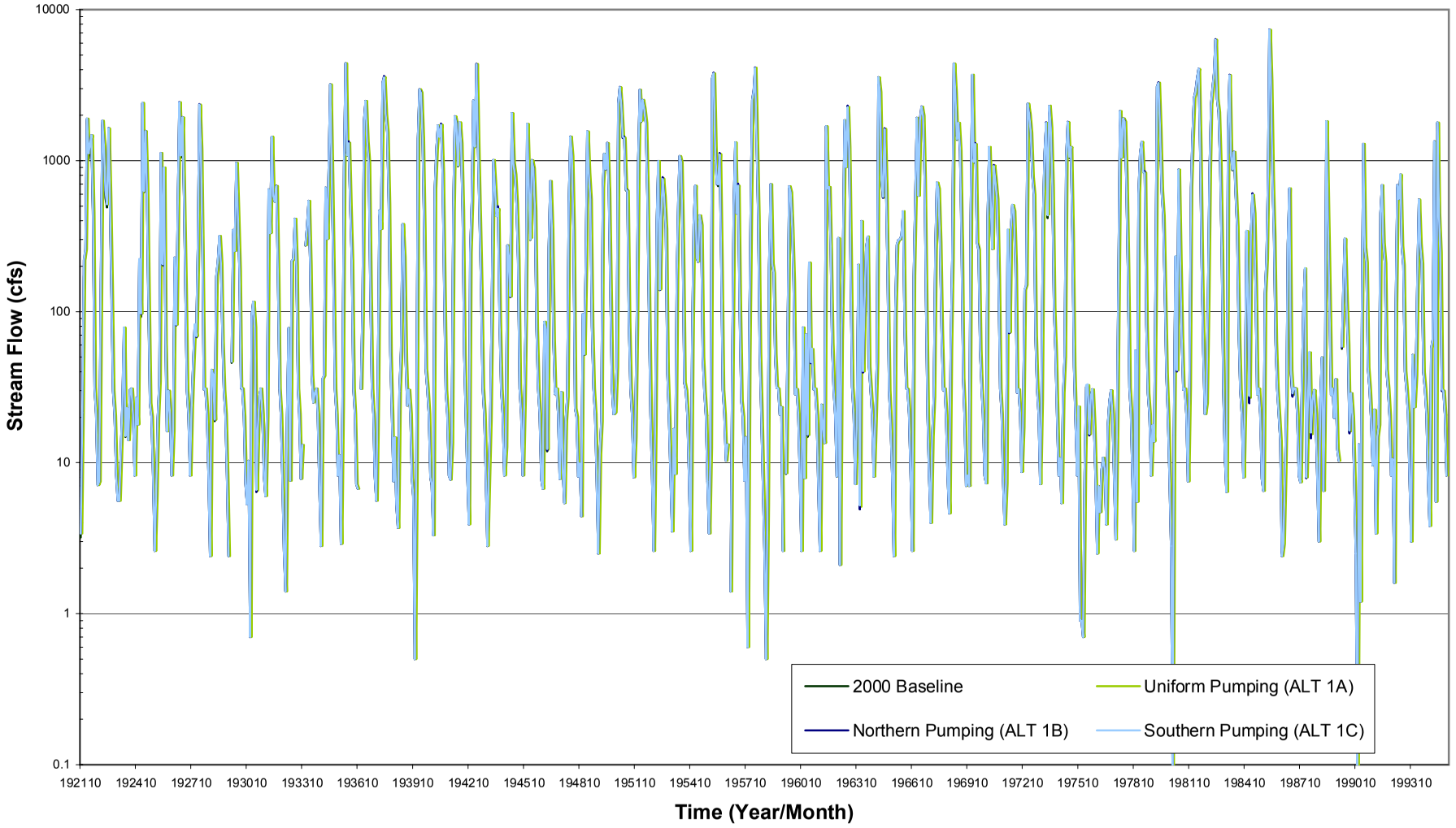

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Figure B.29
Monthly Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

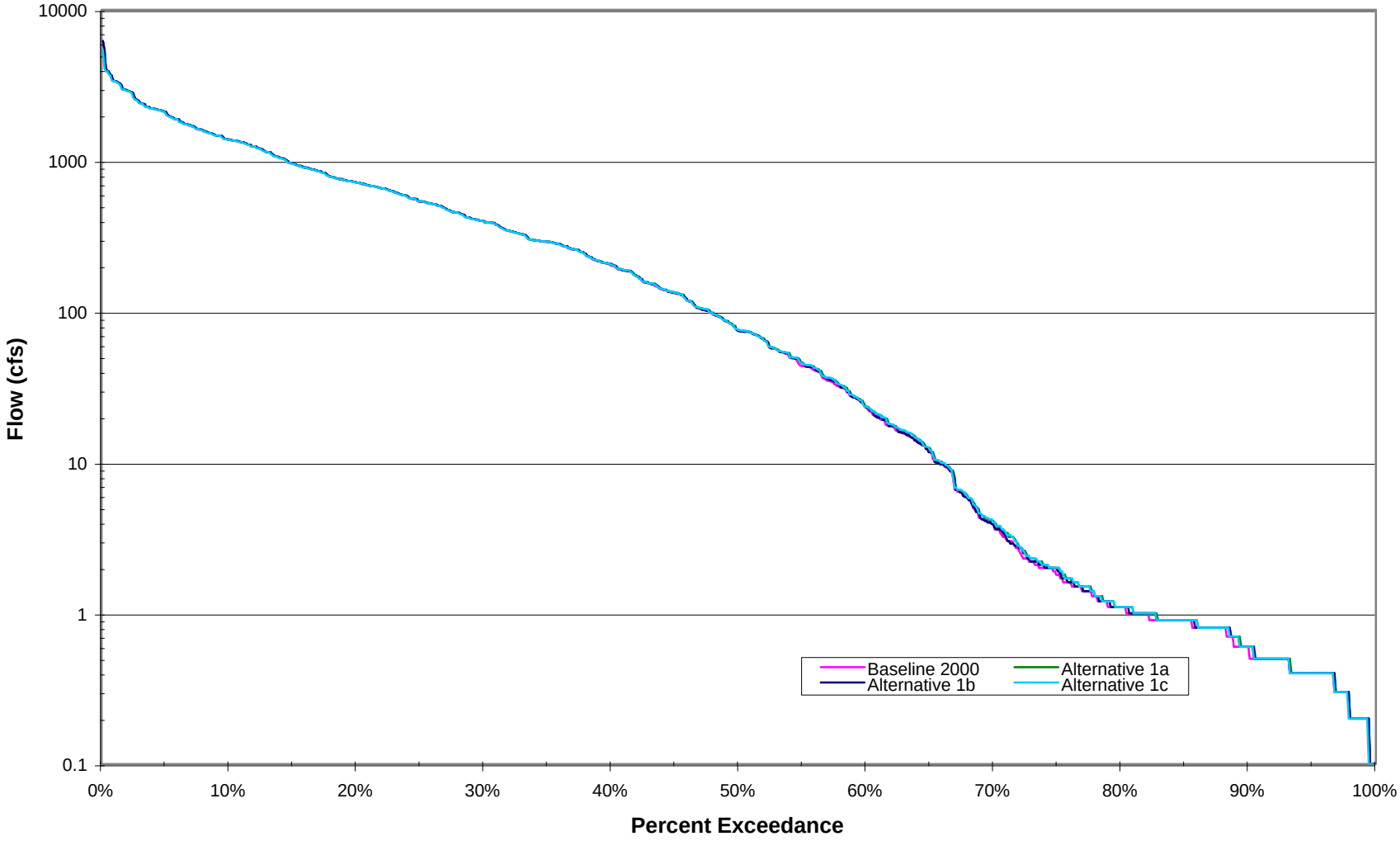


Figure B.30
August Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

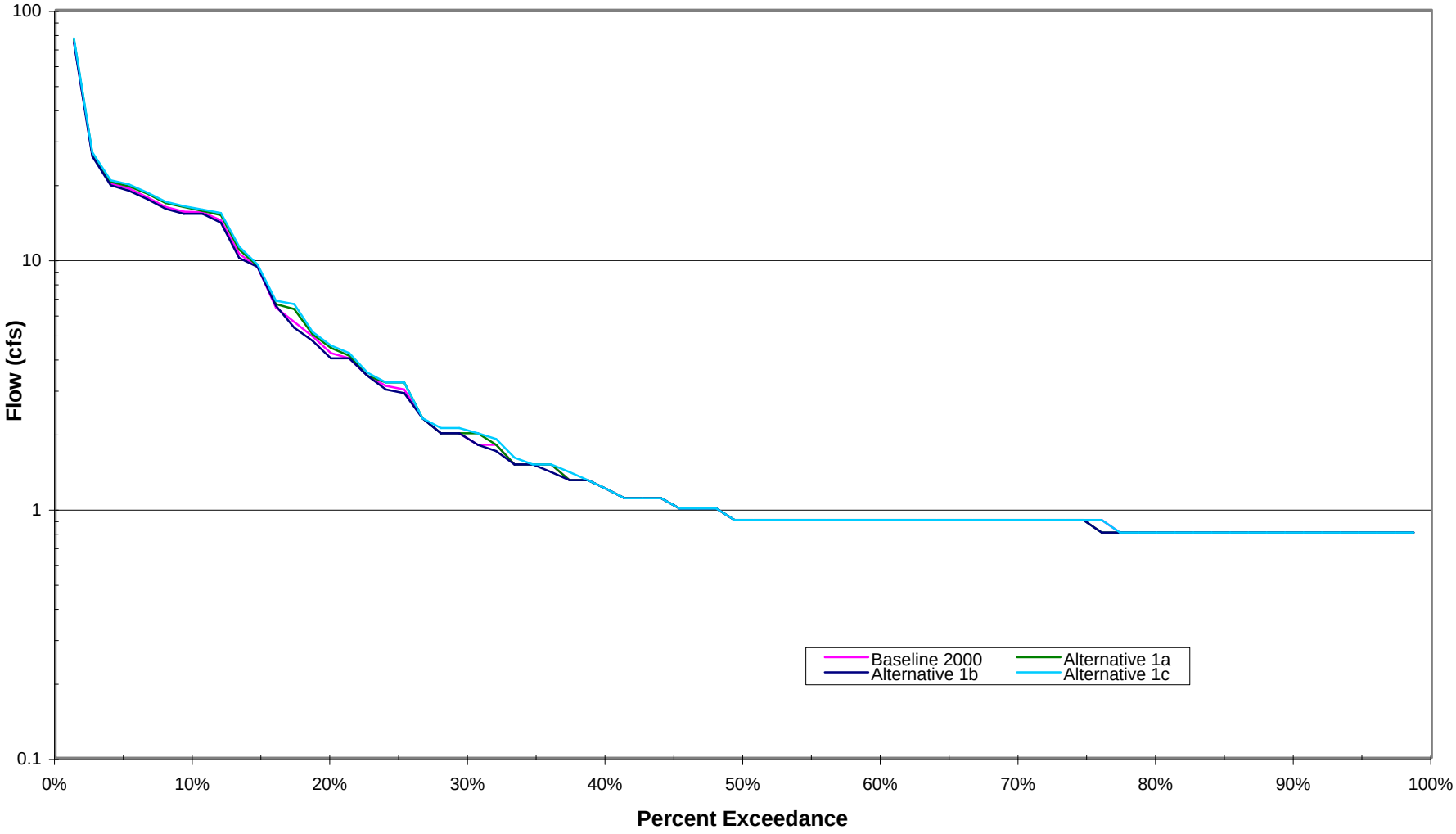


Figure B.31
September Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

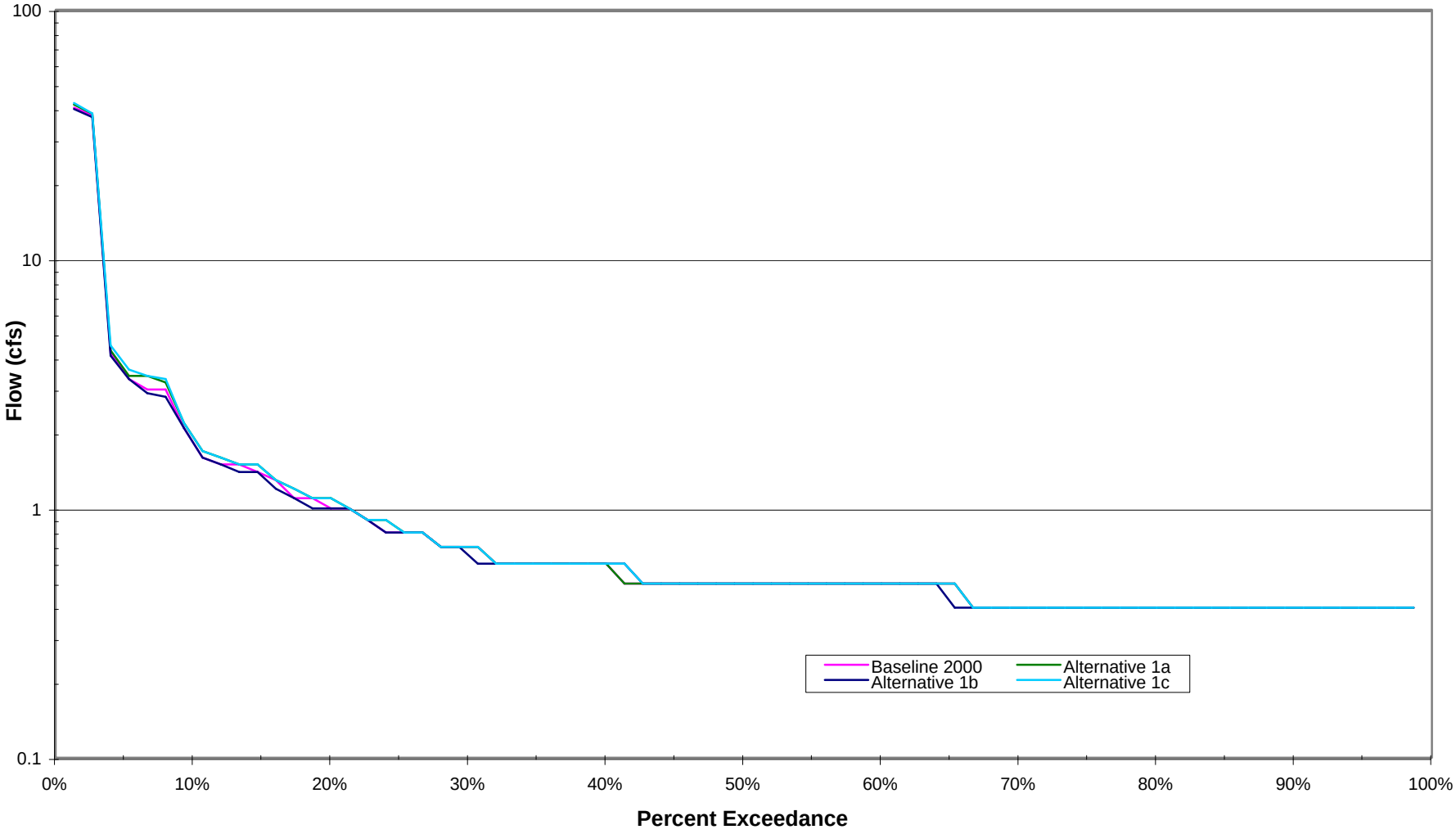


Figure B.32
October Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

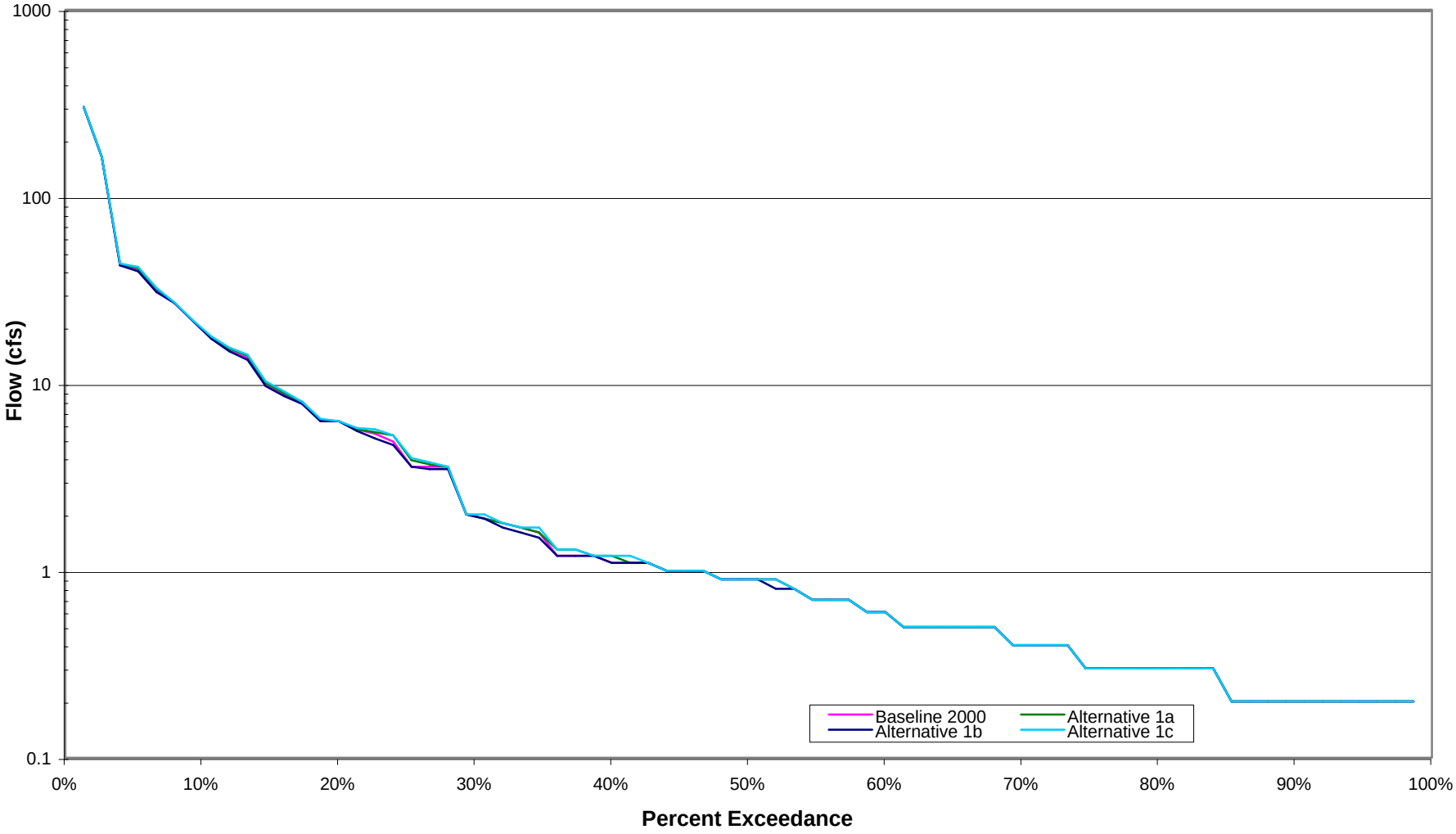


Figure B.33
November Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

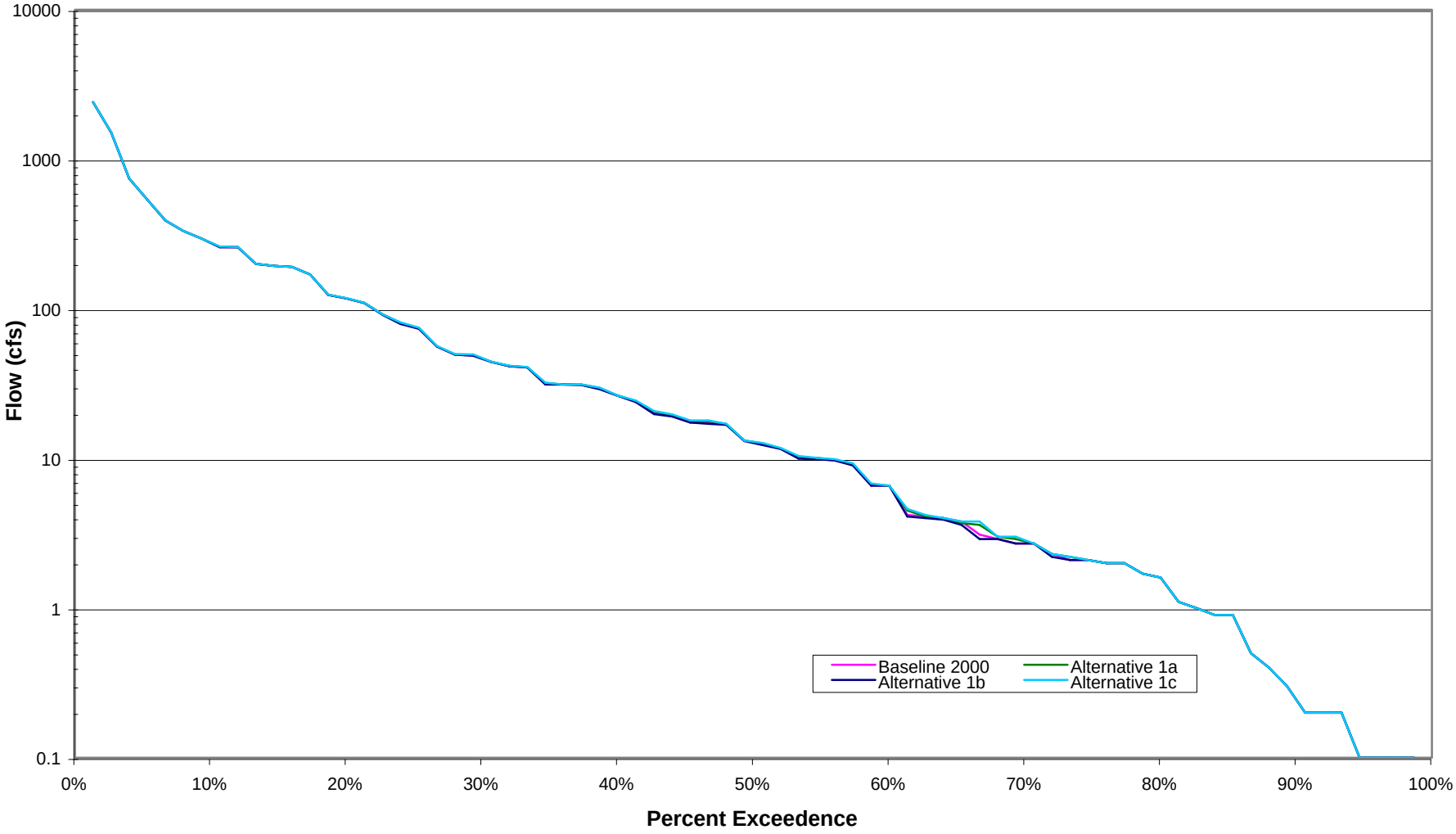


Figure B.34
Monthly Cosumnes River Flow Exceedance Probability
Near Highway 99

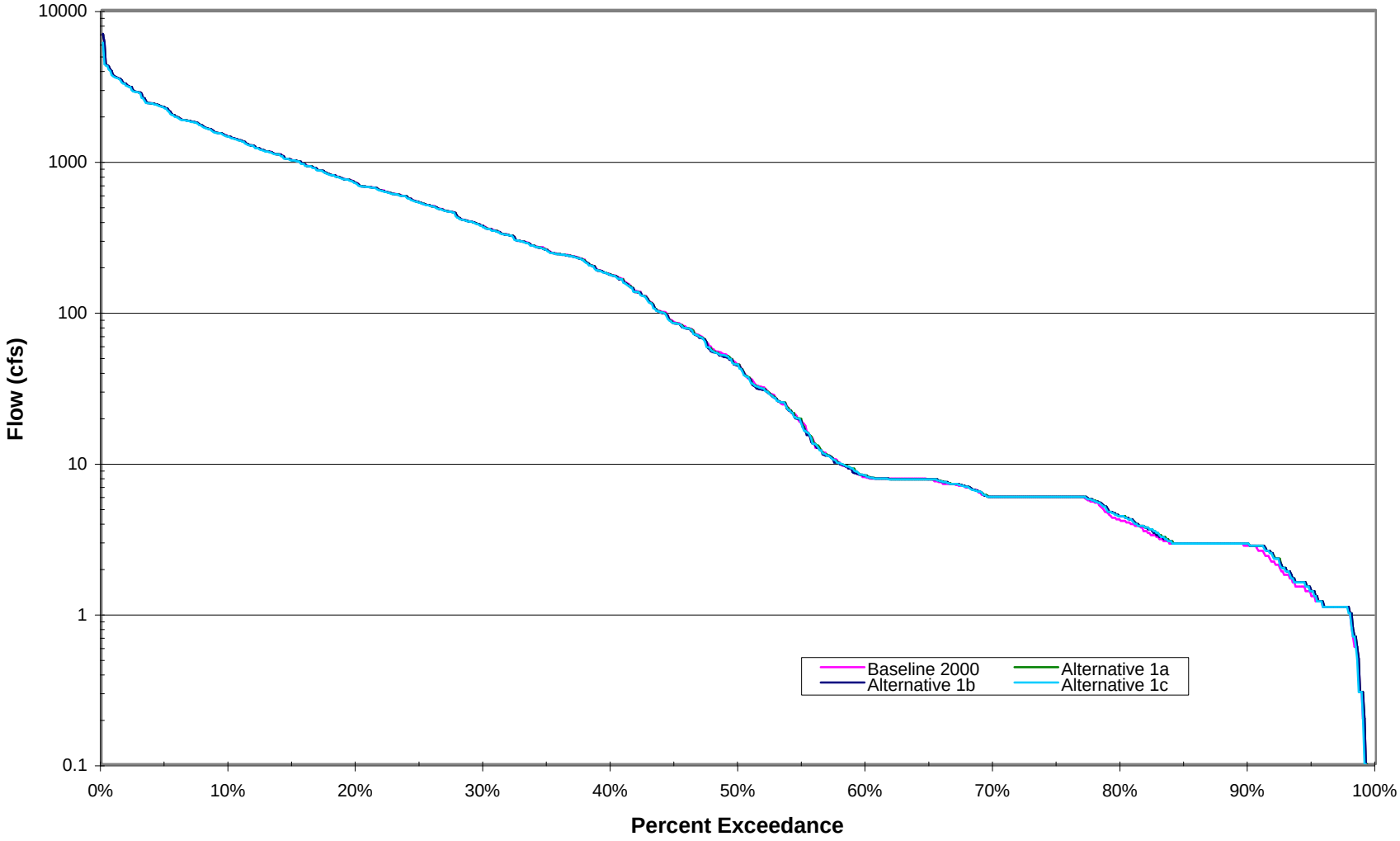


Figure B.35
August Cosumnes River Flow Exceedance Probability
Near Highway 99

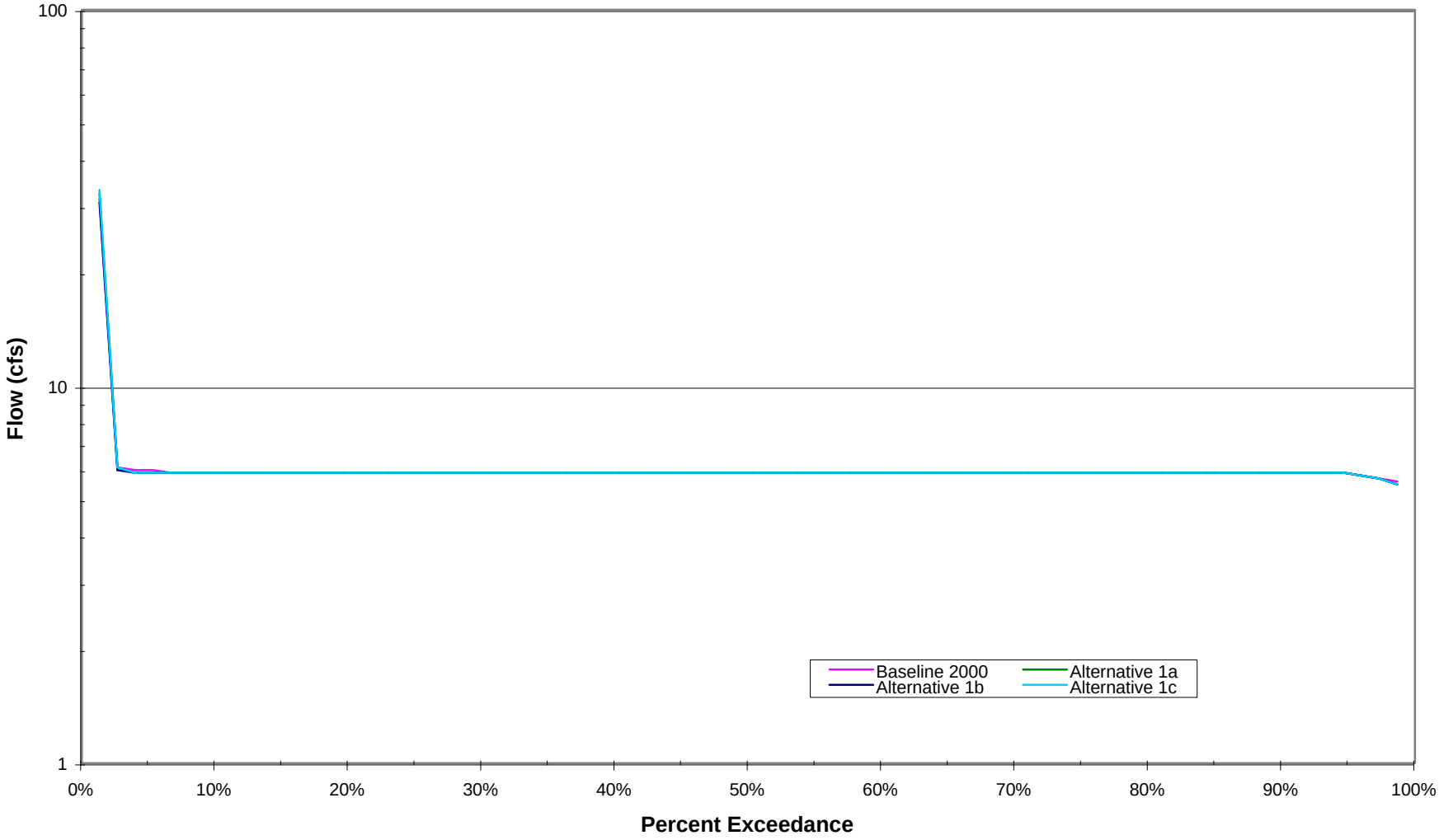


Figure B.36
September Cosumnes River Flow Exceedance Probability
Near Highway 99

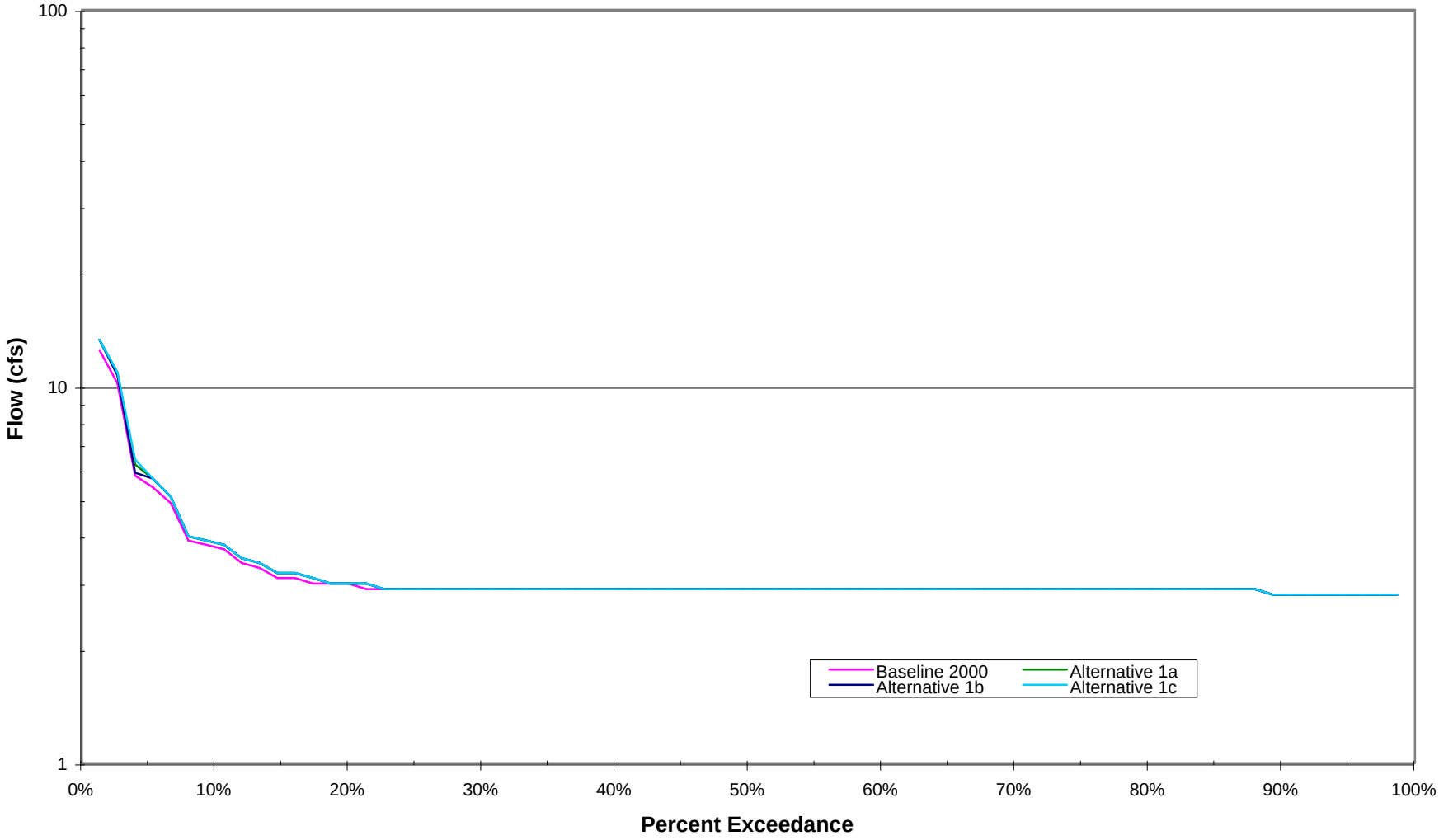


Figure B.37
October Cosumnes River Flow Exceedance Probability
Near Highway 99

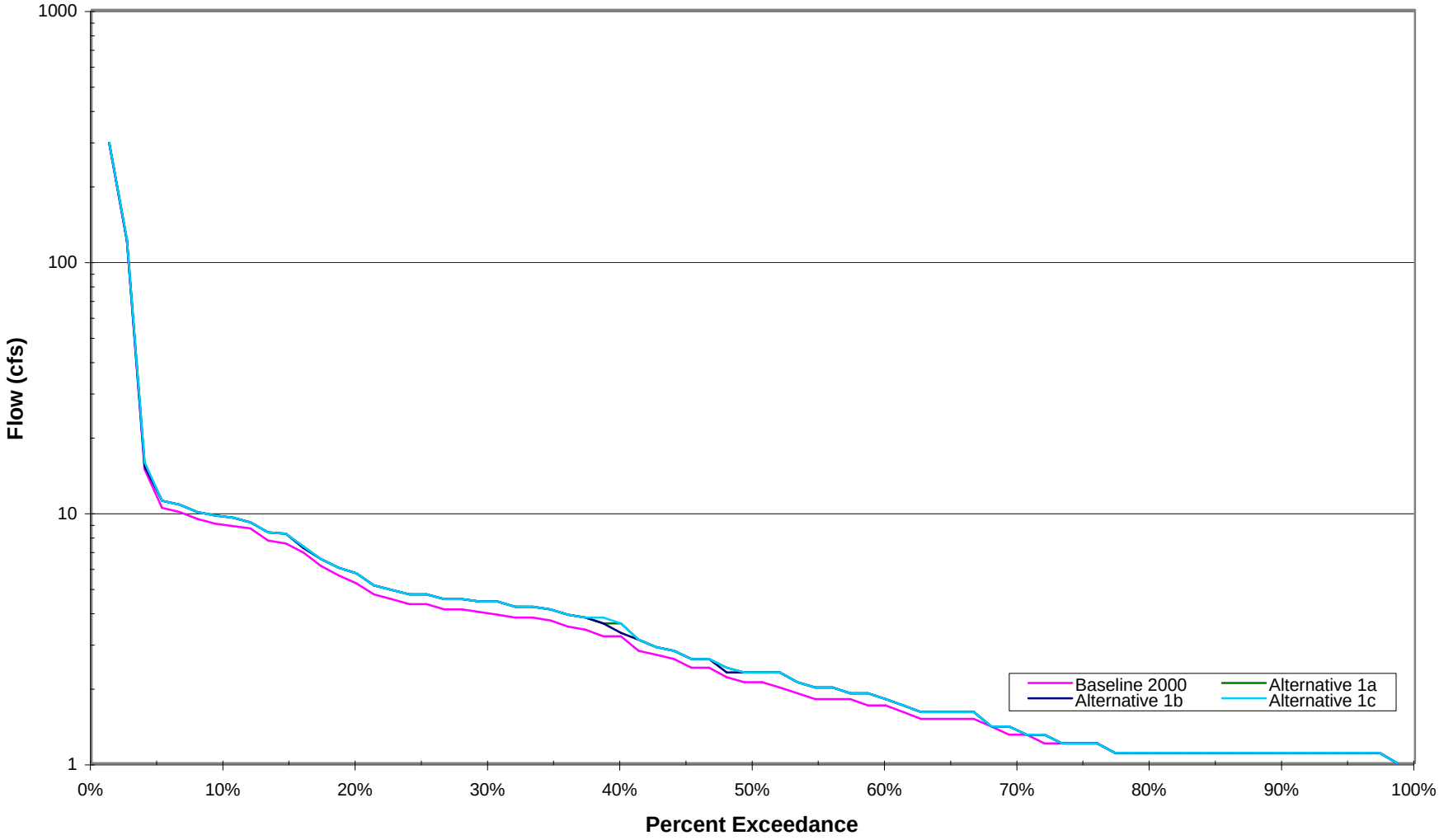
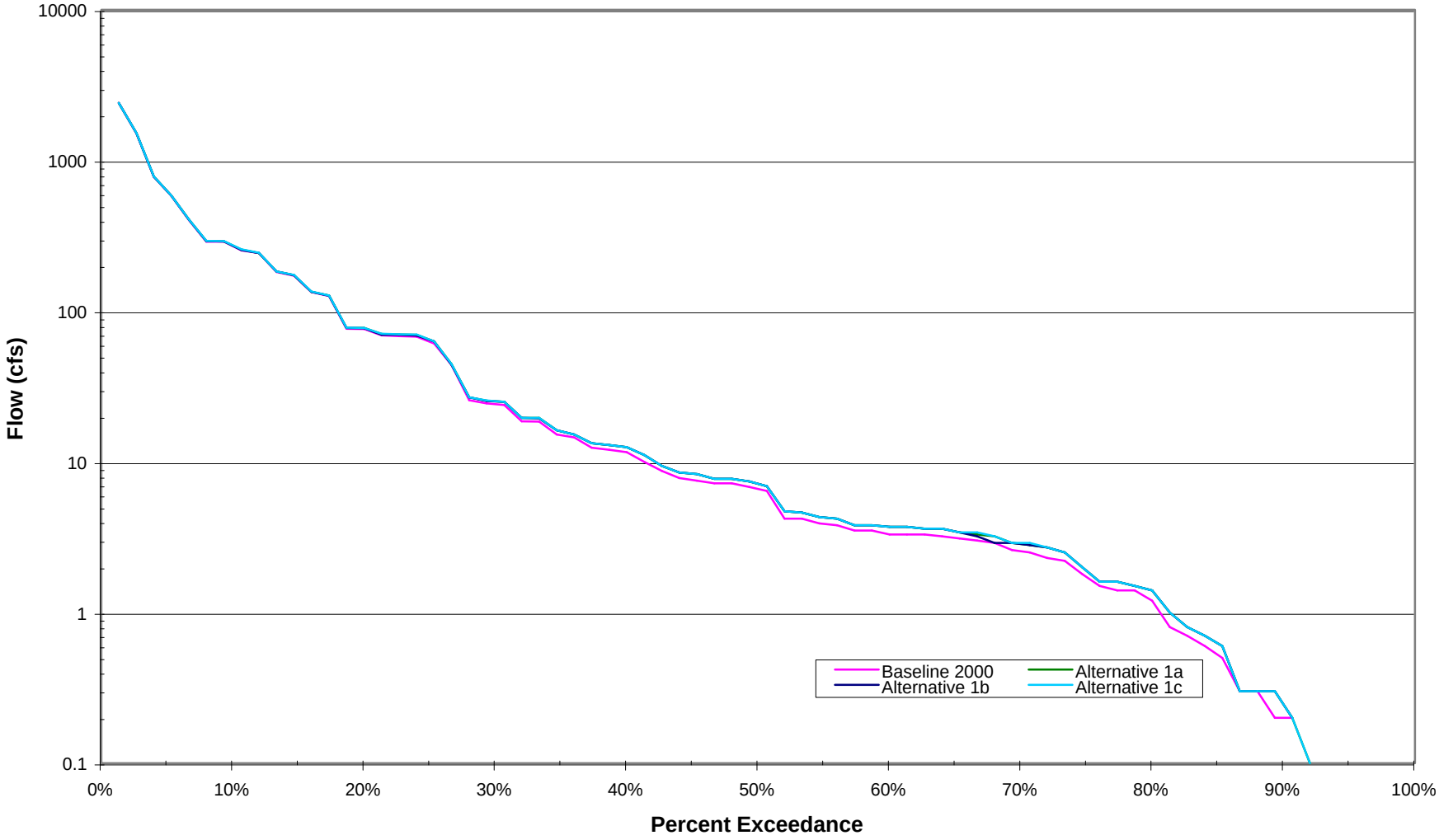


Figure B.38
November Cosumnes River Flow Exceedance Probability
Near Highway 99



APPENDIX C ZONE 40 WATER SUPPLY AVAILABILITY ALTERNATIVES HYDROGRAPHS

Figure C.1
Groundwater Hydrograph at North Area Groundwater Depression (Location A)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

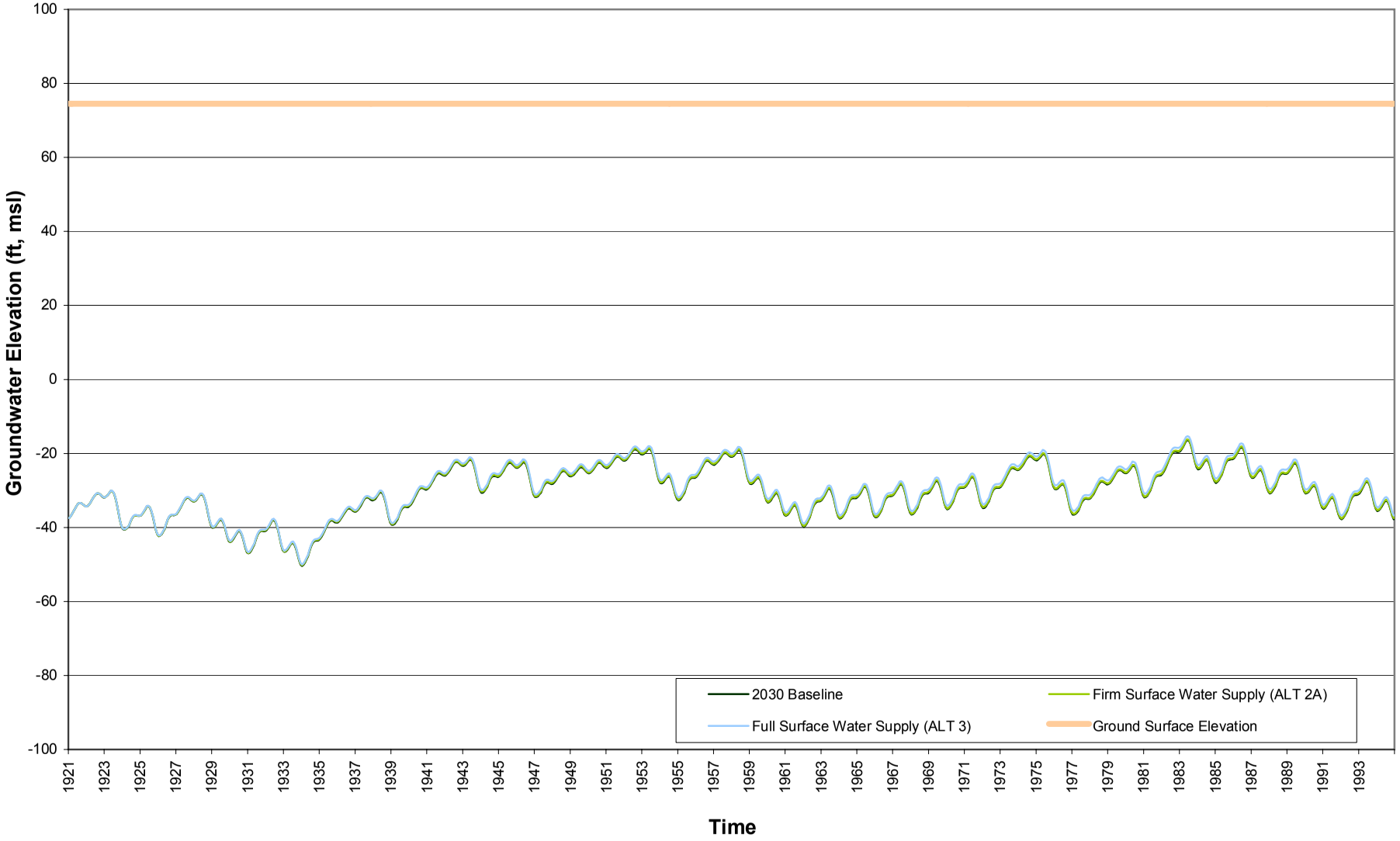


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Figure C.2
Groundwater Hydrograph at City of Sacramento North (Location B)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

