

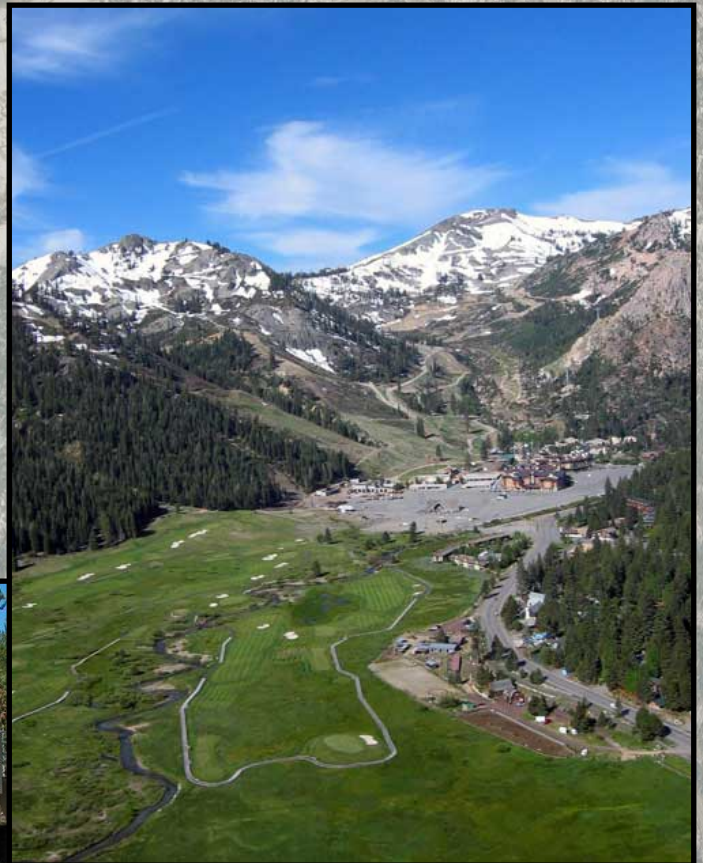
# Water Year 2007 Annual Review and Report Olympic Valley California

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March, 2008

*Prepared by:*

Hydro  etrics  
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## ABBREVIATIONS, SYMBOLS, AND, ACRONYMS

AB	Assembly Bill
ARR	Annual Review and Report
ASR	Aquifer Storage and Recovery
BMO	Basin Management Objective
cfs	Cubic Feet per Second
CHAMP	Chemical Application Management Plan
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DWR	California Department of Water Resources
EPA	United States Environmental Protection Agency
GMP	Groundwater Management Plan
GPM	Gallons per Minute
HSU	Hydrostratigraphic Unit
MCL	Maximum Contaminant Limit
MG	Million Gallons
mg/L	milligrams/liter
MTBE	Methyl tertiary-butyl ether
NRCS	Natural Resources Conservation Service
RSC	Resort at Squaw Creek
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SVPSD	Squaw Valley Public Services District
SVWMC	Squaw Valley Mutual Water Company
TDS	Total Dissolved Solids
TKN	Total kjeldahl nitrogen
TPH	Total Petroleum Hydrocarbons
TRC	Technical Review Committee
µg/L	micrograms/Liter
UST	Underground Storage Tank
VOC	Volatile Organic Compound

## **Section 1**

# **INTRODUCTION**

This report is the first Annual Review and Report (ARR) prepared under the Olympic Valley Groundwater Management Plan (GMP). This report summarizes the groundwater conditions in the basin during Water Year 2007 (October 1, 2006 – September 30, 2007) and documents the status of groundwater management activities and recommended amendments to the GMP. The purposes of this report include:

- Providing a succinct description of current groundwater conditions in Olympic Valley.
- Providing all stakeholders data and analyses that can assist with groundwater management in Water Year 2008.
- Detailing recent basin management activities.
- Recommending future groundwater management activities

This report is intended to provide information to all groundwater users and interested stakeholders in Olympic Valley. Cooperative groundwater management is a priority for effectively managing the groundwater resources in Olympic Valley.

## **1.1 OLYMPIC VALLEY GROUNDWATER MANAGEMENT PLAN**

The California Groundwater Management Act (California Water Code §10753 *et seq.*), enacted as Assembly Bill (AB) 3030 in 1992, encouraged local public agencies to adopt formal plans to manage groundwater resources within their jurisdictions. In September 2002, Senate Bill (SB) 1938 was signed into law amending sections of the Water Code related to groundwater management. SB1938 set forth specific requirements for GMPs including establishing Basin Management Objectives (BMOs), preparing a plan to involve other local agencies in a cooperative planning effort, and adopting monitoring protocols that promote efficient and effective groundwater management.

In accordance with AB3030 and SB1938, the Squaw Valley Public Service District (SVPSD) developed a GMP in 2007. This plan was developed in coordination with input from a Stakeholders group that included representatives from other groundwater users, environmental advocates, regulatory agencies, and the general public. The SVPSD adopted the GMP on May 29, 2007. In accordance with DWR's suggested components for a GMP (DWR, 2003) the Olympic Valley GMP included a requirement for regular reporting of groundwater activities and GMP implementation. This ARR is the vehicle for annually reporting on

groundwater activities, and is an important component of the GMP implementation.

## **1.2 DESCRIPTION OF OLYMPIC VALLEY**

### **1.2.1 BASIN BOUNDARIES AND GMP MANAGEMENT AREA**

The GMP management area does not exactly coincide with the Olympic Valley Basin described in DWR Bulletin 118. The boundaries of the groundwater basin managed under the GMP are defined by geologic and hydrologic features that limit the movement of groundwater in the unconsolidated sediments filling Olympic Valley. These unconsolidated valley fill sediments are bounded by low permeability granitic and volcanic rocks and define part of the GMP management area boundary. These same rocks form the mountains that flank the Valley on the north, west, and south. The hydrogeologic boundary shown on Figure 1 outlines the extent of the sediments filling the basin extending to the Truckee River.

The GMP management area is a subarea of the unconsolidated sediments within the hydrogeologic boundary in Figure 1. The eastern end of the GMP management area is delimited by low permeability glacial moraine deposits. These moraine deposits are considerably less permeable than sediments in other parts of Olympic Valley and are interpreted to be a barrier to groundwater flow.

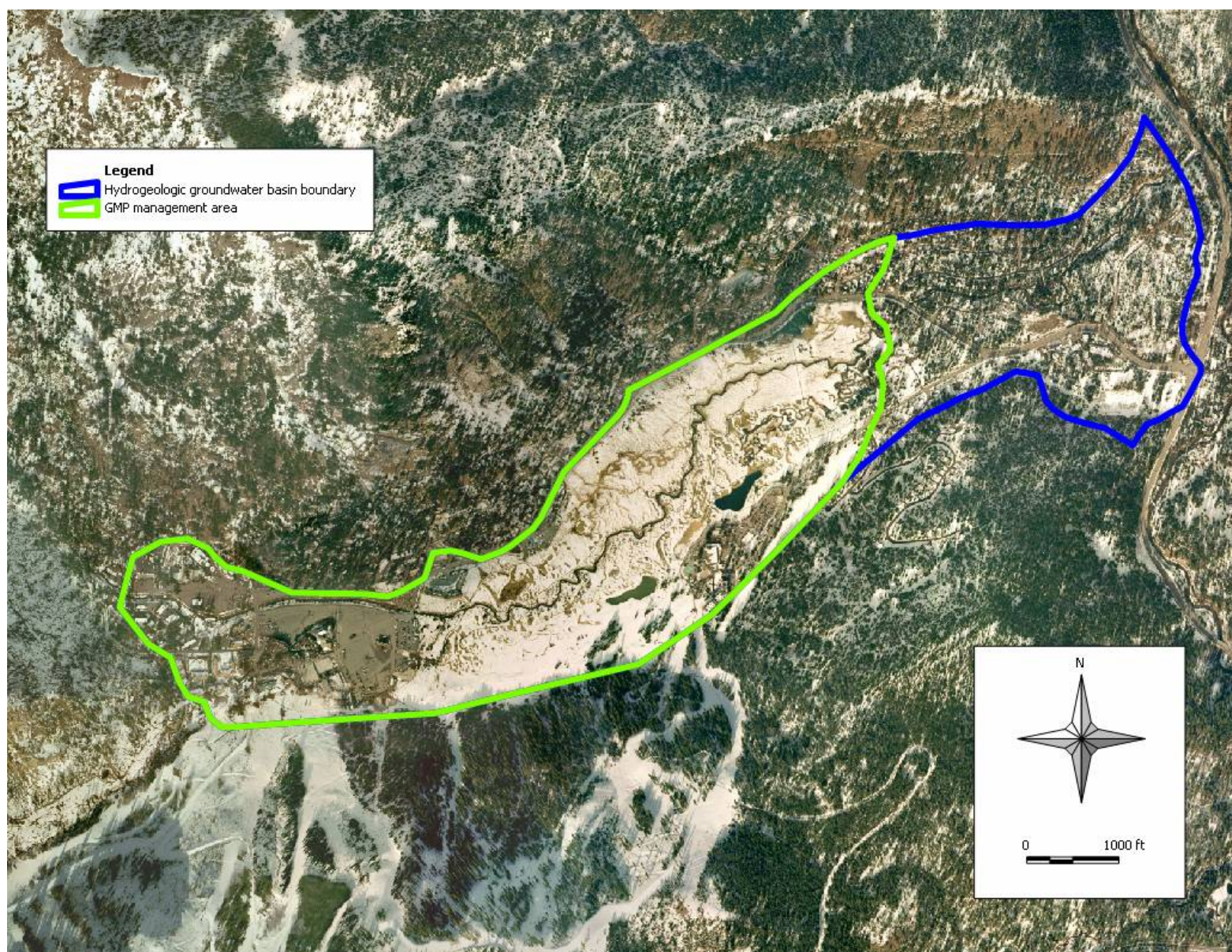


Figure 1: GMP Management Area Boundary

### **1.2.2 GEOLOGY OF GROUNDWATER BASIN SEDIMENTS**

Groundwater extracted from Olympic Valley is derived primarily from unconsolidated sediments filling the Valley. These unconsolidated valley fill sediments are underlain by Cretaceous granitic rocks of the Sierra Nevada batholith and Pliocene volcanic rocks.

The unconsolidated sediments were deposited primarily by glacial, lacustrine, and fluvial processes. The most prominent glacial feature is the terminal moraine at the eastern end of the Valley. This moraine formed a dam in the Valley outlet. Various alluvial, glacial, and lacustrine sediments collected behind this dam, filling in the Valley to its present elevation. This moraine currently serves as a barrier to groundwater flow, and forms the eastern boundary of the area managed under this GMP, as discussed in Section 1.2.1.

Geological interpretation of the basin fill sediments is difficult because the alluvial and lacustrine deposits do not show any clear lateral continuity between wells. However, in general the sediments filling the Valley are coarser in the western part of the Valley, and become finer towards the northeastern part of the Valley. This is consistent with the fact that Squaw Creek flows from west to east through the Valley. Coarser material is deposited by Squaw Creek proximal to the mountain front; finer material is carried farther downstream and deposited in the eastern portion of the Valley.

West Yost & Associates (2005) divided the basin sediments into three hydrostratigraphic units (HSU). HSU 1 is the shallowest unit. This unit consists of fine grained glacial lake and modern stream deposits. The modern Squaw Creek has cut channels in the lake deposits and deposited coarser grained stream sediments within the glacial sediments. HSU 2 underlies HSU 1 and consists of sands and gravels. West Yost & Associates interpreted these sediments as deposited between periods of glacial lake deposition. HSU 3, the deepest unit, consists primarily of dark fine grained sediments which may represent glacial lake deposits.

### **1.2.3 WATER SUPPLY**

All domestic, municipal, and irrigation water in Olympic Valley is derived from local groundwater sources. Groundwater is primarily extracted from glacial deposits and river alluvium filling Olympic Valley; a minor amount is also extracted from fractured bedrock along the sides of the Valley.

The bulk of the groundwater pumped from the Olympic Valley groundwater basin is pumped by three entities: SVPSP, Squaw Valley Mutual Water Company (SVMWC), and the Resort at Squaw Creek (RSC). These three entities

pumped the following quantities from their Olympic Valley basin wells during Water Year 2007.

- SVPSD - 133 million gallons (MG) (408 acre-feet)
- RSC - 100 MG (307 acre-feet) for golf course irrigation and snow making.
- SVMWC – 26.5 MG (81 acre-feet)

A relatively minor amount of groundwater was pumped from the basin by PlumpJack Squaw Valley Inn and Squaw Valley Ski Corporation. Additional groundwater is pumped from outside the GMP management area from horizontal wells along the flanks of Olympic Valley, and from private wells such as the Poulsen Family well at the east end of the Valley. Because these wells lie outside the GMP management area, they are not discussed further in this report.

## **Section 2**

### **DATA AVAILABILITY**

This section reviews the availability of various data relevant to groundwater management in Olympic Valley. This review includes a summary of the data available for Water Year 2007, the data source, frequency, and the period of record if possible.

#### **2.1 CLIMATE DATA**

Climate data are available from two stations within the Olympic Valley: the Old Fire Station precipitation gauge and the SNOTEL snowpack measurement station.