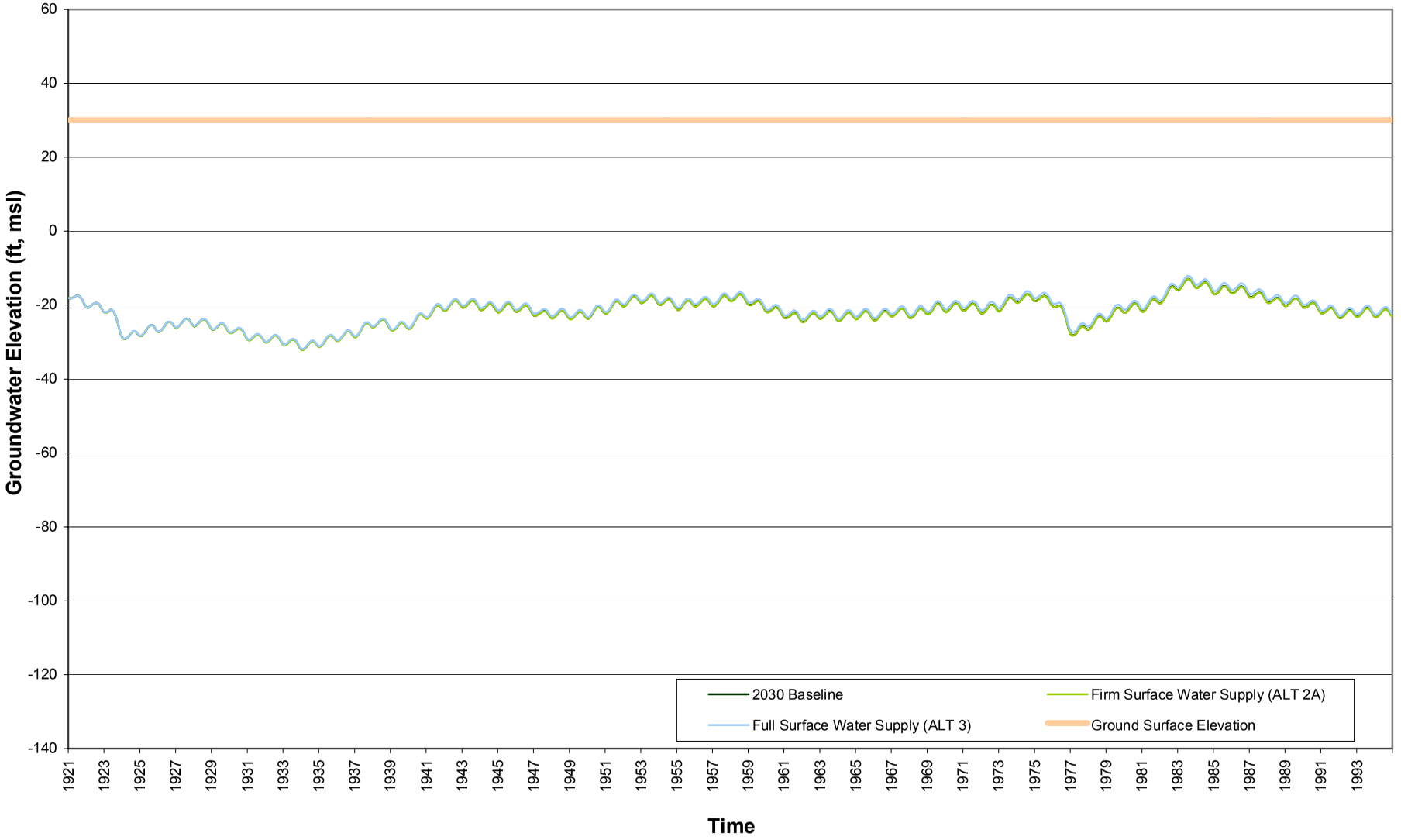

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Figure C.3
Groundwater Hydrograph near Fair Oaks along American River (Location C)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

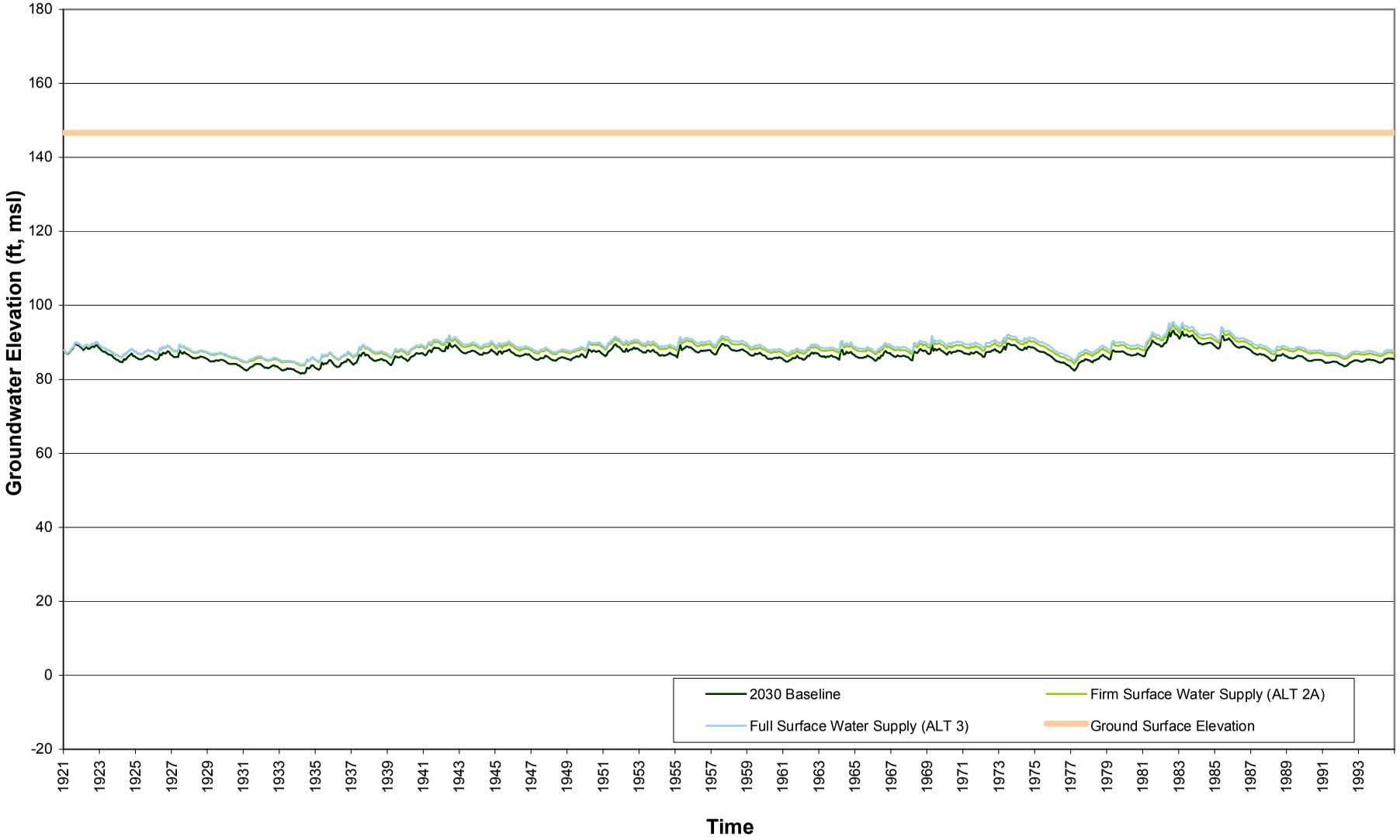

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Figure C.4
Groundwater Hydrograph near H Street along American River (Location D)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

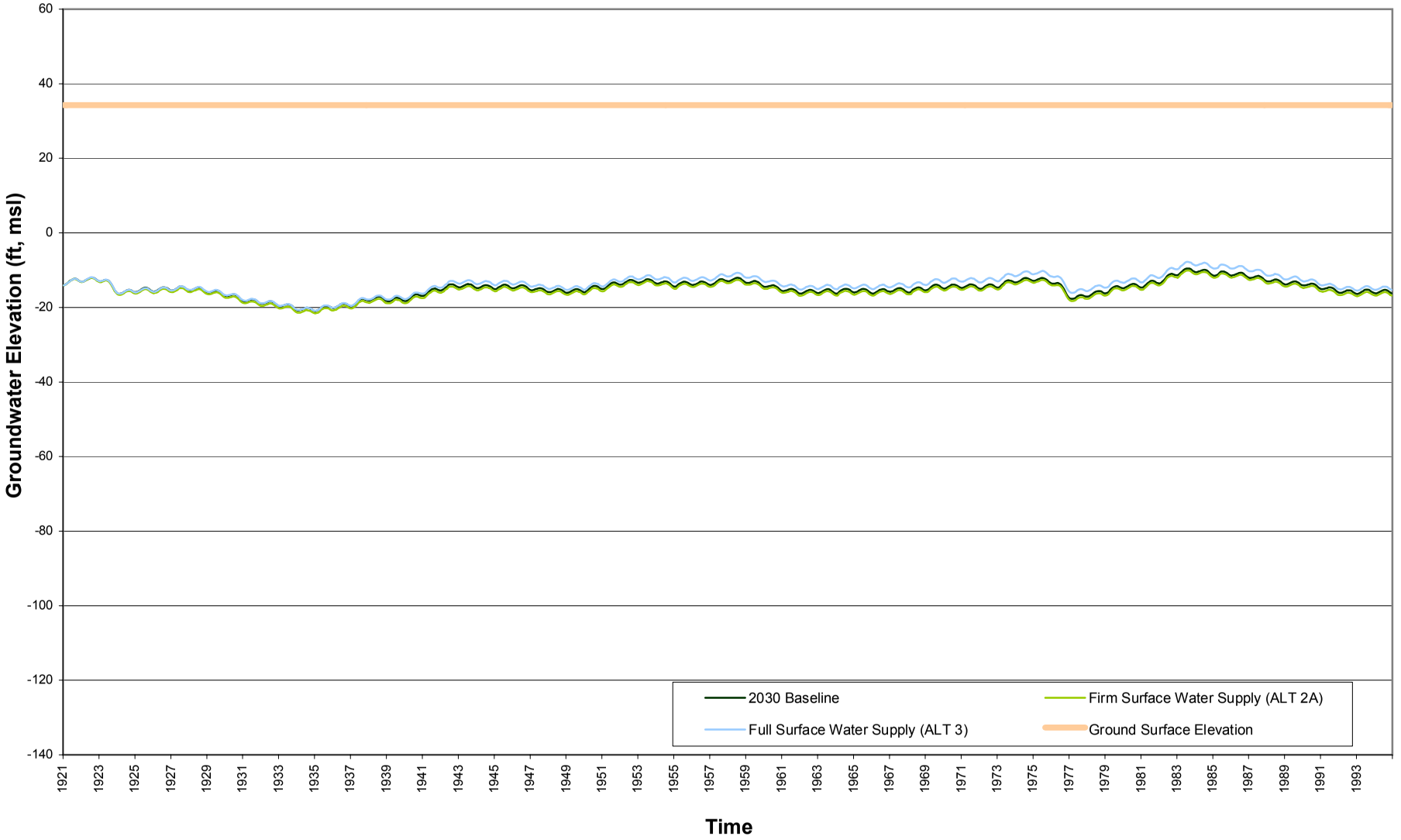

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Figure C.5
Groundwater Hydrograph near Carmichael W.D. along American River (Location E)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

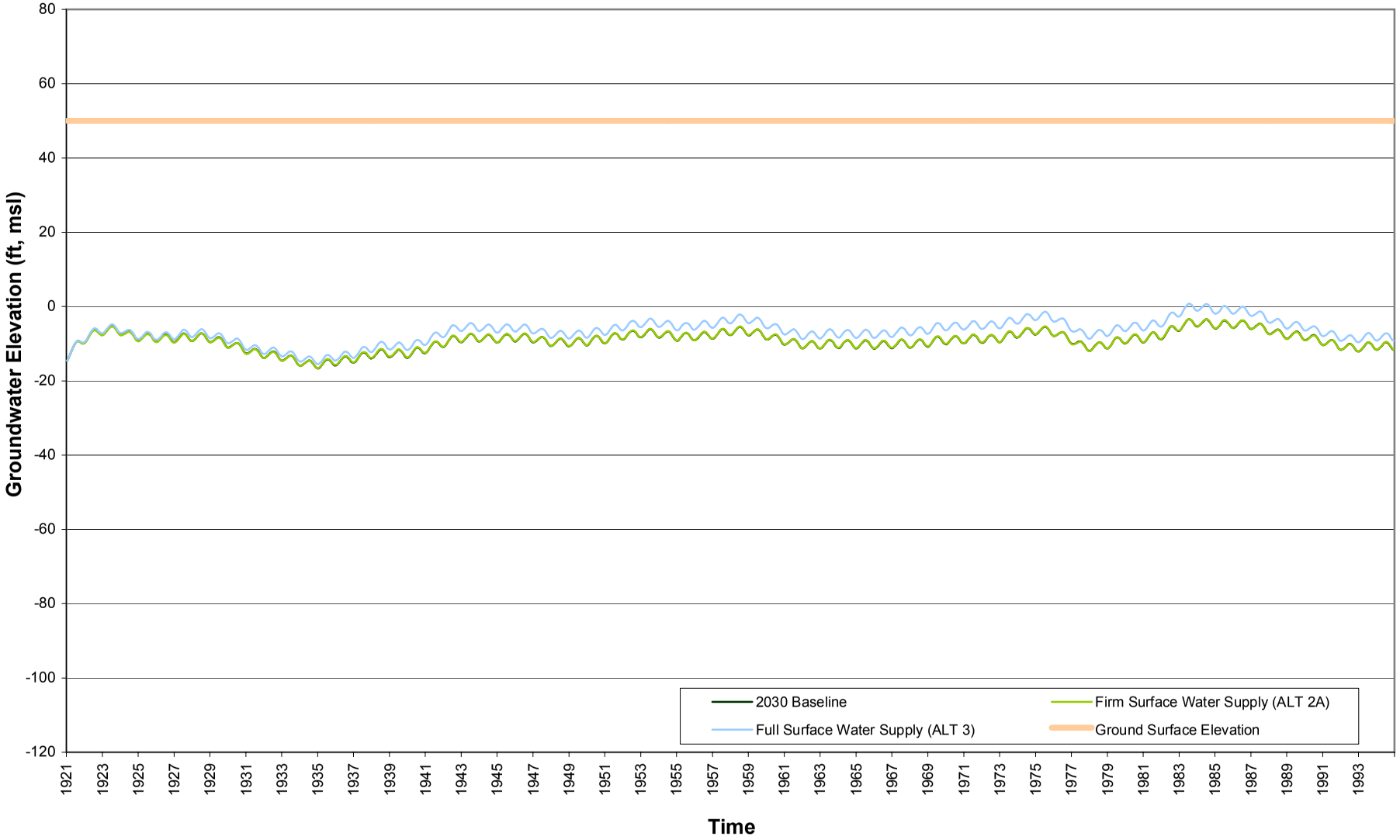

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Figure C.6
Groundwater Hydrograph at Aerojet/Boeing (Location F)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

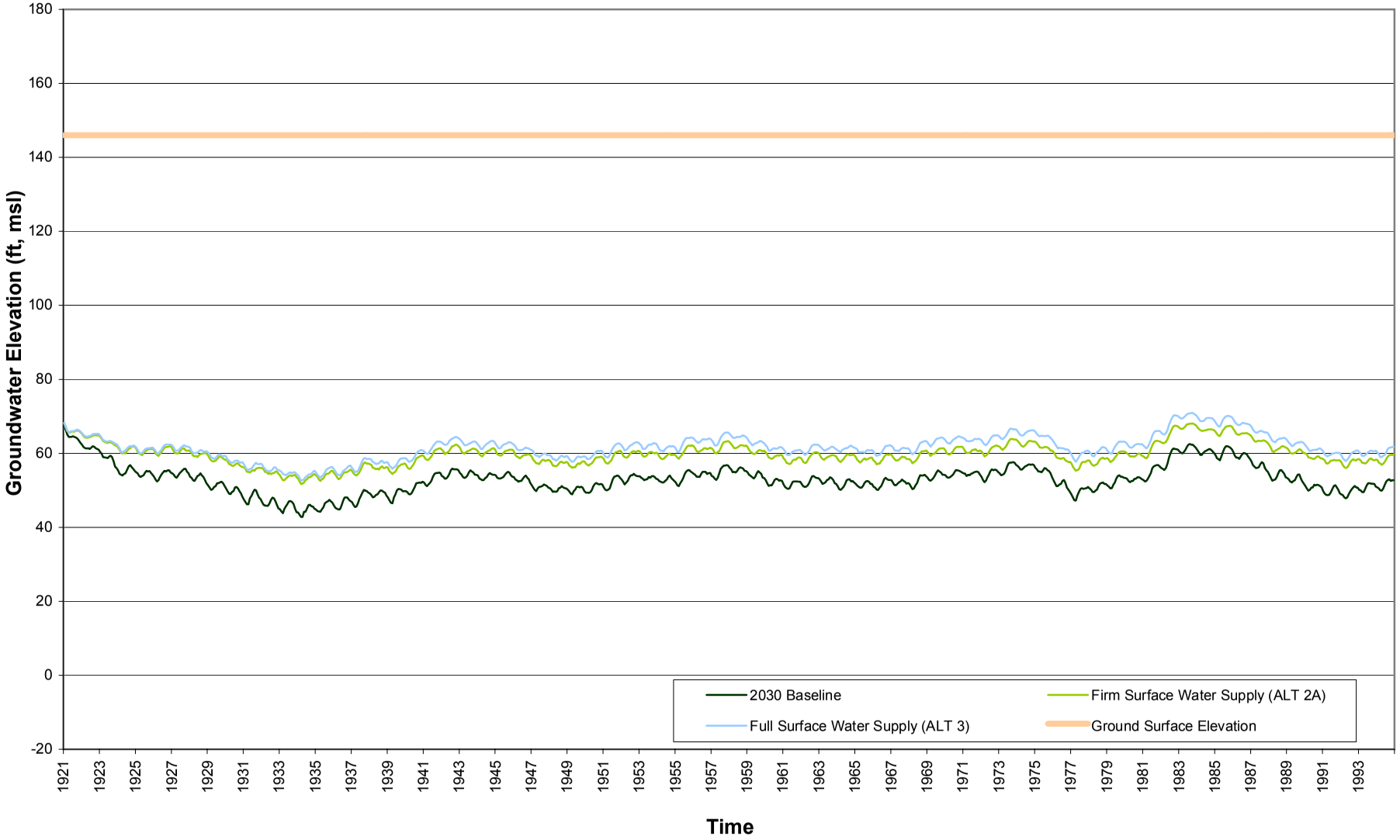

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Figure C.7
Groundwater Hydrograph at City of Sacramento South near Army Depot (Location G)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

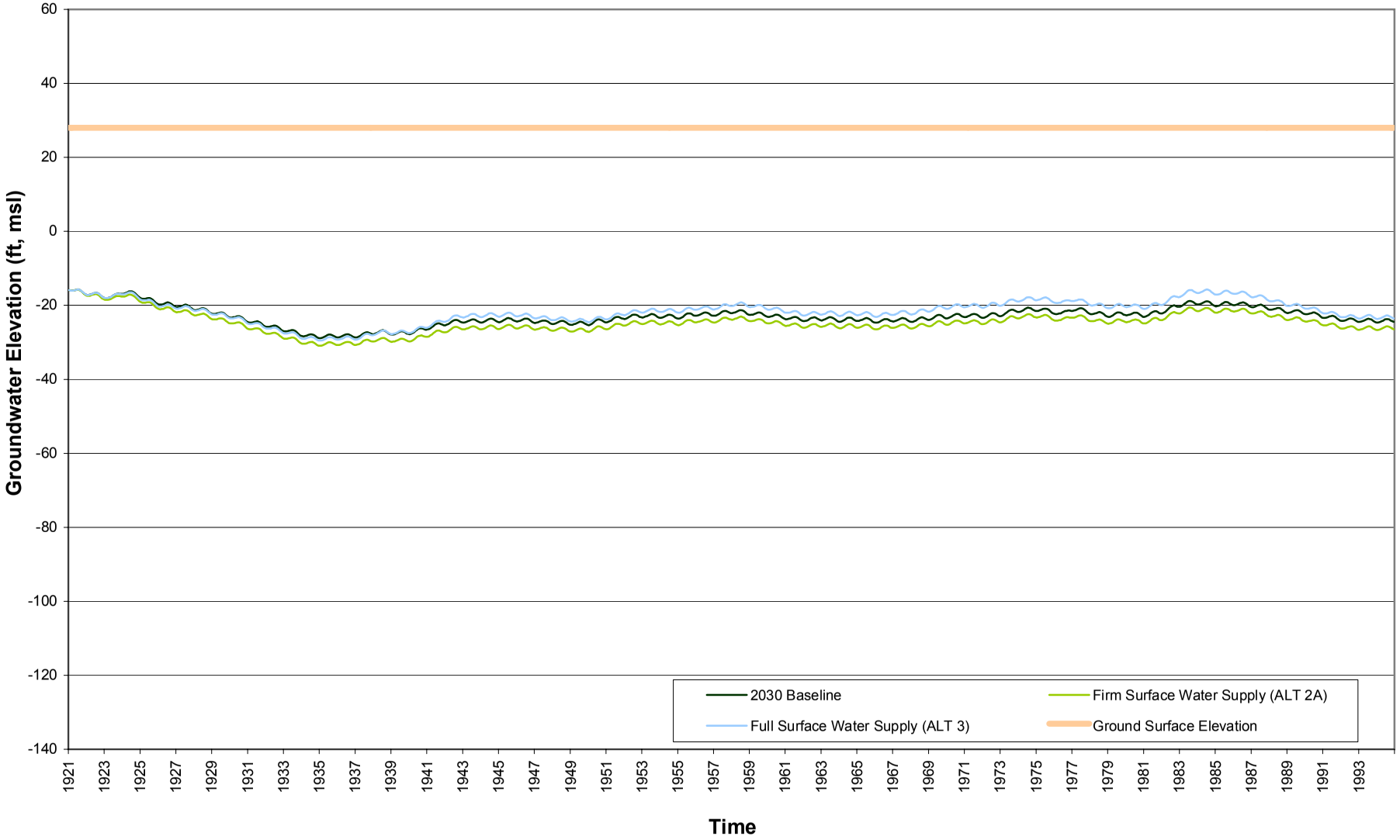

Figure C.8
Groundwater Hydrograph near Mather Remediation Area (Location H)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

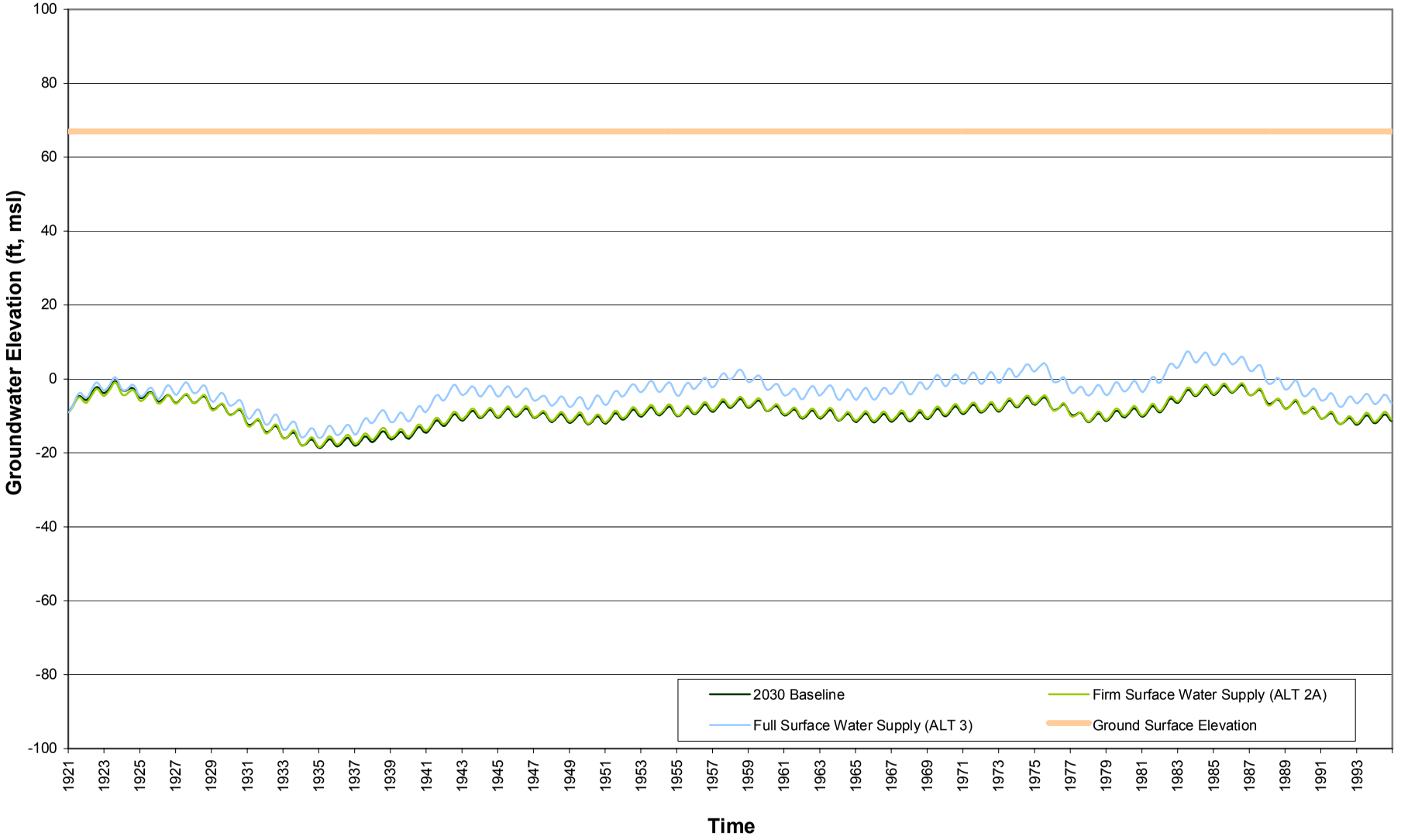

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Figure C.9
Groundwater Hydrograph at Zone 40 Sunrise Area (Location I)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

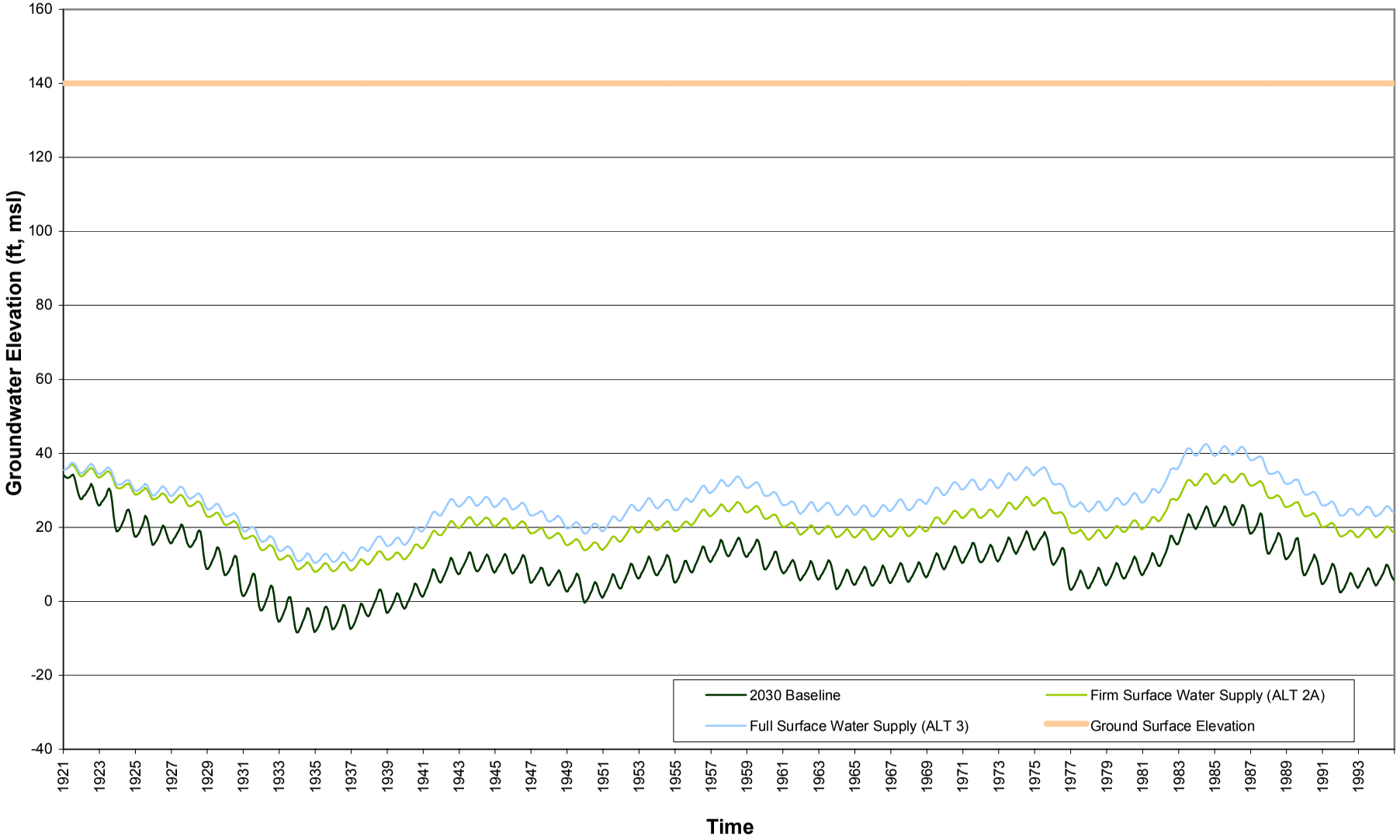

Figure C.10
Groundwater Hydrograph at Northern Zone 40 (Location J)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

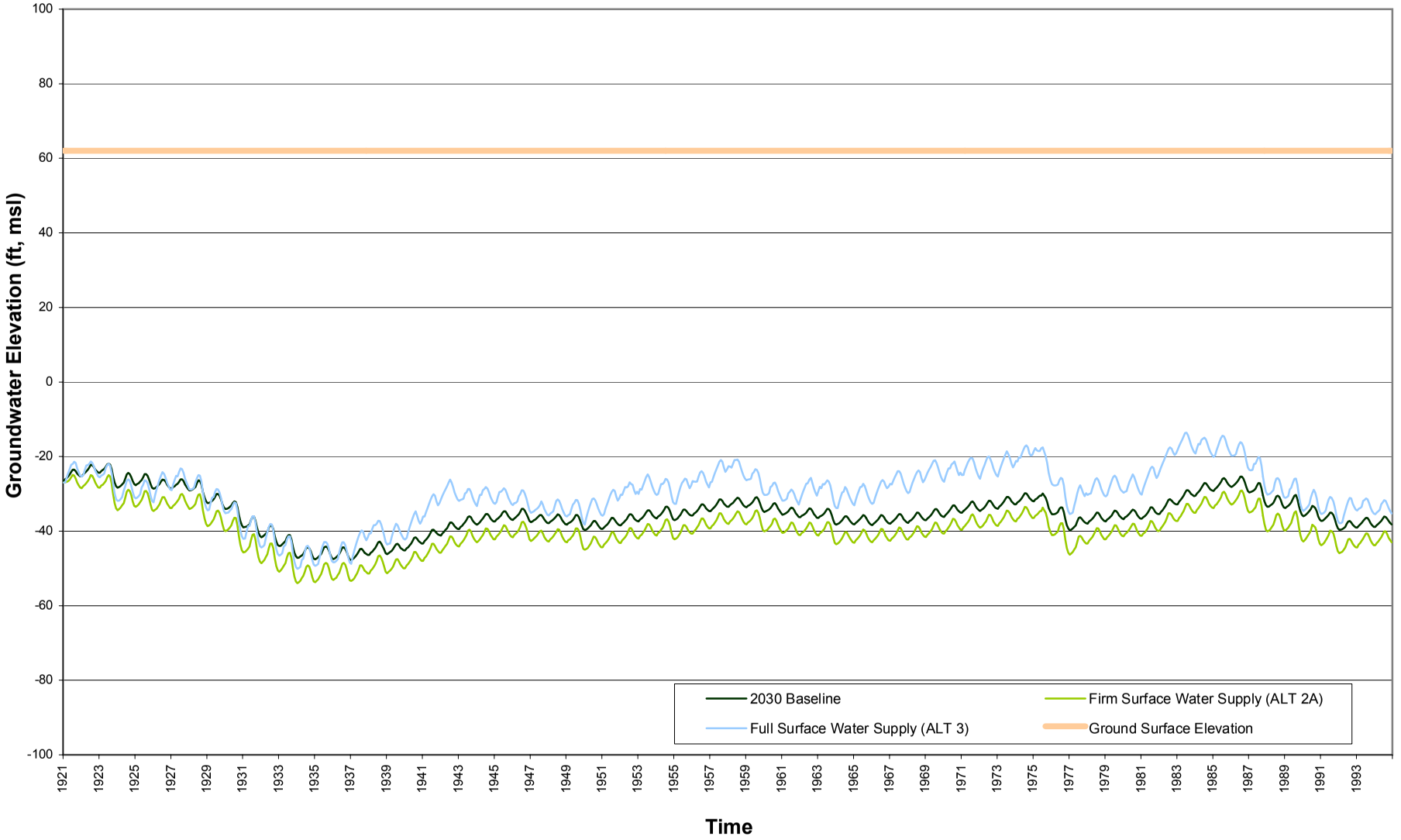

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Figure C.11
Groundwater Hydrograph at Zone 40 near Central Area Groundwater Depression (Location K)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

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Figure C.12
Groundwater Hydrograph at Zone 40 (Location L)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

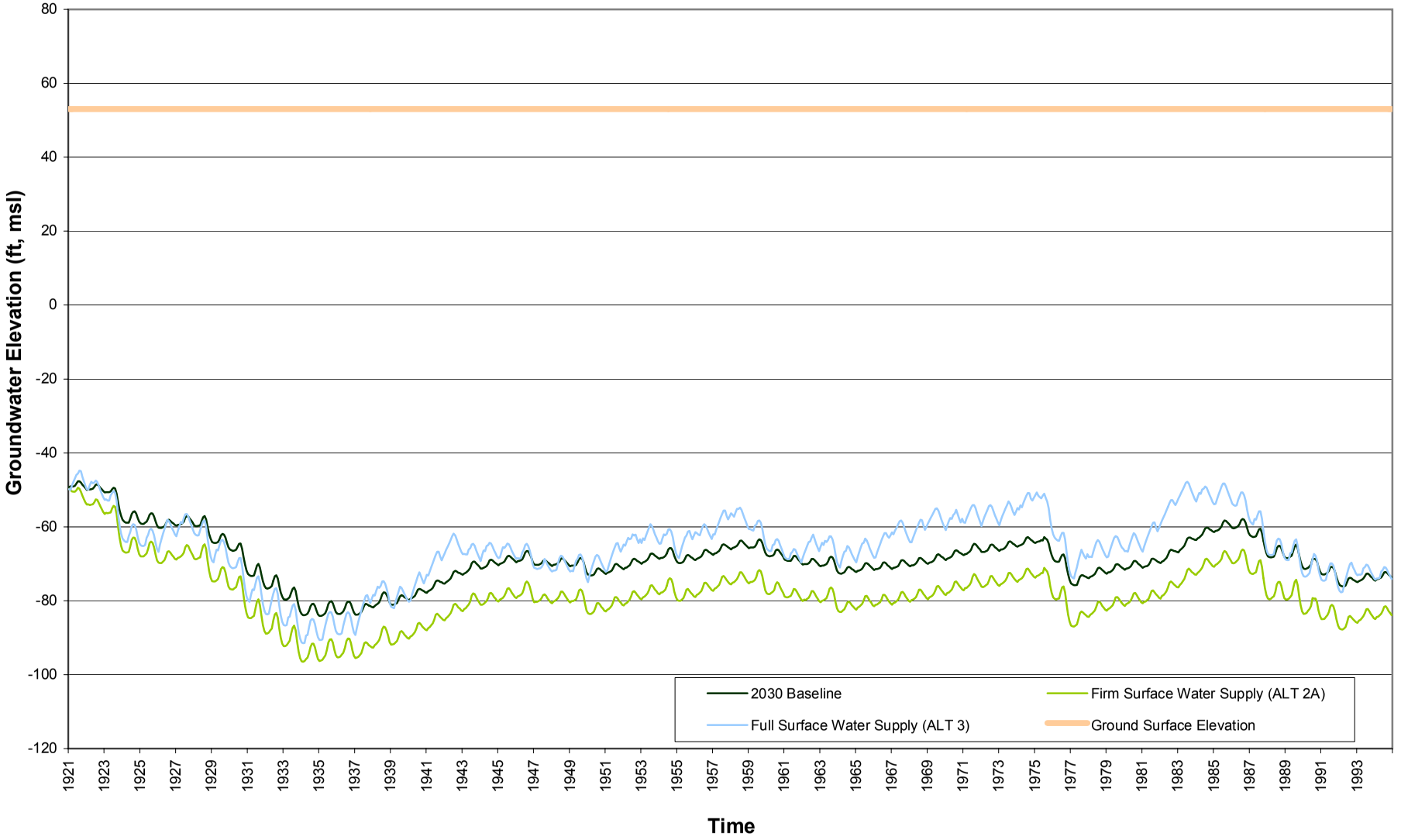

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Figure C.13
Groundwater Hydrograph near Folsom South Canal along Cosumnes River (Location M)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

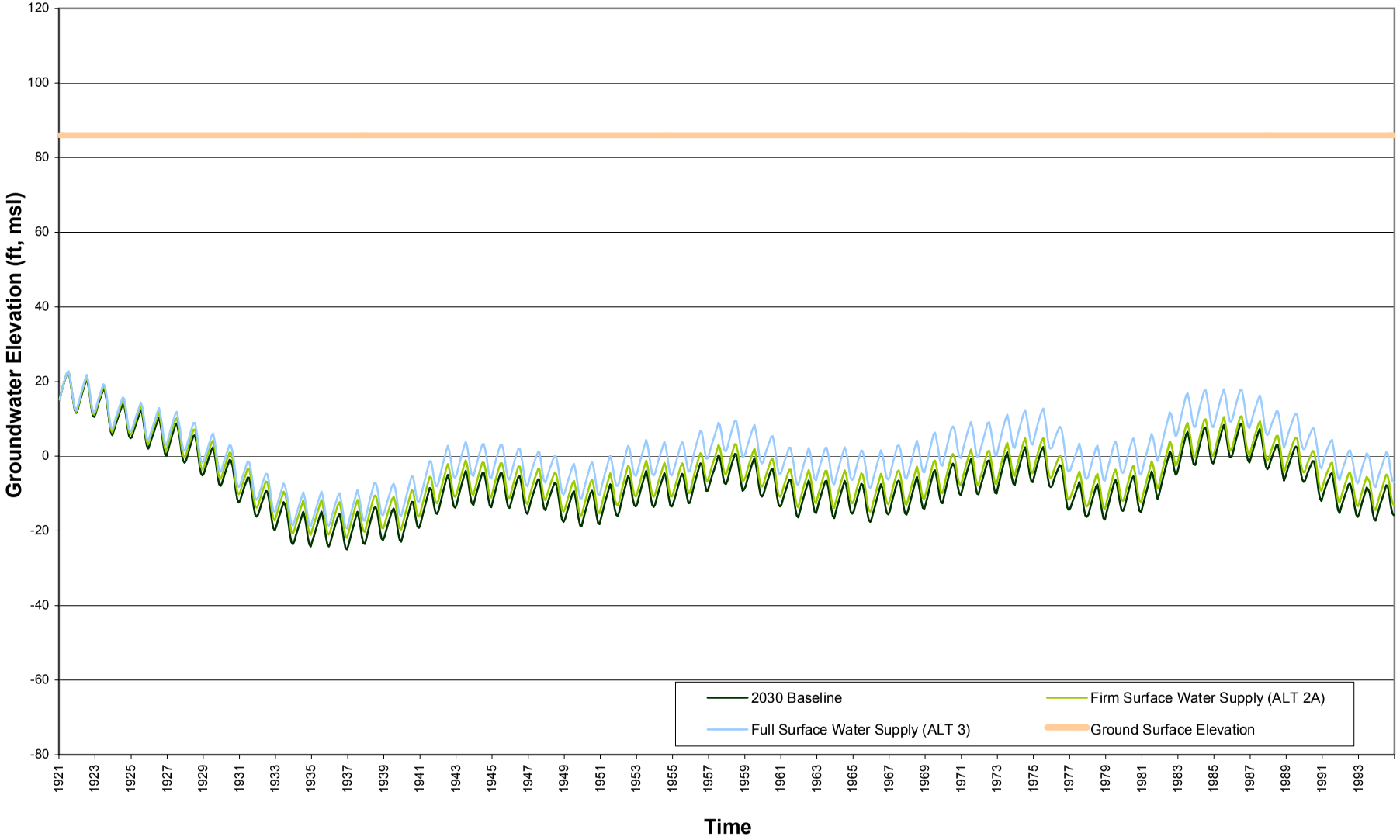

Figure C.14
Groundwater Hydrograph near Remediation Area Keifer Landfill (Location N)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