##### **2.1.1 OLD FIRE STATION**

This station is operated by SVPSD and is located on the Valley floor within the GMP management area. Daily precipitation data are largely complete at this station from Water Year 1965 through the present.

Data at the Old Fire Station were not available for the entire Water Year 2007. Precipitation data from a gauge maintained by Olympic Valley resident Carl Gustafson was used as a substitute for Old Fire Station data between April and September. The Old Fire Station gauge was repaired in September, 2007.

##### **2.1.2 SNOTEL SQUAW VALLEY**

This station is operated by the Natural Resources Conservation Service (NRCS) and is located west of the GMP management area at an elevation of 8029 feet. Data are available for this station since January 1981. Available data include snow depth, precipitation, and temperature. Historical daily and monthly data are available on the internet. Daily data from this station are available for the entire Water Year 2007.

#### **2.2 PUMPING DATA**

Groundwater pumping data from within the GMP management area are available from SVPSD, SVMWC, and RSC. There are no data or estimates of pumping available from other pumpers within the groundwater management area. Total pumping other than SVPSD, SVMWC, and RSC is assumed to be relatively minor.

### **2.2.1 SVPSD PUMPING**

During Water Year 2007 SVPSD pumped four wells within the GMP management area: wells SVPSD#1, SVPSD#2, SVPSD#3, and SVPSD#5. In addition, SVPSD also pumped groundwater from a horizontal well outside the GMP management area. The data from these wells are complete for all wells for Water Year 2007.

### **2.2.2 SVMWC PUMPING**

During Water Year 2007 SVMWC pumped two wells within the GMP management area: wells SVMWC#1 and SVMWC#2. In addition SVMWC pumped water from their horizontal west well which is outside of the GMP management area. The pumping data from the two wells located in the GMP management area are complete for Water Year 2007.

### **2.2.3 RSC PUMPING**

RSC pumps from 3 wells, named 18-1, 18-2, and 18-3R, into storage ponds. All water used by RSC for irrigation or snowmaking is pumped out of these ponds and passes through a single flowmeter. Monthly flow data for Water Year 2007 were provided by RSC. Water Year 2007 snow making and irrigation data are complete.

## **2.3 GROUNDWATER LEVEL DATA**

During Water Year 2007 groundwater level measurements were available from three sources: SVPSD, SVMWC, and the Chemical Application Management Plan (CHAMP) monitoring program of RSC.

### **2.3.1 SVPSD GROUNDWATER LEVEL DATA**

Groundwater levels are currently collected on the SVPSD SCADA system using automatic data loggers at wells SVPSD#1, SVPSD#2, and SVPSD#5. Groundwater level data from all of these wells during Water Year 2007 are complete.

### **2.3.2 SVMWC GROUNDWATER LEVEL DATA**

Monthly static groundwater level measurements are collected by hand from wells SVMWC#1 and SVMWC#2. Groundwater level data for Water Year 2007 are complete.

### **2.3.3 RSC MEADOW AREA GROUNDWATER LEVEL DATA**

Groundwater levels are monitored by RSC at a number of wells in the Olympic Valley meadow. The monitoring is required by the California Regional Water Quality Control Board (CRWQCB) Order Number 6-93-26. This order incorporates provisions of RSC's Chemical Application Management Plan (CHAMP) program including groundwater level monitoring

Groundwater levels are measured during sampling events. The shallow CHAMP wells are sampled every two years; half of the shallow wells are sampled in odd numbered years and half are sampled in even numbered years. The deep CHAMP wells are sampled every four years. These wells are also split into two groups which are sampled two years apart. Groundwater levels are only recorded during the year the wells are sampled.

Water Year 2007 groundwater level data were collected during two sampling events: October 2006 and May 2007. In October 2006 samples were collected from eight shallow wells (301, 307, 309, 312, 316, 318, 322, and 325) and seven deep wells (304, 319, 321, 326, 327, 329, and 330). Water level data were not available from well 332 due to a collapsed casing. In addition to the required Water Year 2007 groundwater level measurements, RSC collected bimonthly groundwater levels in twenty of the CHAMP program monitoring wells, as well as in wells 18-1, 18-2, T-3, and T-4.

## **2.4 STREAM FLOW**

Three creek flow measurement gauges have been operated by Watermark Engineering since late fall 2002. The gauges are located on the Shirley Creek Fork of Squaw Creek, the South Tributary of Squaw Creek, and on Squaw Creek at the bridge east of the meadow. Reports summarizing each Water Year include a summary of visits, daily flow values, and the stage-discharge relation.

## **2.5 GROUNDWATER QUALITY**

Three sources of groundwater quality data are available: municipal supply data available from Title 22 drinking water requirements, data from regulated contamination sites, and groundwater quality monitoring by the CHAMP program at the golf course.

### **2.5.1 MUNICIPAL GROUNDWATER QUALITY**

Groundwater quality data from SPSD and SVMWC is collected as required under CCR Title 22 requirements.

## *SVPSD*

During Water Year 2007 groundwater quality data were collected at the SVPSD#1, SVPSD#2, SVPSD#3, and SVPSD#5 wells. This data are reviewed in Section 4. In addition groundwater quality data for Water Year 2007 were collected from the SVPSD#3 well as part of the required monitoring at the Opera House fuel oil leak site.

## *SVMWC*

Groundwater quality data were collected by SVMWC as required by law during Water Year 2007. Because of time and budget constraints, these data were not collected or analyzed as part of the current report.

### **2.5.2 ENVIRONMENTAL COMPLIANCE SITES**

During Water Year 2007, three sites within the GMP management area had open cases with the CRWQCB. Of the three sites, groundwater quality data were collected only at the Opera House site during Water Year 2007. Nine monitoring wells at the Opera House site and one municipal well (SVPSD#3) were sampled quarterly for Total Petroleum Hydrocarbons (TPH). Additionally well SVPSD#3 was sampled quarterly for Safe Drinking Water Act (SDWA) volatiles.

Data are available online from the CRWQCB through their GEOTRACKER web site. The Opera House site was closed in August 2007 and no further data collection is required at this site.

### **2.5.3 CHAMP PROGRAM**

The CHAMP program samples groundwater quality at 32 shallow and deep monitoring wells in the meadow. The samples are analyzed for nine constituents: nitrate as N, nitrite as N, total nitrogen, total kjeldahl nitrogen, total phosphorus, total dissolved solids, iron, sulfate, and chloride.

Shallow CHAMP wells are sampled every two years. These shallow wells are split into two groups which are sampled in either odd numbered or even numbered years. The deep wells are sampled every four years. These wells are also split into two groups which are sampled two years apart.

Groundwater quality data were collected during three sampling events in Water Year 2007: October 2006, May 2007, and a December 2006 resampling event. In October 2006 samples were collected from eight shallow wells (301, 307, 309, 312, 316, 318, 322, and 325) and seven deep wells (304, 319, 321, 326, 327, 329, and

330). Water quality data were not available from well 332 due to a collapsed casing.

## **Section 3**

# **GROUNDWATER SUPPLY ASSESSMENT**

This section presents the status of the Olympic Valley Groundwater Basin during Water Year 2007 including an analysis of the stream flow, precipitation, pumping, and groundwater levels. Water Year 2007 hydrology is also compared to conditions of past years. In addition to a review of conditions in the basin, the relation between stream flow, pumping, and groundwater levels in municipal production wells is examined in order to provide an understanding of the important variables controlling groundwater levels in the basin.

### **3.1 PRECIPITATION**

Snow-water equivalent precipitation measured by the combination Old Fire Station gauge/Carl Gustafson gauge equaled 28.5 inches during Water Year 2007. This precipitation is 53% of the average annual Water Year precipitation of 53.8 inches; and was the lowest total since Water Year 2001. Snow-water equivalent precipitation measured at the Squaw Valley SNOTEL station equaled 49.0 inches during Water Year 2007. This is 74% of the average precipitation of 66.3 inches; and was the lowest total since Water Year 2001.

Total annual precipitation by Water Year for the Old Fire Station gauge is presented in Figure 2. A horizontal line on Figure 2 shows the average precipitation of Water Year 1965 through Water Year 2007. Total annual precipitation by Water Year for the Squaw Valley SNOTEL Station is presented in Figure 3. A horizontal line on Figure 3 shows the average SNOTEL precipitation of Water Year 1981 through Water Year 2007.