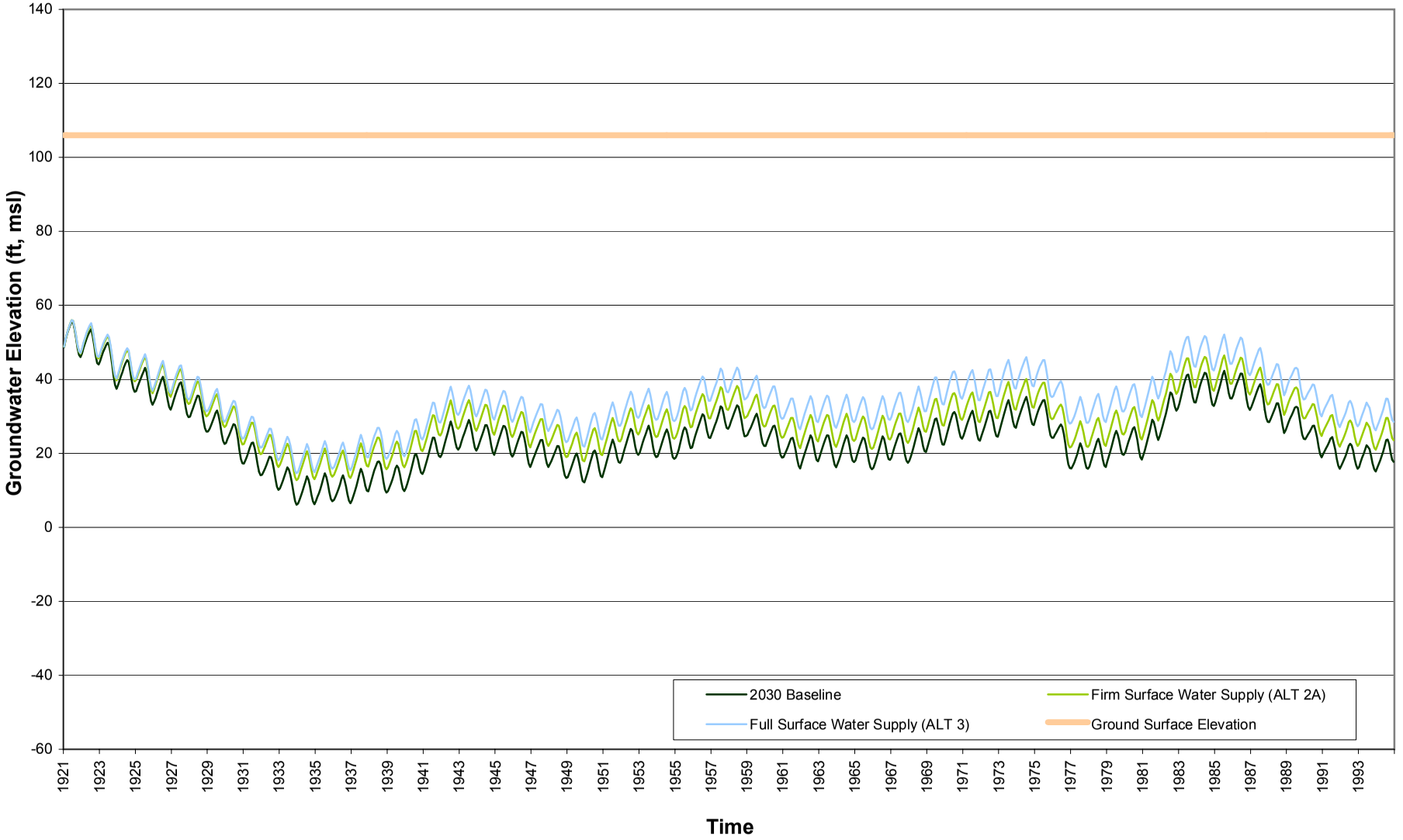

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Figure C.15
Groundwater Hydrograph at Central Area Groundwater Depression (Location O)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

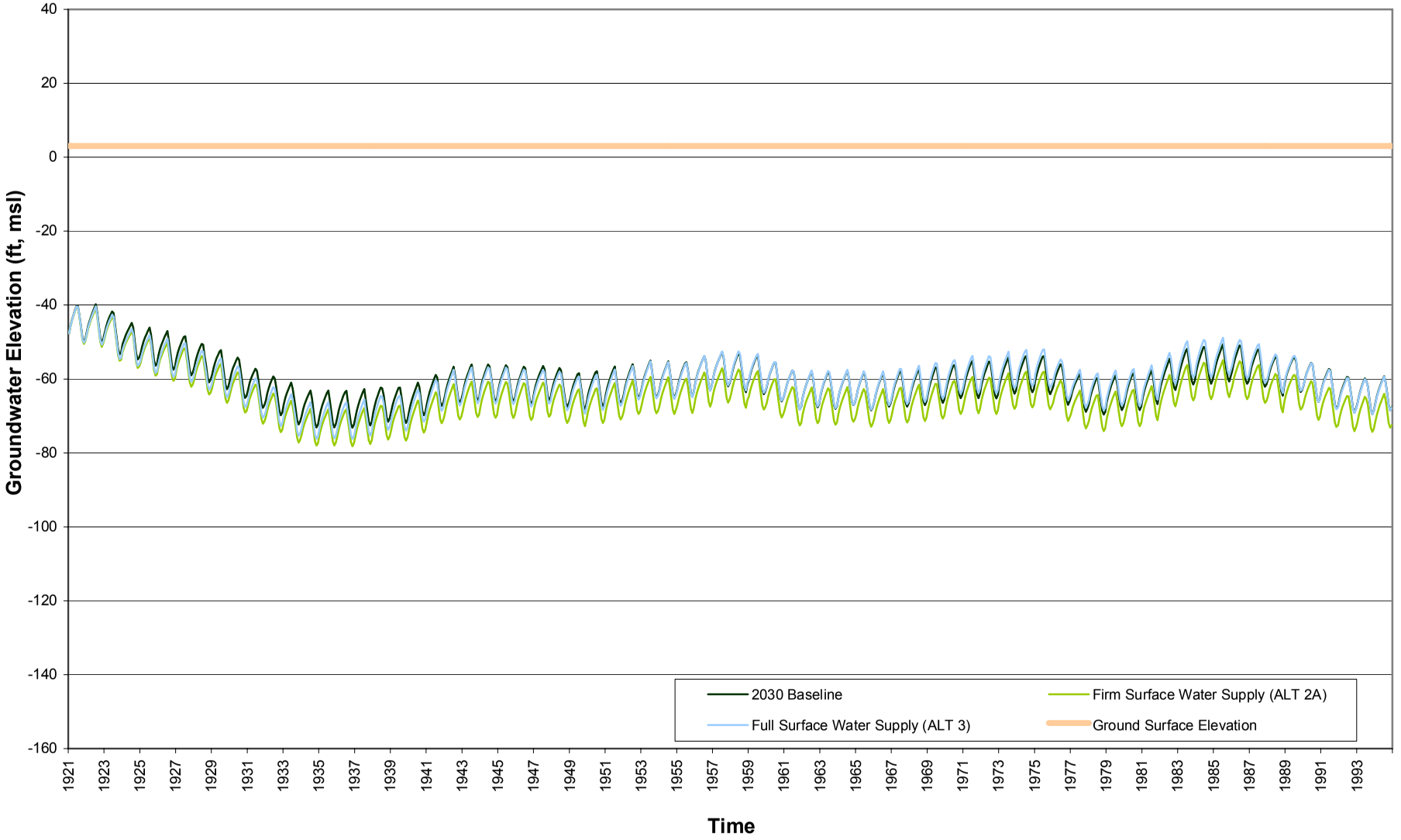

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Figure C.16
Groundwater Hydrograph near Highway 99 along Cosumnes River (Location P)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

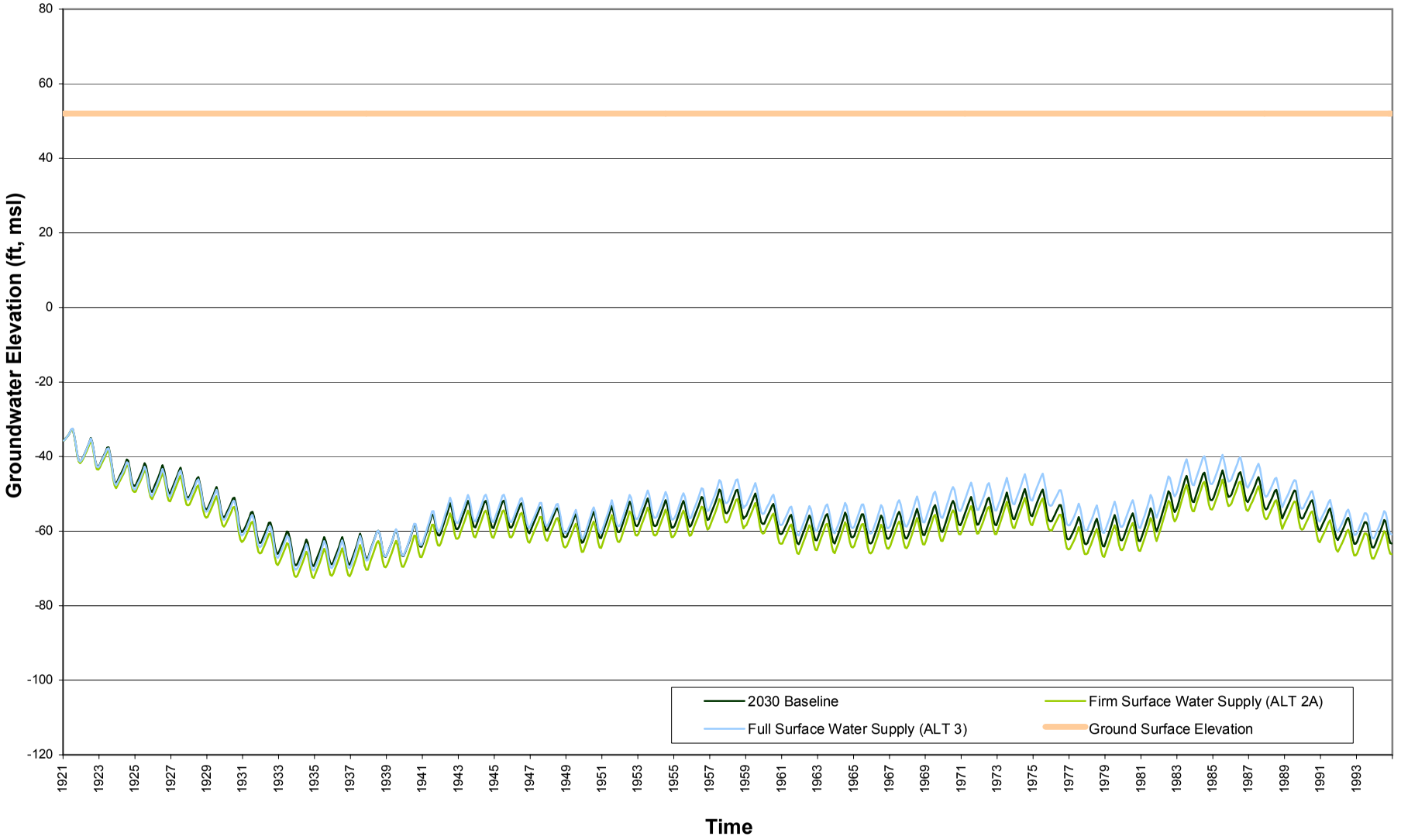

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Figure C.17
Groundwater Hydrograph near South Area Groundwater Depression (Location Q)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

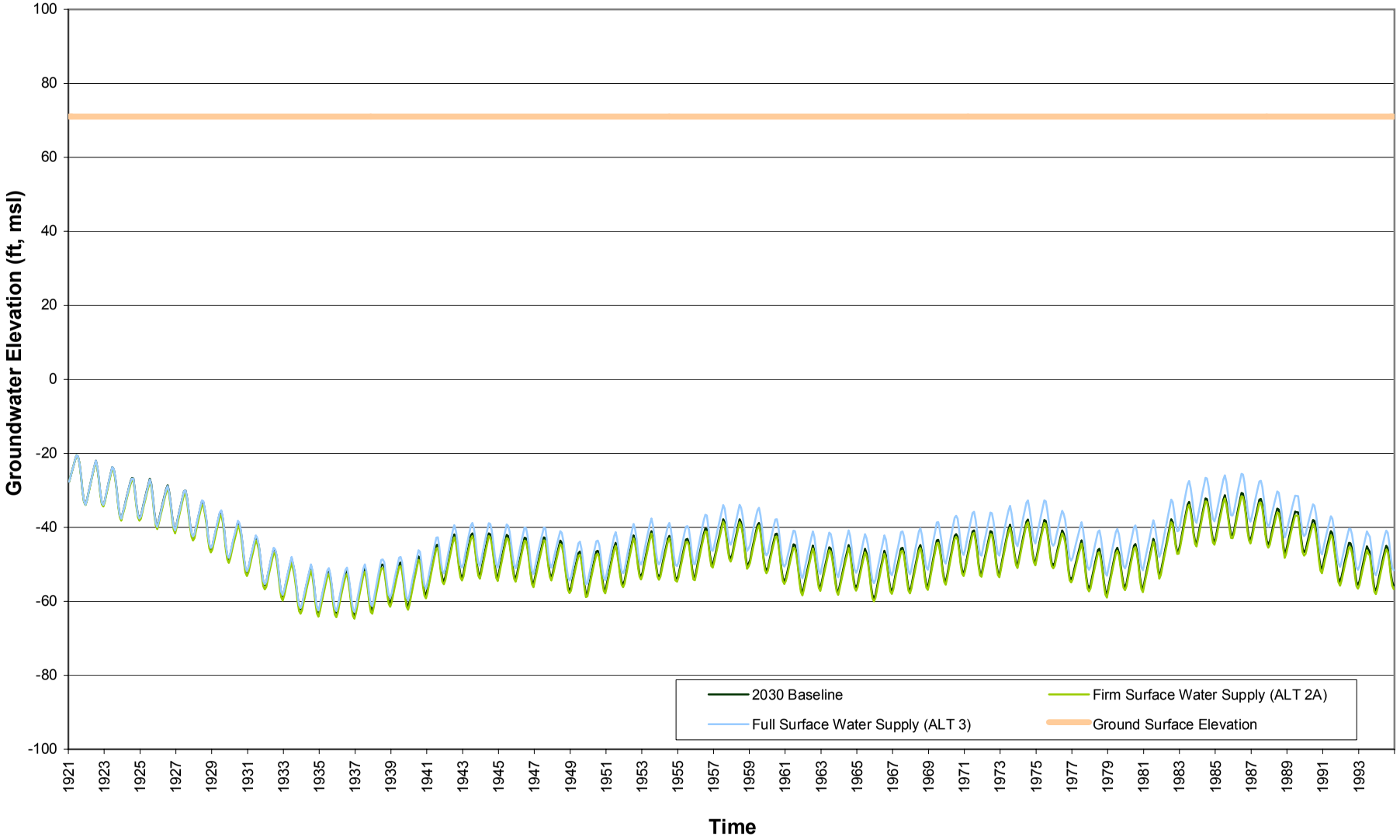

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Figure C.18
Groundwater Hydrograph near Twin Cities along Cosumnes River (Location R)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

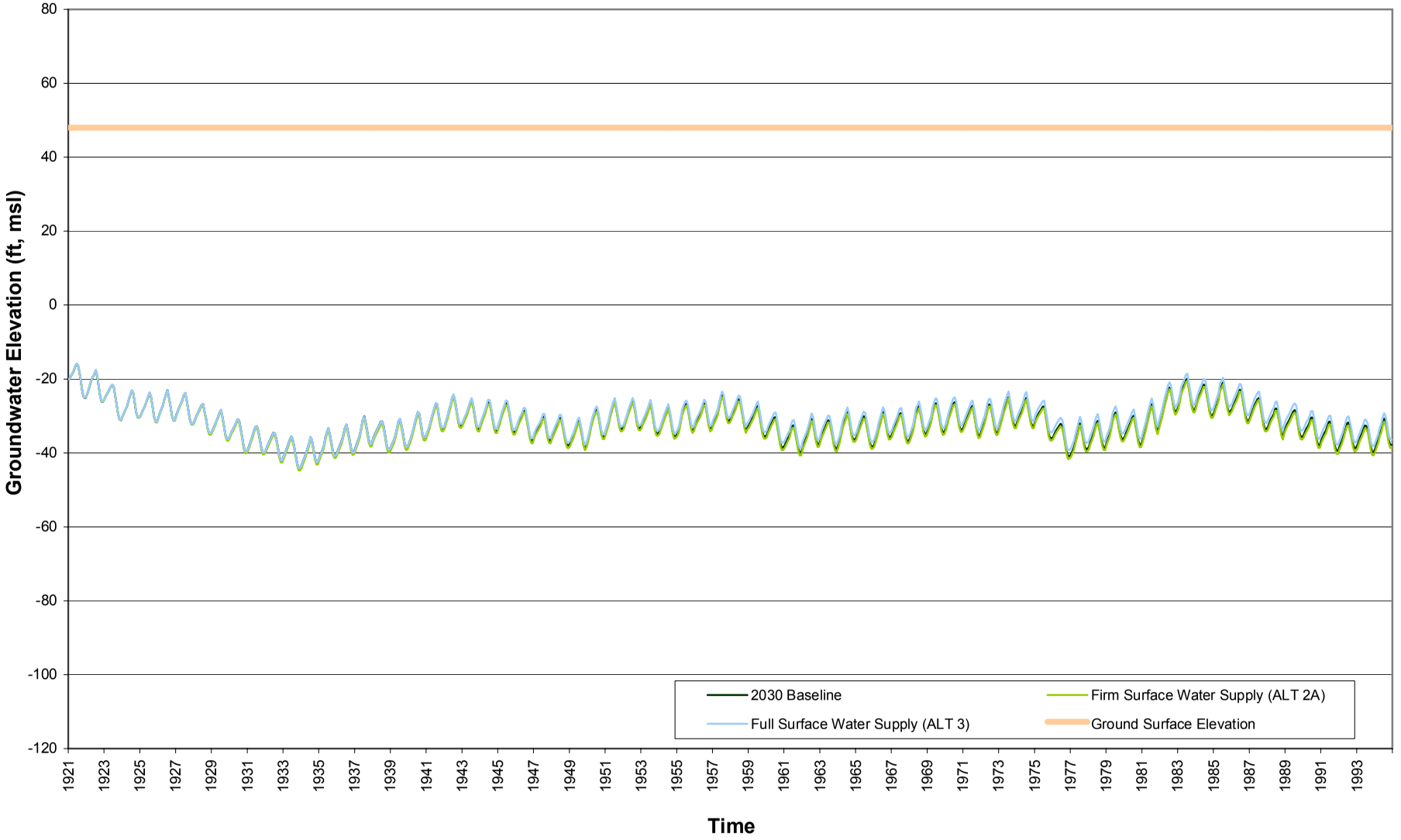

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Figure C.19
Groundwater Hydrograph at Galt Area (Location S)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

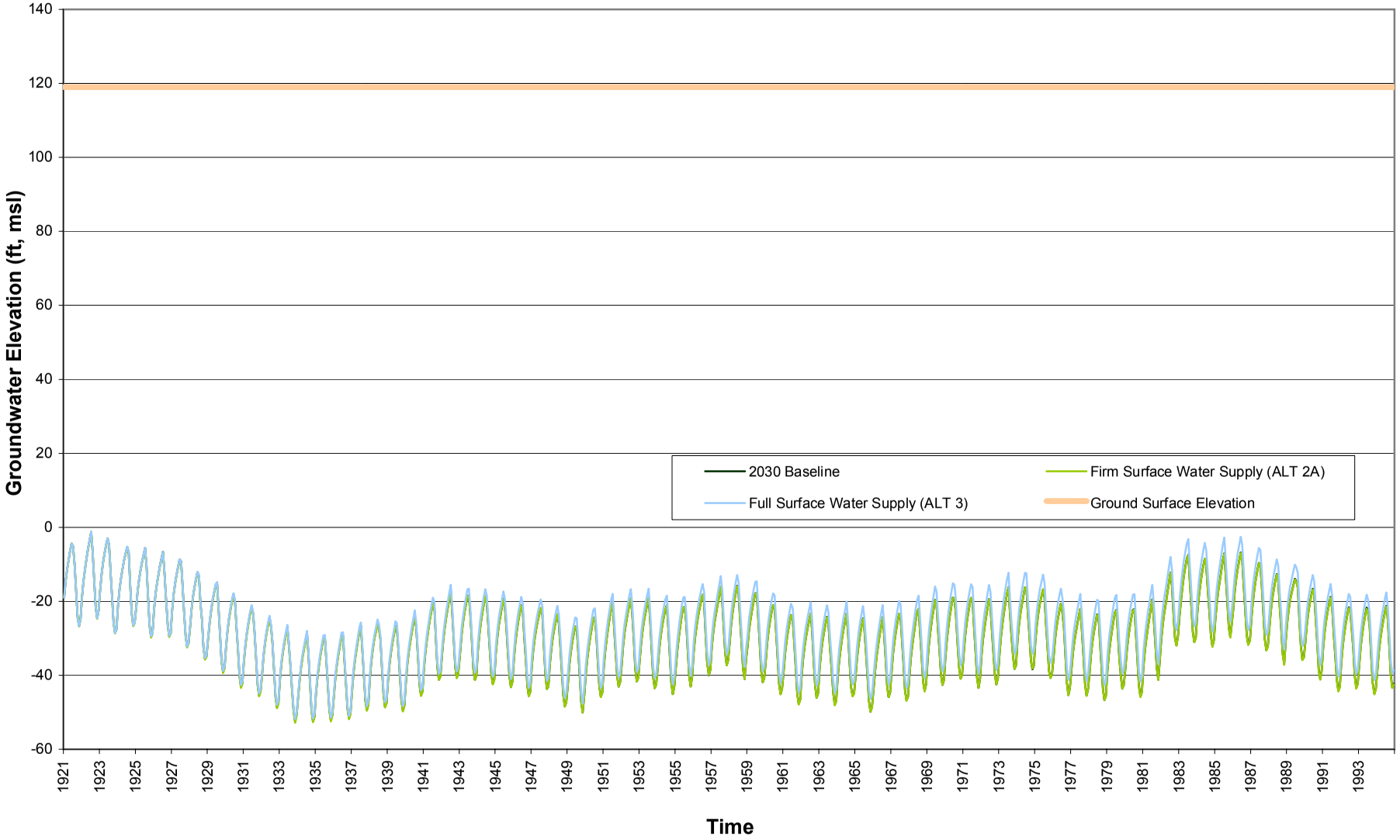

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Figure C.20
Groundwater Hydrograph at West of Grantline Road (Location T)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

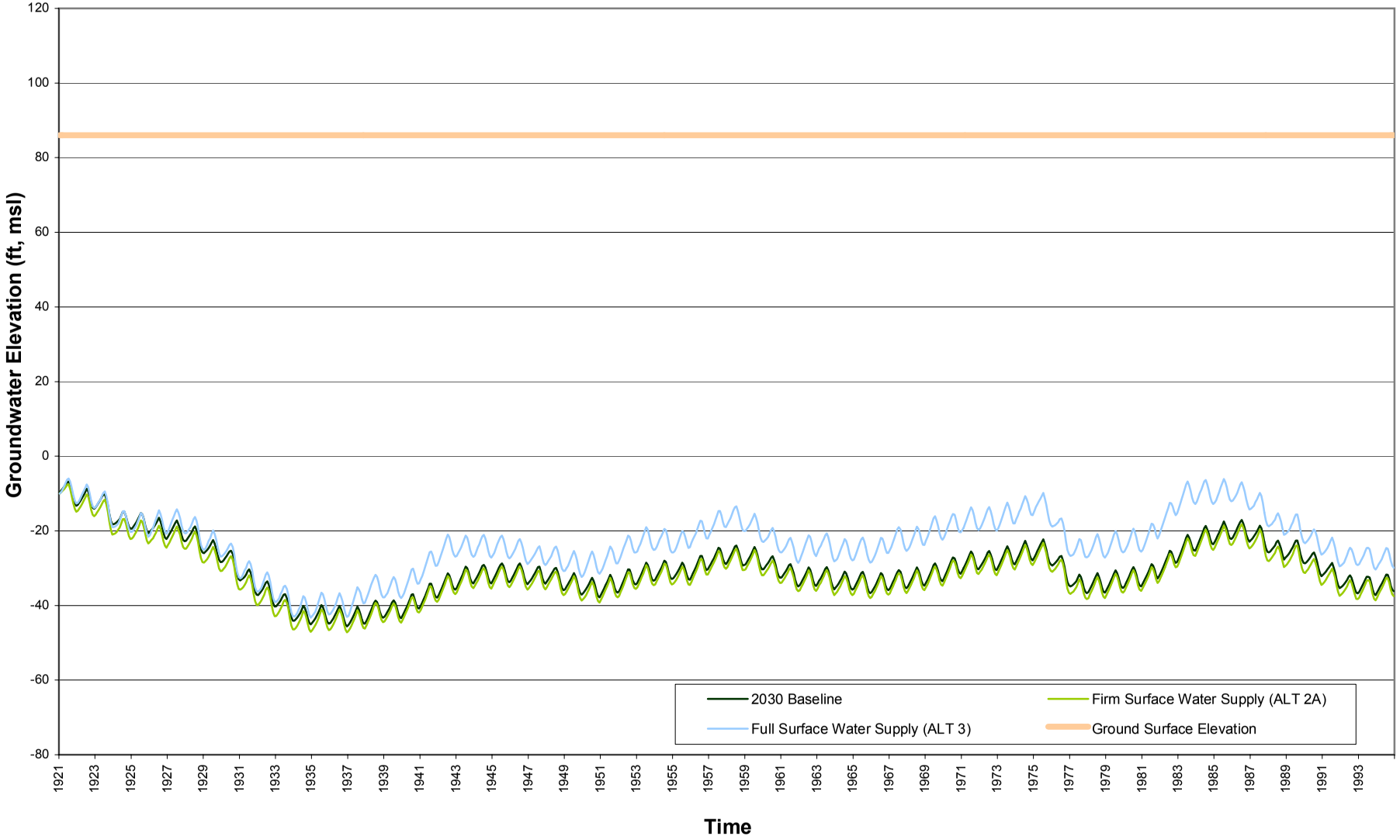

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Figure C.21
Groundwater Hydrograph at Middle of Cosumnes River (Location U)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

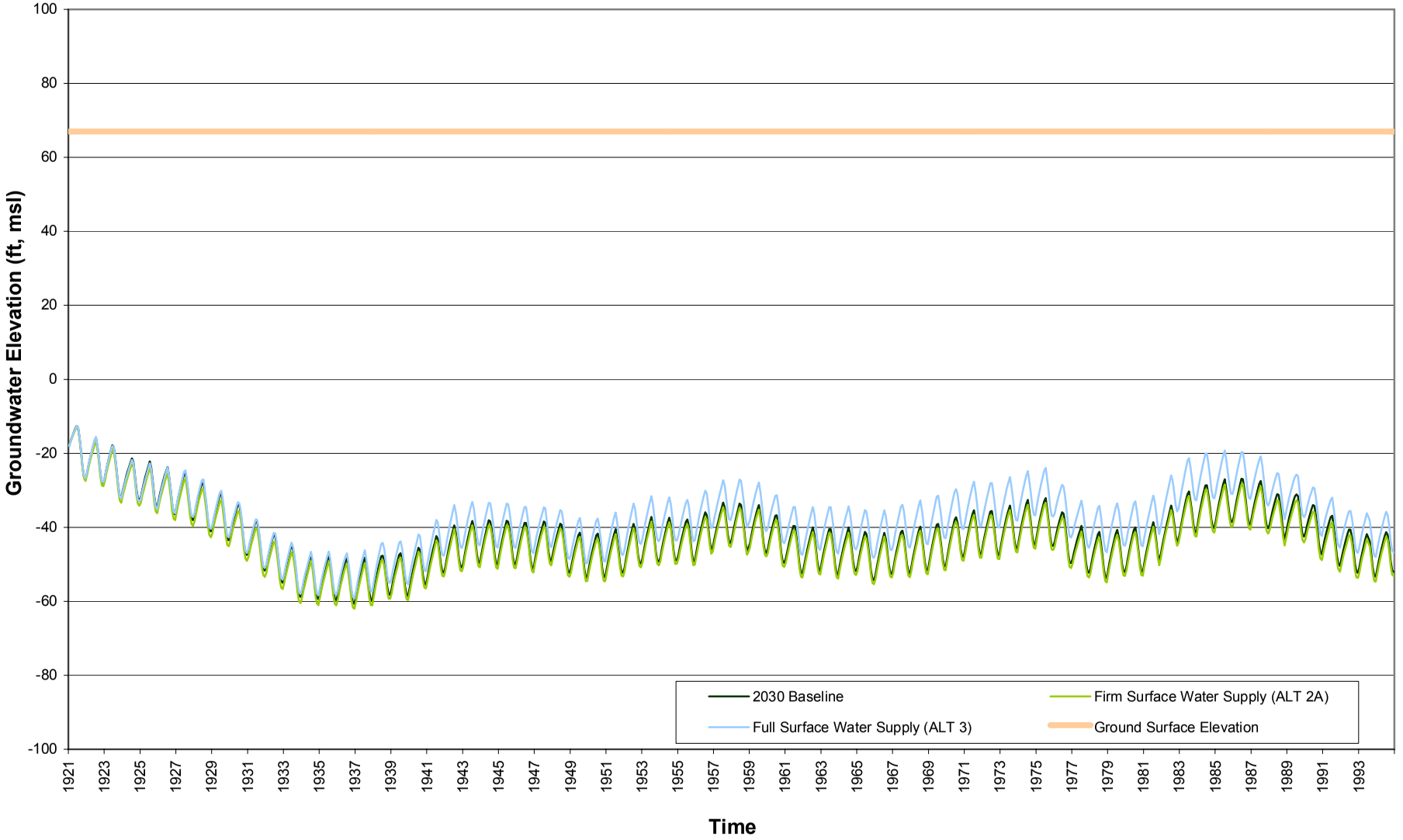

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Figure C.22
Groundwater Hydrograph at Galt - Cone of Depression (Location V)
for 2030 Baseline, Alternative 2A and Alternative 3 Conditions

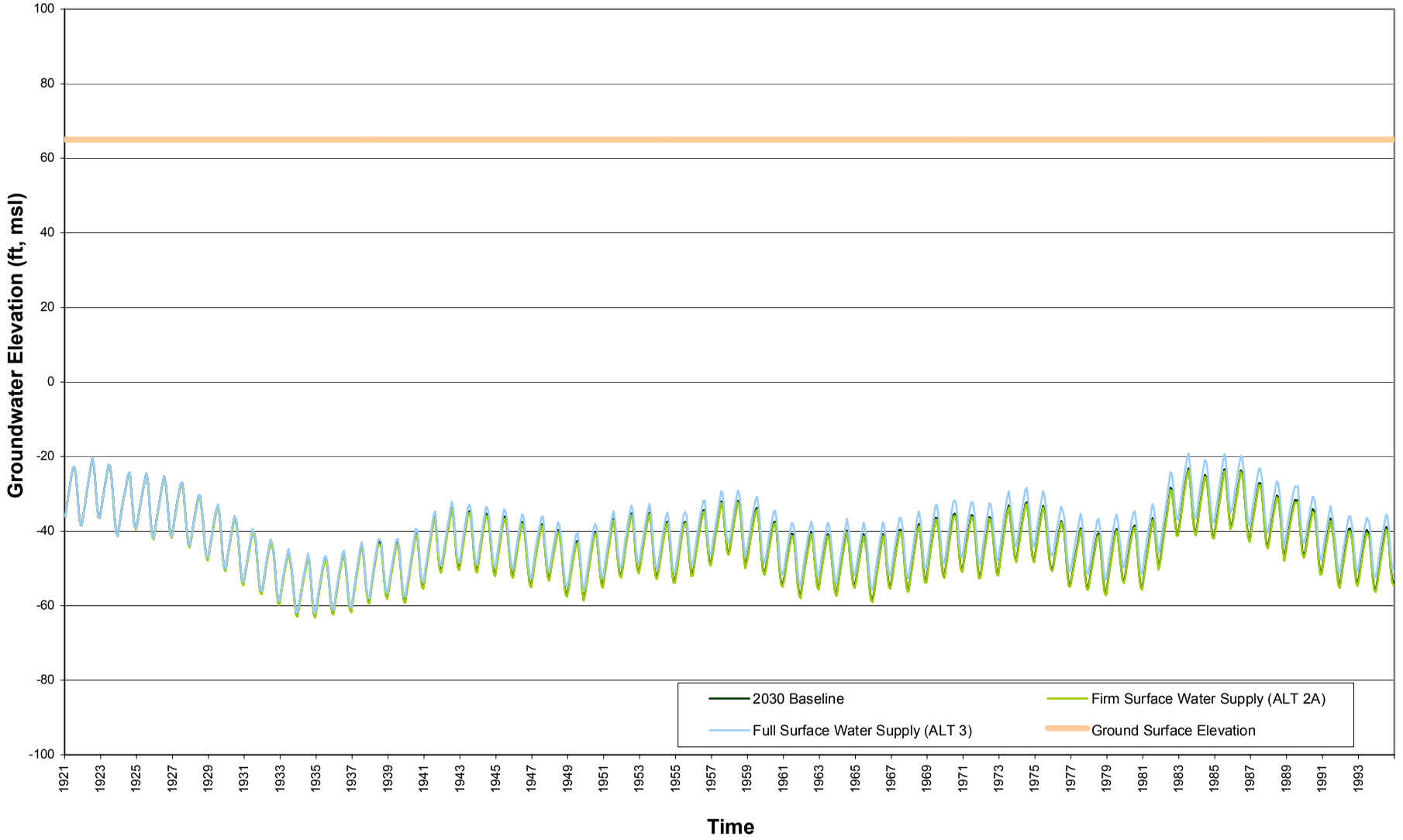

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Figure C.23
Stream Hydrograph at American River near Fair Oaks (Location S1)
for 2030 Baseline and Alternatives 2A and 3 Conditions

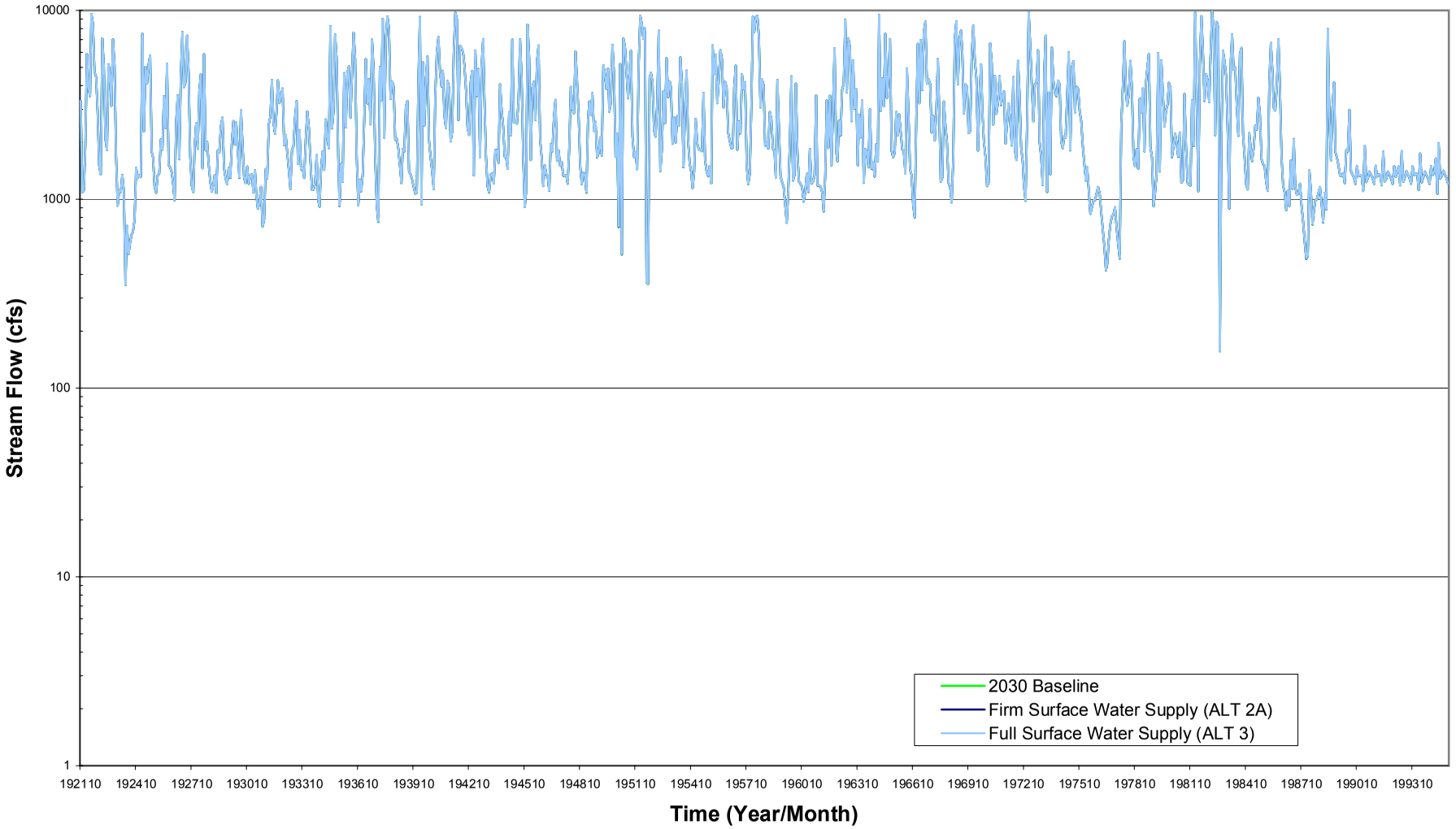

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Figure C.24
Stream Hydrograph at American River near H Street (Location S2)
for 2030 Baseline and Alternatives 2A and 3 Conditions

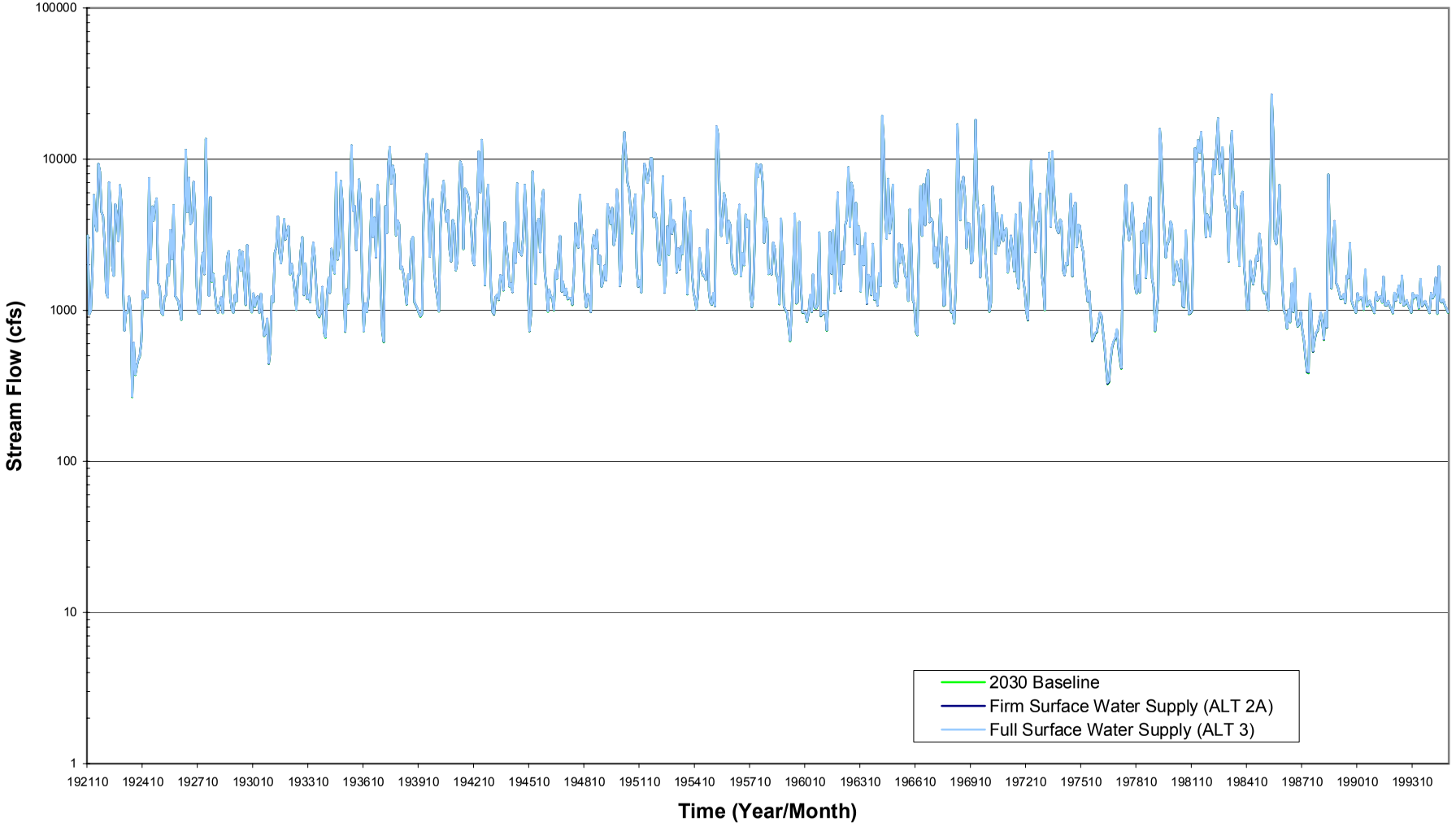

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Figure C.25
Stream Hydrograph at Cosumnes River near Michigan Bar (Location S3)
for 2030 Baseline and Alternatives 2A and 3 Conditions

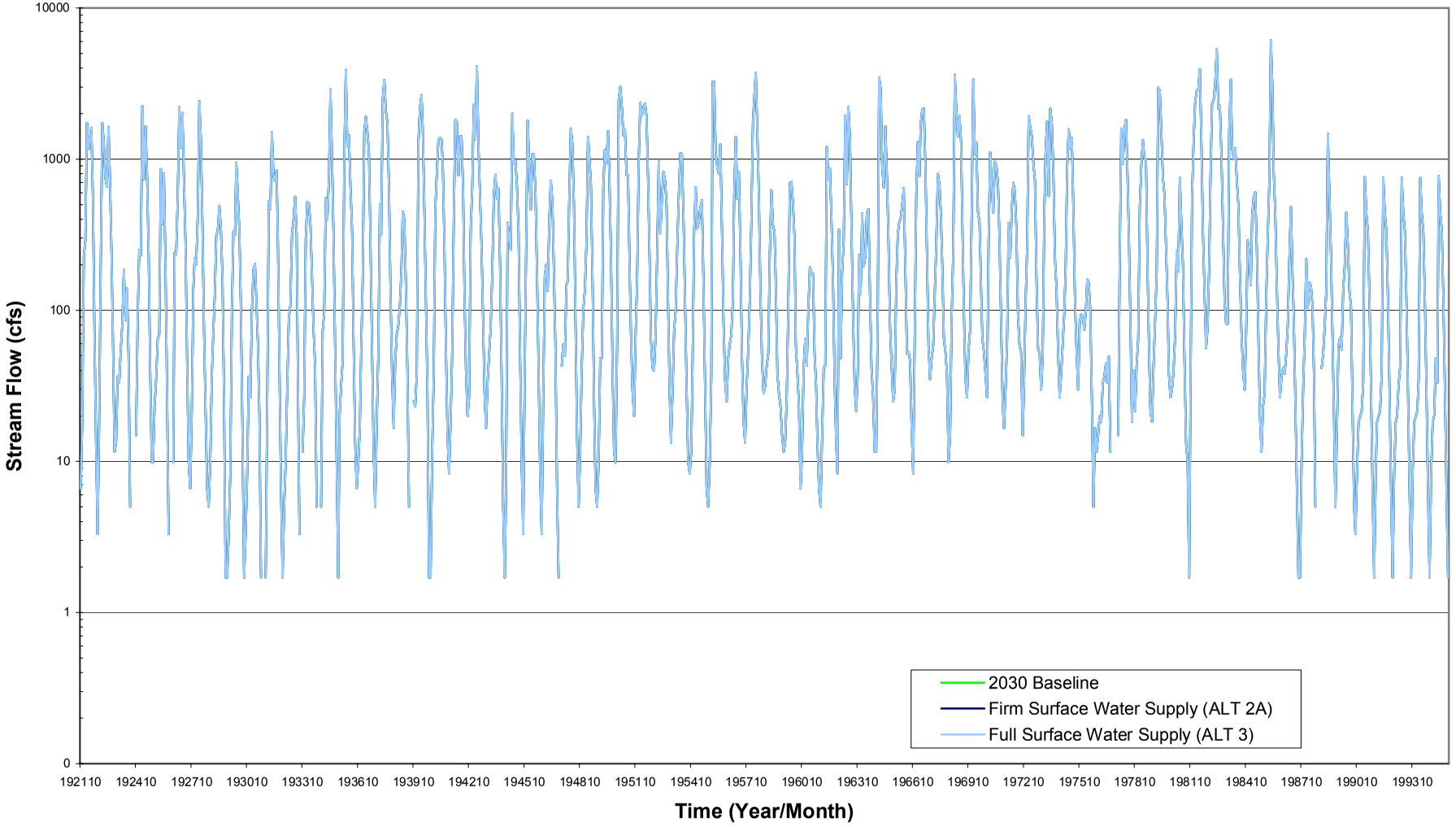

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Figure C.26
Stream Hydrograph at Cosumnes River near Folsom South Canal (Location S4)
for 2030 Baseline and Alternatives 2A and 3 Conditions

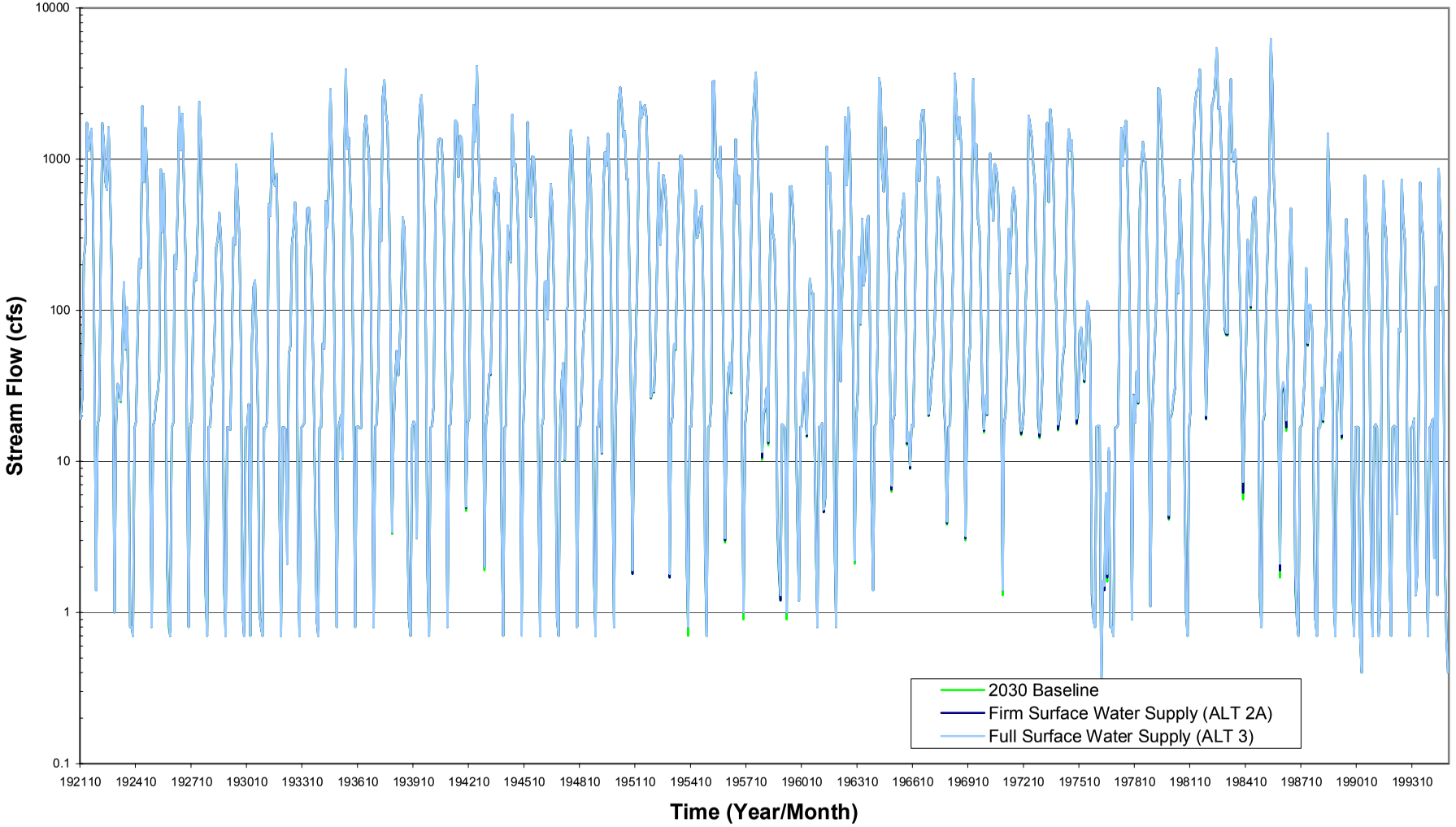

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Figure C.27
Stream Hydrograph at Cosumnes River near Highway 99 (Location S5)
for 2030 Baseline and Alternatives 2A and 3 Conditions

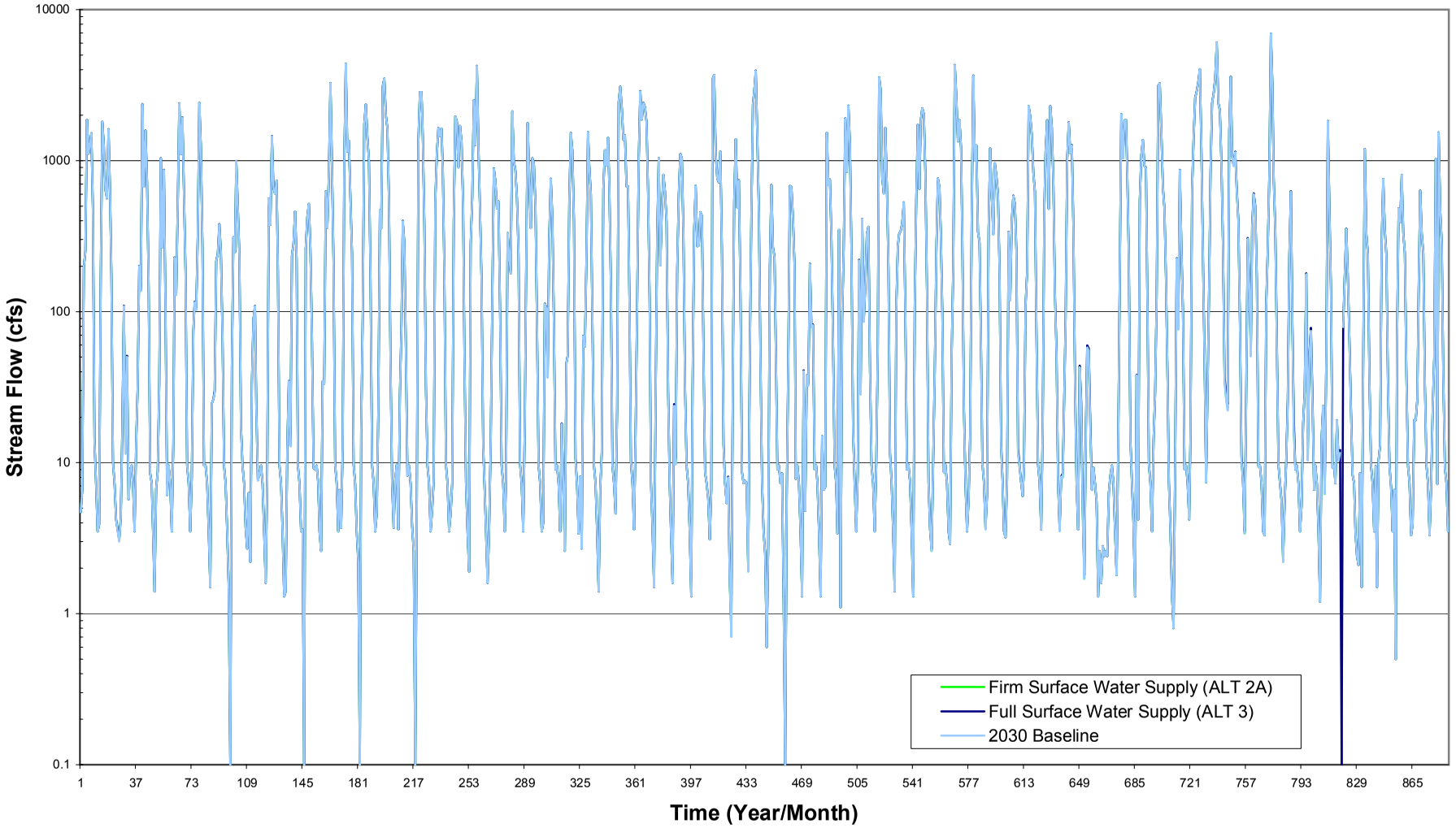

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Figure C.28
Stream Hydrograph at Cosumnes River near Twin Cities Road (Location S6)
for 2030 Baseline and Alternatives 2A and 3 Conditions

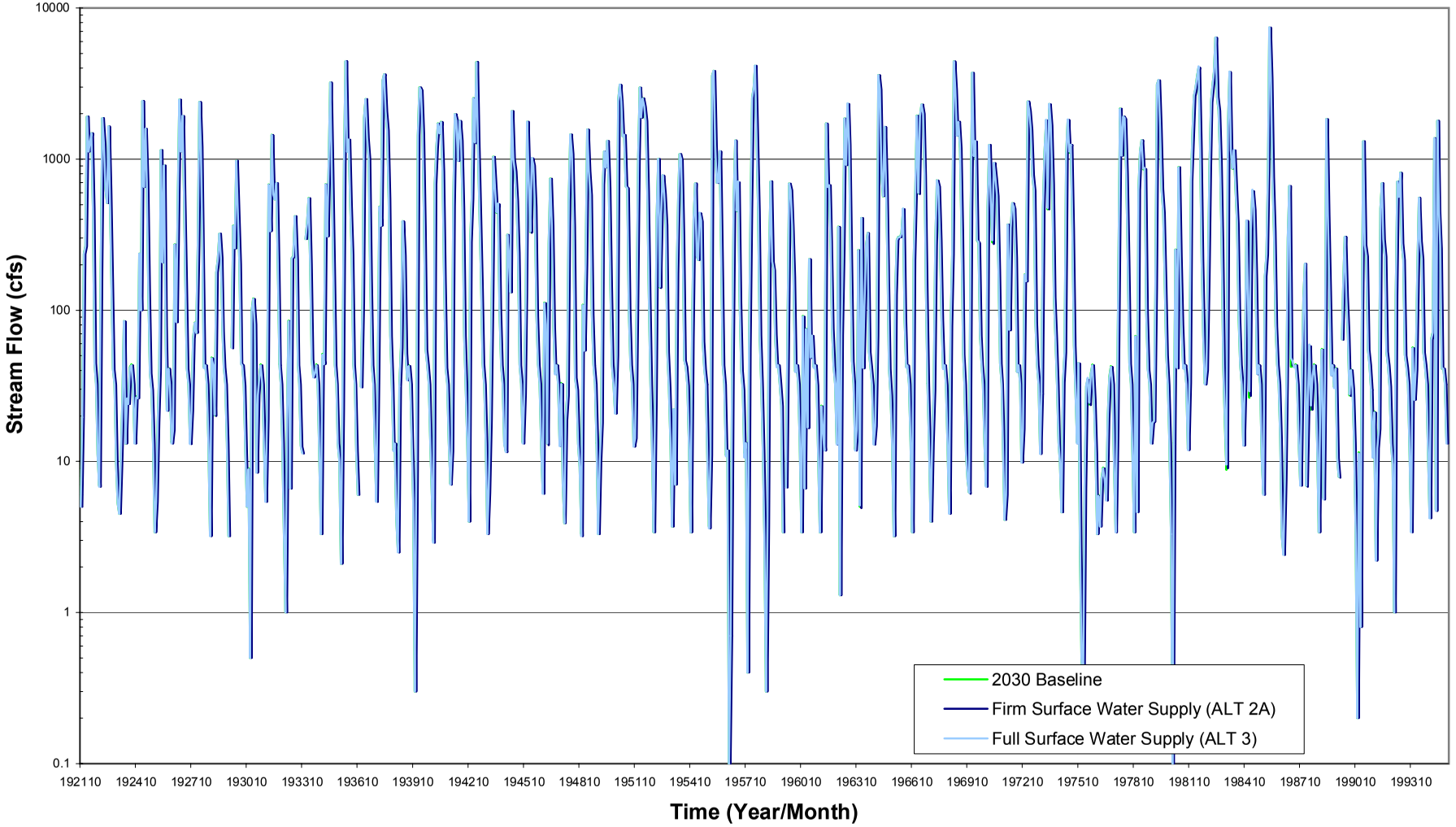

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Figure C.29
Monthly Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

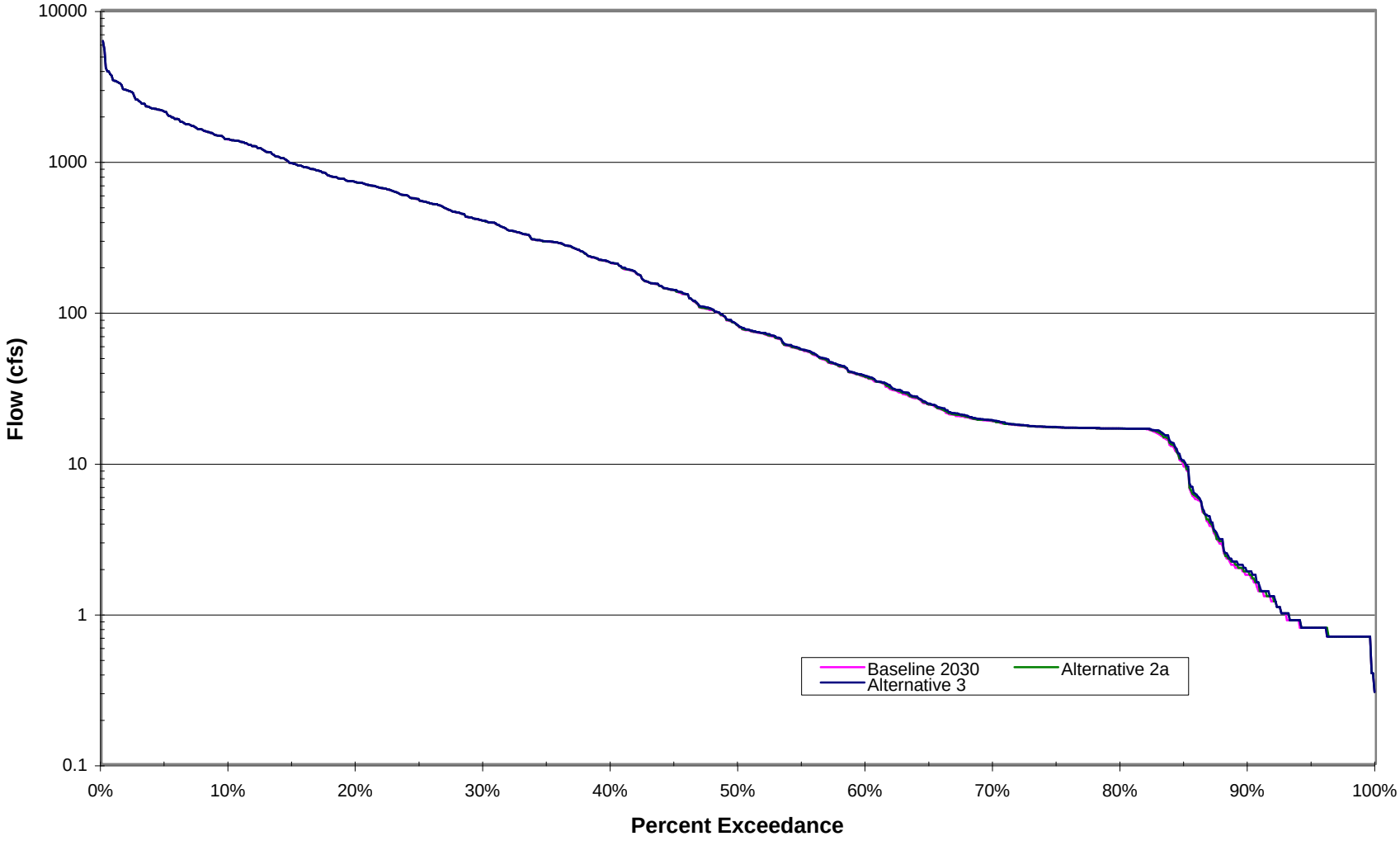


Figure C.30
August Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

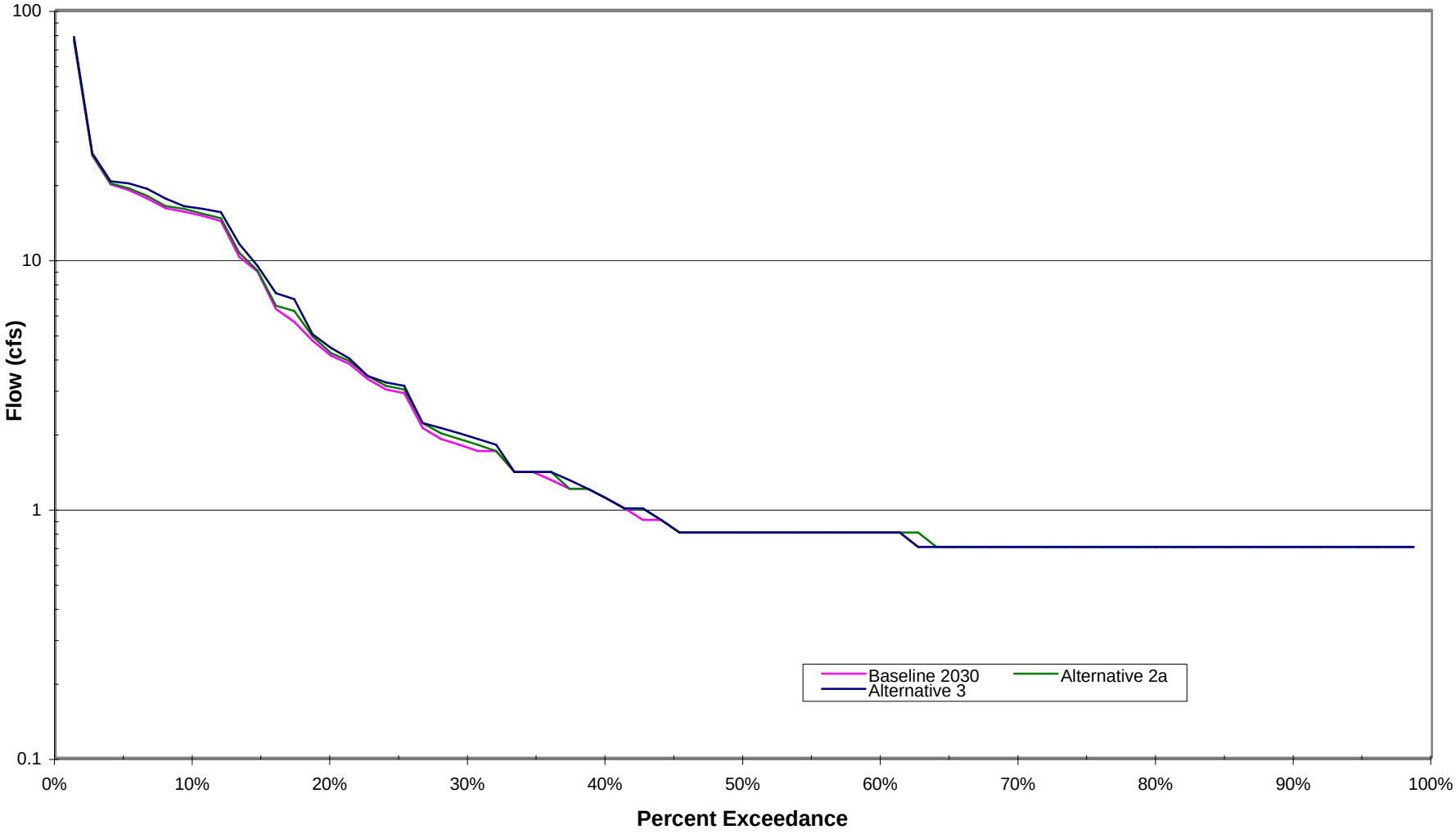


Figure C.31
September Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

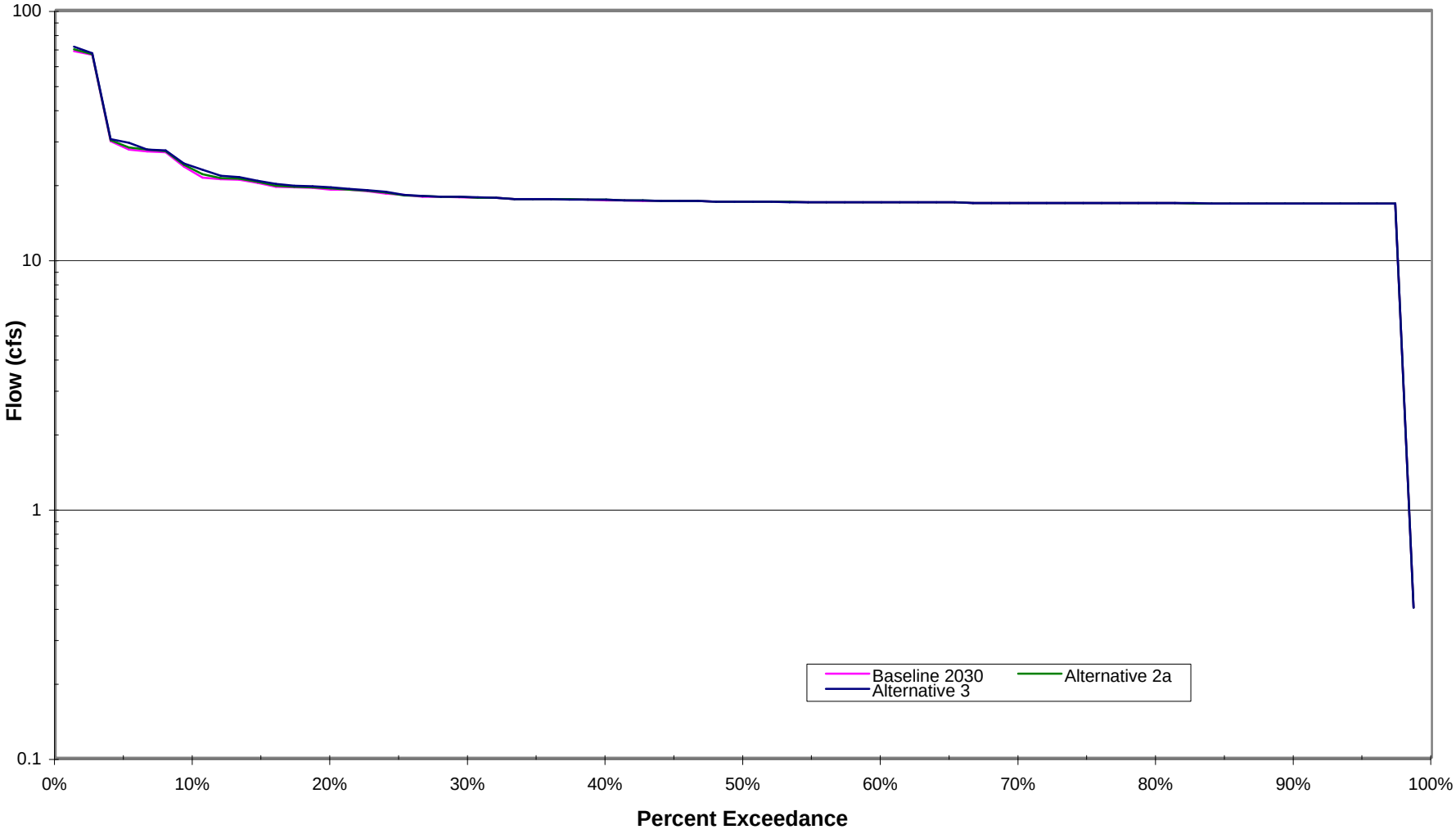


Figure C.32
October Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

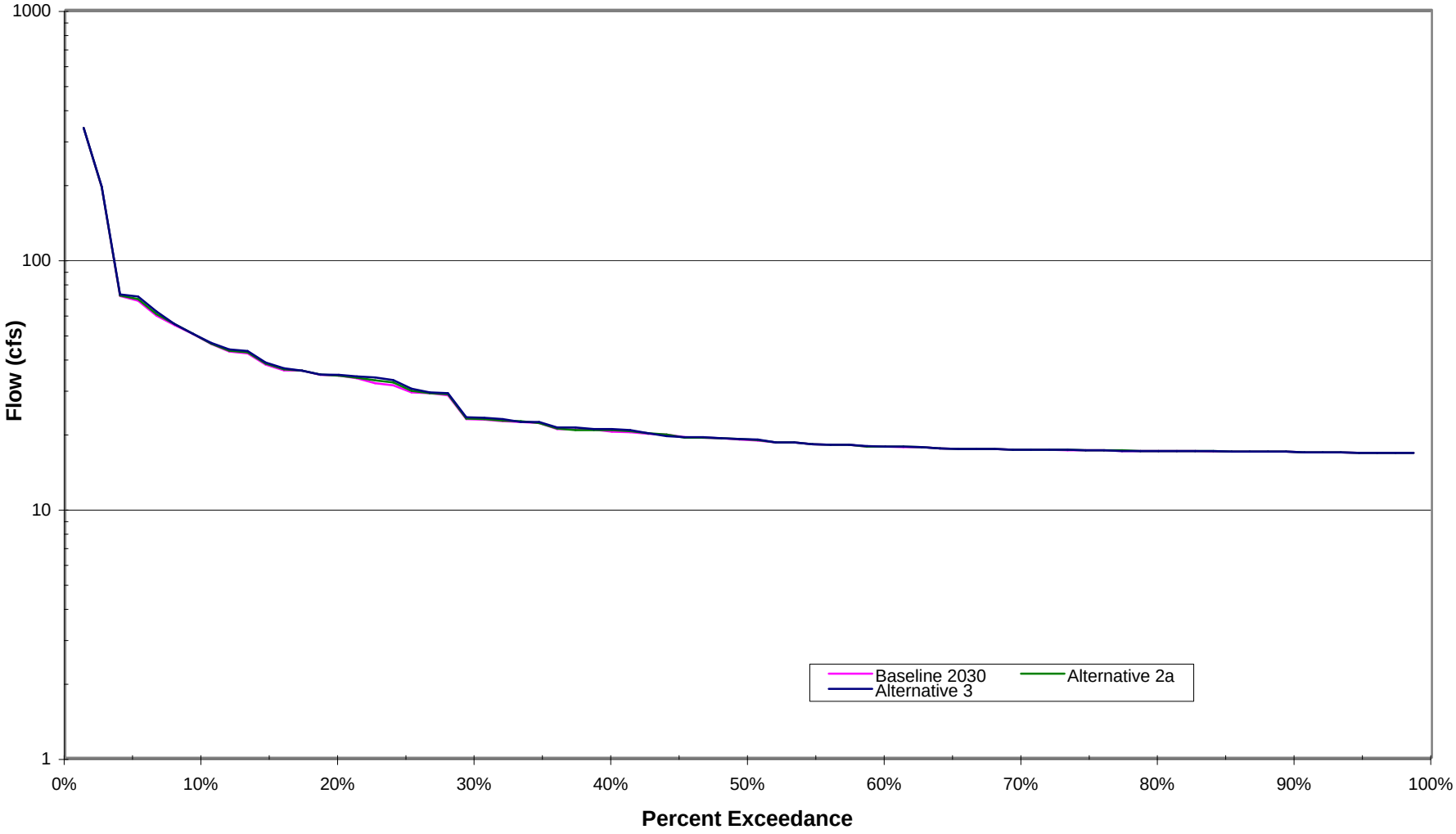


Figure C.33
November Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

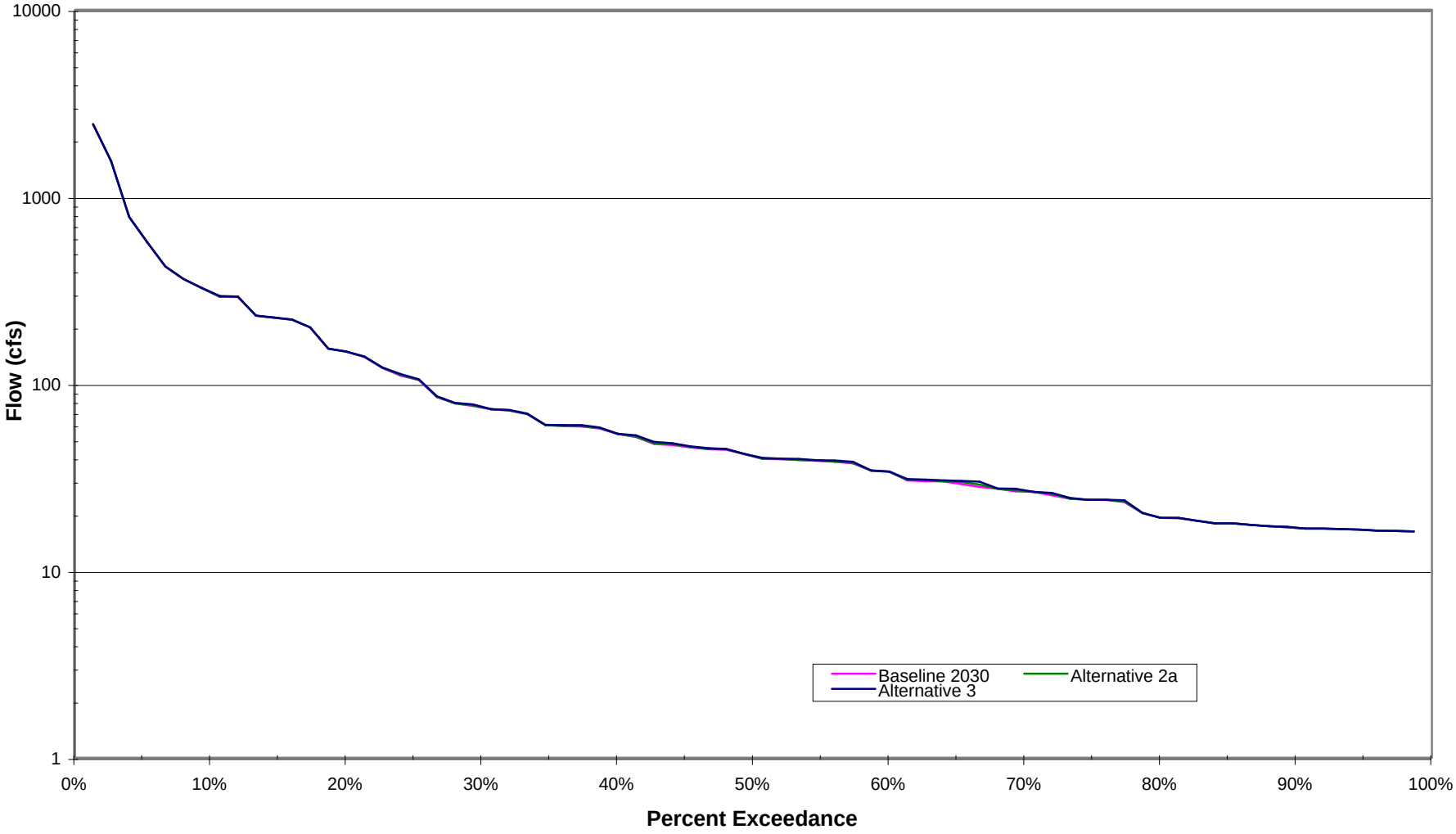


Figure C.34
Monthly Cosumnes River Flow Exceedance Probability
Near Highway 99

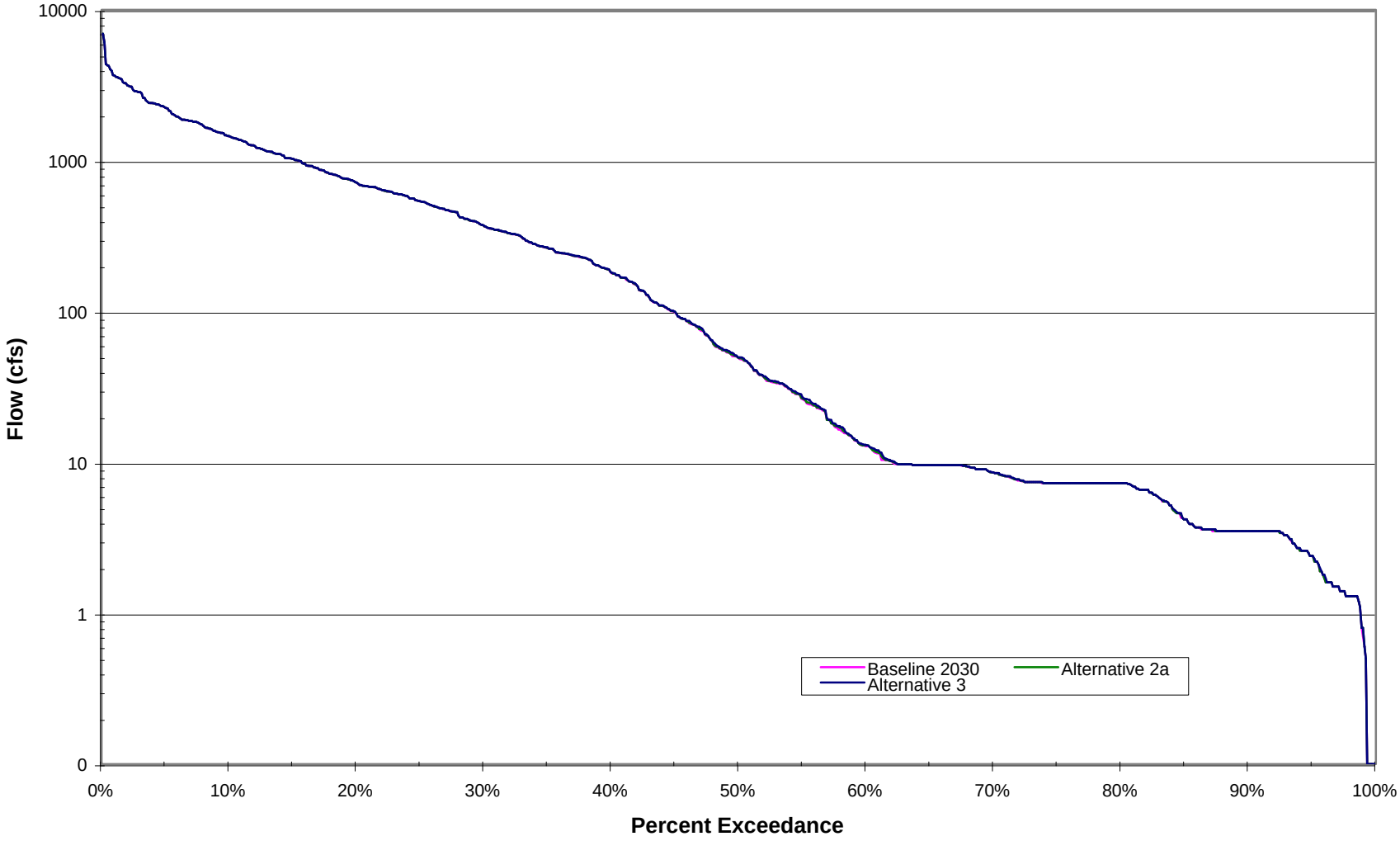


Figure C.35
August Cosumnes River Flow Exceedance Probability
Near Highway 99

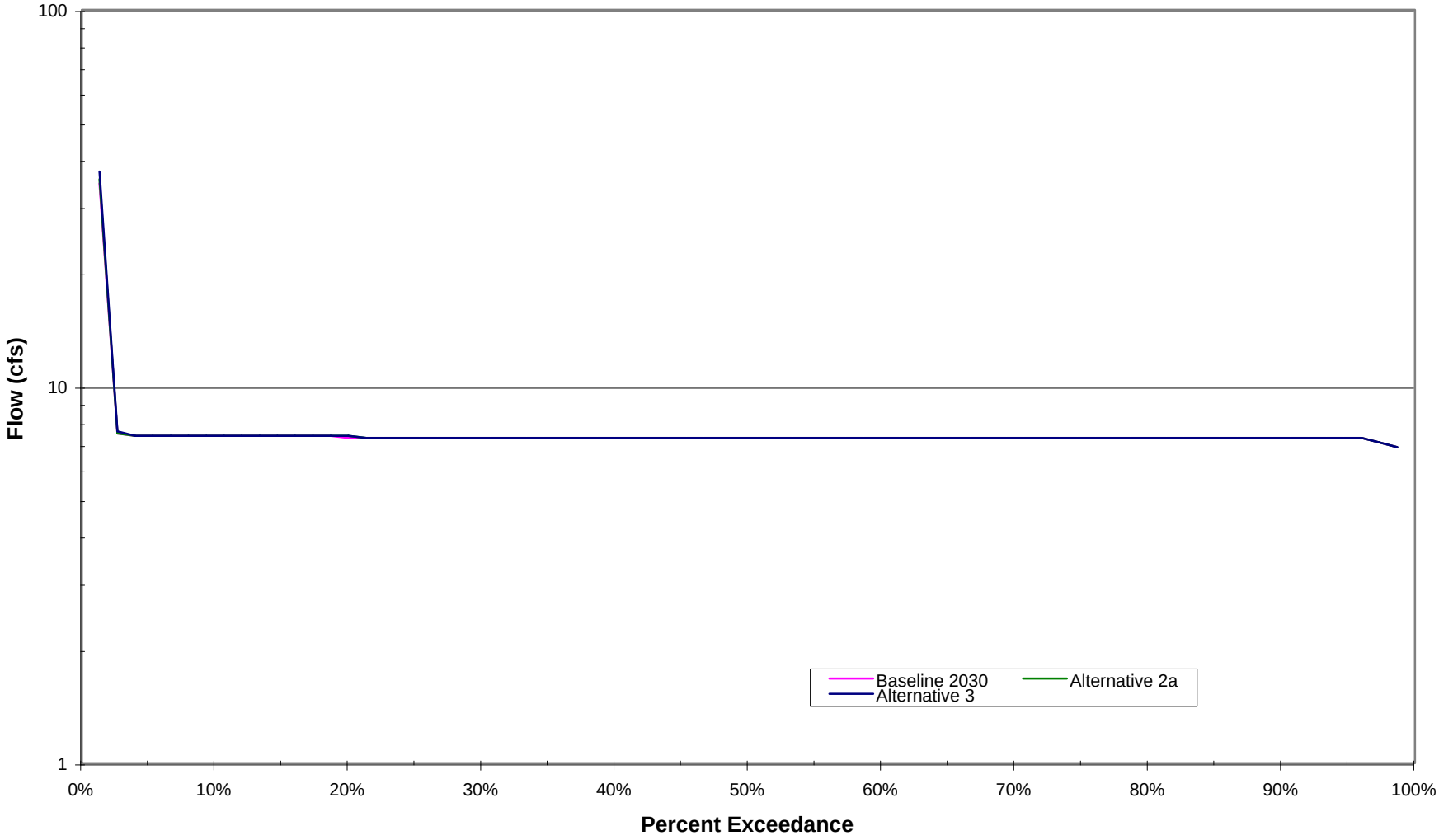


Figure C.36
September Cosumnes River Flow Exceedance Probability
Near Highway 99

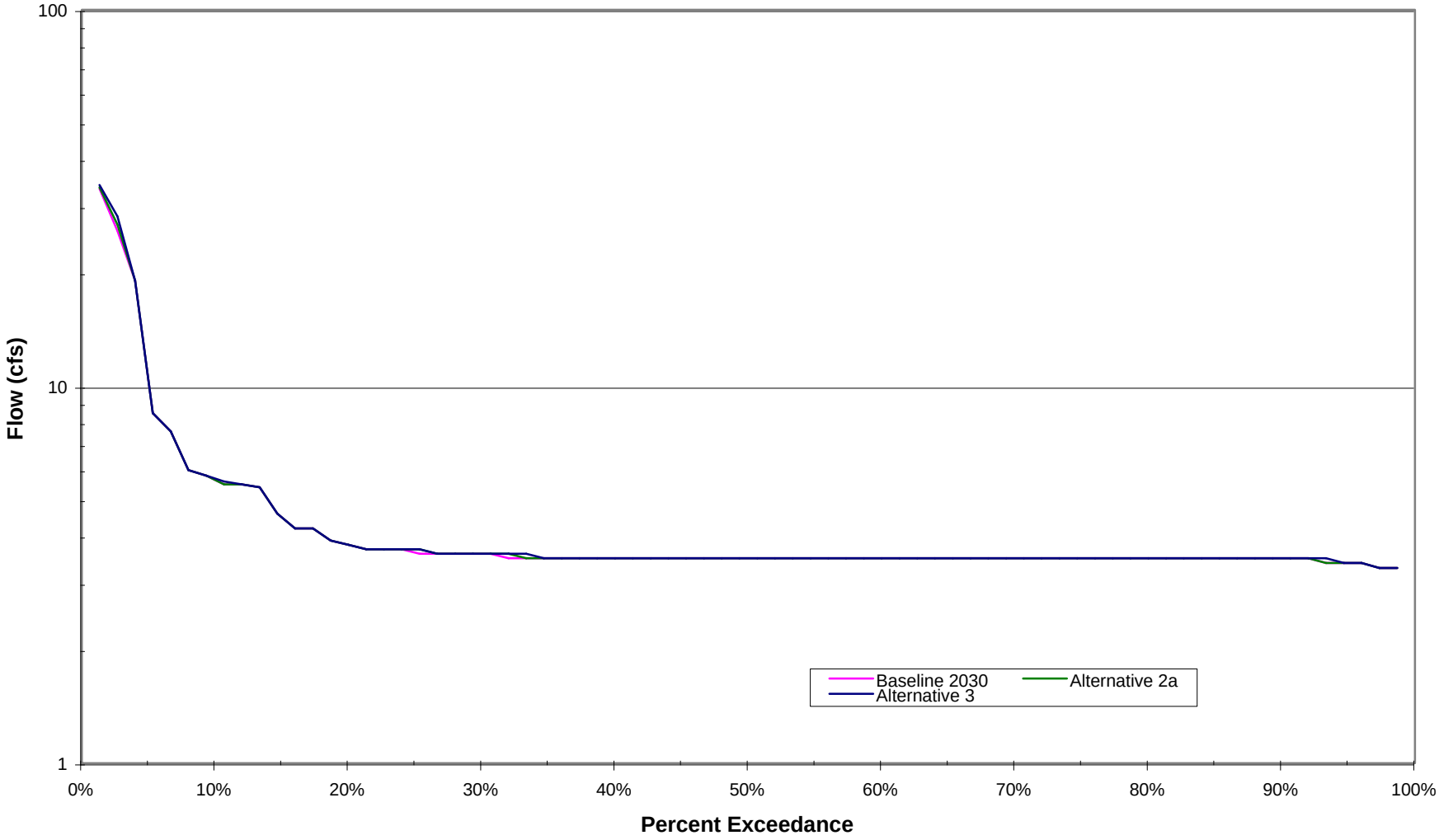


Figure C.37
October Cosumnes River Flow Exceedance Probability
Near Highway 99

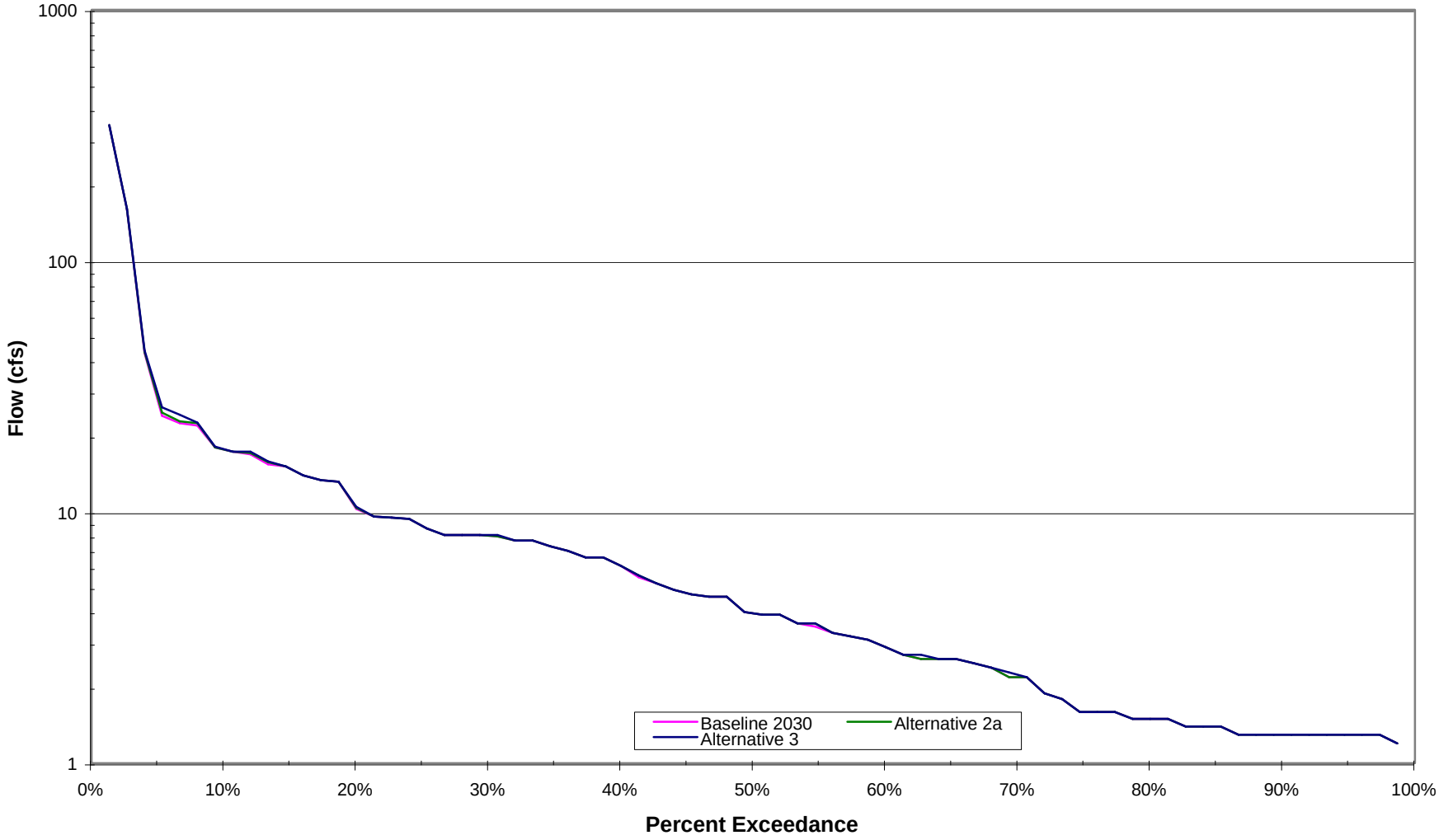
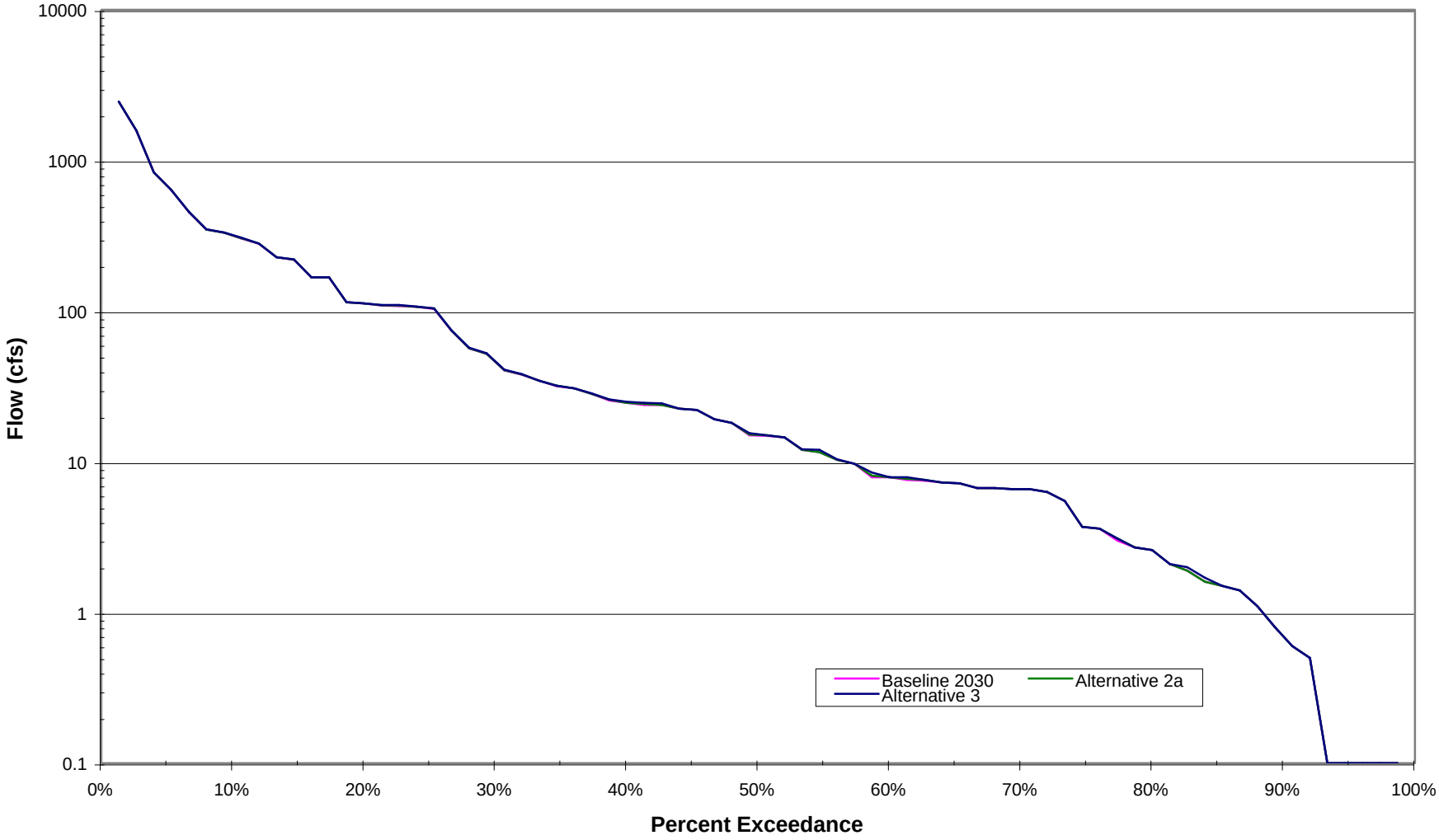