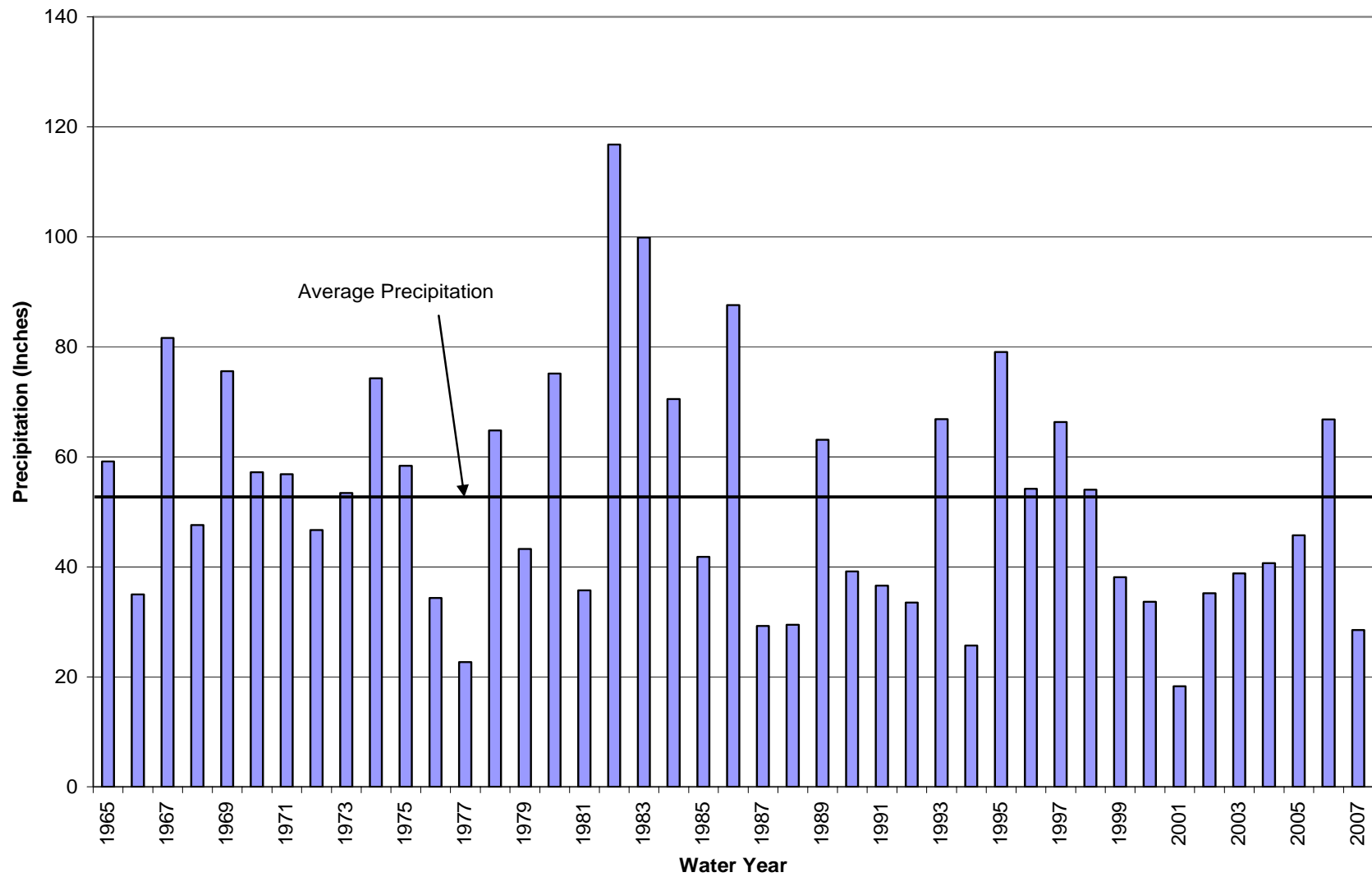


Figure 2: Olympic Valley Precipitation by Water Year: Old Fire Station gauge

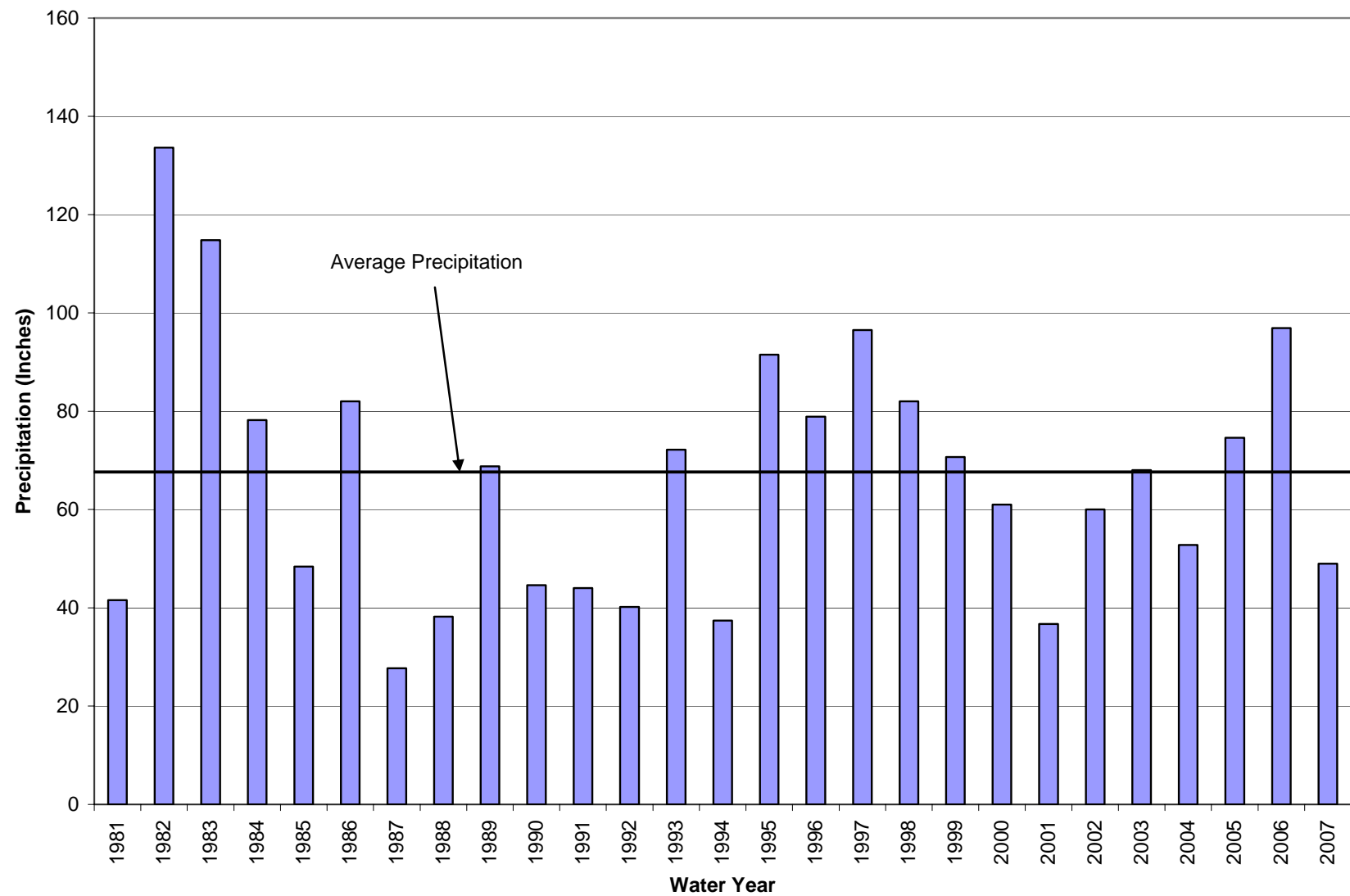


Figure 3: Olympic Valley Precipitation by Water Year: SNOTEL Station

### 3.2 STREAM FLOW

Flow in Squaw Creek is measured at three gauges shown in Figure 4. The two main forks of Squaw Creek are gauged at the eastern end of the Valley, just outside the GMP management area. The northern gauge, QV1, measures flow on Shirley Canyon Creek and the southern gauge, QV2, measures flow on the South Fork of Squaw Creek. Gauge QV3 measures flow downstream of the terminal moraine and east of the GMP management area boundary.

Total annual volumes of flow in Squaw Creek at the three gauges for Water Years 2003 through 2007 are given in Table 1. This table shows that the total flow of Squaw Creek entering Olympic Valley (sum of QV1 + QV2) was lower during Water Year 2007 than during any of the previous four years. Total discharge at gauges QV1 and QV3 was lower than any of the preceding four Water Years and total discharge at QV2 was the second lowest of the five years.

Table 1: Total Water Year Discharge at Squaw Creek Gauges

Water Year <sup>1</sup>	QV1 Shirley Creek (acre-feet)	QV2 South Tributary (acre-feet)	Sum QV1 + QV2 (acre-feet)	QV3 Squaw Creek (acre-feet)
2003	10,100	5,890	15,990	19,000
2004	6,820	4,020	10,840	15,300
2005	14,750	8,420	23,170	24,300
2006	17,340	7,840	25,180	33,940
2007	5,750	4,380	10,130	11,380

<sup>1</sup>Water Year 2003 and 2004 data from West Yost & Associates 2005

Water Year 2005 through 2007 data provided by Watermark Engineering

The measured Creek inflows, shown as the sums of QV1 + QV2 on Table 1, are highly correlated with the measured outflow, QV3. The correlation coefficient between these two factors is approximately 0.95. Even with this high degree of correlation, data on Table 1 show fluctuations that are likely climate or development related. For example, the measured inflows in Water Year 2004 and Water Year 2007 were different by only 710 acre-feet (231 MG); however the outflows were different by approximately 4,000 acre-feet (1303 MG). This may be due to time of snowmelt, speed of snowmelt related to temperature, changes in basin development, or other factors.

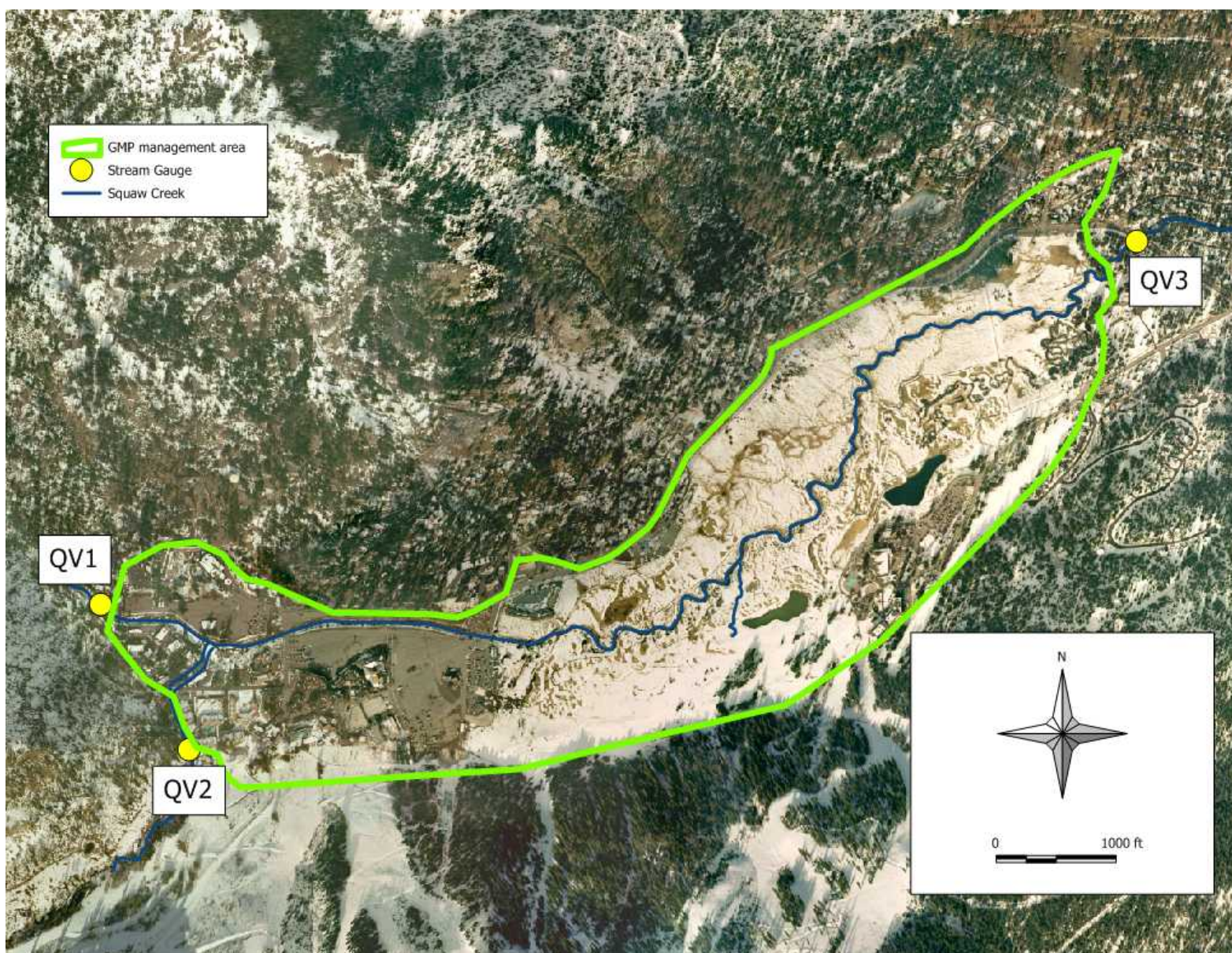


Figure 4: Stream Gauge Locations

Mean daily discharge in Squaw Creek at each of the three gauges during Water Year 2007 is presented in Figure 5. Significant flow in Squaw Creek begins in November with sharp spikes of high flow and very low to zero flows in between. These spikes result from runoff from individual rain storms. In February ( for QV3) or mid March (for QV1 and QV2) the hydrograph character changes; the peak flows become smoother and lower, while the low flows between the peaks are higher and never reach zero. This more continuous and less spiky flow starting in February/March is due to the contribution of snowmelt to stream flow.

The difference between the amount of water flowing into the GMP management area and the amount of water flowing out of the GMP management area through Squaw Creek is shown on Figure 6. When the line on this figure is above zero, more water flows out of the management area than flows into the management area through Squaw Creek. From a basin-wide perspective, this means the creek overall gains flow from groundwater seepage, rainfall and snowmelt runoff, spring flow when the line is above zero. When the line is below zero, more water flows into the management area than flows out of the management area through Squaw Creek. From a basin-wide perspective this means that the creek overall loses water to evaporation, transpiration, and groundwater seepage when the line is below zero.

The cumulative difference between the amount of water flowing into the GMP management area through the two upstream forks of Squaw Creek and the water flowing out of the area is presented in Figure 7. This figure shows the cumulative total of the inflows and outflows that are shown on Figure 6. When the line on Figure 7 is above zero, more water has flowed out of the GMP management area through Squaw Creek than has flowed into the GMP management area through the Creek since the beginning of the Water Year. The graph shows during Water Year 2007 the GMP management area was a net source of approximately 400 MG (1227 acre-feet) of water to Squaw Creek.

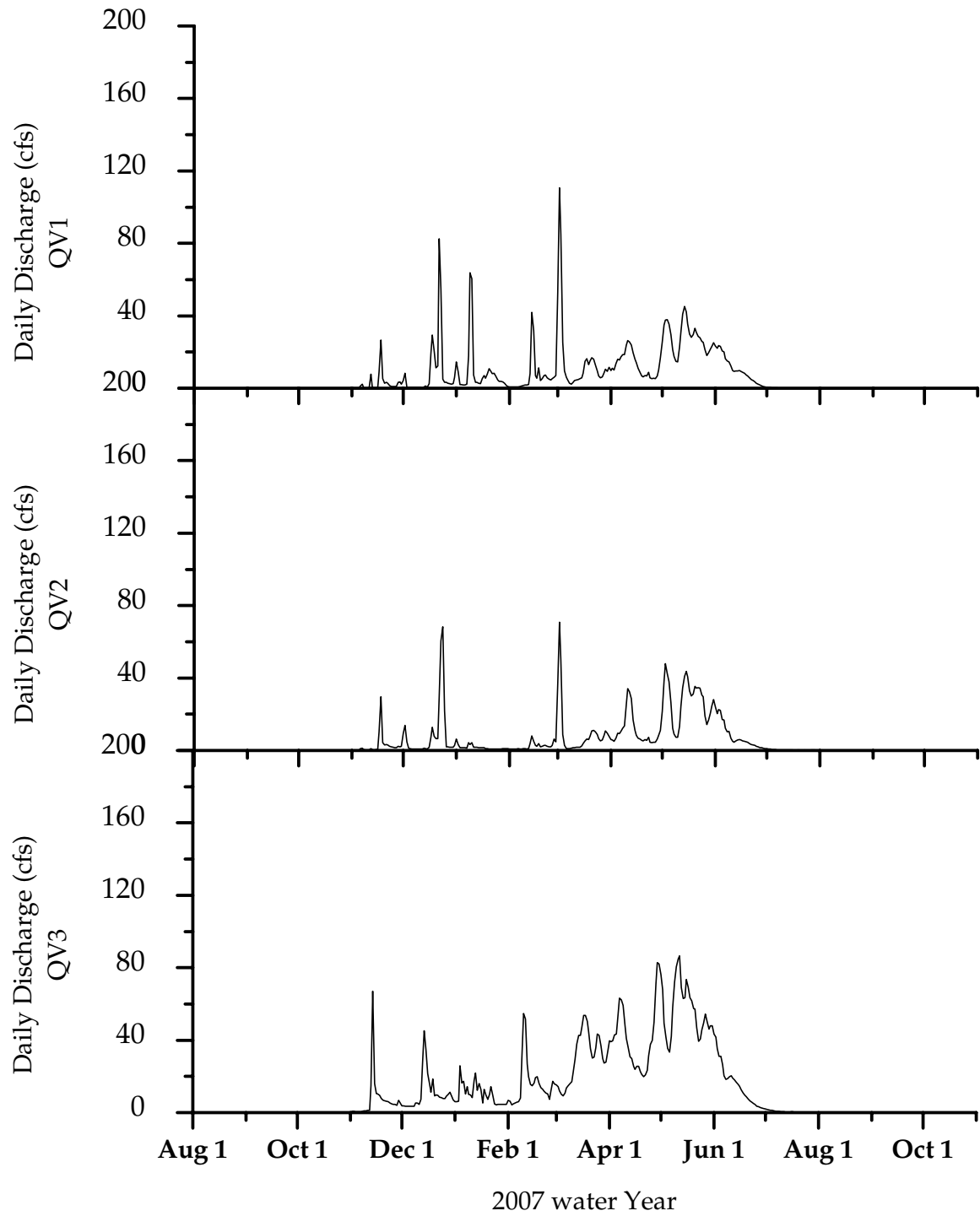


Figure 5: Water Year 2007 Stream flow

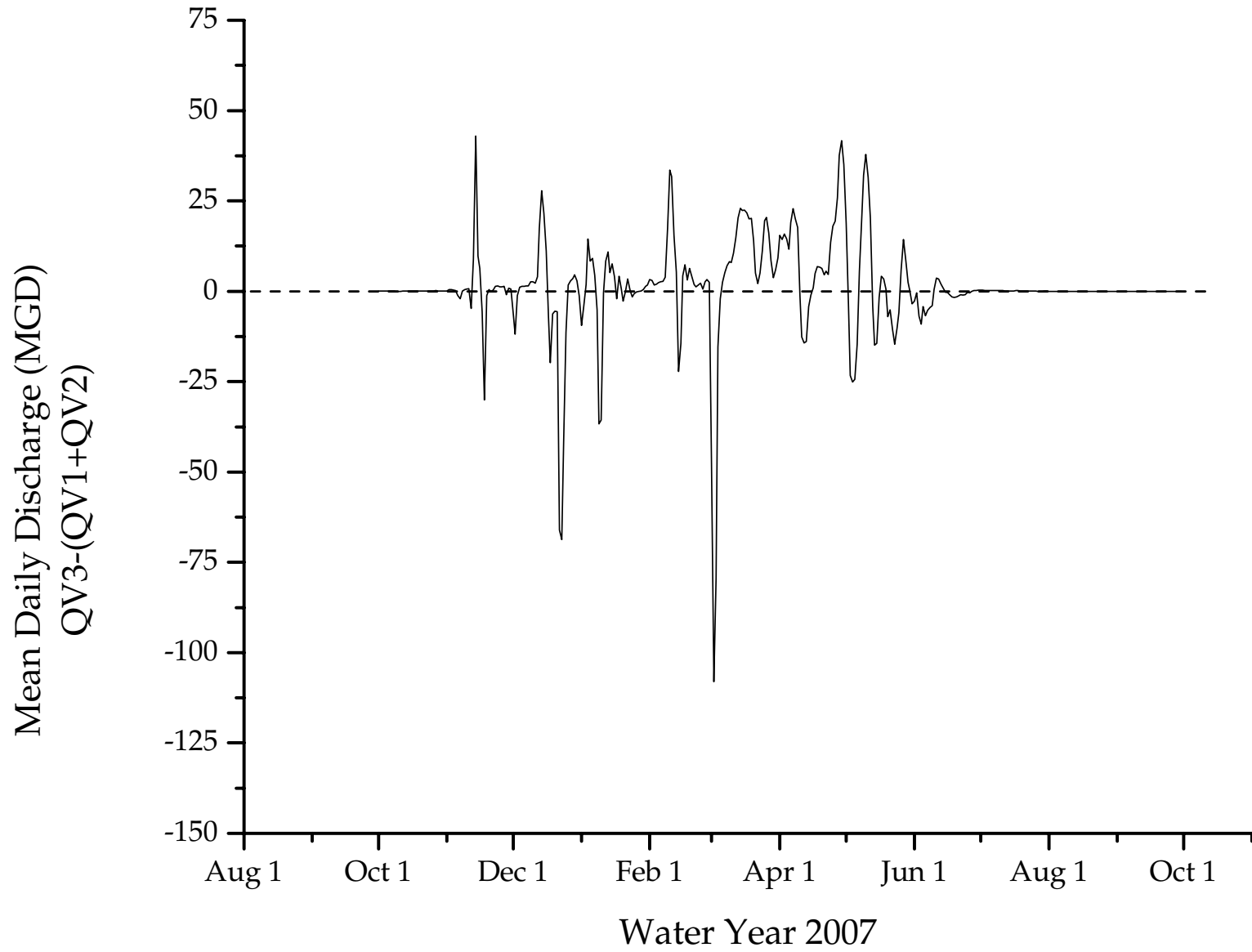


Figure 6: Water Year 2007 Daily Stream Flow Gain

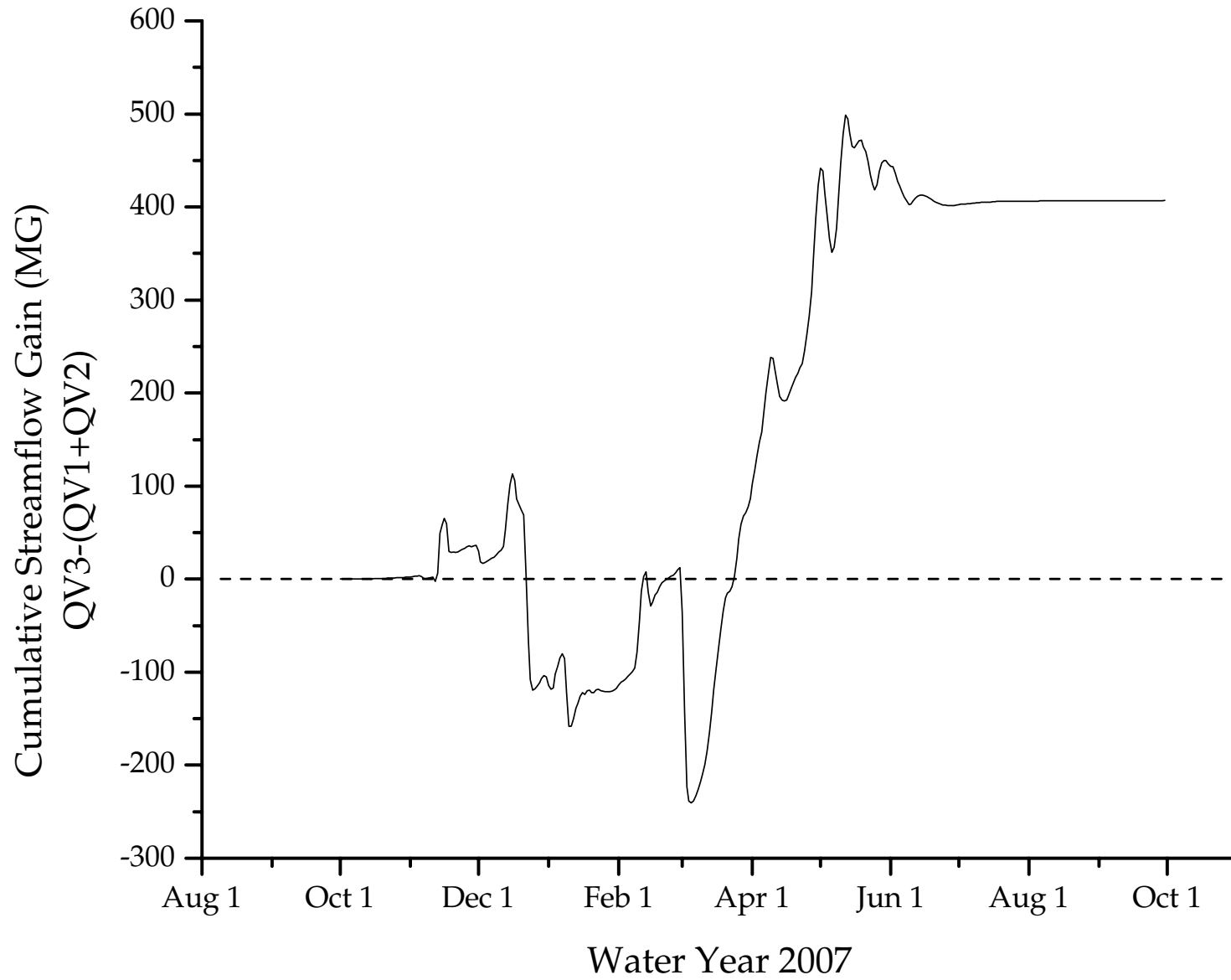


Figure 7: Water Year 2007 Cumulative Stream Flow Gain

Mean daily discharge at gauge QV3 for Water Years 2005, 2006, and 2007 is presented in Figure 8. The daily discharge in Squaw Creek was much lower in Water Year 2007 than in the preceding two Water Years. Peak daily discharge was 610 and 724 cubic feet per second (cfs) in Water Years 2005 and 2006 respectively. Peak daily discharge in Water Year 2007 was only 87 cfs. Total Water Year 2007 discharge at QV3 was approximately one third that of Water Year 2006 and less than one half that of Water Year 2005.

The upper two graphs in Figure 8 show flow at gauge QV3 during Water Years 2005 and 2006 approaching zero in early August. The bottom graph shows flow during Water Year 2007 approaching zero in early July. The flow at QV3 became effectively zero approximately one month earlier in Water Year 2007 than in the previous two Water Years.

The average annual volume of water flowing through Squaw Creek is far greater than the volume of groundwater pumped from the basin. Average annual discharge volume at QV3 during the last five Water Years was 18,780 acre-feet (6120 MG). Water Year 2007 QV3 discharge volume was 11,380 acre-feet (3708 MG); approximately 16 times the average annual volume of 721 acre-feet (235 MG) pumped from the GMP management area.

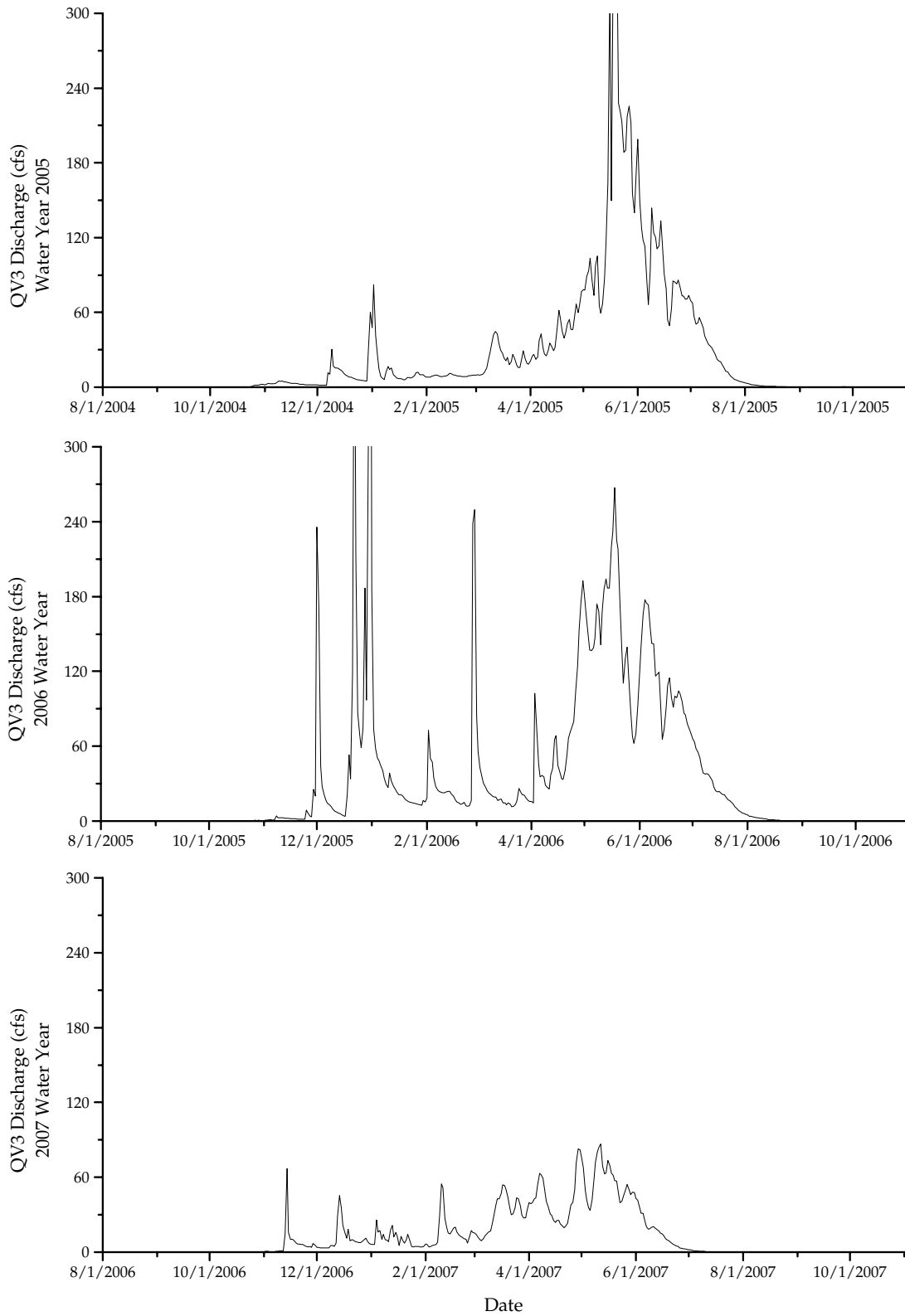


Figure 8: Discharge at QV3 2005, 2006, and 2007

### 3.3 GROUNDWATER PUMPING

Groundwater is extracted from the GMP management area by SVPsD, SVMWC, RSC, PlumpJack Squaw Valley Inn, and the Squaw Valley Ski Corporation. These entities pump from a total of fourteen wells. Four wells are currently pumped by SVPsD, two wells are pumped by SVMWC, three wells are pumped by the Resort at Squaw Creek, one well is pumped by PlumpJack Squaw Valley Inn, and four wells are pumped by the Squaw Valley Ski Corporation. The quantities of groundwater pumped by the PlumpJack Squaw Valley Inn and Squaw Valley Ski Corporation are assumed minor compared to the pumping by the other three entities. There are no other known groundwater extractors in the GMP management area. Figure 9 shows the locations of the known active production wells in the GMP management area.