Figure C.38
November Cosumnes River Flow Exceedance Probability
Near Highway 99



APPENDIX D GROUNDWATER REMEDIATION/REUSE ALTERNATIVES HYDROGRAPHS

Figure D.1
Groundwater Hydrograph at North Area Groundwater Depression (Location A)
for Alternatives 4A, 4B, 2B, and 2C Conditions

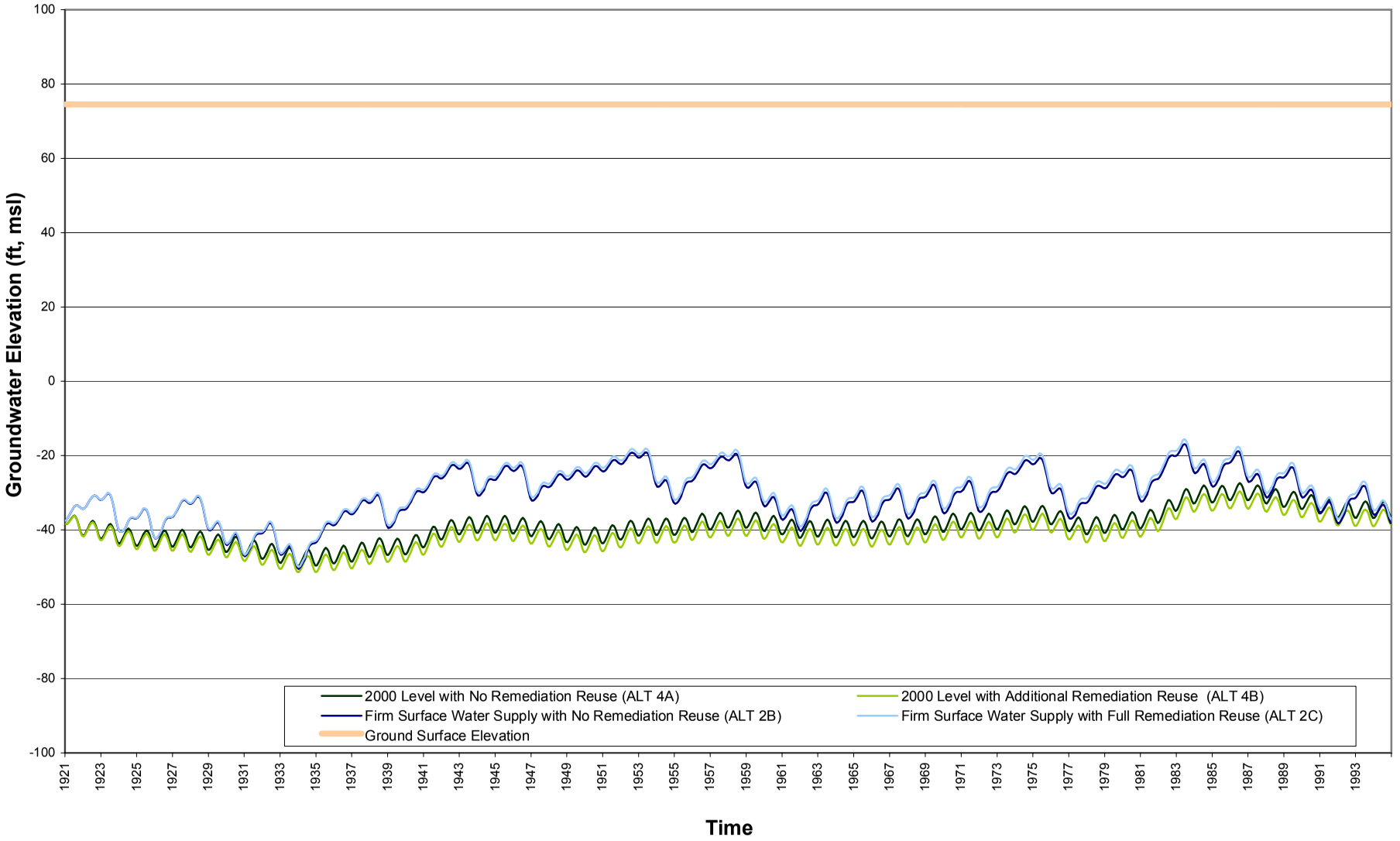


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Figure D.2
Groundwater Hydrograph at City of Sacramento North (Location B)
for Alternatives 4A, 4B, 2B, and 2C Conditions

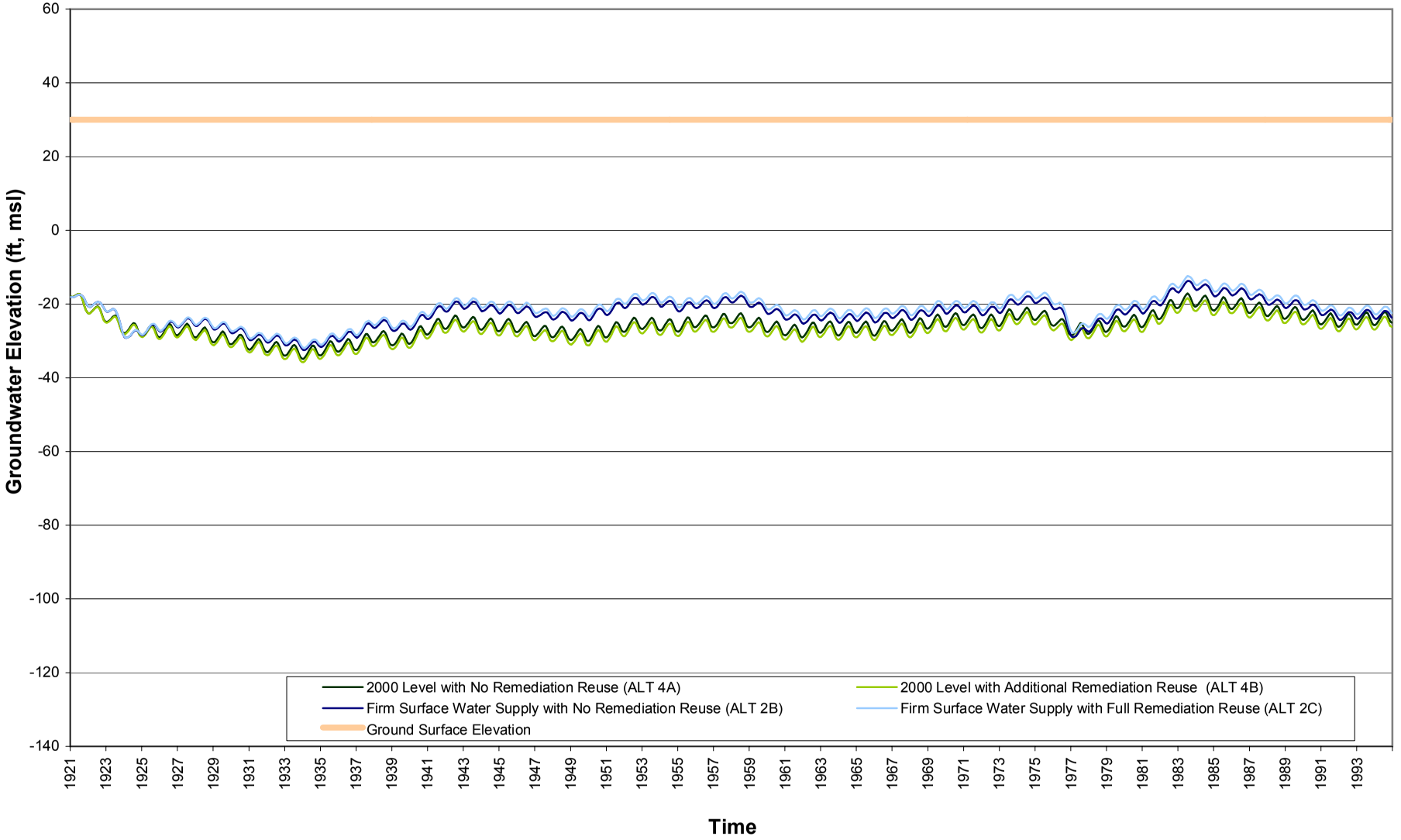

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Figure D.3
Groundwater Hydrograph near Fair Oaks along American River (Location C)
for Alternatives 4A, 4B, 2B, and 2C Conditions

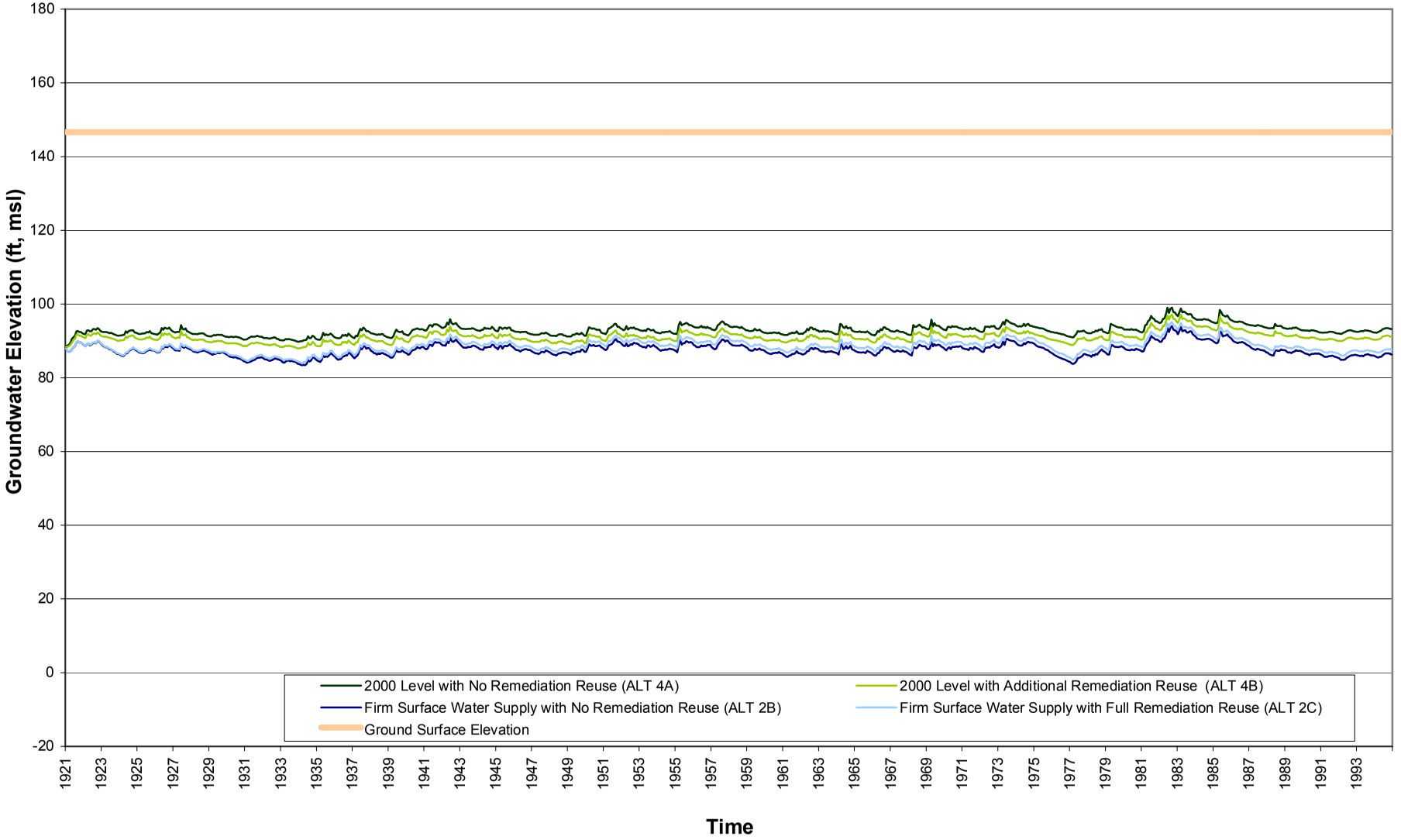

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Figure D.4
Groundwater Hydrograph near H Street along American River (Location D)
for Alternatives 4A, 4B, 2B, and 2C Conditions

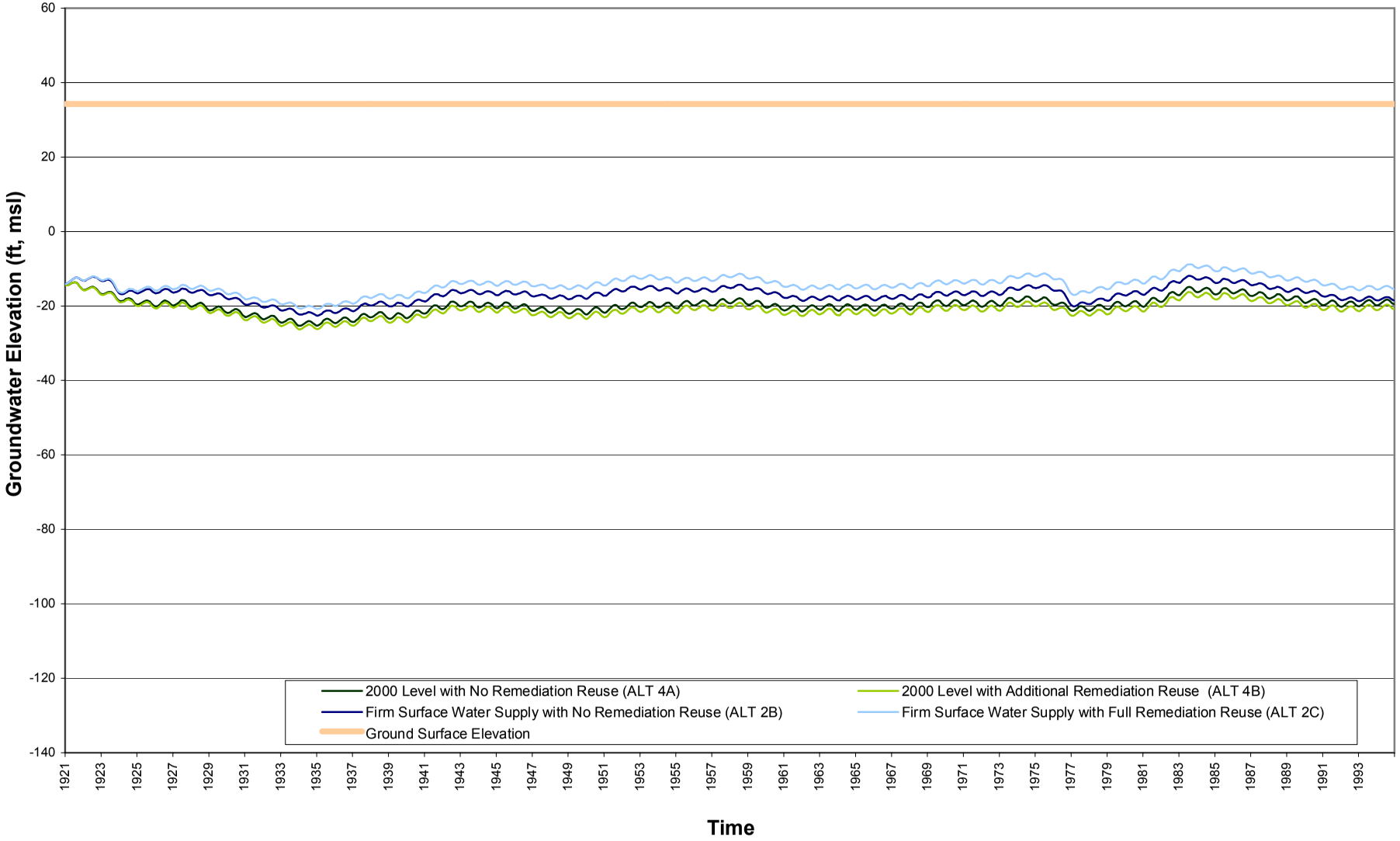

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Figure D.5
Groundwater Hydrograph near Carmichael W.D. along American River (Location E)
for Alternatives 4A, 4B, 2B, and 2C Conditions

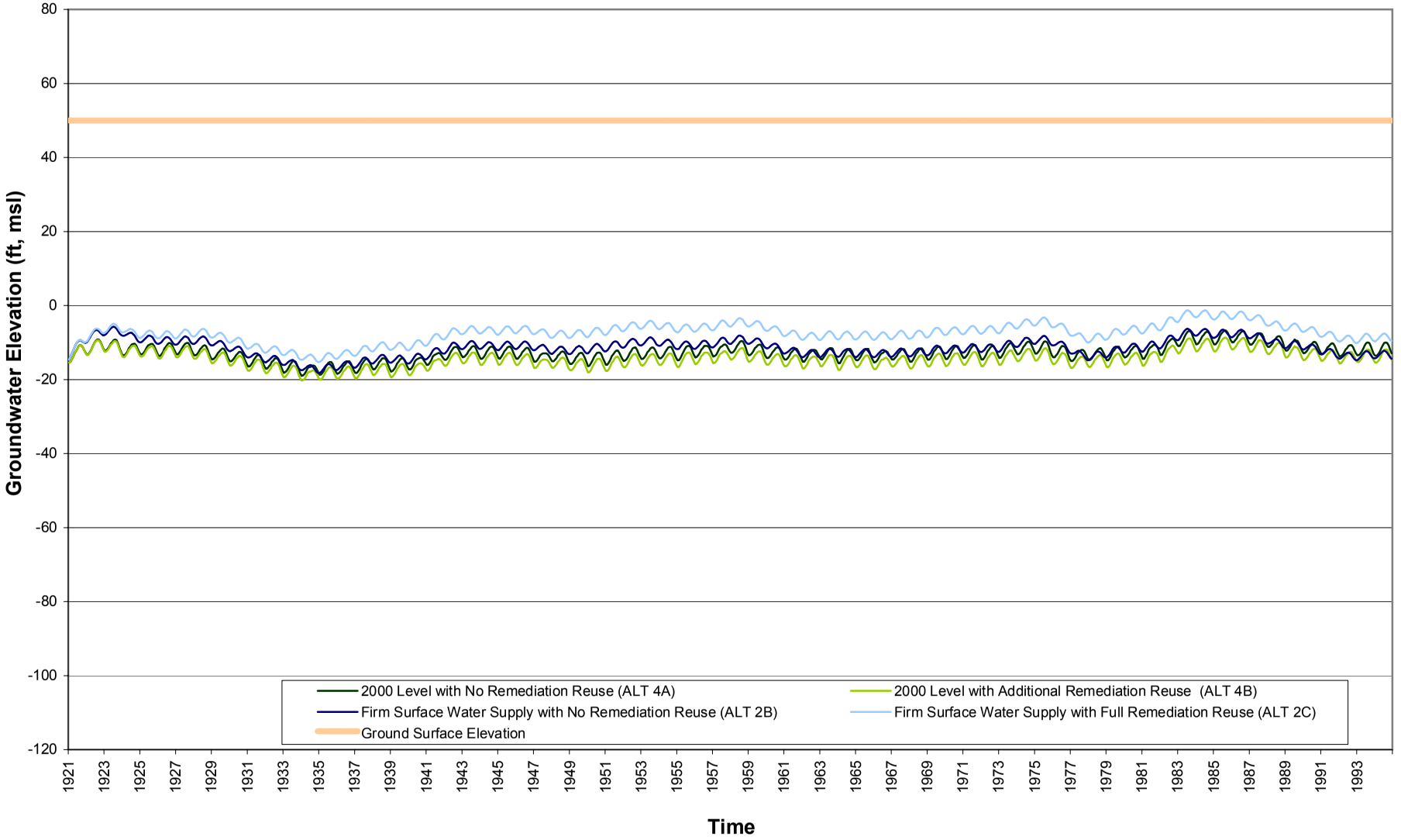

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Figure D.6
Groundwater Hydrograph at Aerojet/Boeing (Location F)
for Alternatives 4A, 4B, 2B, and 2C Conditions

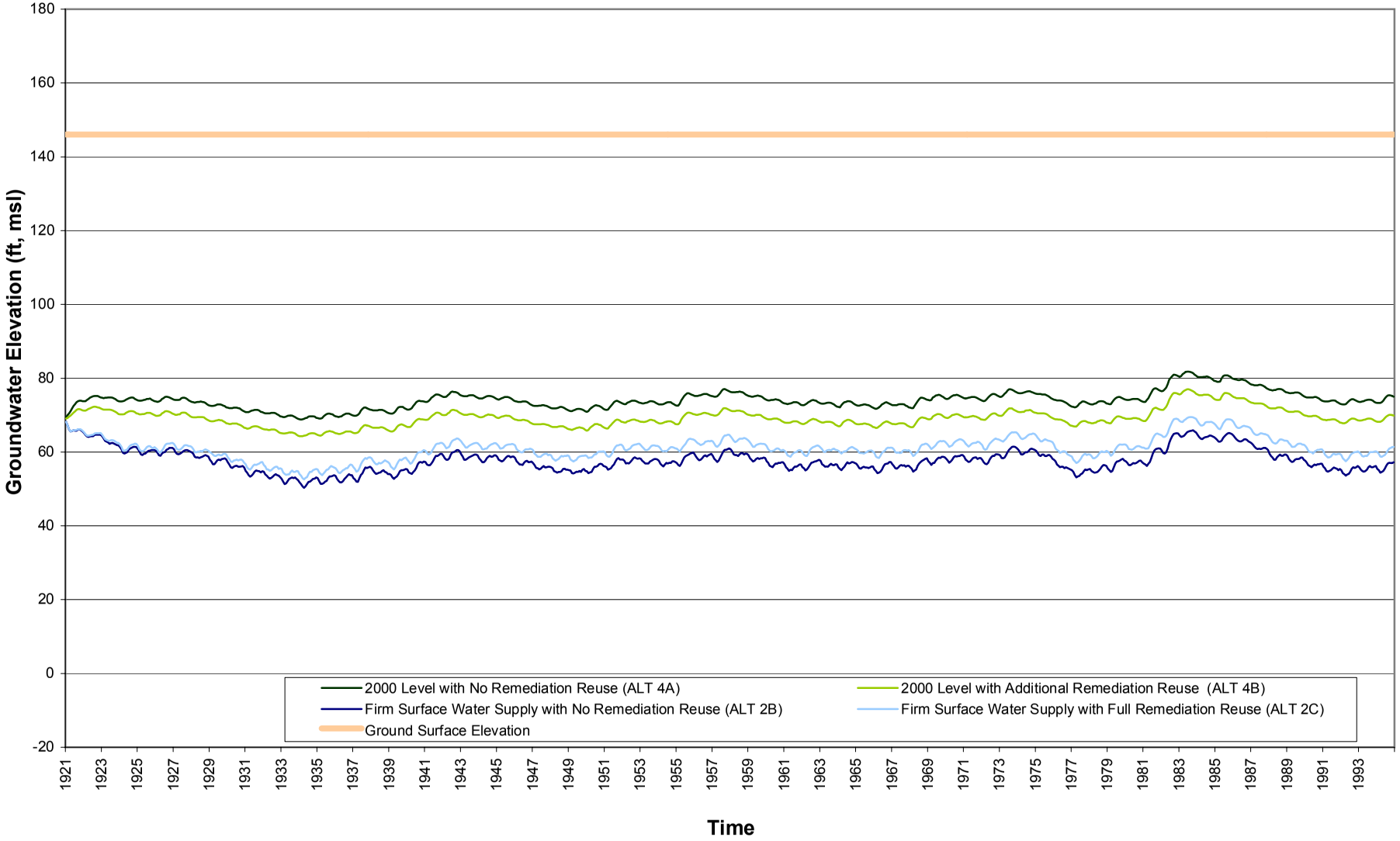

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Figure D.7
Groundwater Hydrograph at City of Sacramento South near Army Depot (Location G)
for Alternatives 4A, 4B, 2B, and 2C Conditions

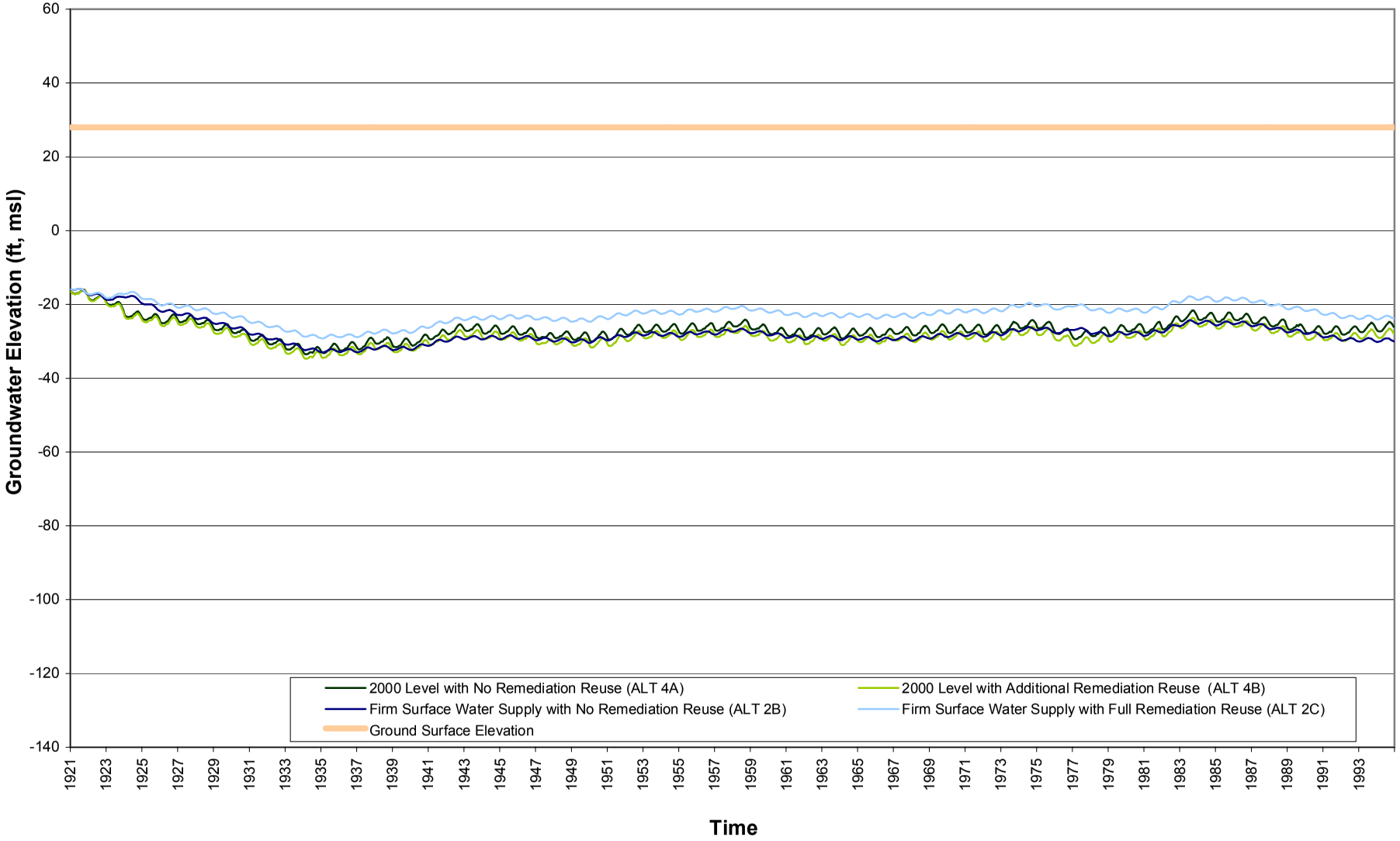

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Figure D.8
Groundwater Hydrograph near Mather Remediation Area (Location H)
for Alternatives 4A, 4B, 2B, and 2C Conditions

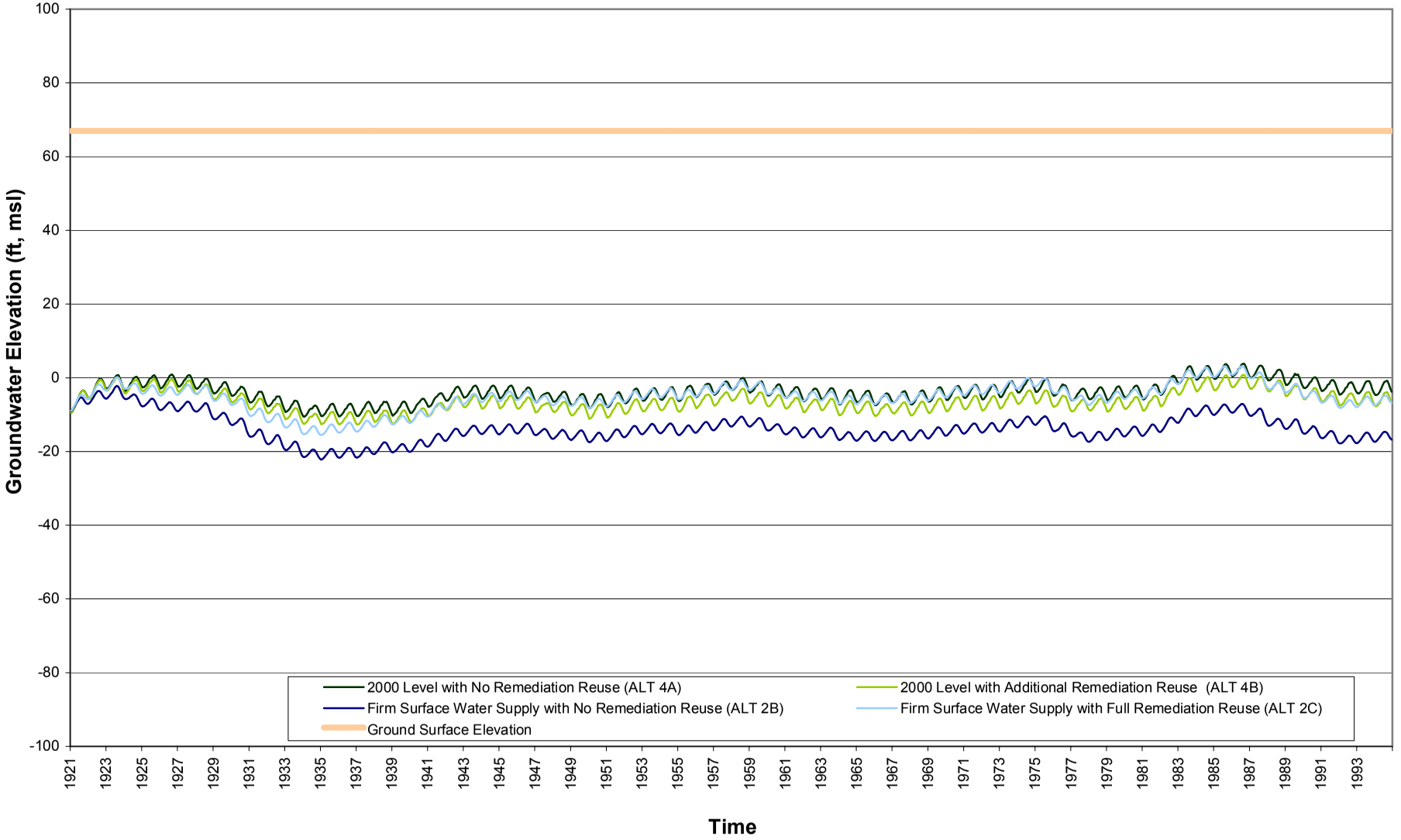

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Figure D.9
Groundwater Hydrograph at Zone 40 Sunrise Area (Location I)
for Alternatives 4A, 4B, 2B, and 2C Conditions

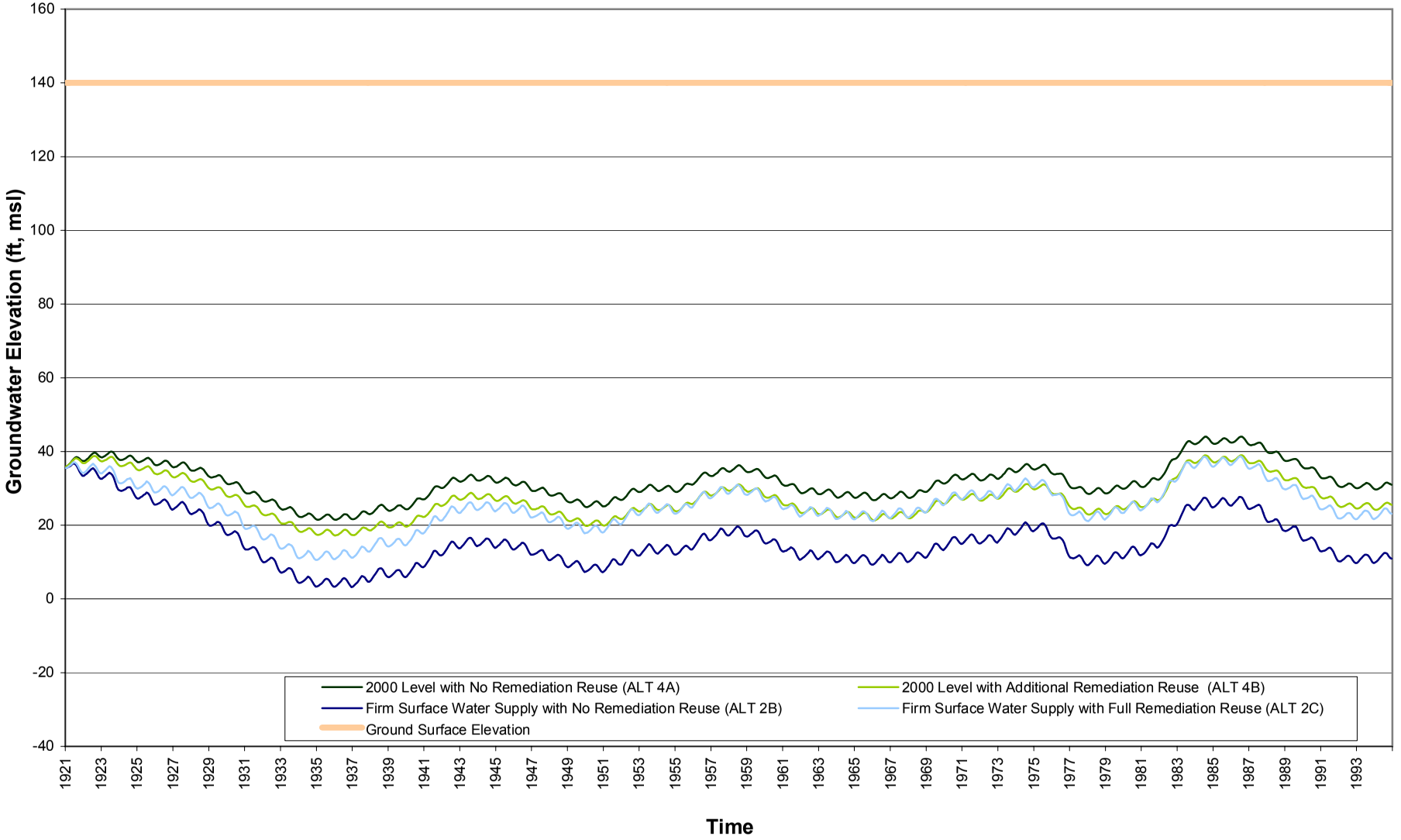

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Figure D.10
Groundwater Hydrograph at Northern Zone 40 (Location J)
for Alternatives 4A, 4B, 2B, and 2C Conditions

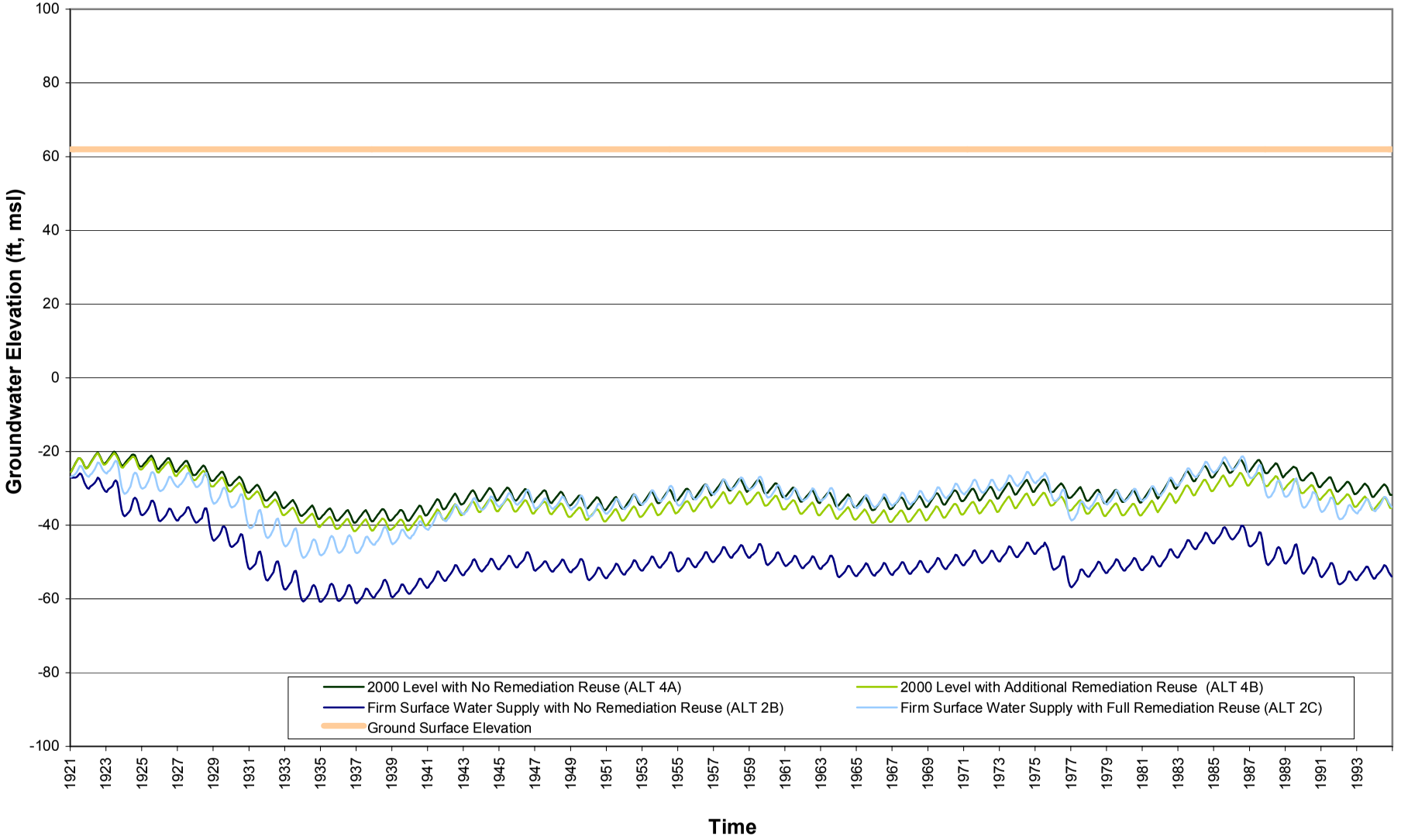

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Figure D.11
Groundwater Hydrograph at Zone 40 near Central Area Groundwater Depression (Location K)
for Alternatives 4A, 4B, 2B, and 2C Conditions