#### 3.3.1 PUMPING TRENDS

Historical pumping by Water Year is shown in Figure 10. Total pumping in this figure includes only pumping from SVPsD, SVMWC, and RSC. All other pumping is considered minor. Pumping data are incomplete for Water Years 2005 and 2006 because we did not collect all historical data for this report; incomplete data records are shown in red on the Figure 10. Pumping presented in this report includes only pumping from the GMP management area, and does not include pumping from SVPsD and SVMWC horizontal wells.

Between Water Years 1993 and 2004, SVPsD, SVMWC, and RSC pumped an average of 236.7 MG (726 acre-feet) per year. The average pumping for each entity is approximately:

- SVPsD - 129 MG (396 acre-feet)
- SVMWC - 33.5 MG (103 acre-feet)
- RSC - 74.2 MG (228 acre-feet).

No clear long-term trends are seen in the annual pumping for SVMWC, SVPsD, or RSC.

Water Year 2007 had one of the highest cumulative pumping totals of any Water Year. The total pumping recorded for Water Year 2007 was 260 MG (798 acre-feet). This Water Year 2007 pumping represents an increase in pumping by SVPsD, SVMWC, and RSC of approximately 10% over the average pumping from Water Years 1993 through 2004.

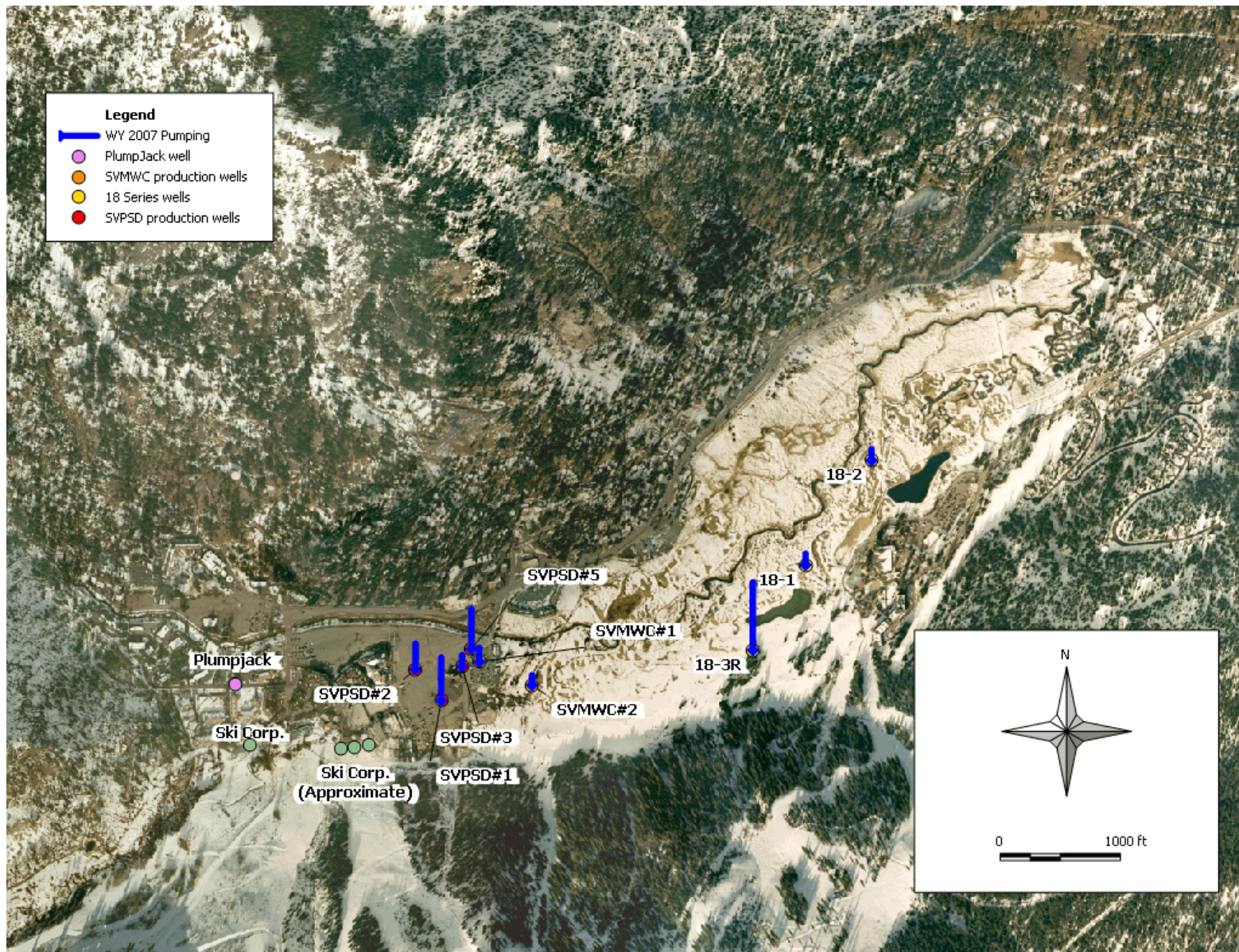


Figure 9: Production Well Locations and Relative WY 2007 Pumping Quantities

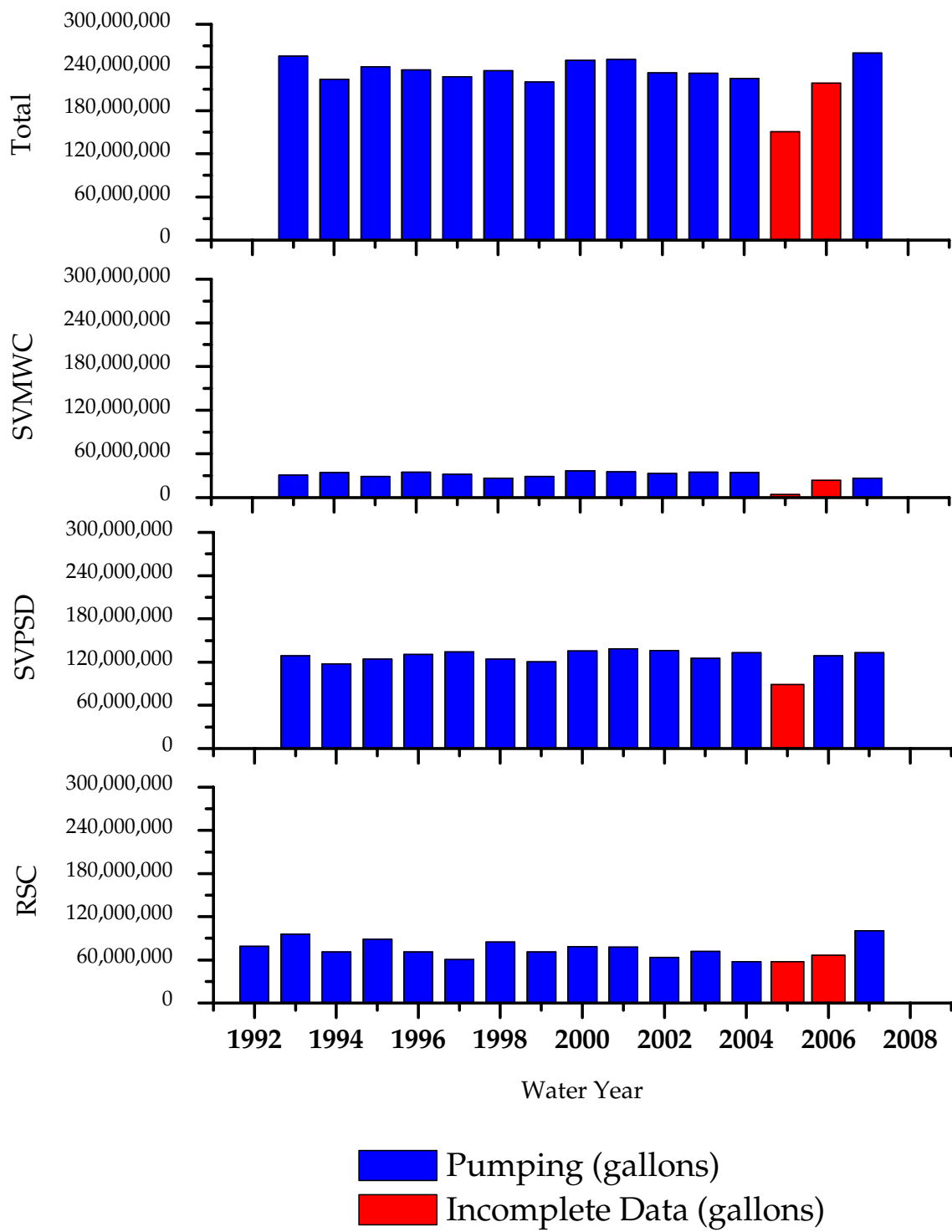


Figure 10: Annual Pumping by Water Year

Historical monthly SVPSPD pumping is presented in Figure 11. There is a trend of increasing monthly peak annual pumping volumes, unlike the total annual pumping levels in Figure 10 which do not show any clear trend. The reason that the monthly peak annual pumping volumes appear to be increasing without a corresponding apparent trend in the annual volumes shown on Figure 10 is that the increase in peak monthly pumping is somewhat offset by fluctuations in wintertime pumping between October and May. In addition the difference in the scales between Figure 10 and Figure 11 may obscure trends in annual pumping that result from the relatively small increase in peak monthly pumping.

Figure 12 presents a plot of total precipitation and total pumping by Water Year. The plot shows that there is no clear visual correlation between total annual pumping and precipitation, implying that the total amount of precipitation does not have a significant effect on water demand. A drought will not cause water supply problems through an increase in demand. This is likely due to lower winter demands during droughts, when ski seasons are shortened.

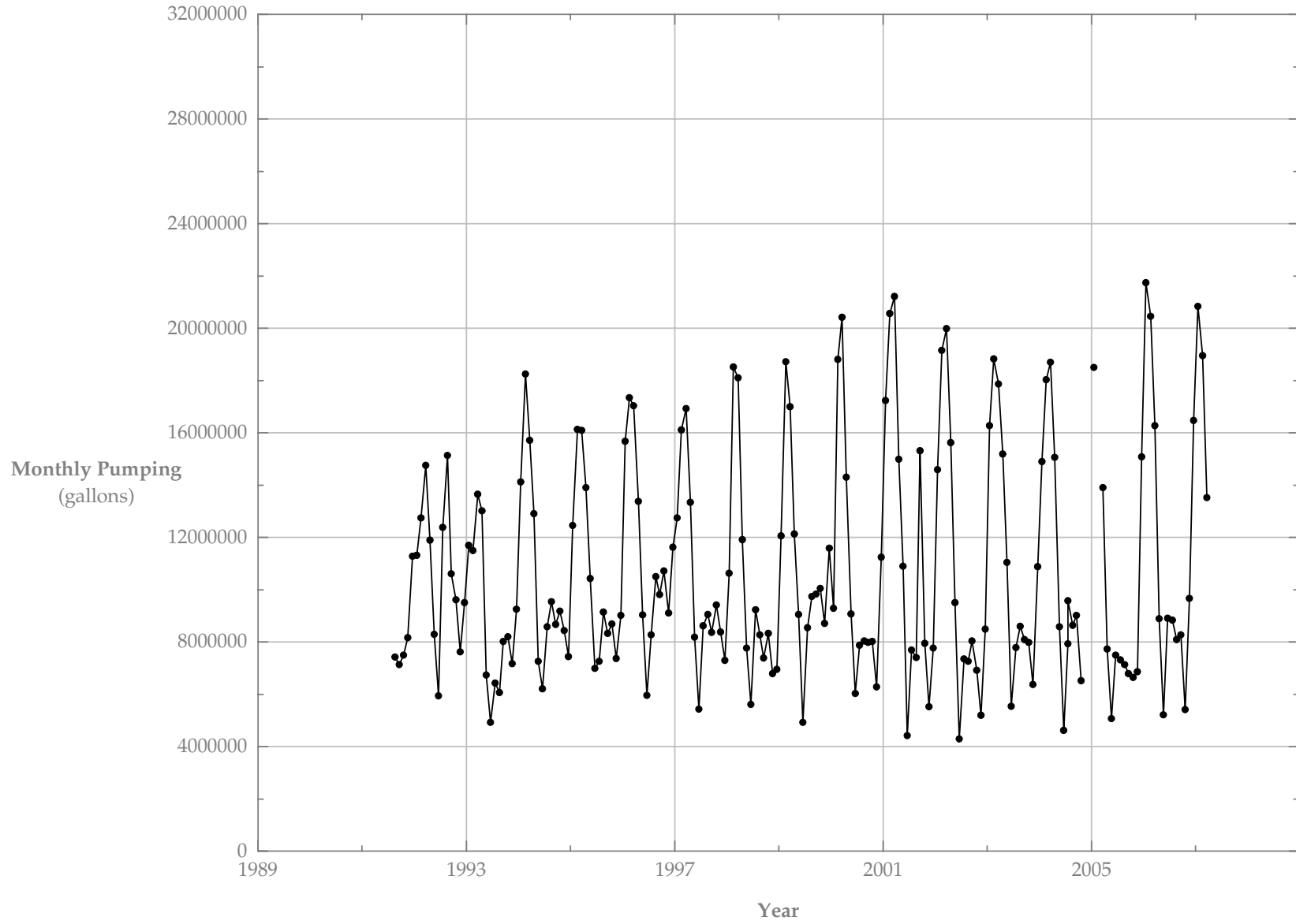


Figure 11: Historical Monthly SPSD Pumping

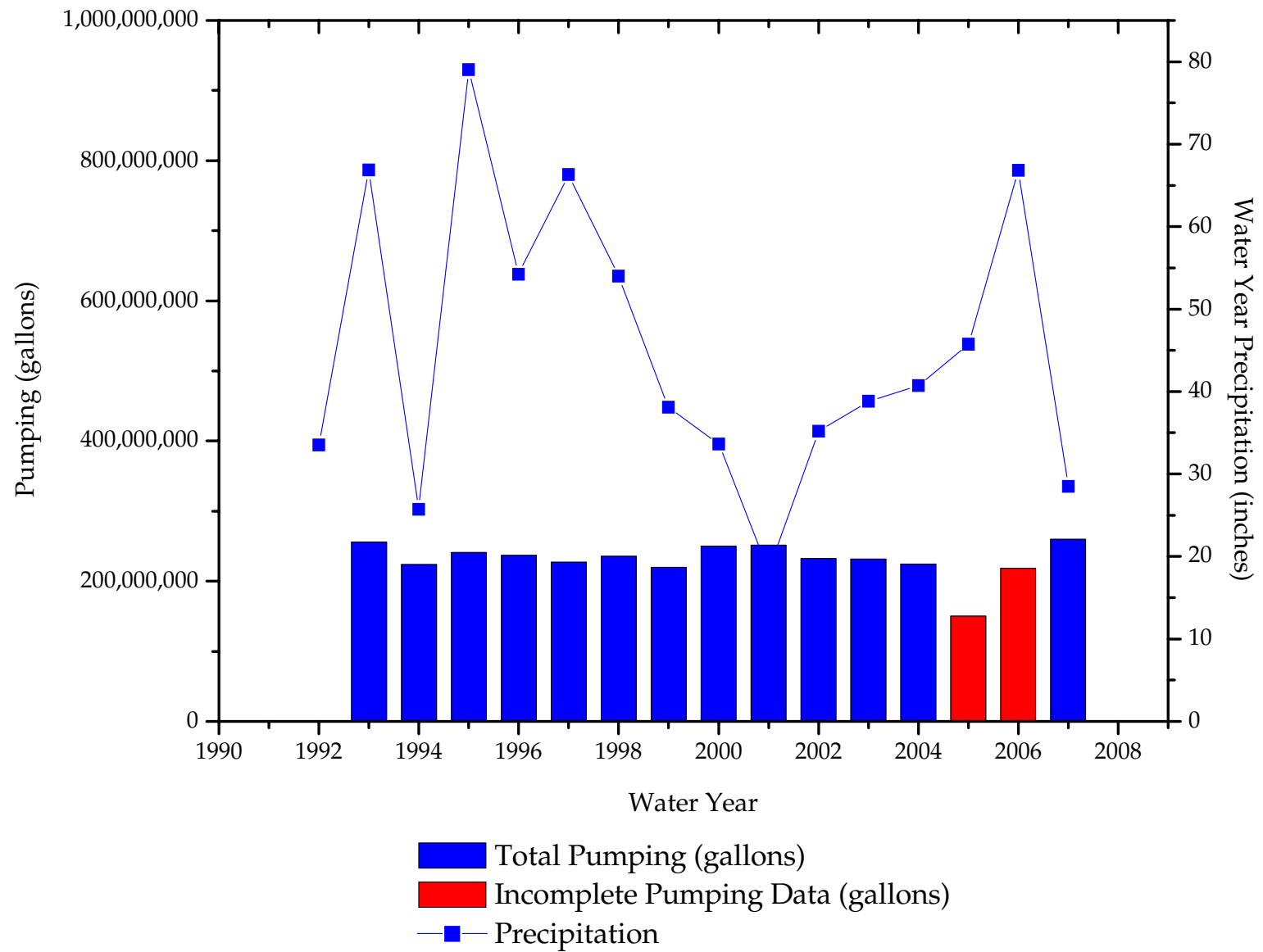


Figure 12: Historical Water Year Precipitation and Water Year Pumping

### **3.3.2 WATER YEAR 2007 MONTHLY PUMPING DISTRIBUTION**

Monthly pumping volumes for Water Year 2007 are presented in Figure 13. Total pumping shown in the top graph is the sum of the RSC, SVPSD, and SVMWC pumping shown in the three lower graphs. The monthly total pumping volume had two peaks during Water Year 2007. The greatest pumping volume appears to have occurred in July. This peak in pumping is apparently due to increased irrigation demand by SVPSD and SVMWC customers as well as peak irrigation pumping by RSC. The December peak in total pumping is primarily due to pumping by RSC for snowmaking. The lowest monthly demand occurs in April after snow making is over and irrigation demand is just beginning.

### **3.3.3 PUMPING PATTERNS**

Figure 9 shows the relative distribution of pumping throughout Olympic Valley. Only SVPSD, SVMWC and RSC pumping is shown on Figure 9. The height of each bar on this figure is proportional to the total pumping at each well. The RSC pumping was estimated for each of the 18 series wells, based on the total annual RSC pumping.

Pumping patterns have not changed significantly in recent years. This is due to two factors:

1. There are a limited number of entities that pump groundwater from the Olympic Valley basin.
2. There have been no new production wells drilled in the basin and the pumping distribution remains relatively constant among the existing wells.

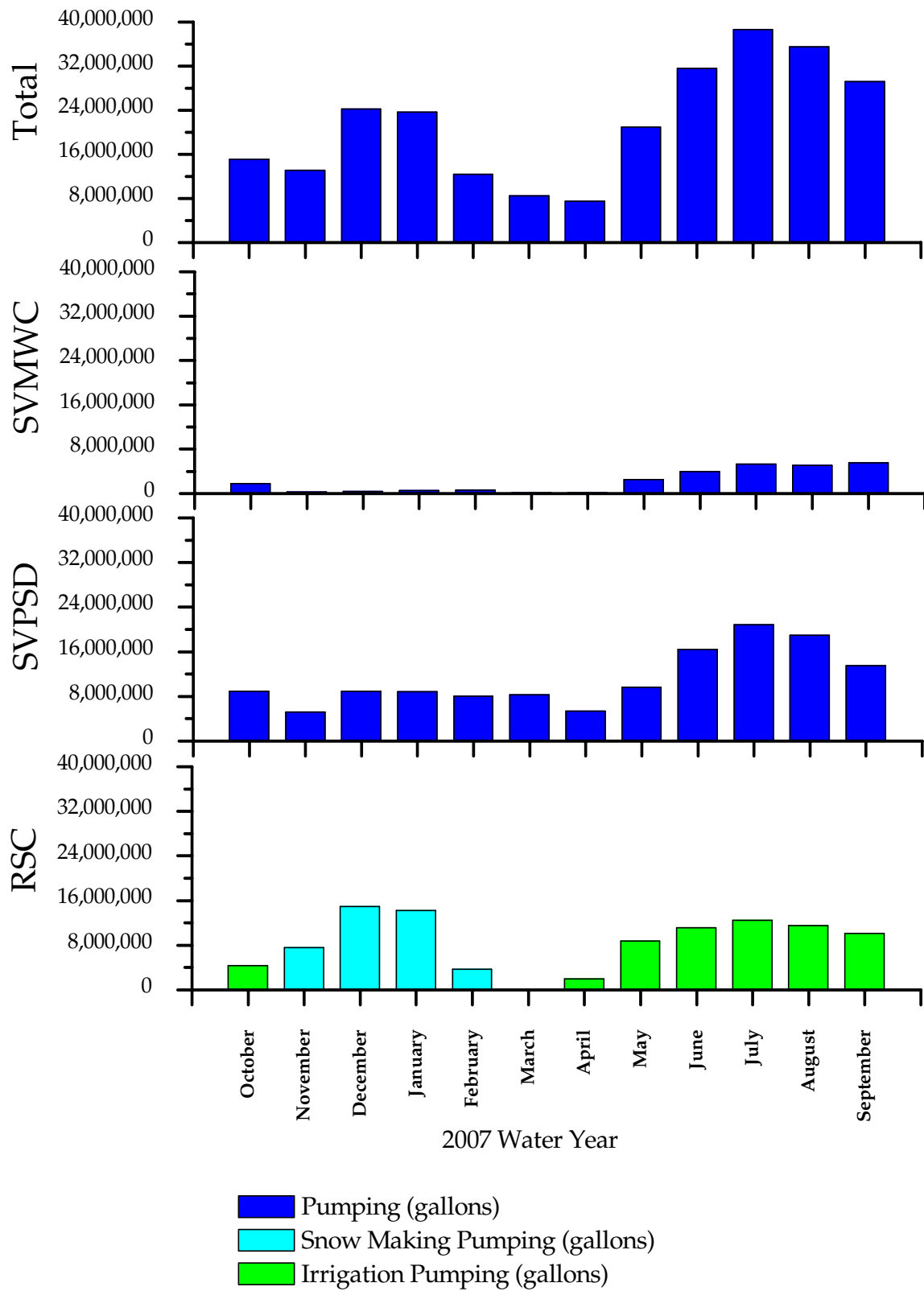


Figure 13: 2007 Water Year Monthly Pumping Distribution

## 3.4 GROUNDWATER LEVELS

### 3.4.1 HYDROGRAPHS

Hydrographs in this report are grouped by location. Most of the pumping in the basin is concentrated in the west end of the basin and groundwater levels are more strongly influenced by pumping in this area. In the meadow area there is relatively little or no pumping; hydrographs from meadow wells show little fluctuation from pumping, and groundwater level data are sparse for these wells.

#### *WEST END OF GROUNDWATER BASIN*

Hydrographs of historical groundwater levels in wells SVPD#1, SVPD#2, and SVPD#5 are presented in Figure 14 through Figure 16. These hydrographs show that groundwater levels in the west end of the groundwater basin were generally lower in Water Year 2007 than in previous years. Low groundwater levels during Water Year 2007 in all three of these wells approached historical lows. The highest groundwater levels measured in Water Year 2007 in each of these wells were lower than the high groundwater levels measured in Water Year 2006. In well SVPD#2, which has the longest period of record, the annual high groundwater level was lower than any Water Year since 2001 and 2002.