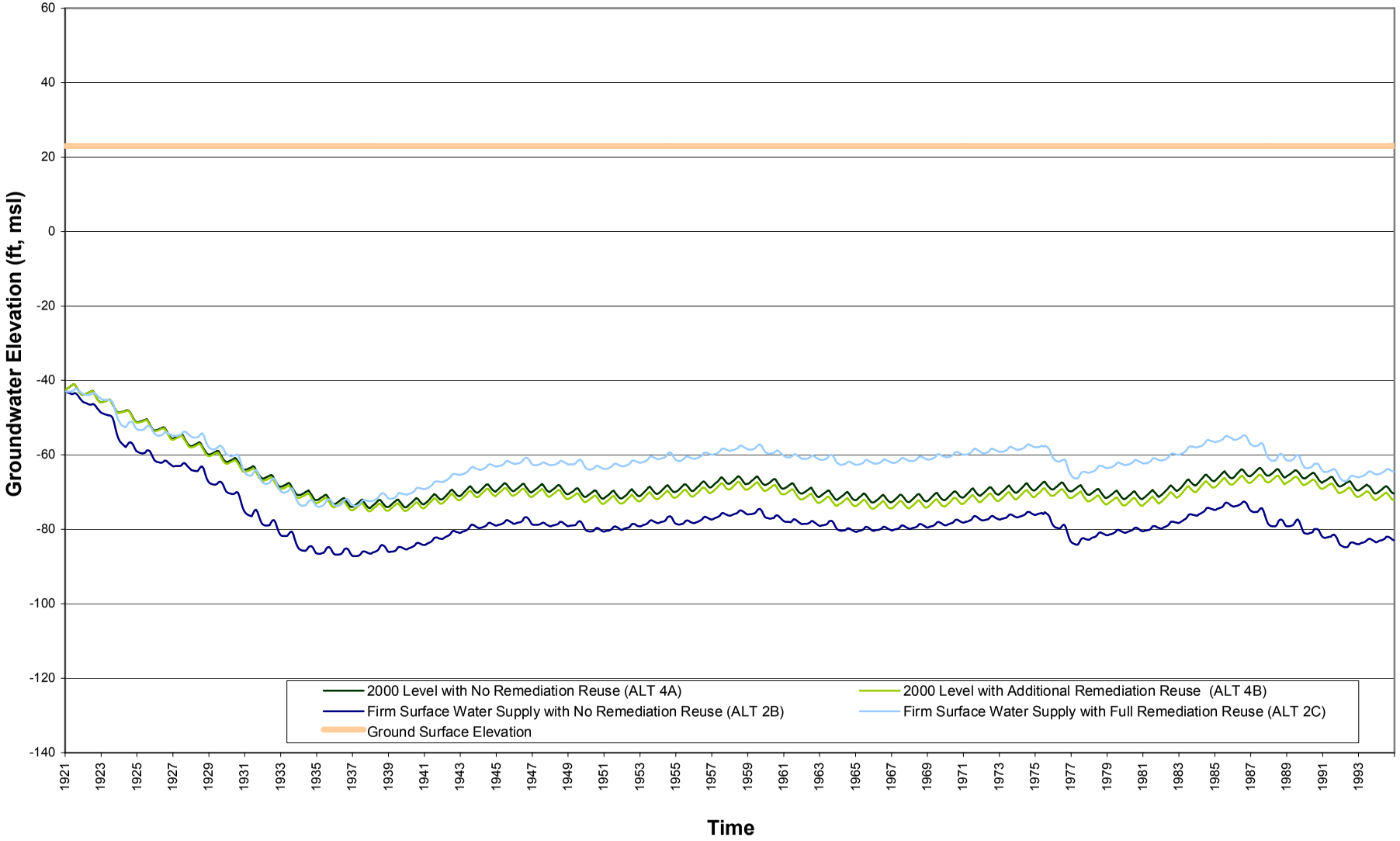

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Figure D.12
Groundwater Hydrograph at Zone 40 (Location L)
for Alternatives 4A, 4B, 2B, and 2C Conditions

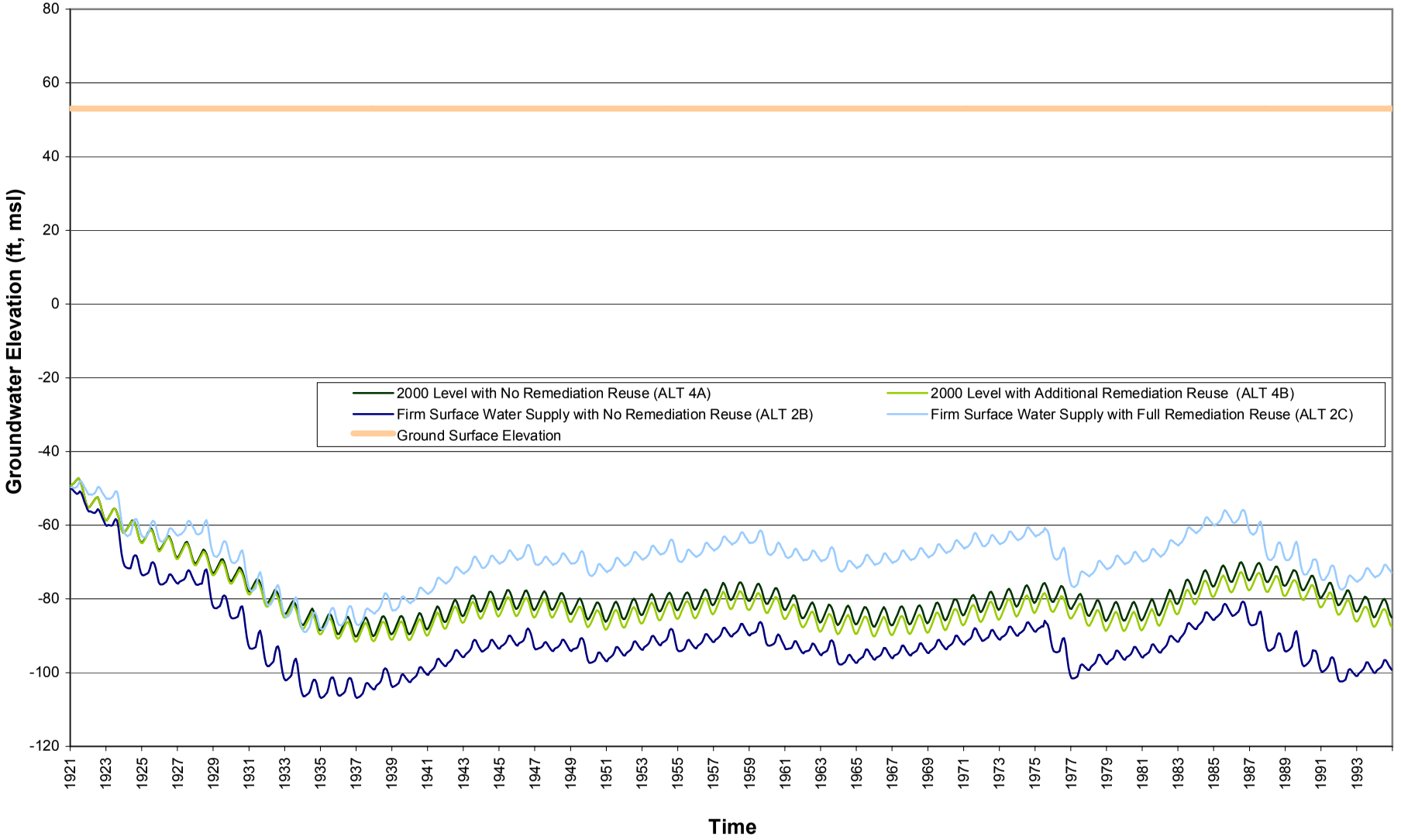

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Figure D.13
Groundwater Hydrograph near Folsom South Canal along Cosumnes River (Location M)
for Alternatives 4A, 4B, 2B, and 2C Conditions

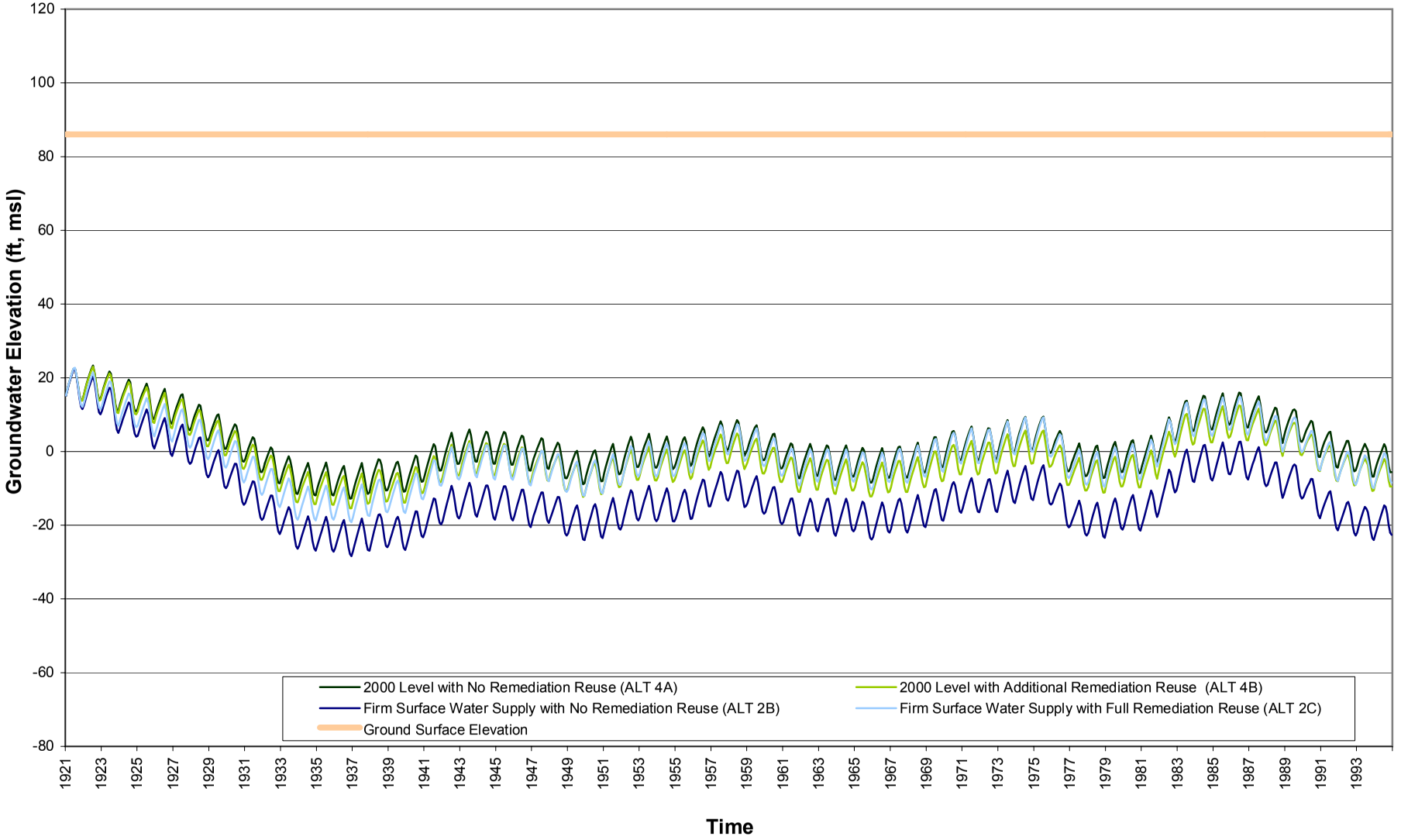

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Figure D.14
Groundwater Hydrograph near Remediation Area Keifer Landfill (Location N)
for Alternatives 4A, 4B, 2B, and 2C Conditions

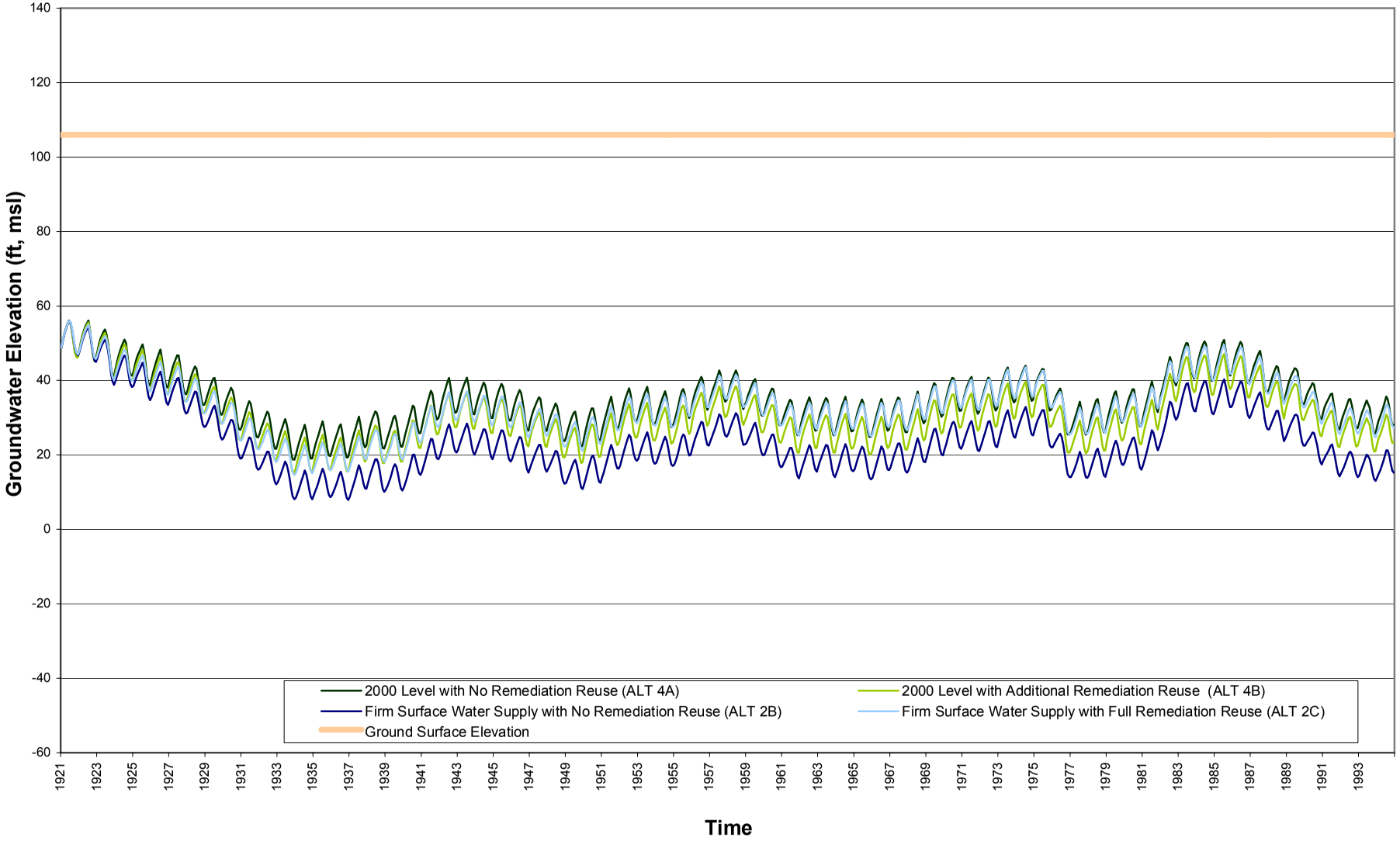

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Figure D.15
Groundwater Hydrograph at Central Area Groundwater Depression (Location O)
for Alternatives 4A, 4B, 2B, and 2C Conditions

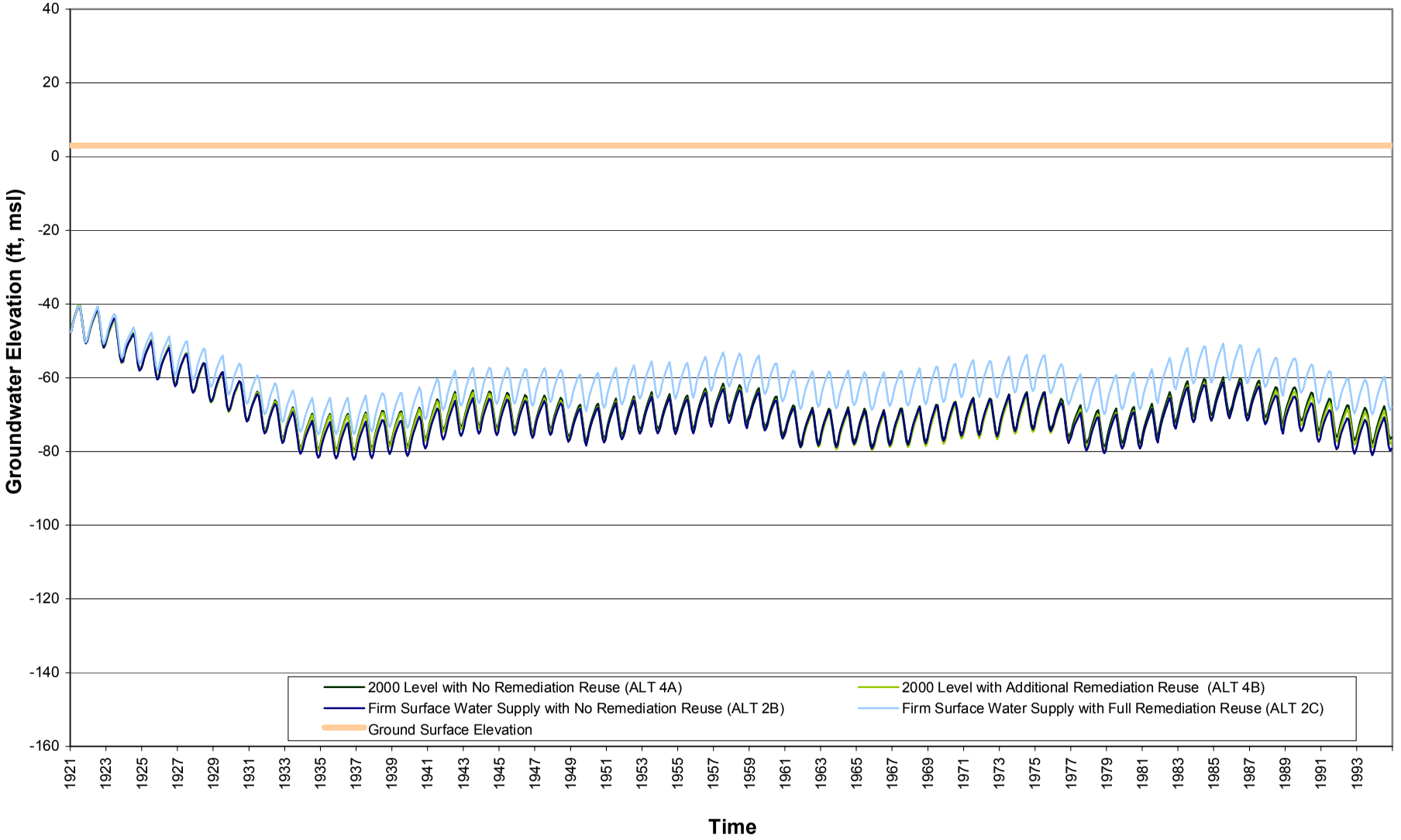

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Figure D.16
Groundwater Hydrograph near Highway 99 along Cosumnes River (Location P)
for Alternatives 4A, 4B, 2B, and 2C Conditions

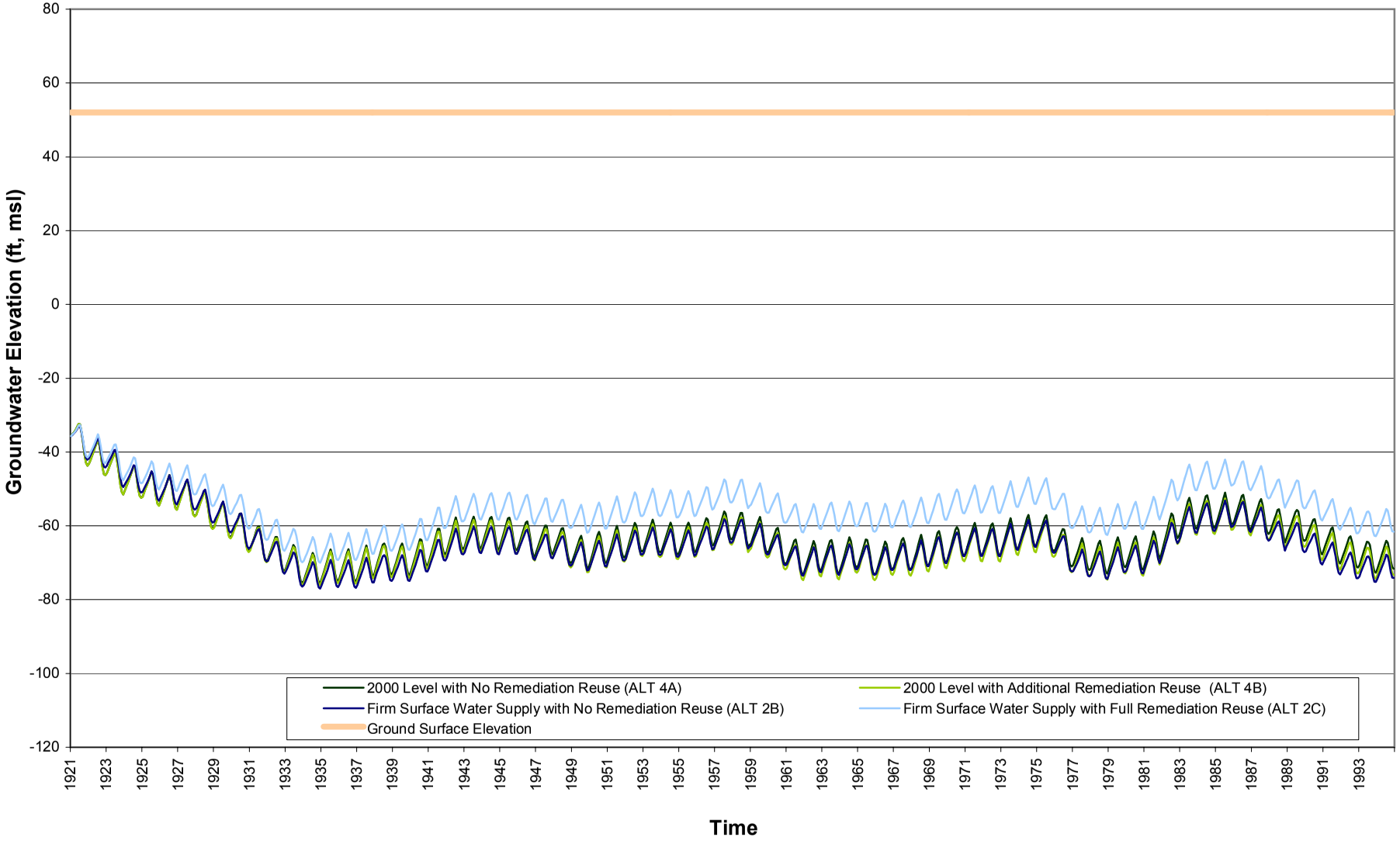

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Figure D.17
Groundwater Hydrograph near South Area Groundwater Depression (Location Q)
for Alternatives 4A, 4B, 2B, and 2C Conditions

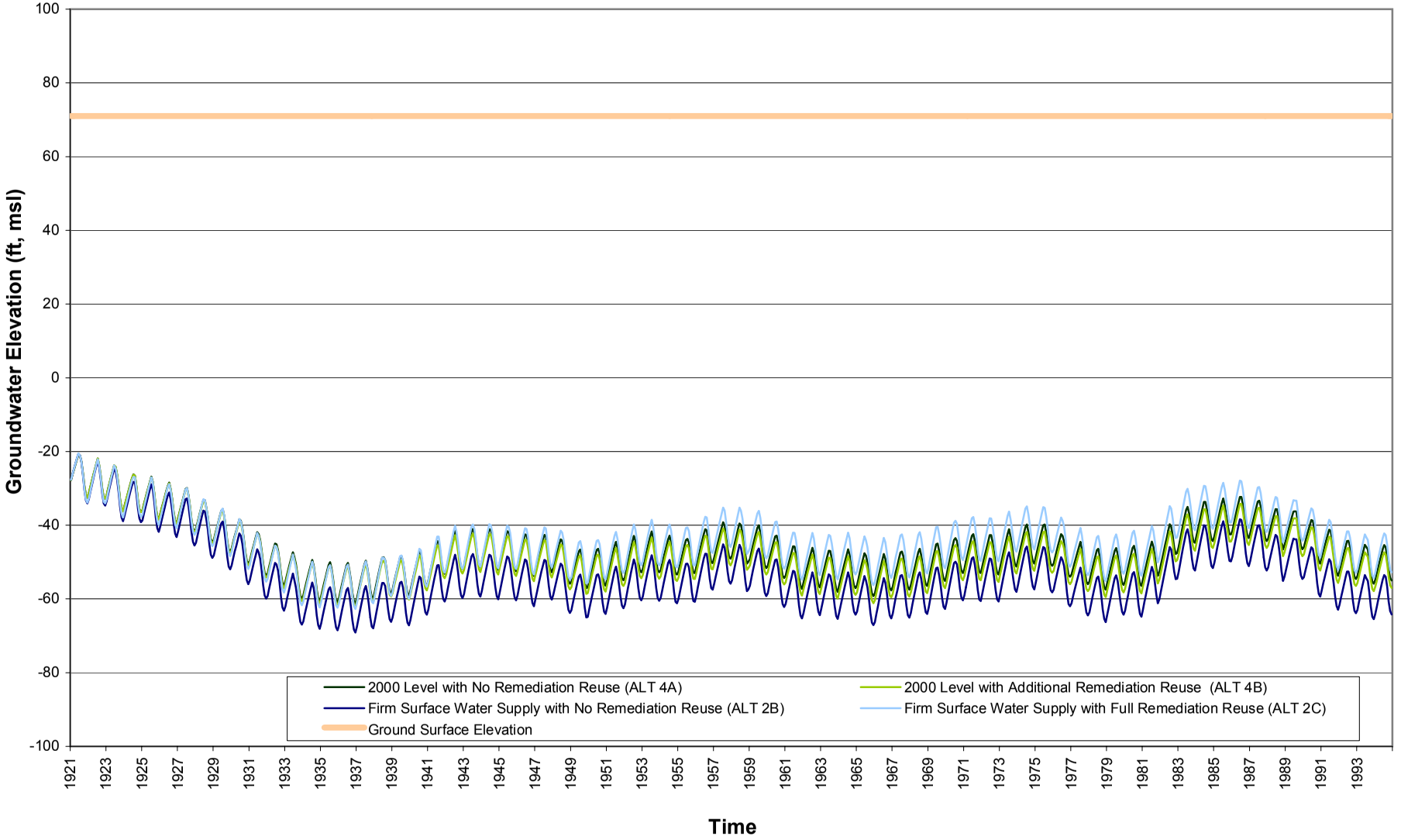

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Figure D.18
Groundwater Hydrograph near Twin Cities along Cosumnes River (Location R)
for Alternatives 4A, 4B, 2B, and 2C Conditions

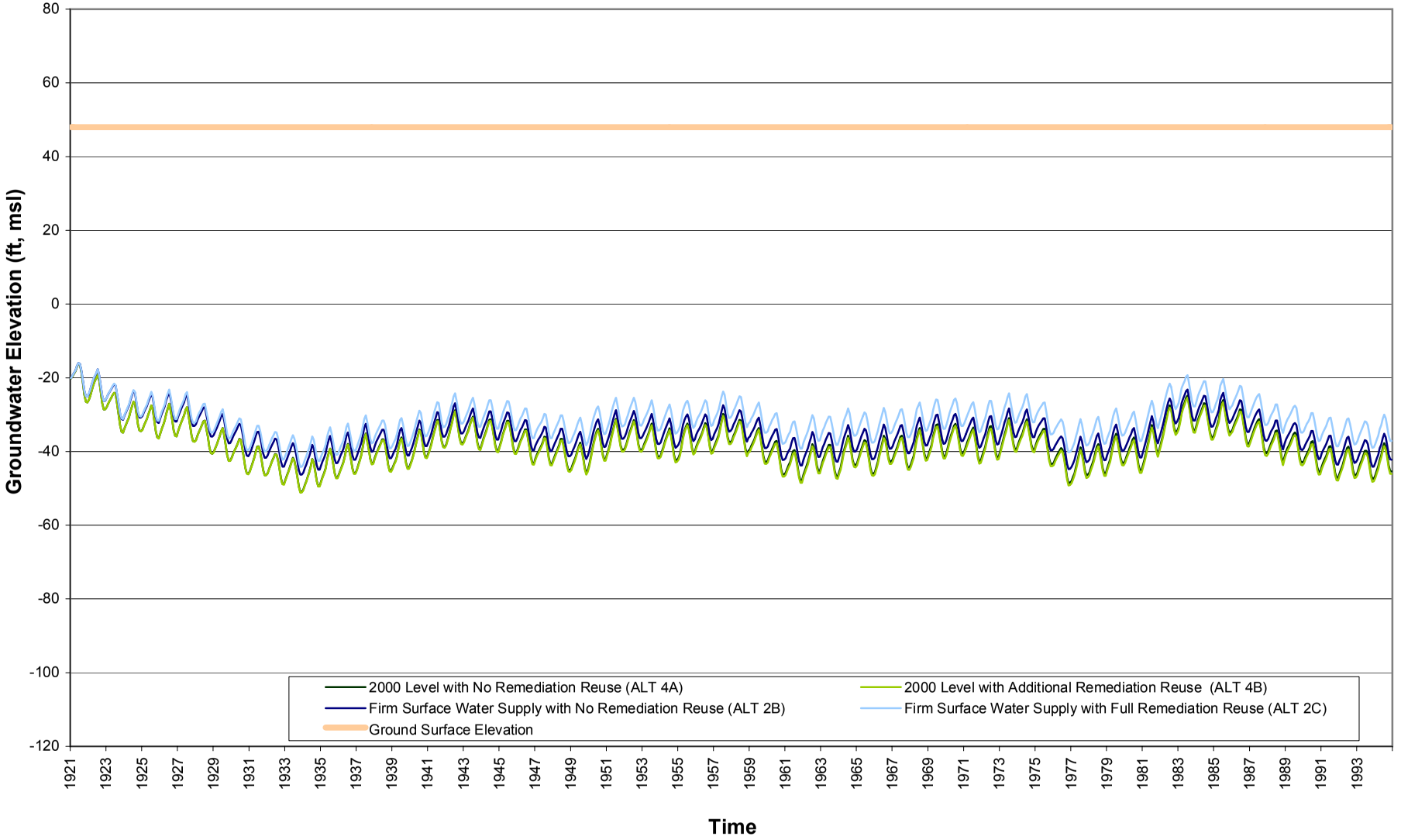

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Figure D.19
Groundwater Hydrograph at Galt Area (Location S)
for Alternatives 4A, 4B, 2B, and 2C Conditions

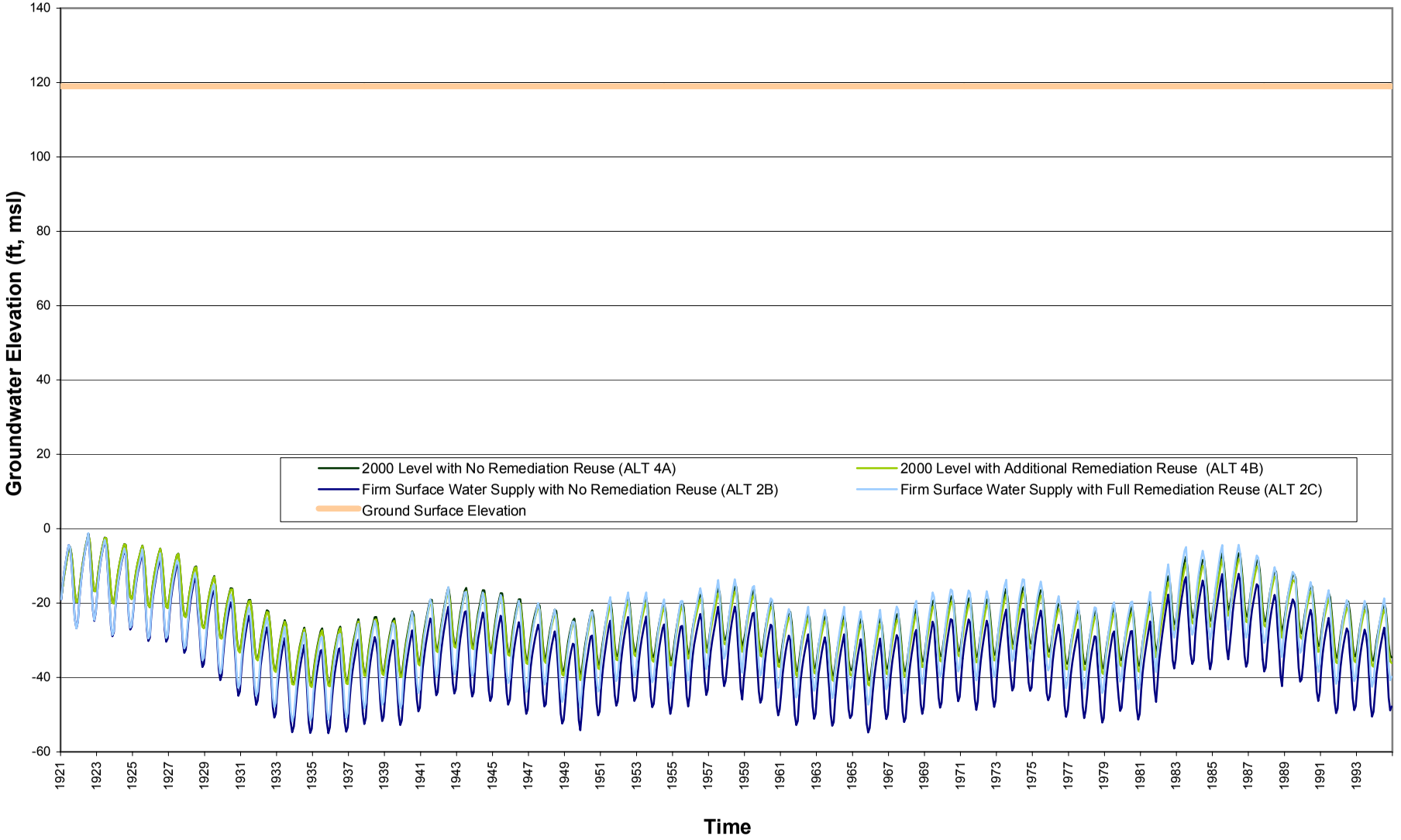

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Figure D.20
Groundwater Hydrograph at West of Grantline Road (Location T)
for Alternatives 4A, 4B, 2B, and 2C Conditions

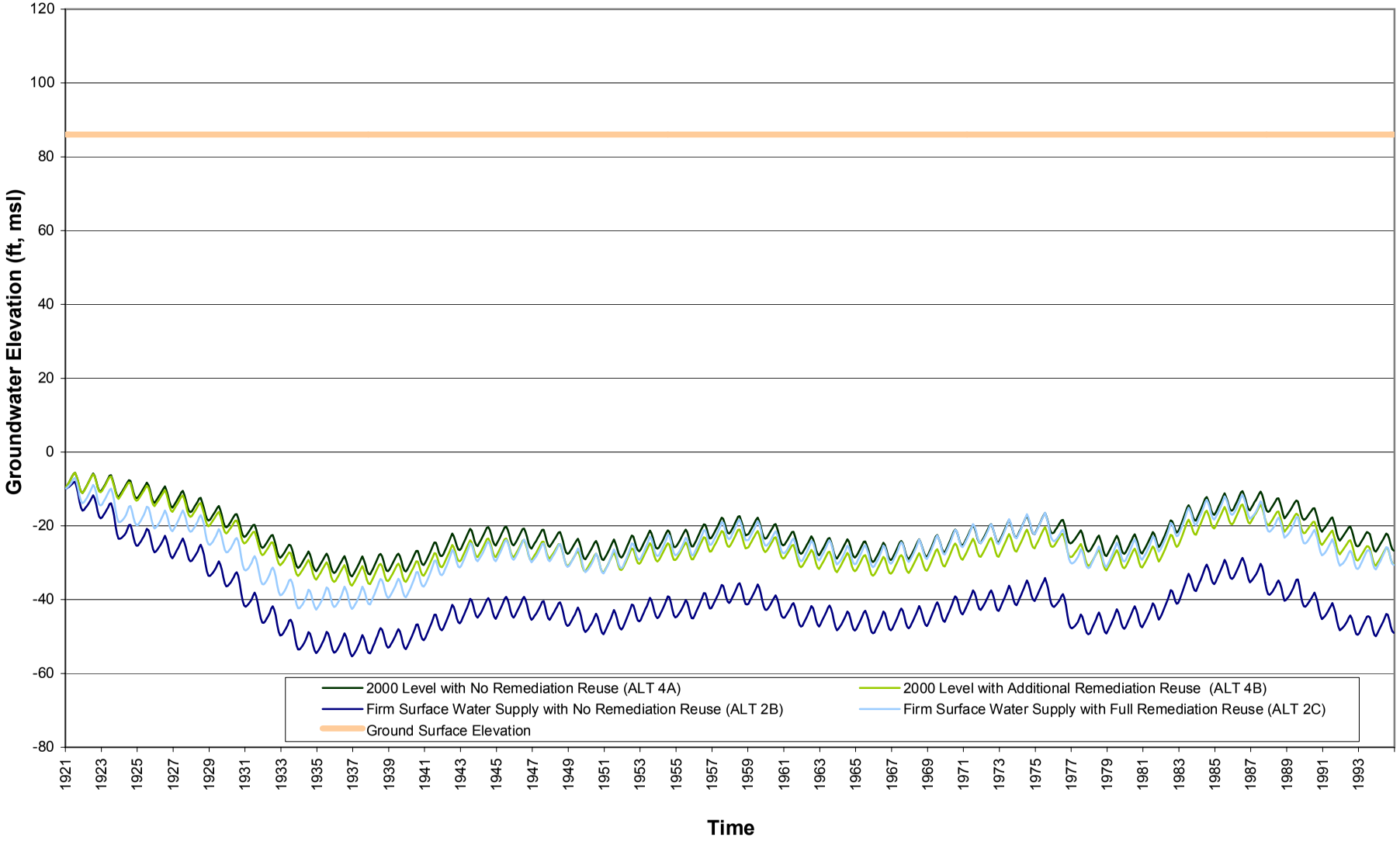

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Figure D.21
Groundwater Hydrograph at Middle of Cosumnes River (Location U)
for Alternatives 4A, 4B, 2B, and 2C Conditions

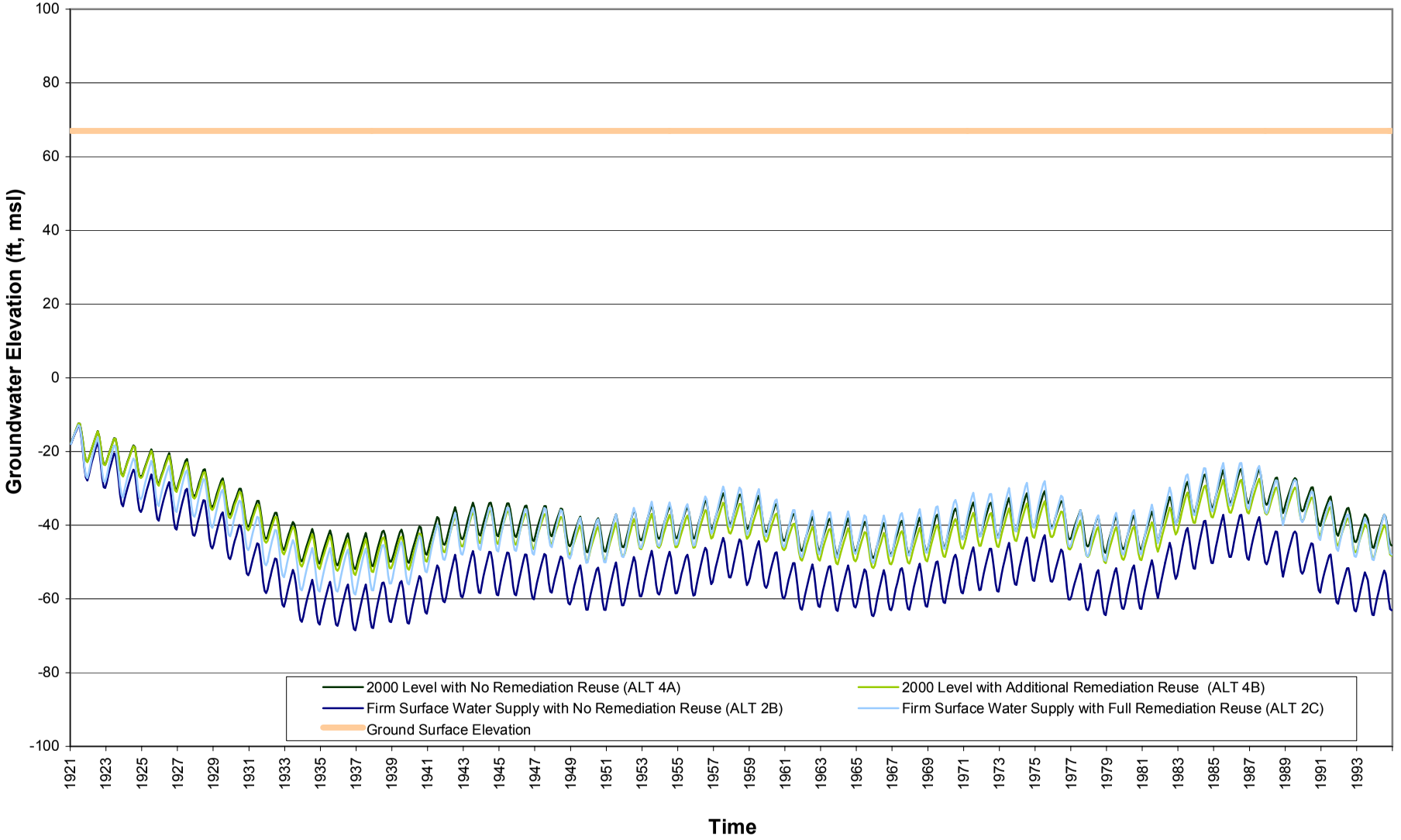

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Figure D.22
Groundwater Hydrograph at Galt - Cone of Depression (Location V)
for Alternatives 4A, 4B, 2B, and 2C Conditions

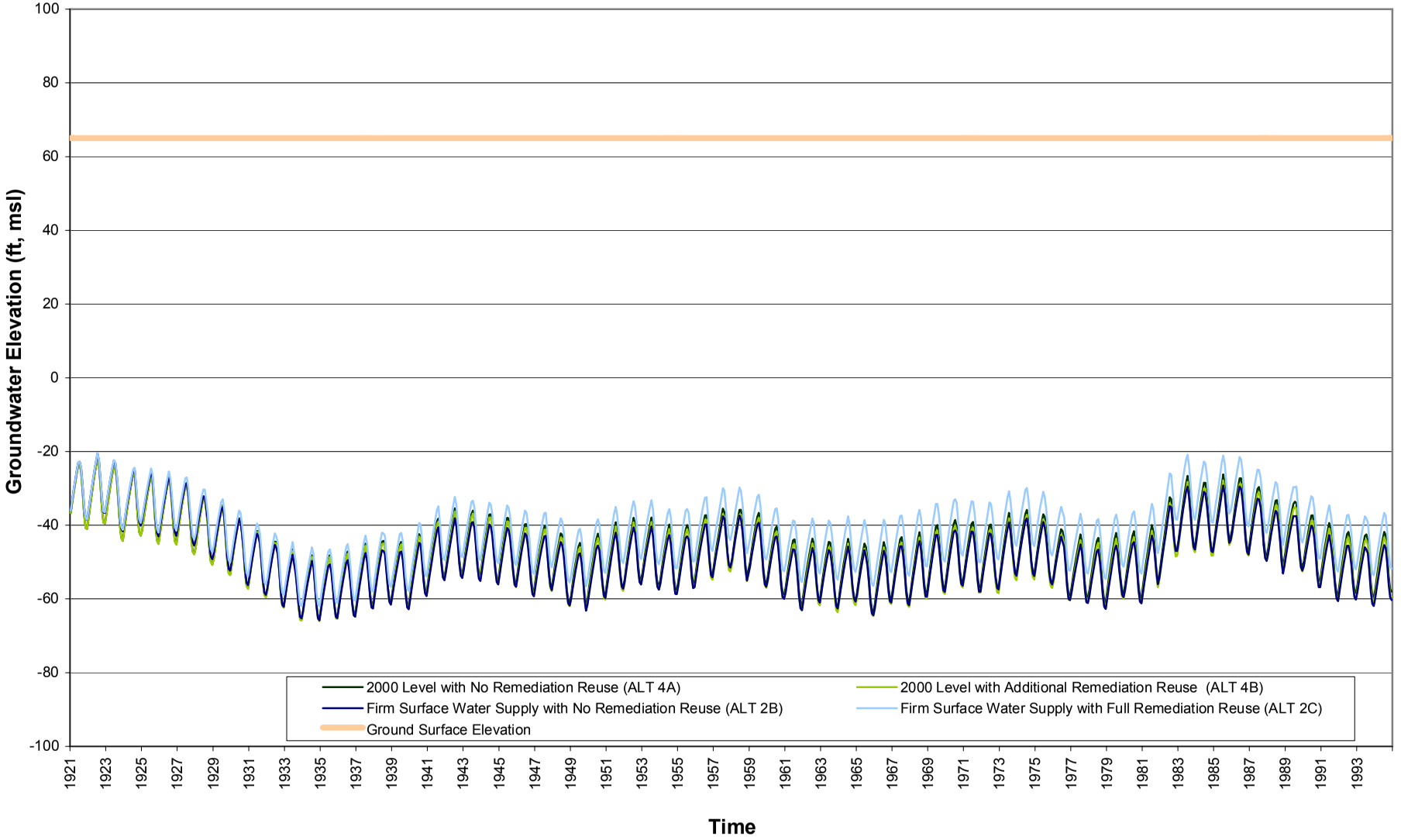

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Figure D.23
Stream Hydrograph at American River near Fair Oaks (Location S1)
for Alternatives 4A, 4B, 2B, and 2C Conditions