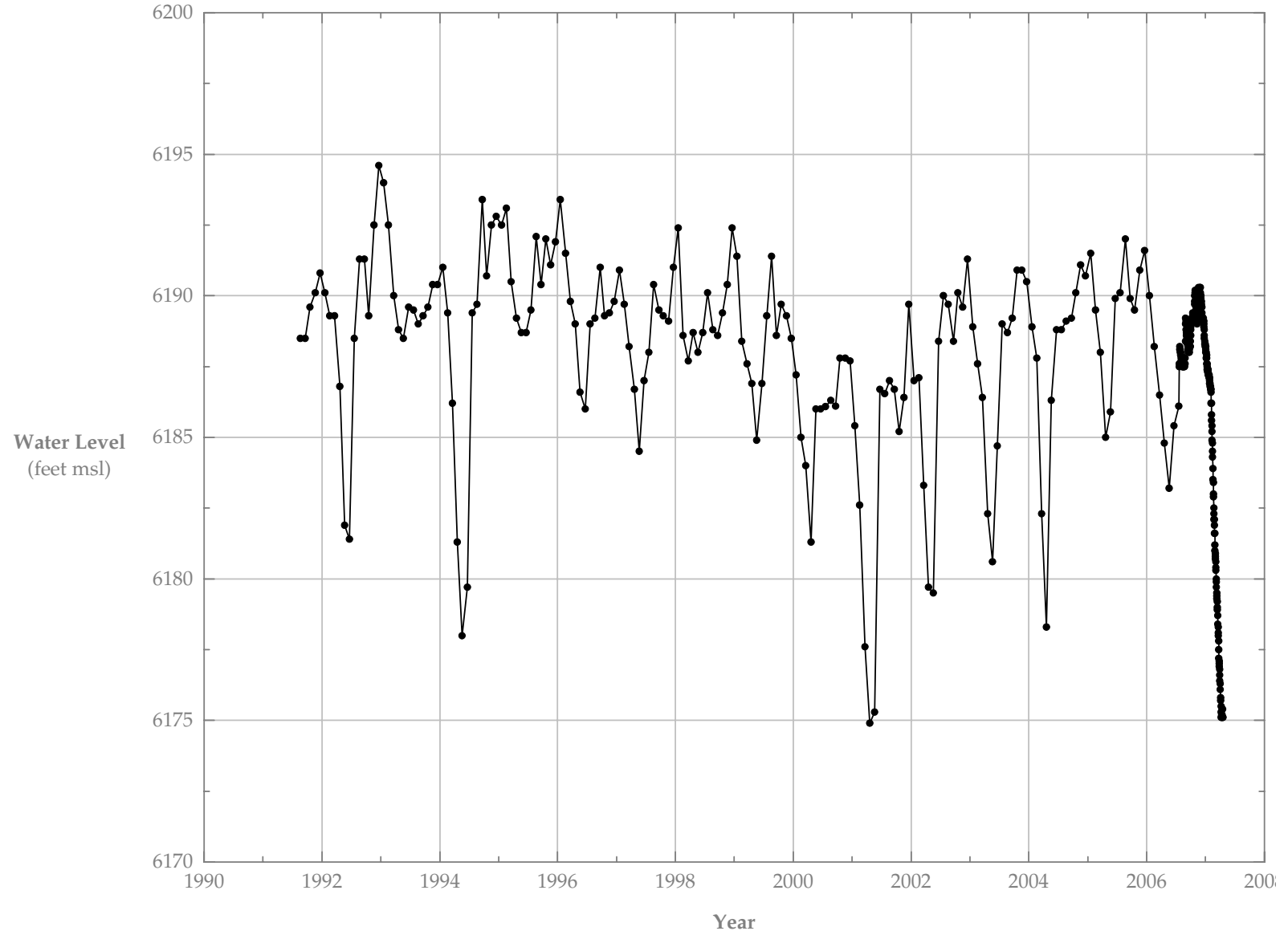


Figure 14: SVPsD #2 Groundwater Level Hydrograph

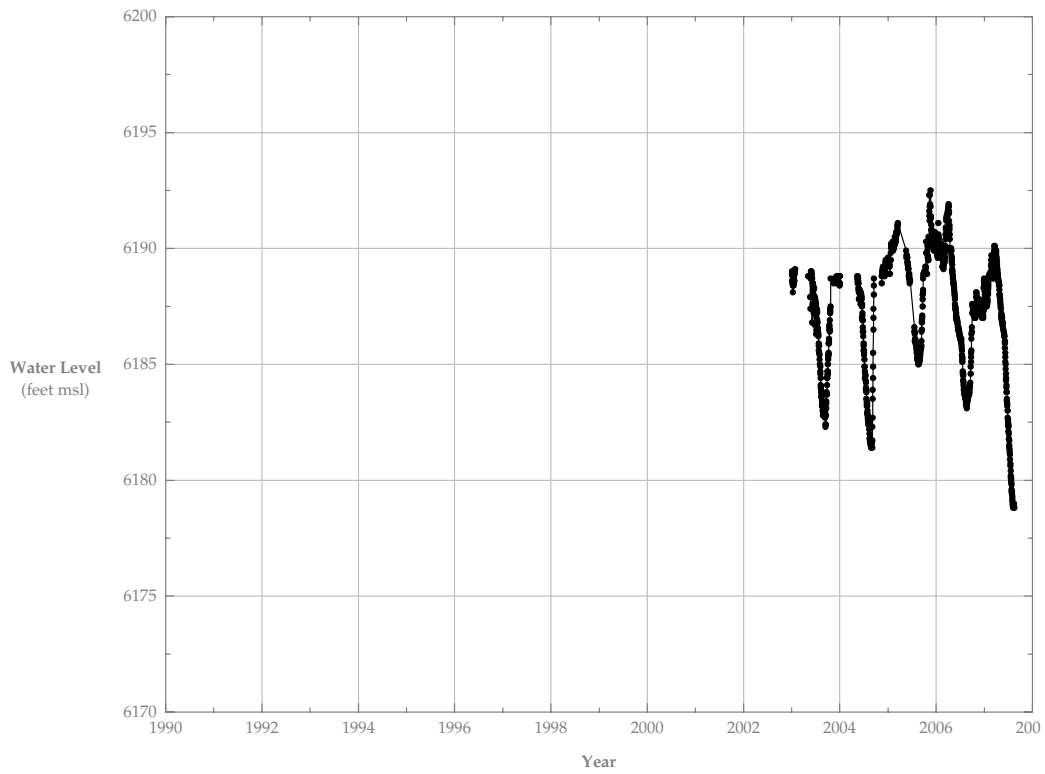


Figure 15: SVPsD #1 Groundwater Level Hydrograph

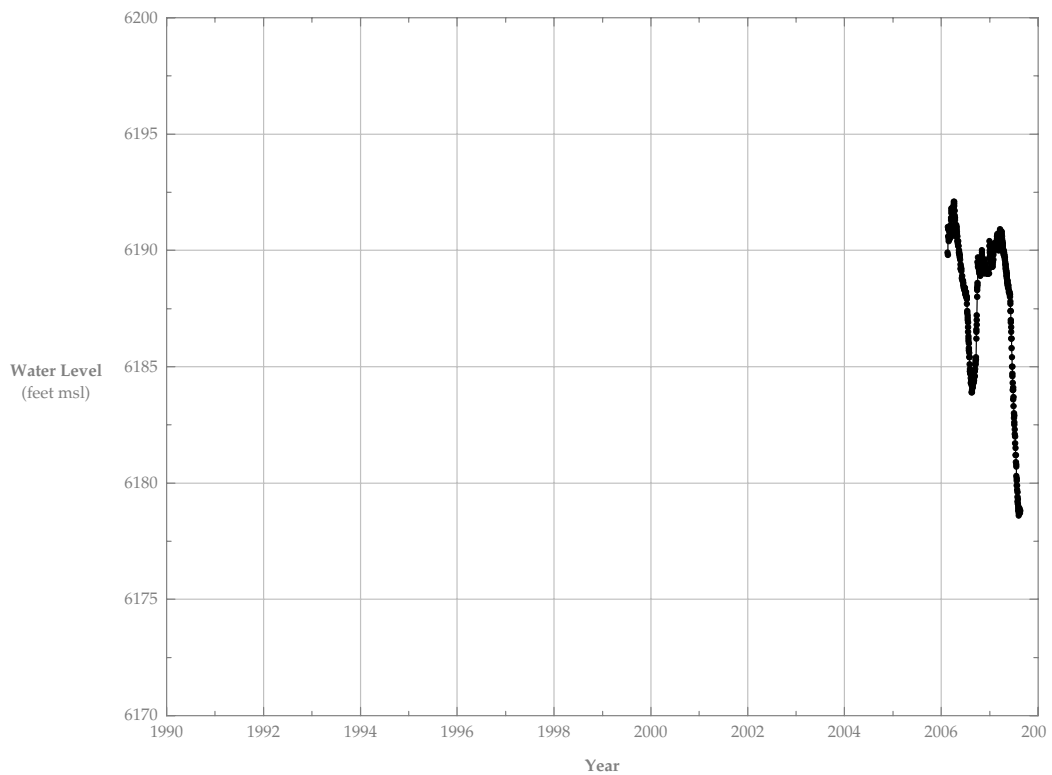


Figure 16: SVPsD #5 Groundwater Level Hydrograph

Figure 17 and Figure 18 show that annual peak groundwater levels in wells SVMWC#1 and SVMWC#2 have displayed little variation historically, and there is no long-term rise or fall in peak groundwater levels.

Figure 19 compares groundwater levels in well SVPSD#2, stream flow, and SVPSD pumping for the Water Year 2007. Daily mean values of groundwater levels, stream flow, and SVPSD pumping are plotted on this figure. The hydrograph at the top of Figure 19 shows that the aquifer filled up rapidly in response to stream flow and rainfall recharge: during the first period of high flow in Squaw Creek the groundwater level in well SVPSD#2 approximately reached the maximum or full level, as shown with the left most vertical line in Figure 19. Later, slightly higher groundwater levels occur as snowmelt creates more sustained flows in the Creek raising the level of the Creek.

Groundwater levels first begin to slowly decline in May 2007. This first drop in groundwater levels is due to two mechanisms: groundwater levels drop as stream flows in Squaw Creek drop; and groundwater levels drop in response to increased pumping that occurs during this period. The initial groundwater level decline likely does not represent a regional lowering of the aquifer; rather it represents a localized deepening of the cone of depression. During this period there is flow in the stream available to recharge the aquifer and keep the basin full.

A second, steeper drop in groundwater levels occurs when flows in Squaw Creek cease, and the Creek no longer recharges the aquifer. Without a source of recharge, groundwater levels drop more rapidly even though pumping is decreasing. This section of the hydrograph represents a regional lowering of groundwater levels in the western portion of the basin.