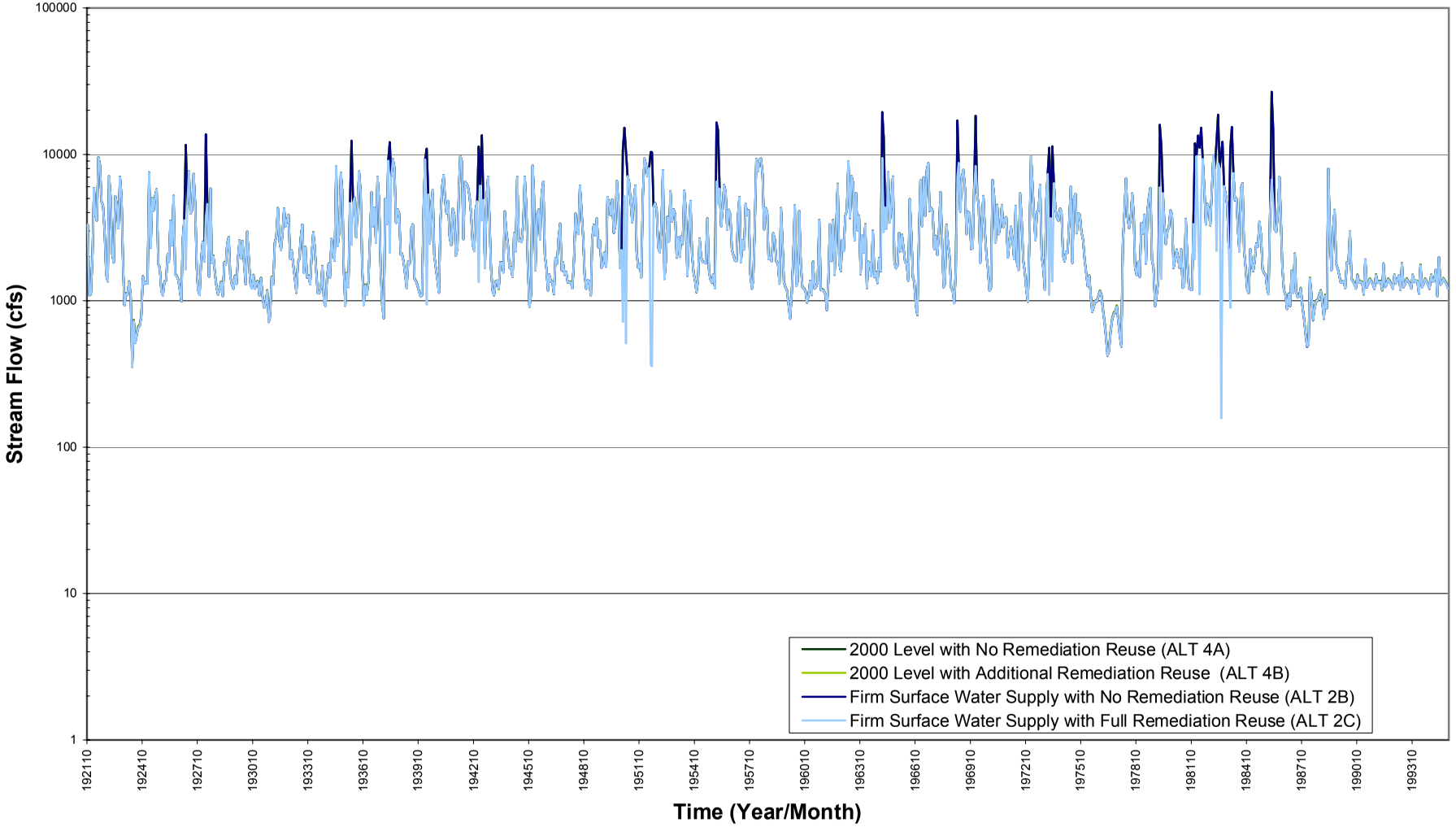

Figure D.24
Stream Hydrograph at American River near H Street (Location S2)
for Alternatives 4A, 4B, 2B, and 2C Conditions

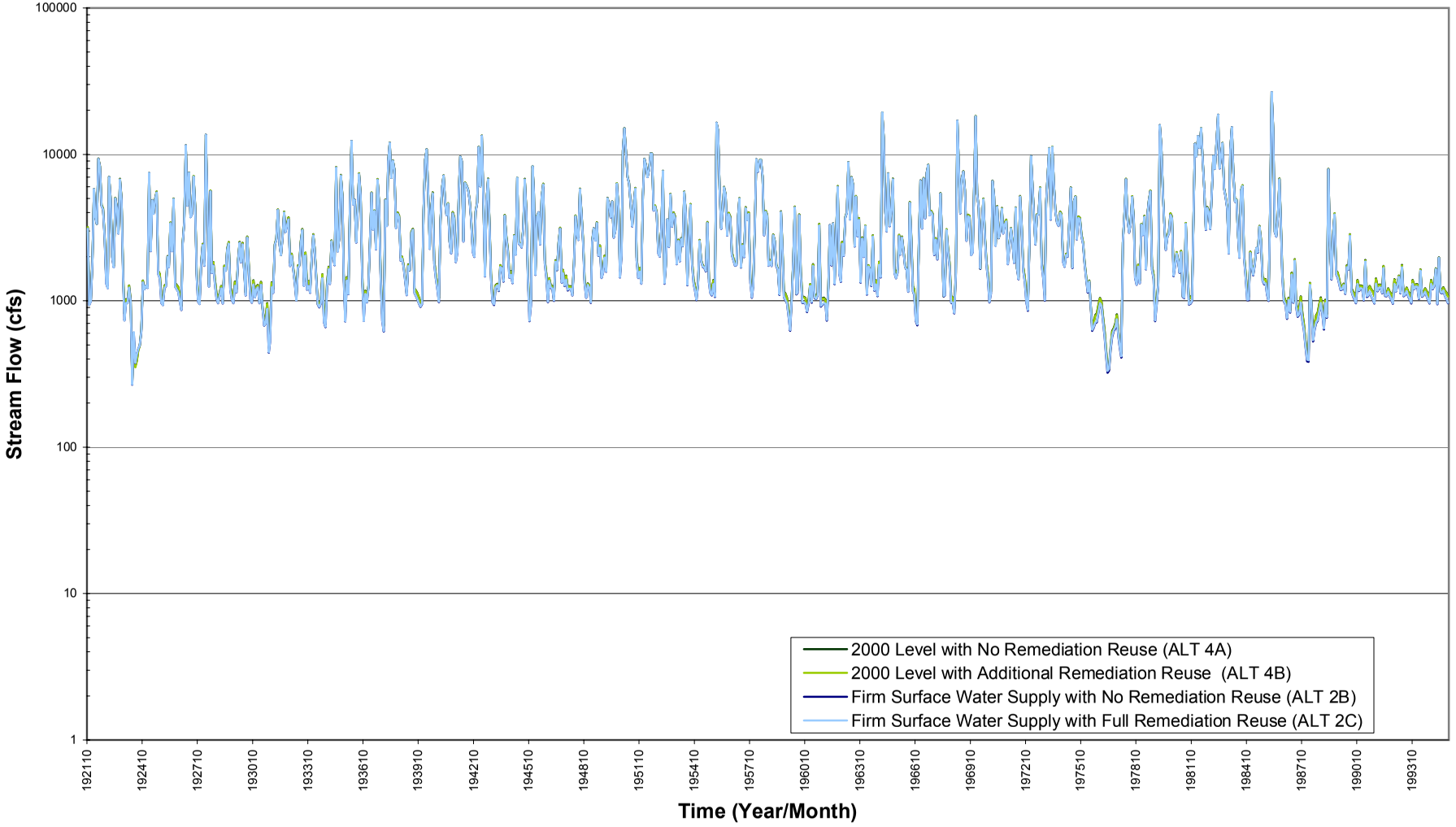

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Figure D.25
Stream Hydrograph at Cosumnes River near Michigan Bar (Location S3)
for Alternatives 4A, 4B, 2B, and 2C Conditions

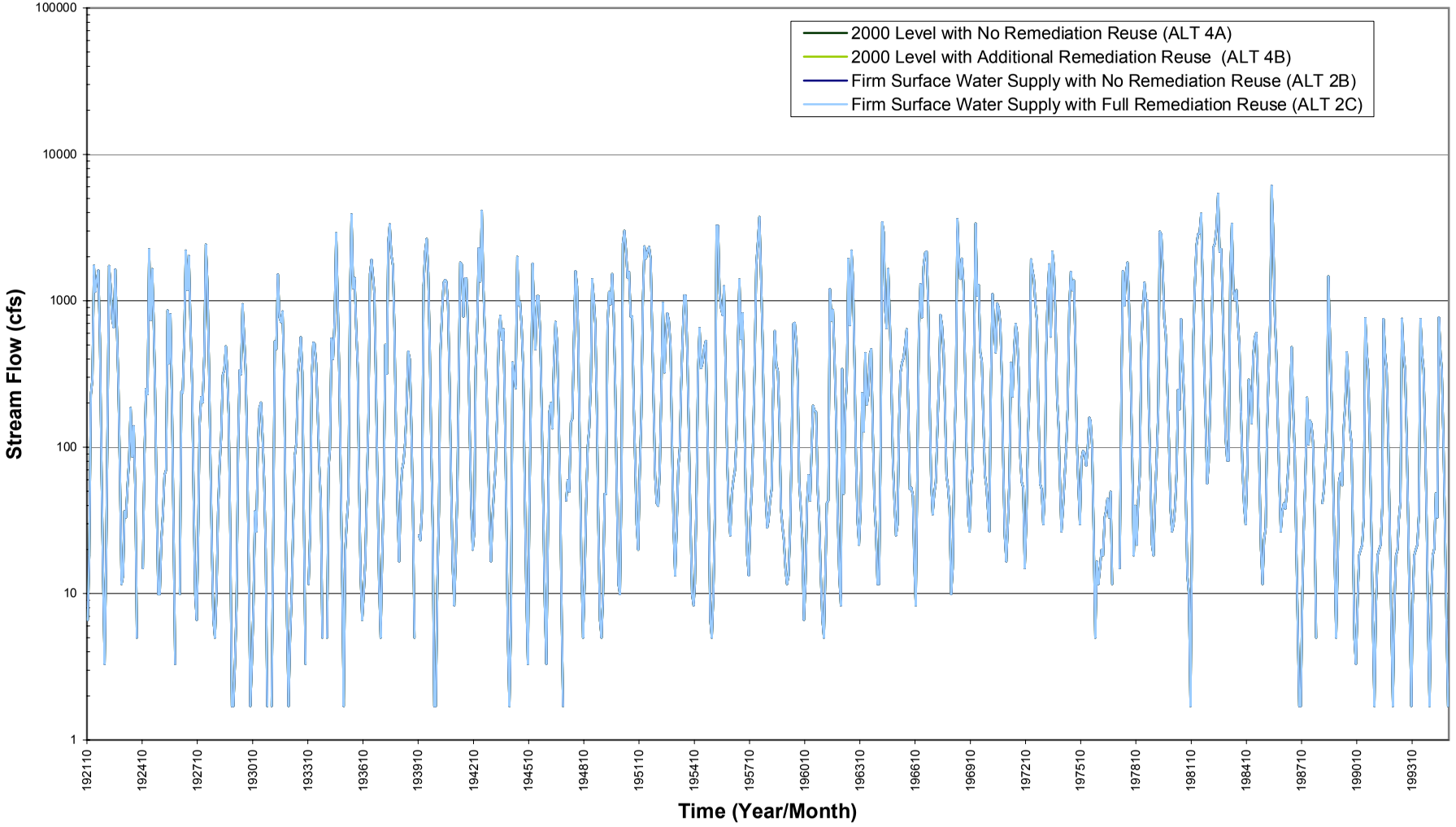

Figure D.26
Stream Hydrograph at Cosumnes River near Folsom South Canal (Location S4)
for Alternatives 4A, 4B, 2B, and 2C Conditions

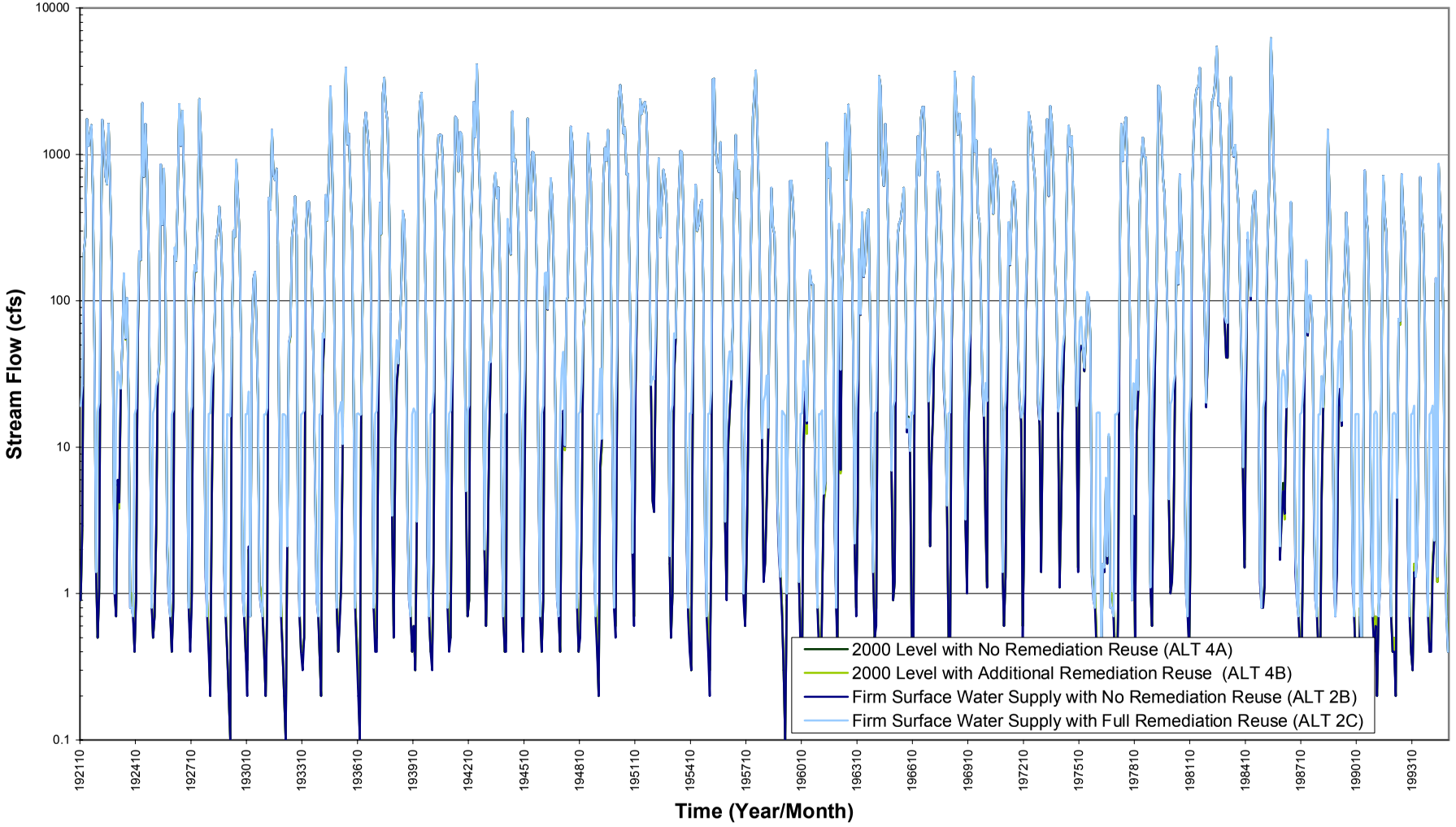

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Figure D.27
Stream Hydrograph at Cosumnes River near Highway 99 (Location S5)
for Alternatives 4A, 4B, 2B, and 2C Conditions

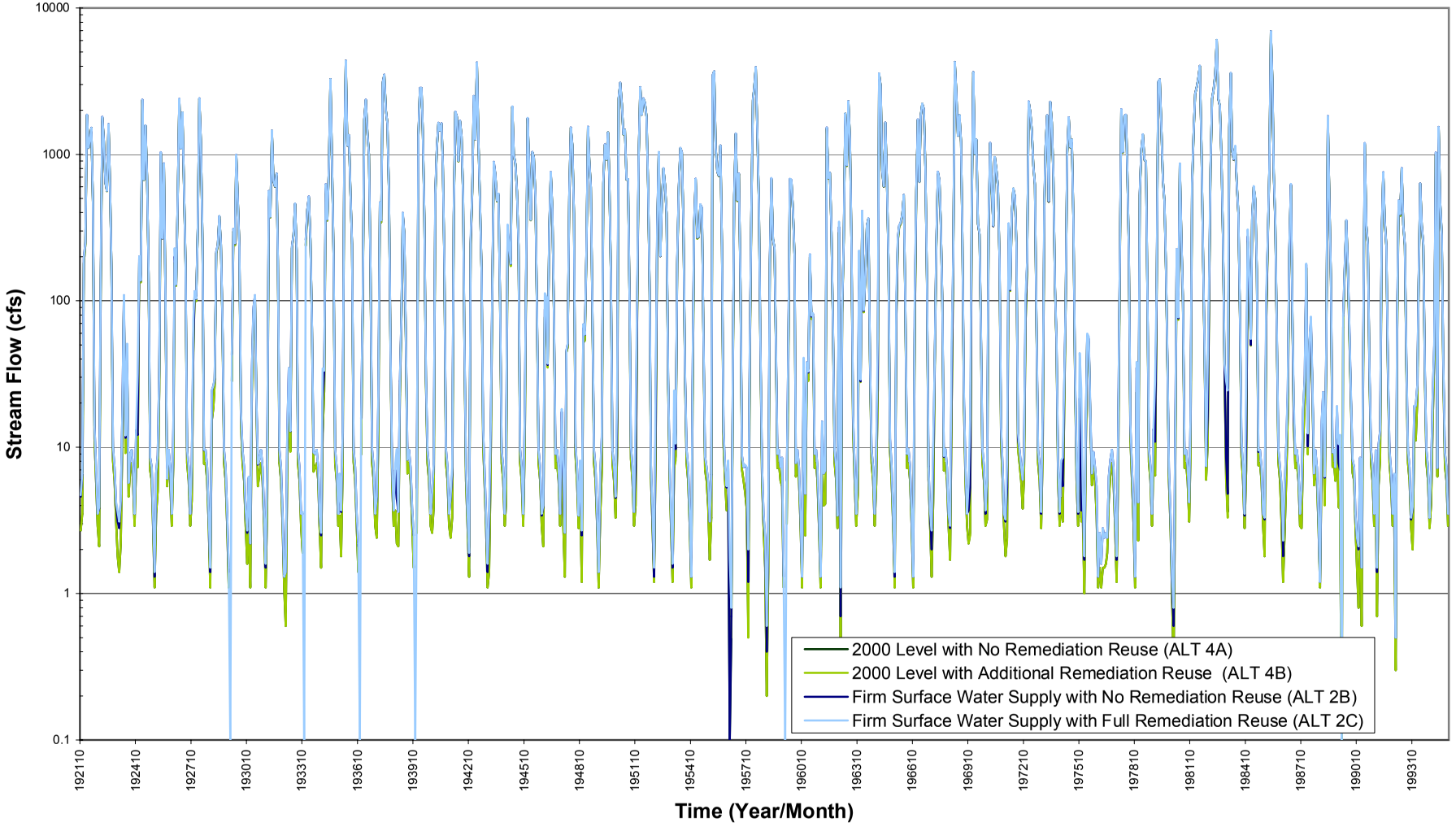

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Figure D.28
Stream Hydrograph at Cosumnes River near Twin Cities Road (Location S6)
for Alternatives 4A, 4B, 2B, and 2C Conditions

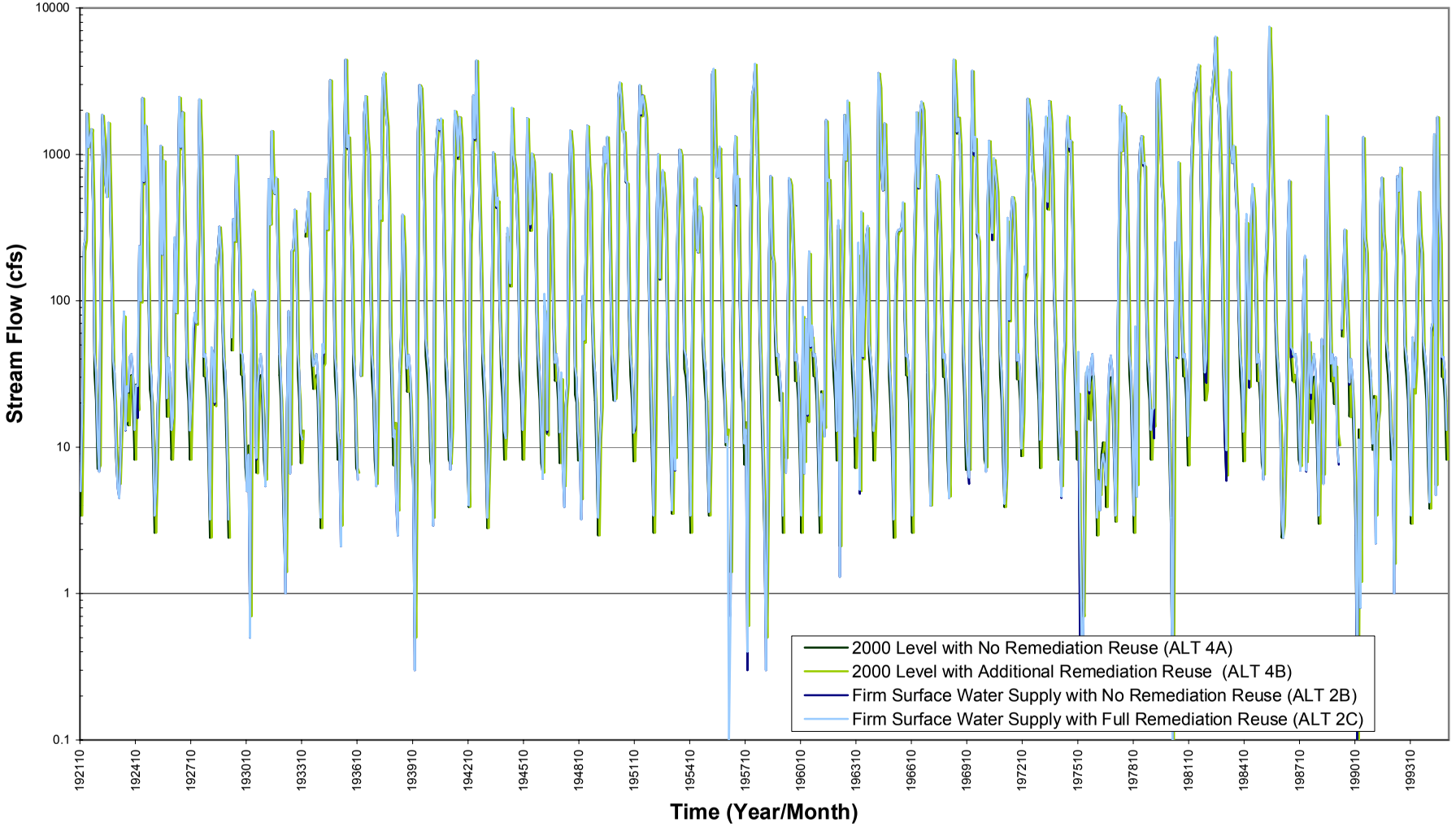


Figure D.29
Monthly Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

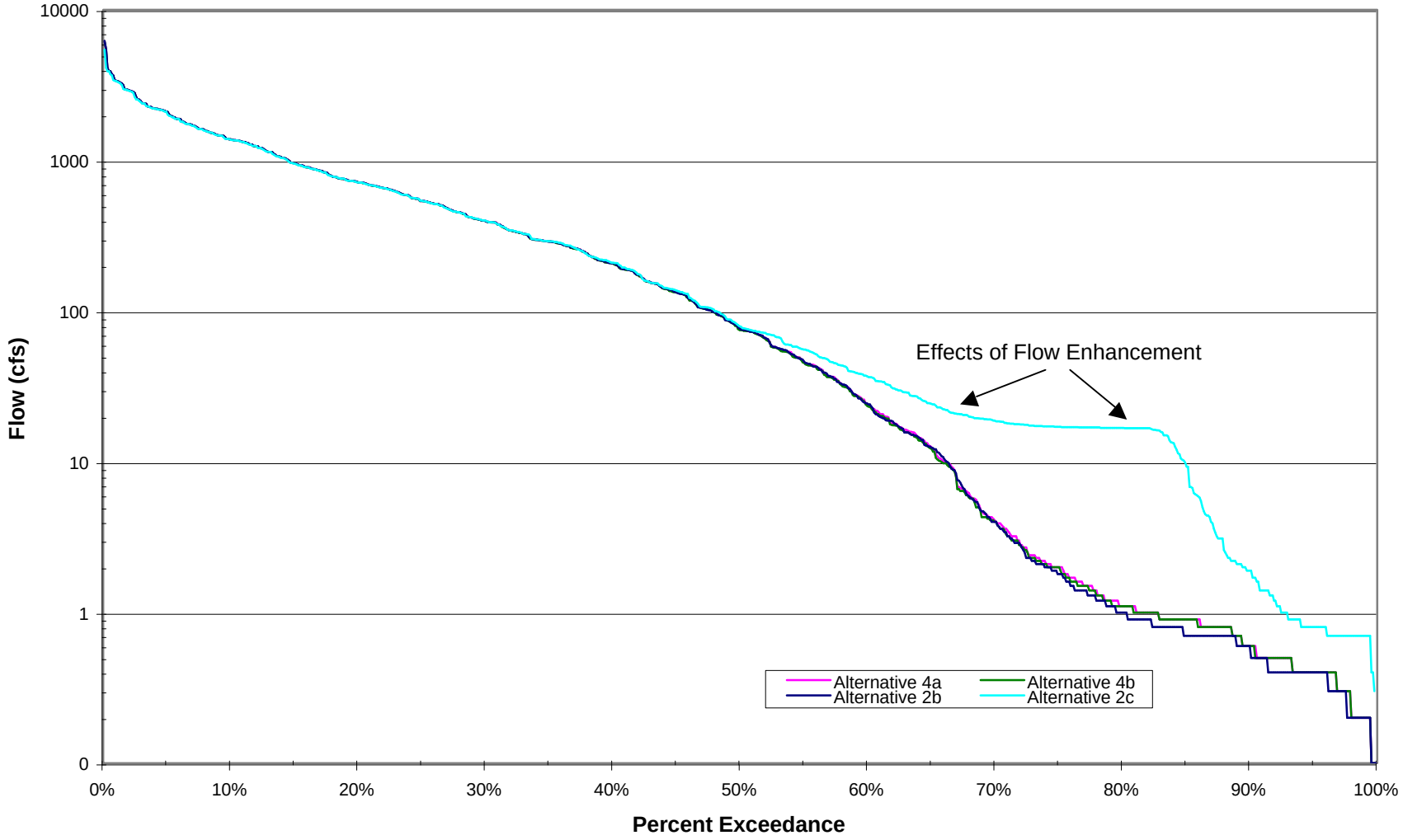


Figure D.30
August Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

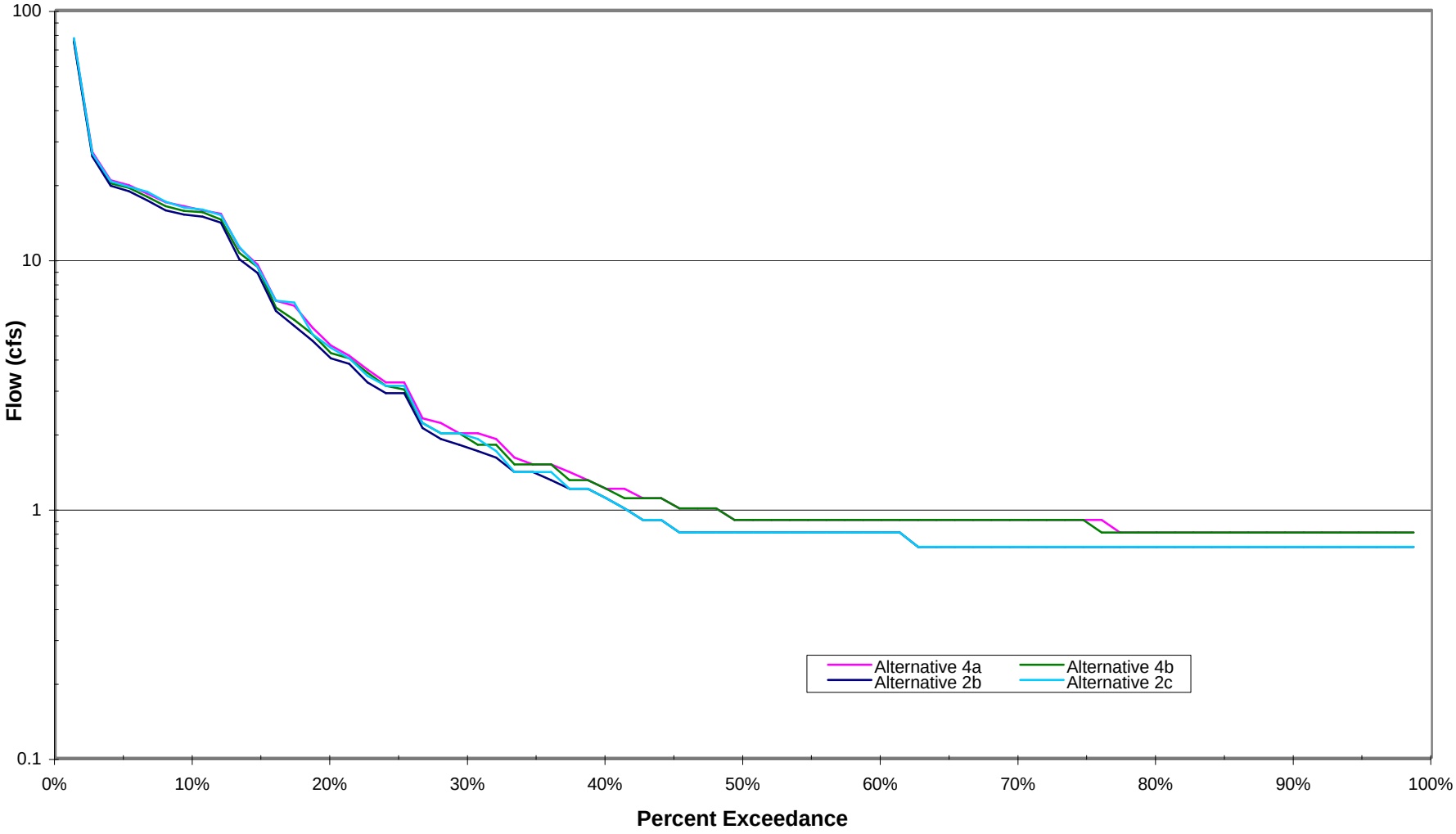


Figure D.31
September Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

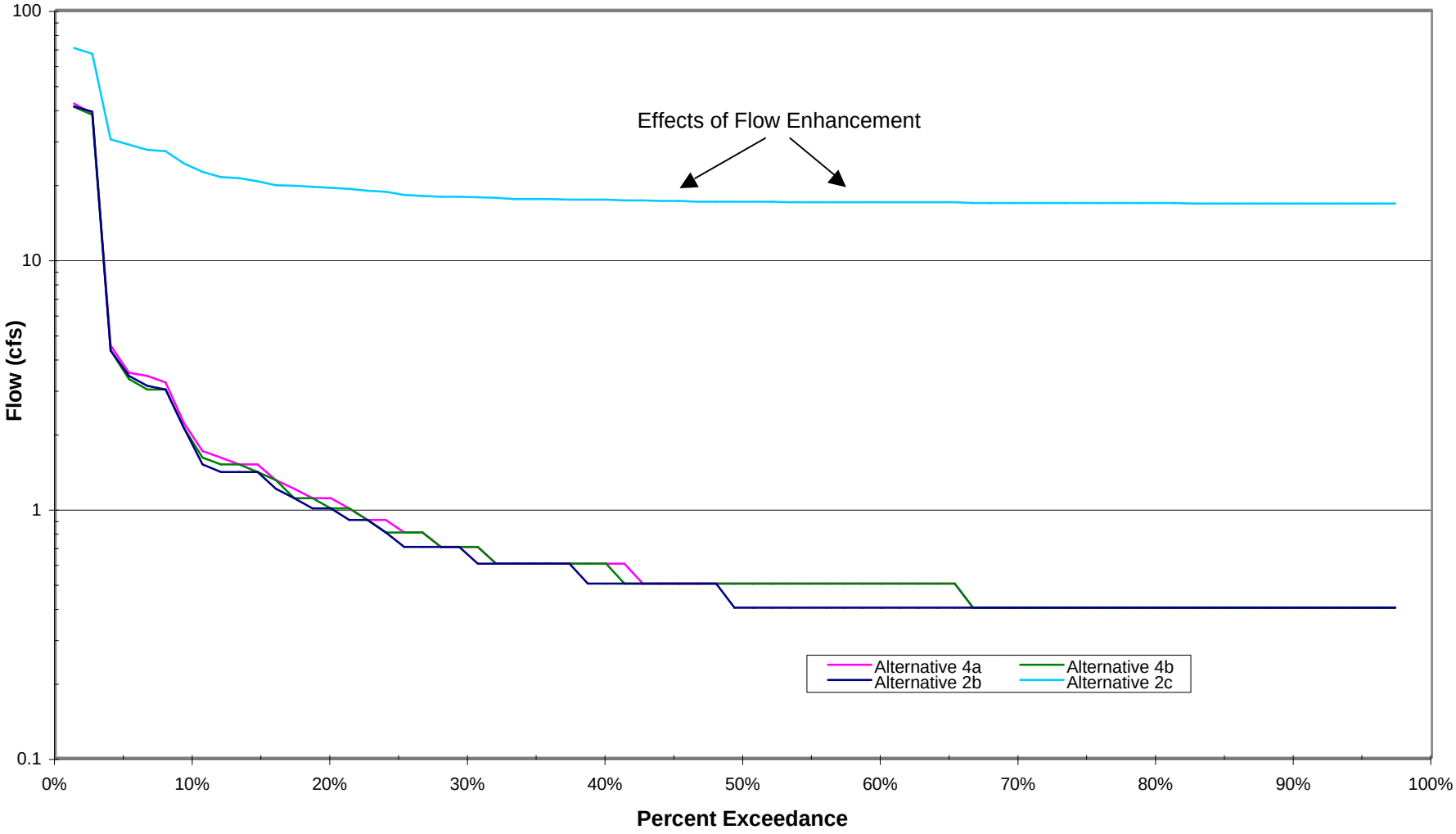


Figure D.32
October Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

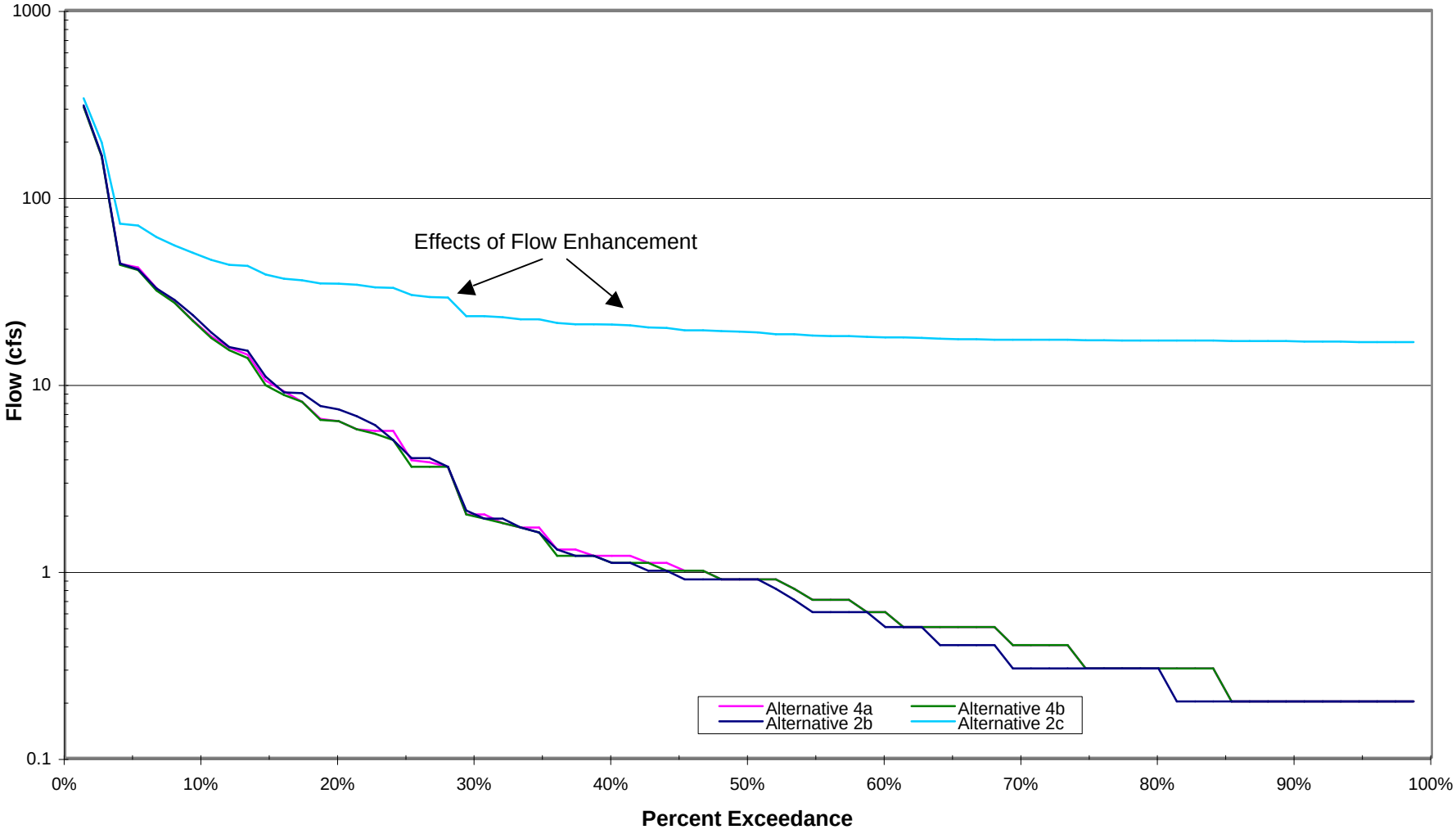


Figure D.33
November Cosumnes River Flow Exceedance Probability
Near Folsom South Canal Crossing

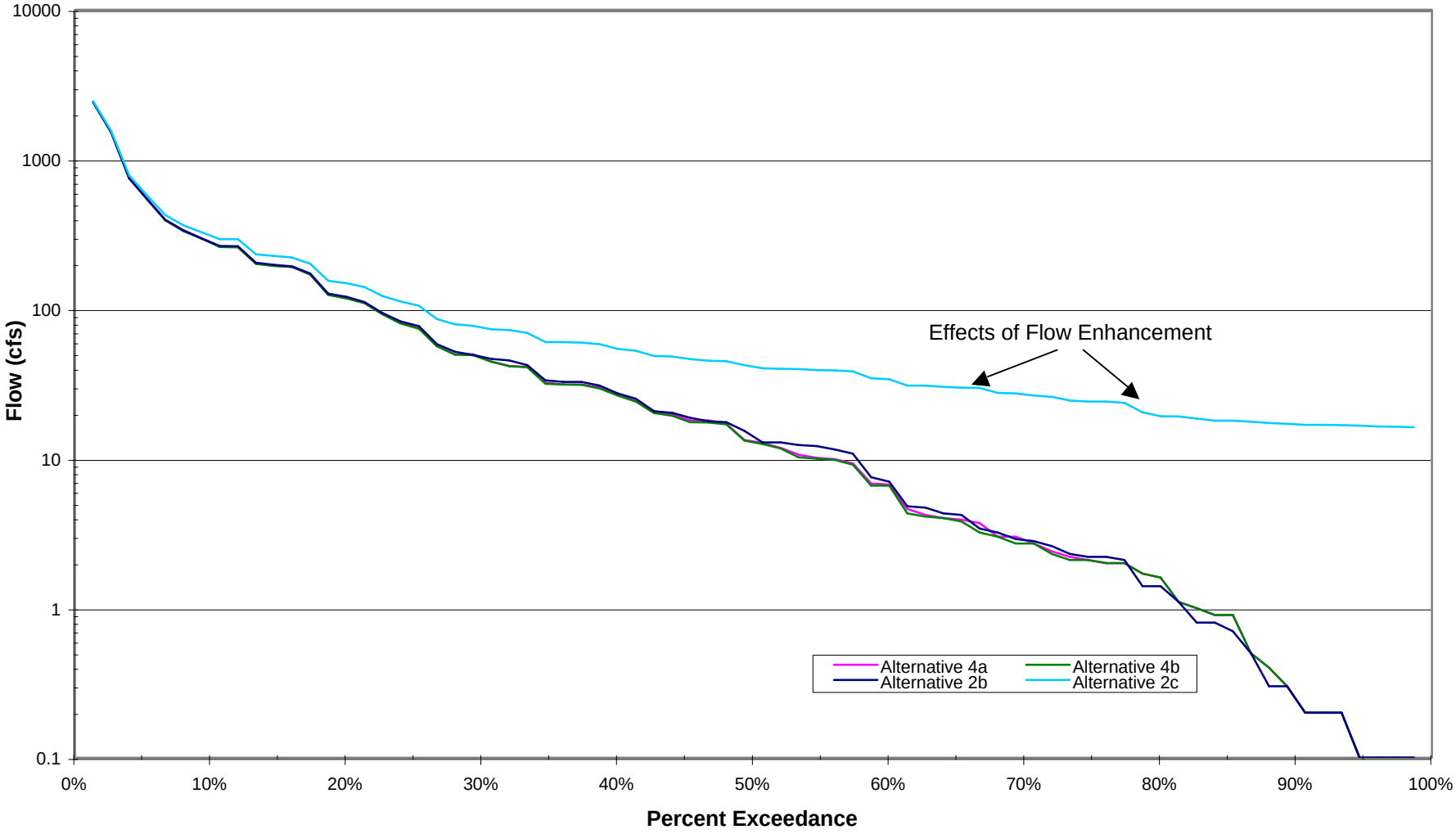


Figure D.34
Monthly Cosumnes River Flow Exceedance Probability
Near Highway 99

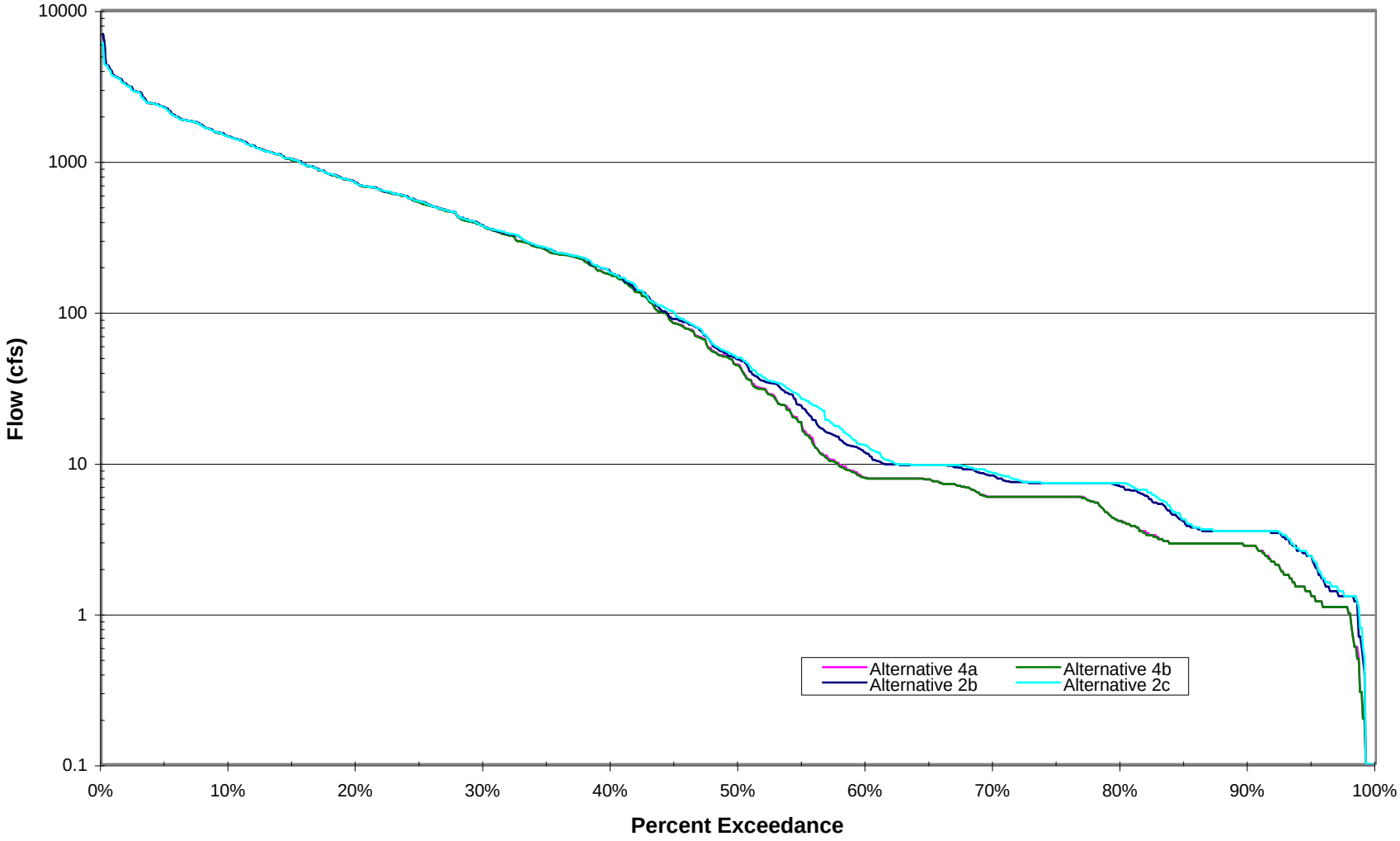


Figure D.35
August Cosumnes River Flow Exceedance Probability
Near Highway 99

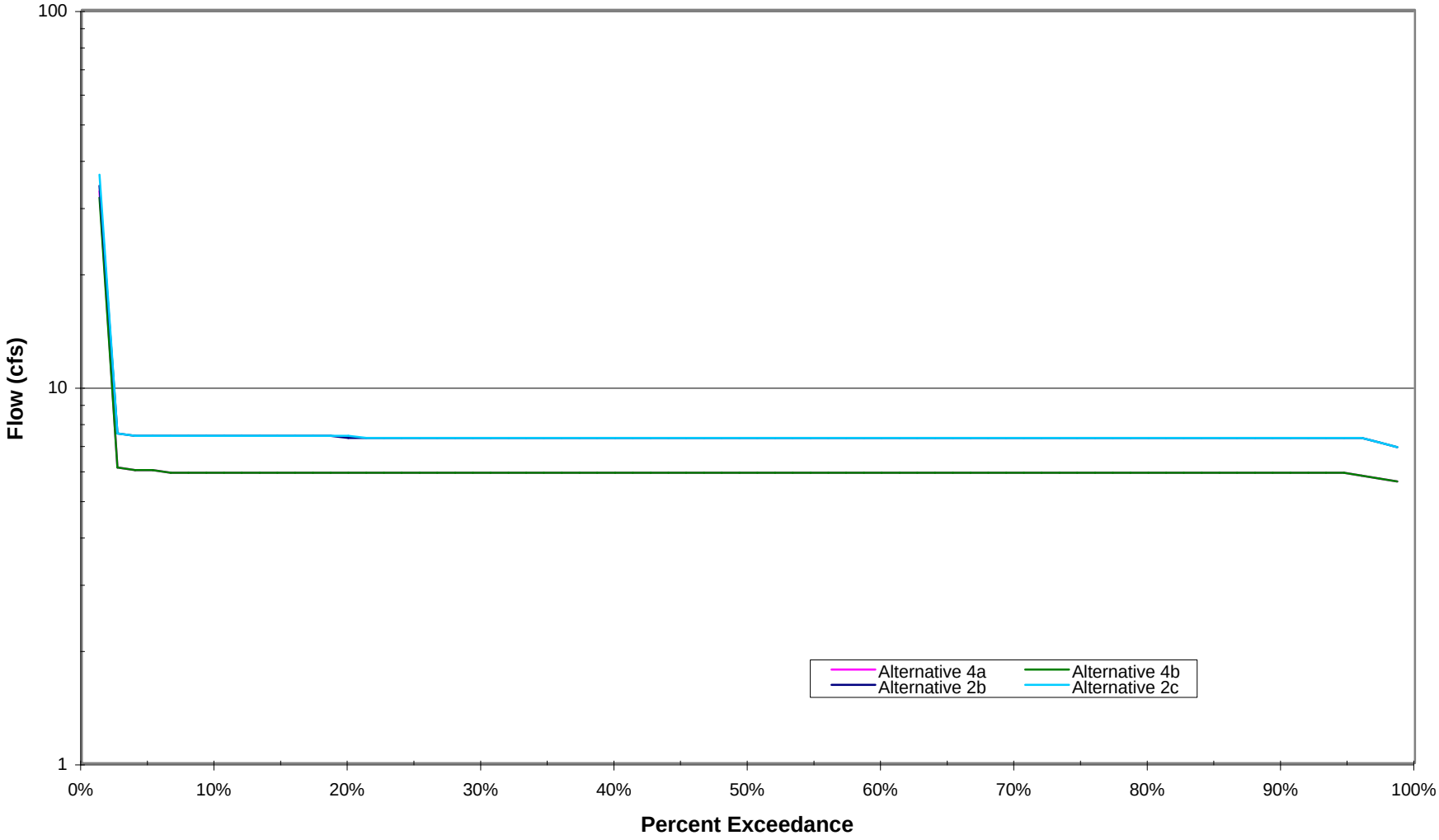


Figure D.36
September Cosumnes River Flow Exceedance Probability
Near Highway 99

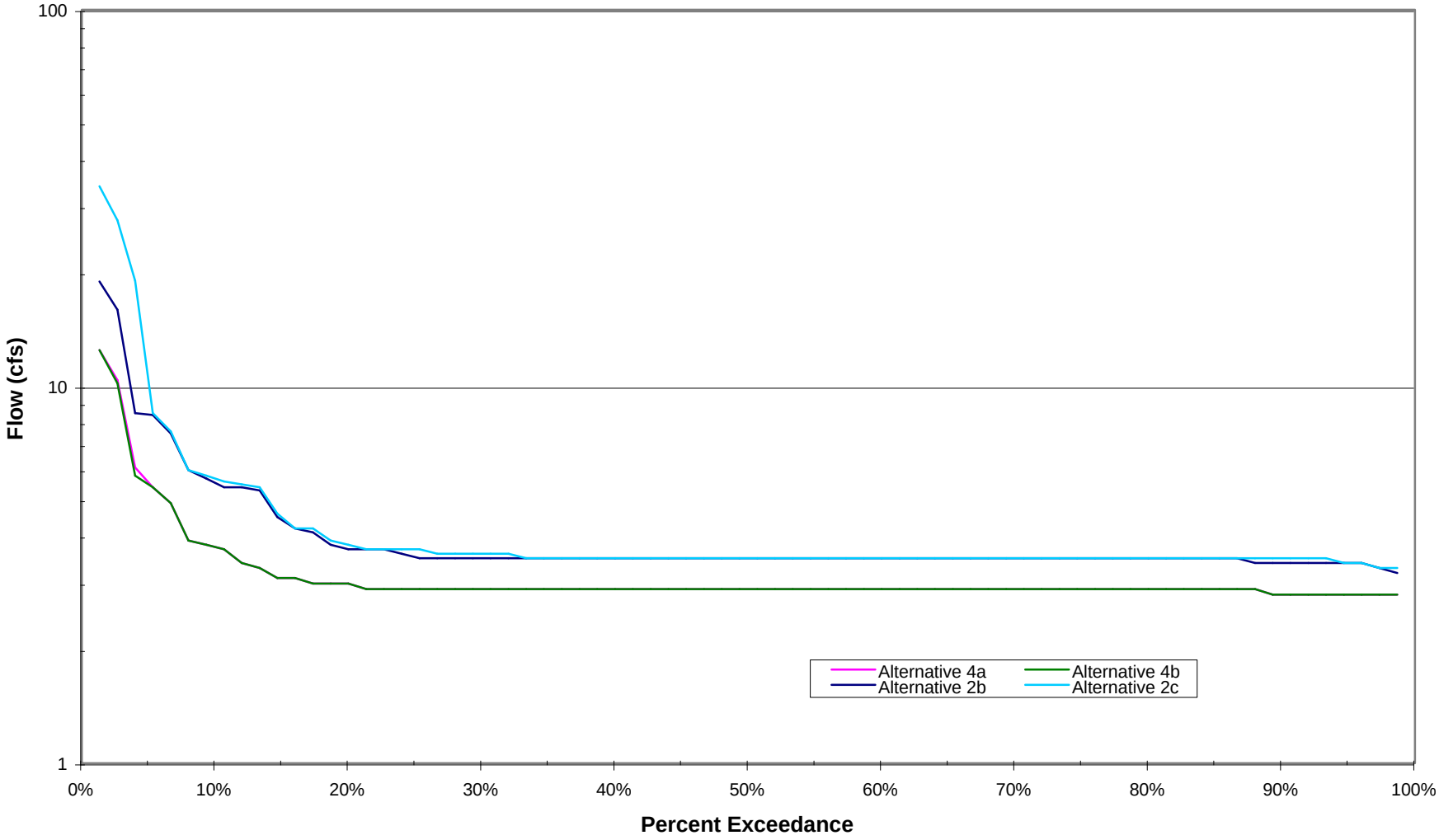


Figure D.37
October Cosumnes River Flow Exceedance Probability
Near Highway 99

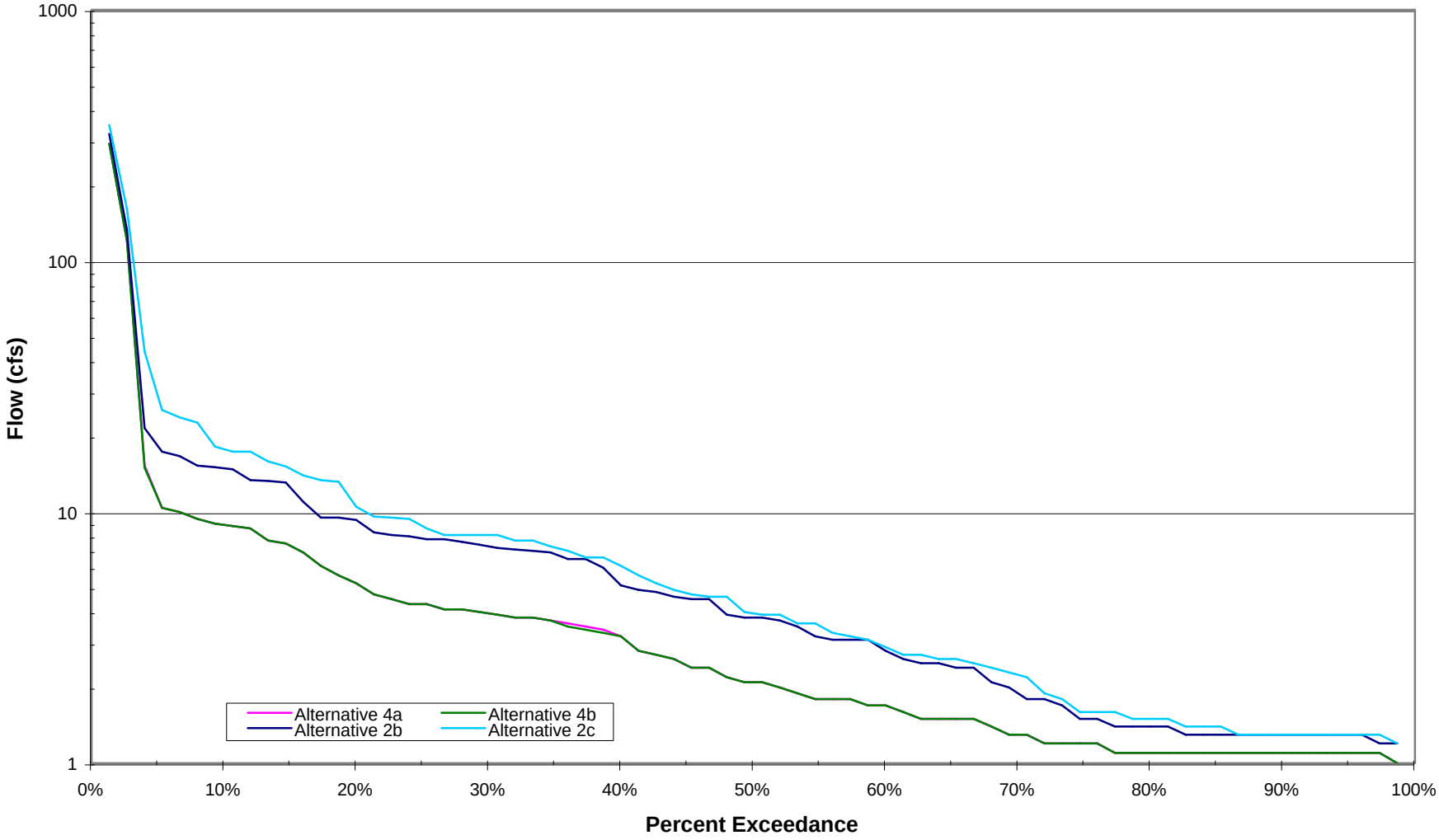
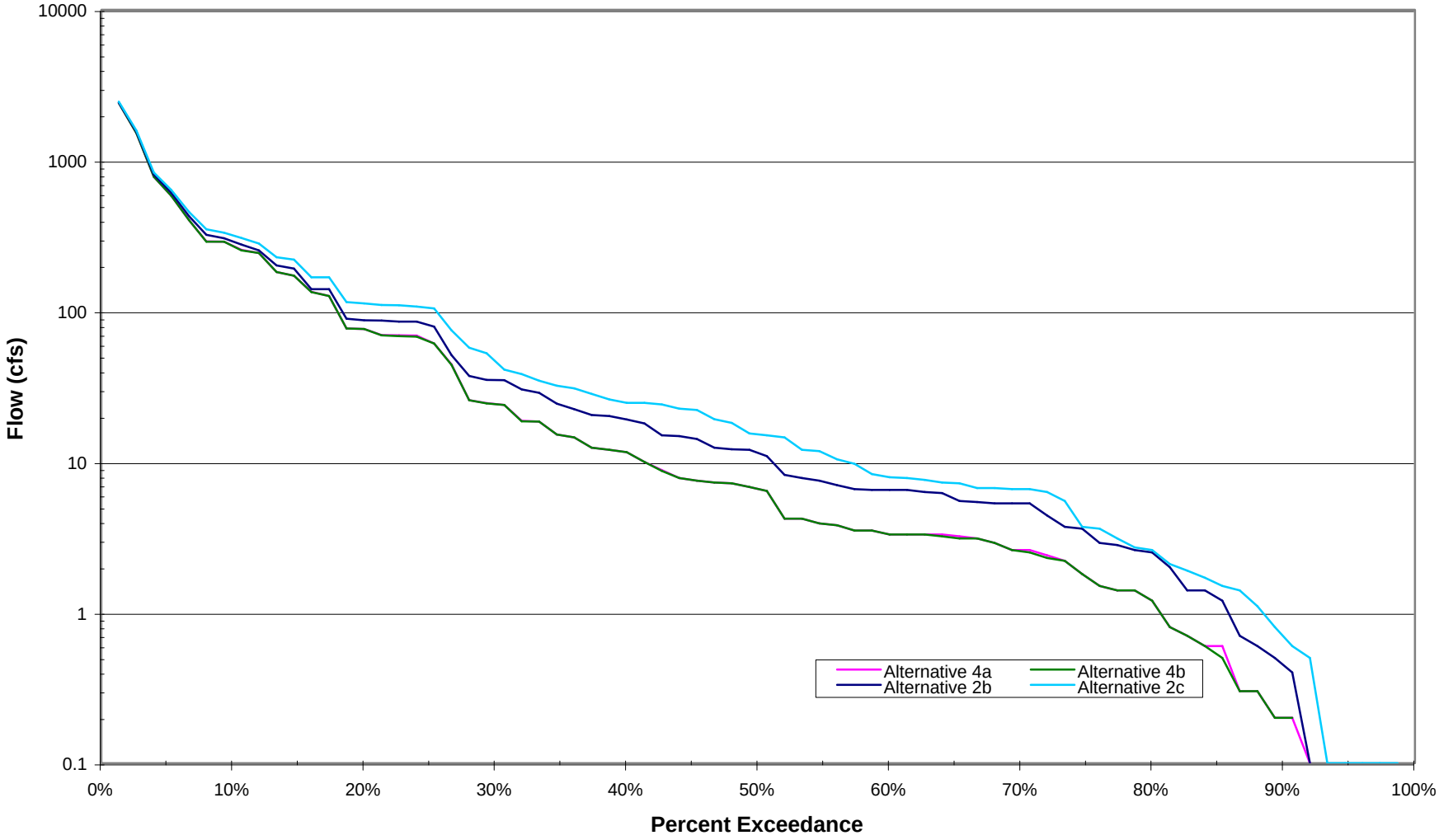


Figure D.38
November Cosumnes River Flow Exceedance Probability
Near Highway 99



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TECHNICAL MEMORANDUM

To:	Bob Caikoski	**CC:**	Jim McCormack
Prepared By:	Ali Taghavi, Saquib Najmus, and Michael Cornelius	Date:	October 9, 2002
Subject:	Technical Memorandum on Application of Existing Sacramento County IGSM to Hydrologic Analysis of Zone 40 Master Water Supply Plan Update		

INTRODUCTION

The Sacramento County Department of Environmental Review and Assessment has contracted WRIME, Inc. to provide necessary technical support on additional hydrologic analysis and alternatives evaluation for the Sacramento County Water Agency's proposed Zone 40 Master Water Supply Plan.

The purpose of this Technical Memorandum (TM) is twofold:

- To describe the Integrated Groundwater and Surface Water Model (IGSM) model, which is used to evaluate the Sacramento County groundwater basin including the Zone 40 Master Plan Area
- to document the appropriateness of using the Sacramento County IGSM to evaluate potential groundwater impacts of the proposed plan(s).

This Technical Memorandum is organized into the following sections:

- *Surface Water and Groundwater Interactions;*
- *Potential Program Codes*
- *IGSM – Background & Application History*
- *Sacramento County IGSM*

- *Use of Sacramento County IGSM for Zone 40 Master Water Supply Plan*
- *Conclusions*

SURFACE WATER AND GROUNDWATER INTERACTION ISSUES

The complex hydrologic and hydrogeologic system in the Sacramento County has been divided into three different areas:

1- The North Basin which includes the hydrologic, land use and water use conditions north of the American River,

2- The Central Basin which includes the hydrologic, land use and water use conditions south of the American River and north of the Cosumnes River and includes the Zone 40, and

3- The Galt Area which includes the hydrologic, land use and water conditions in the southeast portion of Sacramento County south of the Cosumnes River.

These three areas were identified in previous countywide groundwater analyses of the Water Forum. A brief summary of the recharge, water use, and groundwater conditions is presented below for each area.

NORTH OF AMERICAN RIVER

The area north of the American River in Sacramento County is called the North Basin. The North Basin is bounded by the Sacramento River on the west and the American River on the south; both of these rivers are sources of recharge to the groundwater basin. To the north, the North Basin extends beyond Sacramento County into Sutter and western Placer County. The North Basin is largely urbanized, resulting in relatively high rainfall runoff and reduced groundwater recharge from precipitation.

Historically, there has been significant use of surface water in areas near the rivers, while the highest groundwater use was near the center of the basin. Groundwater elevations are lower near the center of the basin, due to local groundwater pumping and distance from the rivers

which recharge the basin. From 1970 to 1990 , surface water supplied about one-half the total water used in the basin. Groundwater was used to meet the remaining water demands.

Near the center of the basin, groundwater elevations have fallen over time to approximately 50 feet below sea level - approximately 120 feet below the ground surface; this cone of depression is centered near the southern boundary of the former McClellan Air Force Base.

SOUTH OF AMERICAN RIVER

The Central Basin is bounded on the north by the American River, on the southwest by the Sacramento River, and on the southeast by the Cosumnes River. All three rivers are sources of recharge to the Central Basin. The Central Basin mix of agricultural, agricultural-residential, and urban land uses has more exposed ground surface than the North Basin, resulting in a greater opportunity for groundwater recharge from precipitation. The Central Basin receives additional recharge as inflow from the east, and from infiltration of irrigation water and return flows.

Most of the areas within the City of Sacramento's Place of Use (POU) are supplied with surface water from the American and Sacramento Rivers, while the rest of the Central Basin relies primarily on groundwater. From 1970 to 1990 the water supply to the Central Basin consisted of approximately 25 percent surface water and 75 percent groundwater. Less than 1 percent of the water supply is from recycled water. Groundwater pumping for agriculture and an urban demand has resulted in a cone of depression centered near Elk Grove where groundwater elevations are about 60 feet below mean sea level, approximately 115 feet below the ground surface.

Zone 40 is approximately 33 percent of the Central Basin. A small portion of the Zone 40 area demands are currently met with surface water. Cal-Am has a contract with the City of Sacramento for 2,500 acre-feet in their Southgate service area. The remaining areas rely on groundwater to meet their needs including other private and public water companies and private wells are used for domestic and agricultural uses.

GALT AREA

The Galt Area groundwater basin is in the southeast Sacramento County. It is bounded on the northwest by the Cosumnes River and on the south by Dry Creek, which are potential sources of recharge to the basin. The Galt Area Basin has a mix of agricultural, agricultural-residential, and urban land uses. This land use mix has more exposed ground surface than the North Basin, resulting in a greater opportunity for groundwater recharge from precipitation. The Galt Area Basin may get additional recharge as inflow from the east, and from infiltration of irrigation water and return flows.

Surface water use in the area is limited; most of the water supply is from groundwater. From 1970 to 1990, the water supply for the Galt Area Basin consisted of approximately 5 percent surface water and 95 percent groundwater.

The long-term reliance on groundwater supply has resulted in groundwater elevations declining over time to approximately 50 feet below sea level, - approximately 100 feet below ground surface. The cone of depression in this basin is located east of the City of Galt.

POTENTIAL PROGRAM CODES

There are several program codes available for simulation of groundwater flow conditions. Popular codes that are typically applied to the analysis of groundwater basins are:

- MODFLOW
- FEMWATER
- MIKESHE
- FEMFLOW3D, and
- IGSM

These codes can be divided into two categories of simulation models:

- **Groundwater models,** which typically simulate groundwater flow with pre-calculated recharge from the surface system, such as recharge from rainfall or irrigation applied water. Description of the interaction between a stream and groundwater system is limited

due to lack of simulation of surface processes such as runoff. Examples of these models are MODFLOW and FEMWATER.

- **Integrated hydrologic models,** which simulate groundwater flow and some of the surface hydrologic processes, including rainfall runoff, land and water use, irrigation applied water, soil moisture simulation, infiltration and recharge to the groundwater system. These models also provide reasonable simulation of the stream-aquifer interaction. Examples of this type of model are MIKESHE, FEMFLOW3D, and IGSM.

The above model codes were recently evaluated for DWR, among others, for suitability in hydrologic and/or groundwater models used to evaluate conjunctive use programs. A list of program features and capabilities needed for regional hydrologic model applications were developed, and each model was evaluated for meeting the requirements. This list along with additional information on model features is available from DWR (Yolo County Conjunctive Use Program, Hydrologic Modeling Goals and Objectives, May 2002). Based on this list, MIKESHE and FEMFLOW3D models were considered to meet parts of the modeling needs. MIKESHE is a proprietary model code, and therefore does not meet DWR requirements, and FEMFLOW3D has limited support and field application for conjunctive use planning. Based on DWR's model selection criteria, IGSM code is the most suitable model for evaluation of conjunctive use scenarios in the Central Valley groundwater basin. IGSM code is public domain and meets most of the feature requirements of DWR.

IGSM – BACKGROUND AND APPLICATION HISTORY

DESCRIPTION OF IGSM

IGSM is a comprehensive numerical mode, which simulates various components of the hydrologic cycle and their interaction with one another. Originally developed by researchers at the University of California at Los Angeles (UCLA) in the late 1970s, the IGSM has been upgraded to a state-of-the-art comprehensive hydrologic model through numerous project applications in California, other states, and in Europe. The latest version of IGSM, Version

5.0, was completed in December 2000, under the sponsorship of the California Department of Water Resources (DWR).

The IGSM uses a highly efficient numerical solution technique (See Method of Fractional Steps, by N. N. Yanenko, Springer-Verlag, New York, 1971) to solve a weakly nonlinear system of groundwater flow equations obtained through Galerkin finite element formulation of the flow domain. This non-iterative method is one of the numerous solution techniques (iterative and non-iterative) used in solving groundwater flow problems (See *Numerical Solutions of Partial Differential Equations in Science and Engineering*, by L. Lapidus and G. Pinder, John Wiley and Sons, New York, 1982). The fractional step method has gained wide acceptance by engineers and fluid dynamicists for its computational efficiency, convergence properties, and stability (See A Fractional Step Method for Unsteady Incompressible Flows on Unstructured Meshes, by G. K. Despotis & S. Tsangaris, Journal of Computational Fluid Dynamics, 1997). The resulting linear system of equations, obtained through the application of the fractional step method to advance the time step, is solved in IGSM through an iterative method, called Successive Over Relaxation (SOR).

IGSM is a quasi-3 dimensional finite element model that simulates, among other hydrologic components, the following:

- Groundwater flow;
- Streamflow;
- Reservoir operations;
- Rainfall runoff processes;
- Land use processes (crop consumptive use and evapotranspiration);
- Unsaturated zone flow; and
- Land subsidence.

A schematic of different hydrologic components modeled in IGSM is presented in Figure 1.

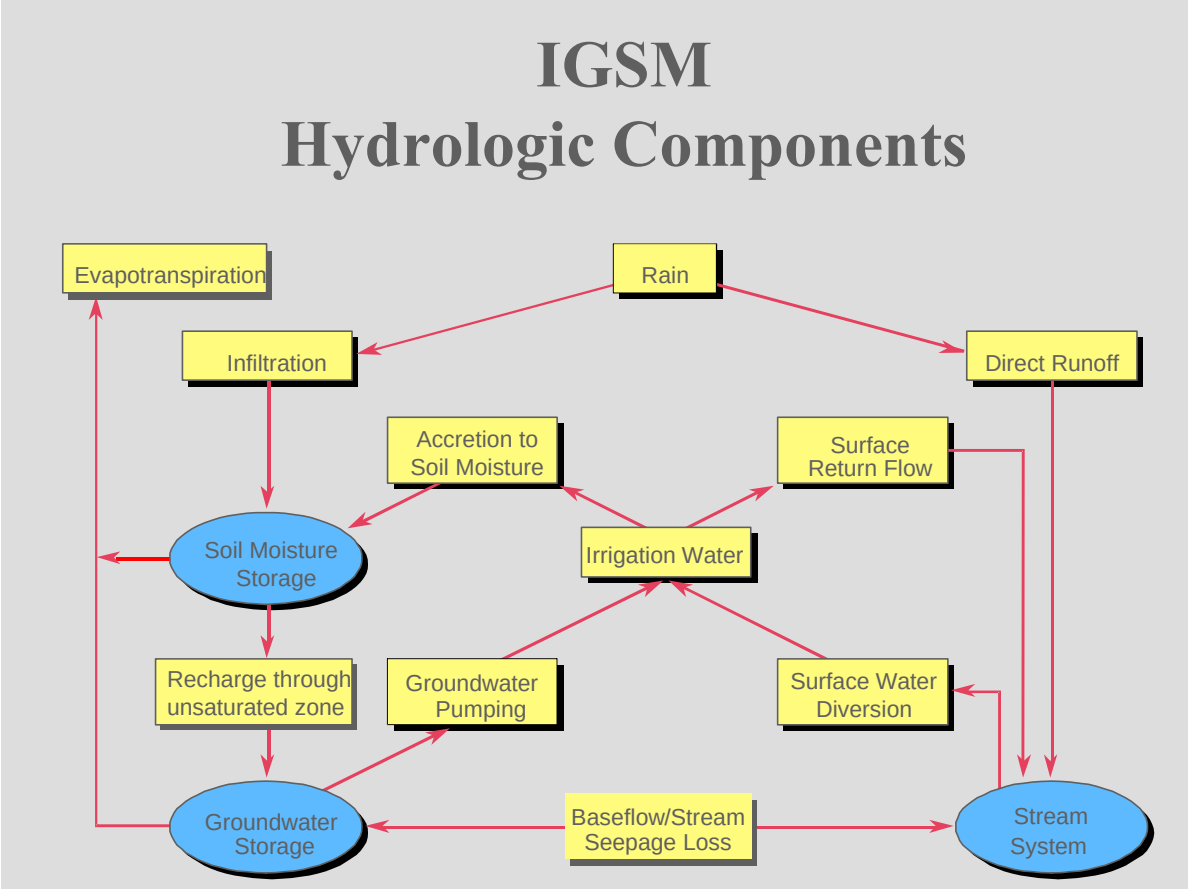

Figure 1: The hydrologic components of the IGSM

The IGSM model has been successfully applied to numerous groundwater basins in California, Colorado, and Florida, as shown in Table 1.

Table 1
IGSM PROJECT APPLICATIONS (1982-2002)

Basin/Location	Basin Area (Sq. Mi.)	Basin Management	Stream/Lake Impact Analysis	Groundwater Recharge	Conjuctive Use	Seawater Intrusion	Groundwater Availability	Water Quality
Alameda County, CA	120	◆	◆	◆		◆	◆	◆
Central Valley, CA	20,000	◆	◆		◆		◆	
Cherry Creek, CO	12		◆				◆	
Chino Basin, CA	270	◆					◆	◆
City of Sacramento, CA	100	◆	◆		◆		◆	
Colusa County, CA	458	◆		◆	◆		◆	
East Orange County, FL	900		◆	◆				
Friant-Kern Service Area	1,000	◆			◆		◆	
Imperial Valley, CA	580	◆	◆				◆	
Pajaro Valley, CA	120	◆		◆	◆	◆	◆	◆
Pomona Valley, CA	25	◆					◆	
Sacramento County, CA	800	◆	◆		◆		◆	
Salinas Valley, CA	780	◆	◆		◆	◆	◆	◆
San Joaquin County, CA	873	◆	◆	◆	◆		◆	
Soquel Creek Basin, CA	115	◆	◆	◆	◆	◆	◆	
Southeast Bay Plain, CA	59	◆		◆	◆	◆	◆	
Stony Creek Fan, CA	1,100	◆	◆	◆	◆		◆	
Sutter/Placer County, CA	341	◆		◆	◆			
West Orange County, FL	120	◆	◆	◆	◆			
Yuba County, CA	270	◆	◆	◆	◆		◆	

The IGSM is a well-maintained and well-supported model; it is kept up-to-date and is modified to address field application related issues as they arise during a project. The program code is regularly maintained by the code developers to incorporate new features and address newly discovered program bugs or mode deficiencies.

The IGSM has been reviewed by several technical advisory committees at the State, Federal, and local levels, including US Bureau of Reclamation, USGS, DWR, and Monterey County Water Resources Agency.

As part of an on-going review of various models at the California Water and Environmental Modeling Forum (CWEMF), review of IGSM code was initiated in 2001; findings are pending the administrative review of the draft results. The Department of Water Resources

(DWR), Modeling Support Branch, is also reviewing the IGSM code and its application to the Central Valley of California (CVGSM). The DWR has developed a plan and schedule to publish a version of the code that will be supported by the DWR.

The model developers have recently performed an independent model code and application review to evaluate specific features of the model. This review process has focused on code featuresapplied to real-world example problem with fairly well controlled hydrologic and hydrogeologic parameters. The IGSM simulations for the example problem were compared to similar simulations by MODFLOW, and the results have indicated reasonably good agreement between the two models. The results of this review were presented at the 2002 CWEMF conference in Asilomar, and is available on-line at www.cwemf.org.

DWR and the model developers are refining the model code and appropriate applications to implement the findings from on-going reviews of the code. DWR released a Beta version of the IGSM code with the Central Valley application in September 2002,this new version includes a flexible time step simulation capability for the groundwater flow simulation. The full version is scheduled for release by DWR in December 2002.

SACRAMENTO COUNTY INTEGRATED GROUND AND SURFACE WATER MODEL (IGSM)

HISTORY OF MODEL DEVELOPMENT

Sacramento County IGSM was developed for the County of Sacramento Department of Water Resources and the City-County Office of Metropolitan Water Planning in 1993. The original version of the model simulated the land and water use system in the urban and agricultural areas of the County, stream and river systems in the County and the groundwater flow system for the period 1970 to 1990. The model was later updated to include the hydrologic conditions to 1995, and is currently being updated to hydrologic conditions through water year 2000. The Sacramento County IGSM is not only an integrated simulation model, but also contains a vast amount of data on geologic conditions, land and water use,

groundwater pumping and recharge, as well as streamflow information. The specific features and data in the model are as follows:

1- The model includes the entire groundwater basin in Sacramento County, an area of about 900 square miles
2- The model area is subdivided into approximately 1600 small triangular and quadrilateral elements to simulate the horizontal movement of groundwater in the relatively complex hydrogeologic setting in the Sacramento County
3- Three distinct geologic formations are incorporated in the model to consider the shallow and deep pumping zones, as well as the older Miocene formation which includes the base of fresh groundwater
4- The model area is subdivided into 35 subareas, based on institutional and/or political boundaries, to provide geographic coverage for spatial input data such as crop mix and water use, as well as water budget reporting
5- Twelve rivers, streams, and creeks are included in the model, so that the details of the interaction between the streams and the groundwater system are simulated properly
6- Eleven rainfall stations are included in the model to incorporate detailed aerial distribution of the rainfall and corresponding runoff and recharge in the County
7- Two land use surveys (1976 and 1984) are included in the original model that simulates the historical hydrologic conditions in the County; a third land use survey (1993) was added to the model to evaluate the projected hydrological conditions in the basin; and the year 2000 land use survey is currently being added into the model to enable the model to simulate the projected and future hydrologic conditions in the County. The land use surveys along with the urban acreage and agricultural crop acreage will enable the model to simulate the water use conditions, as well as recharge conditions under various land use settings in the County.
8- Four hydrologic soil classifications are incorporated to provide spatial distribution of the infiltration from both rainfall and applied water through the soil zone
9- The model provides monthly and annual water budgets for the surface and stream system, as well as the groundwater system, in addition to regional and local groundwater flow and groundwater levels.

CALIBRATED MODEL

The Sacramento County IGSM was calibrated using a 3-step process:

1. Water Budget Analysis;
2. Groundwater Level Calibration;
3. Streamflow Calibration.

The water budget analysis was conducted for smaller subregions of the model area. The Groundwater Team of the Water Forum reviewed the water budget analysis. The water budget analysis ensured that the model represented the land and water use in the model area appropriately.

The Sacramento County IGSM was originally calibrated using historic and observed water level measurements at 67 wells during water years 1970-90. The original model calibration was reviewed during the hydrologic and land use updates, but no changes to the original calibration parameters were required to maintain calibration for the extended hydrologic period (1970 to 1995). A comparison of the simulated and observed groundwater levels at all calibration wells indicate that the simulated groundwater levels follow the long-term trends of the observed records, as well as the seasonal fluctuations. The statistical analysis of the simulated groundwater levels and observed records, also indicate that 92 percent of the simulated groundwater levels are within 10 feet of the observed levels, which is a reasonable difference based on experience with modeling of regional groundwater basins in Central Valley, as well as the accuracy of measurement of static groundwater levels in most wells.

The model was also calibrated to the observed flows at two streamflow gaging stations, (i) Cosumnes River at McConnel gage, and (ii) Morrison Creek near Sacramento gage. Both of these gages measure unregulated flows of high and low magnitude. An analysis of the simulated streamflows and observed records indicate that 85 percent of high flows are simulated within 20 cfs of the recorded streamflows, and 90 percent of the low flows are simulated within 10 cfs of the recorded streamflows. Given the level of accuracy in the

recorded streamflows as well as the simulation formulations of physical processes, this level of accuracy is within acceptable range of most streamflow simulation models.

SACRAMENTO COUNTY IGSM APPLICATIONS

Sacramento County IGSM has been applied in numerous studies and programs over the past 12 years. The model has been debugged, refined, and updated during many of these studies, at various levels of detail. Table 2 shows the projects where the Sacramento County IGSM has been applied.

Table 2

Applications of Sacramento County Integrated Groundwater-Surface Water Model

Sacramento IGSM Application	Year	Study Name	Study Area	Basin Management	Stream/Lake Impact Analysis	Groundwater Recharge	Conjunctive Use	Groundwater Availability	Water Quality Analysis
1	1992	City of Sacramento IGSM	City of Sacramento POU	X	X		X	X	
2	1993	Sacramento County IGSM	Sacramento County	X	X		X	X	
3	1996	American River Water Resources Investigation	Western Placer County/ Sutter County, Sacramento County, San Joaquin County	X	X		X	X	X
4	1996	Northridge WD Conjunctive Use Study	North American River Basin		X		X		
5	1996	Rio Linda Water Supply Analysis	North American River Basin				X	X	
6	1997	Sacramento Water Forum	Sacramento County	X	X	X	X	X	
7	1998	Sunrise Douglas Water Supply Analysis	Sacramento County Central Basin		X			X	X
8	1999	Sunrise Douglas Water Supply Analysis	Sacramento County Central Basin		X			X	X
9	1999	Zone 40 (North Vineyard Well Field)	Sacramento County Central Basin		X		X	X	
10	2000	American River Basin Cooperating Agencies (ARBCA)	North American River Basin	X	X		X		
11	2002	Zone 40 Water Master Plan Update	Sacramento County Central Basin		X	X	X		

USE OF SACRAMENTO COUNTY IGSM FOR ZONE 40 MASTER PLAN UPDATE ANALYSIS

Analysis of hydrologic impacts of the alternative water demand and supply options for the Zone 40 Master Plan Update requires a comprehensive numerical computer tool. As shown in previous sections, the Sacramento County IGSM has been developed based on long-term hydrologic and land and water use data, calibrated to observed groundwater and streamflow records with reasonable accuracy, reviewed by a number of agencies, and applied to a number of planning level projects, including analysis for the Water Forum.

The Zone 40 Master Plan Update will evaluate the hydrologic impacts of demand and supply alternatives on groundwater and surface water. In order to evaluate the appropriateness of the model for such analysis, the following capabilities of the model should be considered:

1. Evaluate changes in land use on groundwater and stream system
2. Evaluate changes in surface water diversions on groundwater and stream system
3. Evaluate changes in pumping on groundwater and stream system
4. Ability to Evaluate effects of changes in groundwater conditions on the stream system
5. Evaluate the changes in stream gains/losses as a result of surface water operations and/or groundwater operations

These abilities should be evaluated for short-term and long-term hydrologic conditions, as well as steady-state conditions.

Based on the theoretical foundations of the model, as well as the numerous applications of the model to Sacramento County and other similar basins, it is our professional opinion that the Sacramento County IGSM can perform the above evaluations with a reasonably good degree of accuracy for planning level projects. In order to demonstrate model capabilities for specific issues with respect to impacts to Cosumnes River, a set of test runs were performed as part of the work to prepare this memorandum. These test runs are designed to evaluate the

sensitivity of the model (changes in streamflows and groundwater levels) to changes in groundwater pumping at specific wells.

SACRAMENTO COUNTY IGSM TEST RUNS

To analyze the potential impacts of changes in pumping rates and/or patterns in Sacramento County on the river/stream system, two separate analyses of impacts of change in pumping rates were made at four wells along the American River, and separately along Cosumnes River. These analyses consisted of changing the pumping rate at the four wells by 2, 5, and 10 times the baseline-pumping rate. The effects of these pumping rate changes were evaluated at groundwater levels at the pumping wells and nearby locations, as well as at the nearby stream nodes. The following conclusions are reached from this analysis:

- The groundwater levels at stream nodes along American River as well as, at groundwater nodes nearby the pumping wells responded appropriately to changes in groundwater pumping at the four selected wells. For example, the magnitude of groundwater elevation declines was proportional to the increase in localized groundwater pumping, while reflecting the seasonal fluctuations and long-term trends of groundwater levels identified in the baseline condition.
- The American River flows are somewhat sensitive to the changes in groundwater pumping. Due to the large volume of flows compared to the changes in pumping at the selected wells, the changes in streamflow are typically observed only during dry hydrologic periods, when significant changes in hydrologic condition coincide with increased pumping.
- The groundwater levels at stream nodes along Cosumnes River as well as at the groundwater nodes nearby the pumping wells responded similarly to the change in groundwater elevations described above in the American River example.
- The Cosumnes River flows are not significantly sensitive to the changes in groundwater pumping because in most hydrologic conditions, there is little or no hydraulic connection between the primary groundwater system and the Cosumnes River. The simulated response on the Cosumnes River streamflow is reasonable based on the physical and hydrologic settings of the stream and groundwater system.

- A review of the historical groundwater levels at observation wells nearby the Cosumnes River indicates that during the period 1940 through present, there have not been indications of substantial hydraulic connection between the Cosumnes River and groundwater system. Based on the same observations, the groundwater levels in the proximity of Cosumnes River near Highway 99 are approximately 60 feet lower than the riverbed. Since the Sacramento County IGSM has been calibrated to the historical groundwater and streamflow conditions, in the unlikely event of substantial changes to the physical relationships between the stream and groundwater system, the model should be re-calibrated to reflect the new physical conditions.

CONCLUSIONS

In this section, we present a professional opinion based on the above qualitative and quantitative evaluation of the IGSM.

1. The IGSM model has a history of successful field application in Sacramento County as well as in many other basins in California.
2. IGSM code has been reviewed by various agencies, including USBR, DWR, and USGS, as well as independent consultants and researchers.
3. IGSM uses standard theory of stream-aquifer interaction described in standard textbooks.
4. IGSM uses a unique locally iterative technique to address the non-linearities associated with stream-aquifer interaction. The literature of non-linear numerical mathematics abounds in different iterative and non-iterative techniques to approximate the non-linear problems. The method used in IGSM did not result in any divergence as shown in the calibration of wells near the streams.
5. The model represents the historical hydrologic response of the groundwater basin, as well as the streamflow conditions in the American and Cosumnes Rivers in Sacramento County appropriately based on the results of calibration to the historical physical conditions.

6. The results of the sensitivity analysis of pumping at wells near the American and Cosumnes Rivers also indicate that IGSM is appropriately simulating the stream-aquifer responses.

Based on the above findings, it is our professional opinion that IGSM is an appropriate analytical tool for use in the analysis of hydrologic effects of alternatives considered under the Zone 40 Master Plan update.