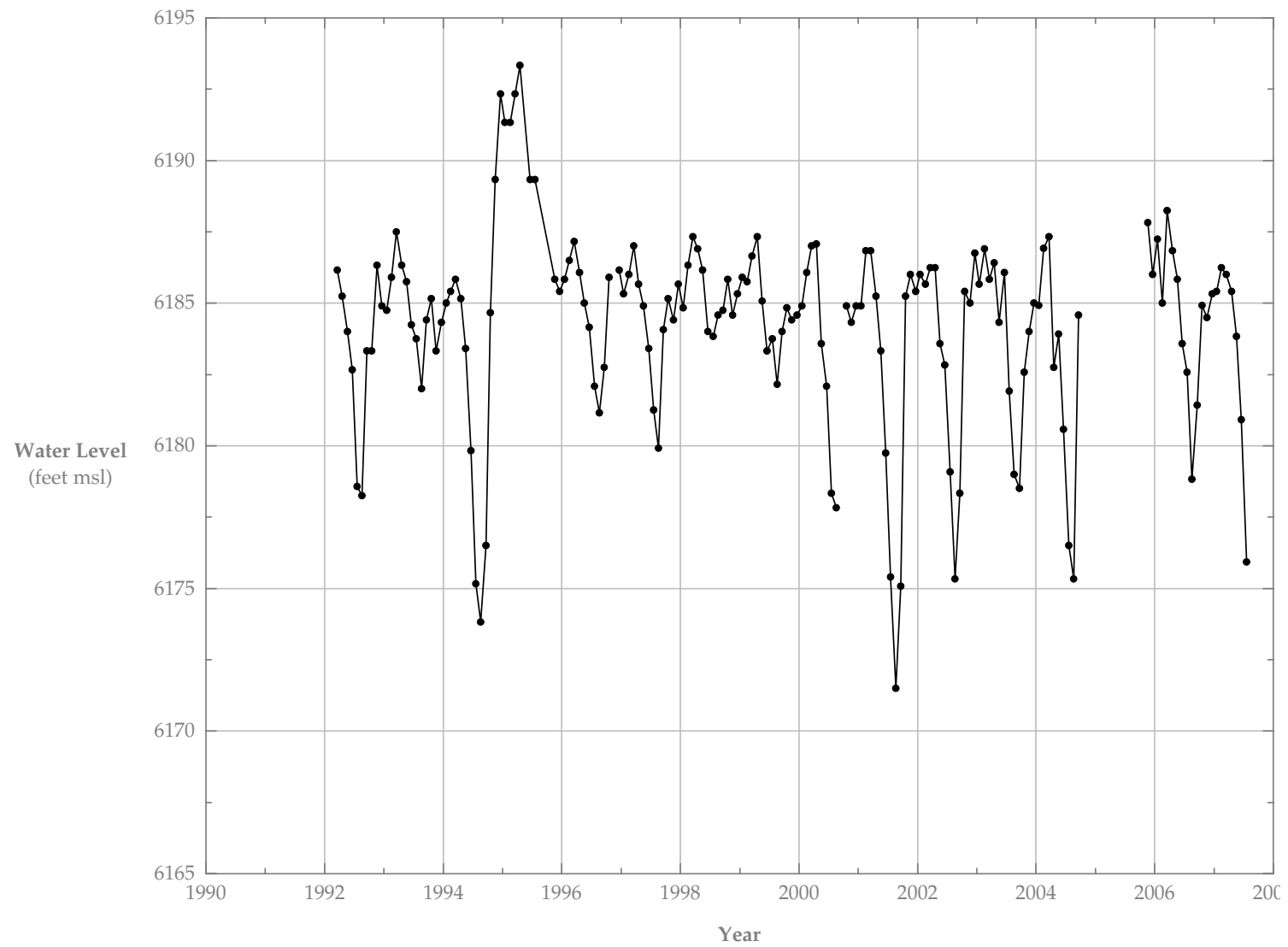


Figure 17: SVMWC #1 Groundwater Level Hydrograph

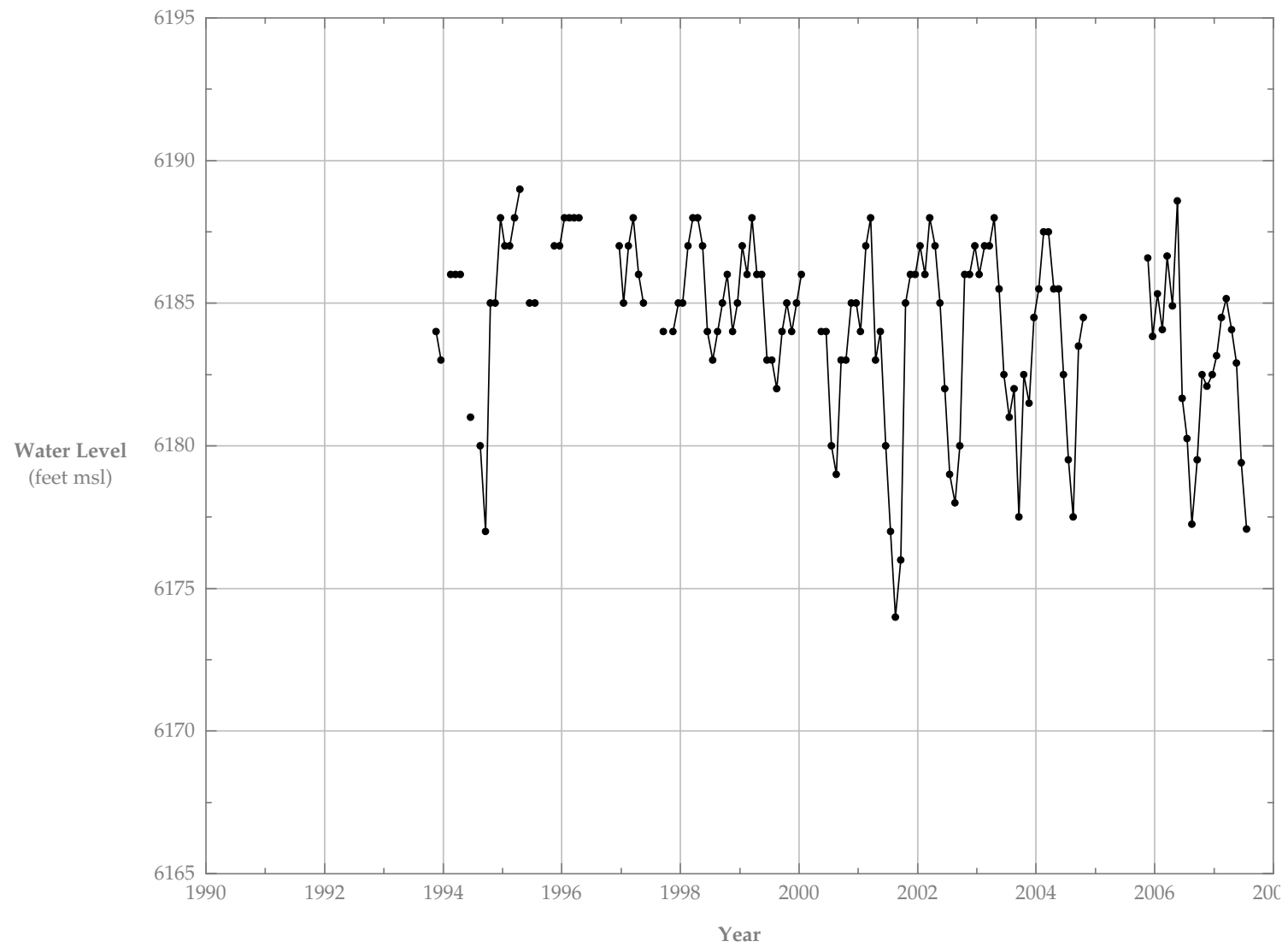


Figure 18: SVMWC #2 Groundwater Level Hydrograph

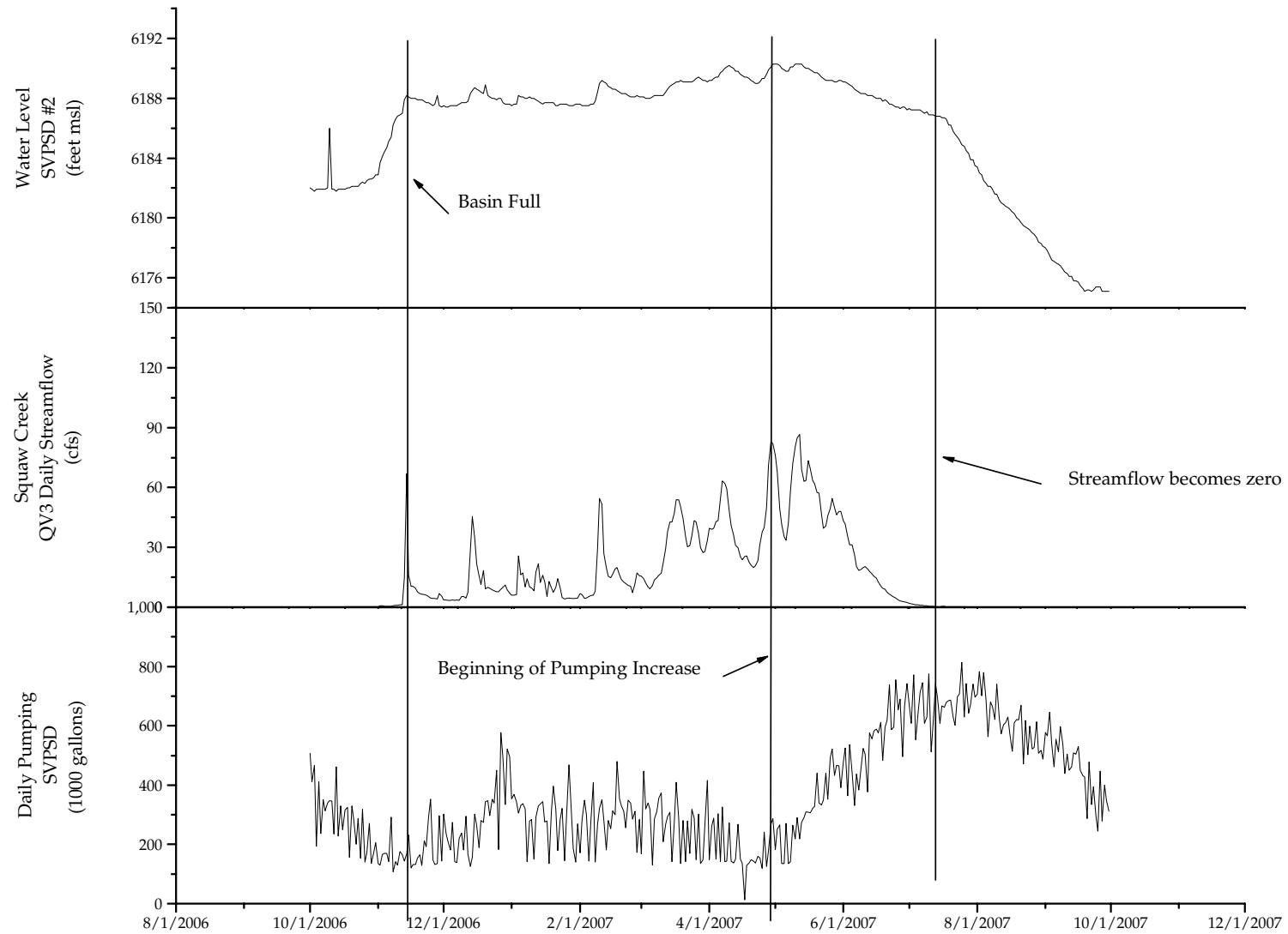


Figure 19: Water Year 2007 Groundwater Levels, Stream flow, and Pumping

Figure 20 compares hydrographs for wells SVPSD#2 and SVMWC#1 with Water Year precipitation measured at the Squaw Valley SNOTEL station. Low groundwater levels, such as those following Water Years 2001 and 2007, correlate with years of low precipitation. There is a lag between the low groundwater levels and the low precipitation because low groundwater levels occur in the summer of the year following the low precipitation.

While Figure 20 shows a correlation between very low precipitation and low groundwater levels, it is likely that the correlation is stronger between early cessation of stream flow in Squaw Creek and low groundwater levels. In Figure 20, precipitation is being used as a surrogate for stream flow duration. The likely connection between precipitation and groundwater level is as follows:

1. The basin fills up with the first significant flow in Squaw Creek and stays relatively full until stream flow ceases, as seen in Figure 19. The basin likely fills up every year, even in low precipitation years.
2. Groundwater levels decline regionally only after stream flow in Squaw Creek ceases.
3. The date at which stream flow ceases is likely related to the amount of snow pack in the previous winter. The lowest precipitation years have a small snow pack which melts earlier causing stream flow to cease earlier in those years.
4. The volume of groundwater pumped *after* stream flow ceases and before the first significant flows in the fall or winter, determines how far groundwater levels will decline in the basin.

During Water Year 2007, flow in Squaw Creek ceased in early July 2007, approximately one month earlier than during the previous two Water Years. This early cessation of flow is the apparent reason for the low groundwater levels in municipal production wells observed in 2007.

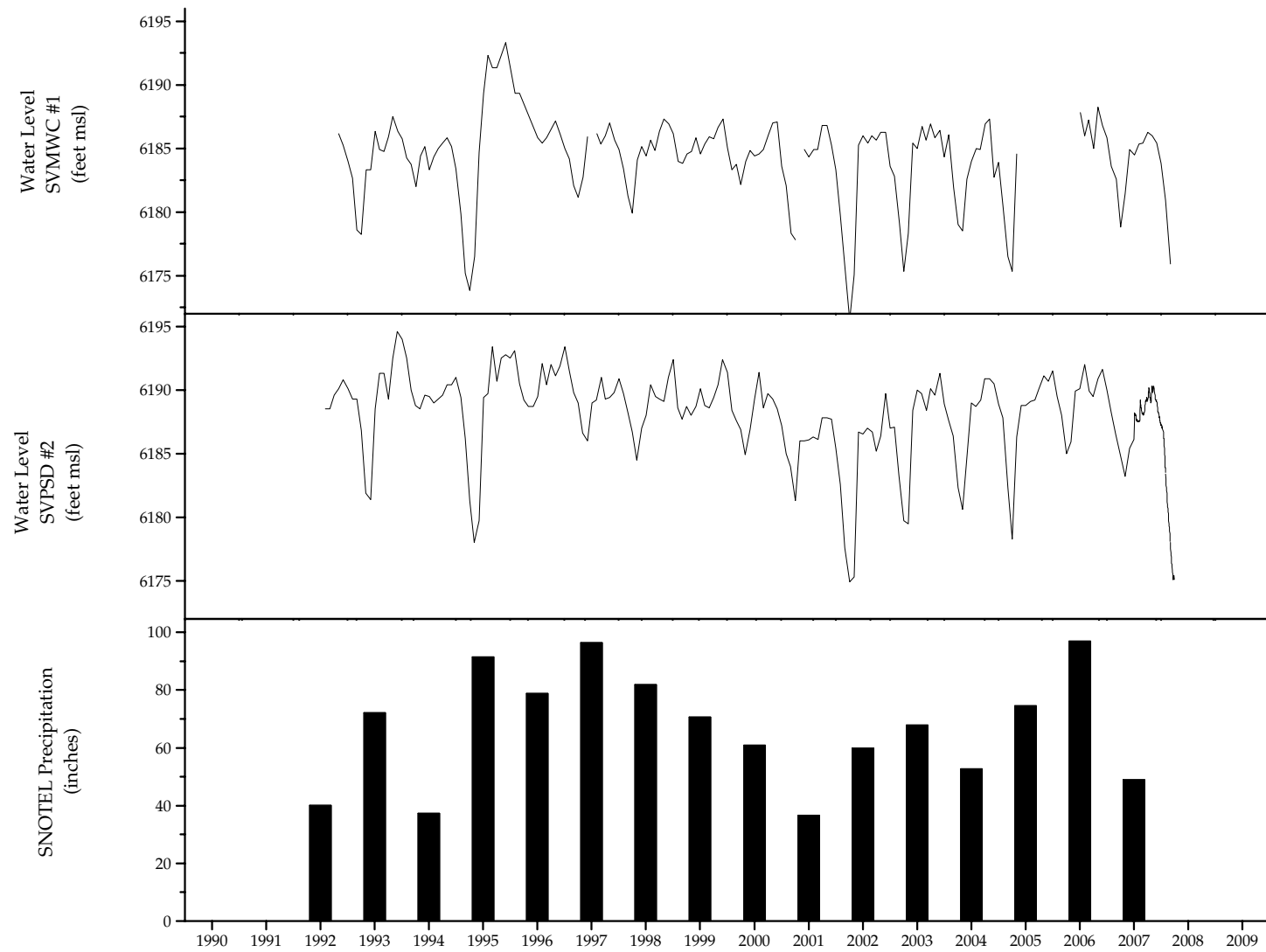


Figure 20: Monthly Precipitation, Groundwater Levels, and Pumping

## *MEADOW AREA*

Groundwater level data from the meadow were collected by RSC as part of the CHAMP program monitoring. The CHAMP program measures groundwater levels in 32 monitoring wells, shown on Figure 21. Hydrographs from representative wells were selected based on location and completeness of data. These hydrographs are shown in Figure 22 through Figure 25. Wells 315 (Deep) and 318 (Shallow) are located at the northeastern end of the meadow, well 312 (Shallow) is located in the center of the meadow, and well 328 (Shallow) is located closer to the western end of the meadow. No apparent long term trends are seen in groundwater levels in any of these wells. Fluctuations of between three and feet are seen in the meadow hydrographs. Until Water Year 2007, data were not collected frequently enough under the CHAMP schedule to see annual fluctuations.

There was no simultaneous measurement at any shallow and deep well pair during Water Year 2007 so vertical gradients in the meadow could not be calculated.

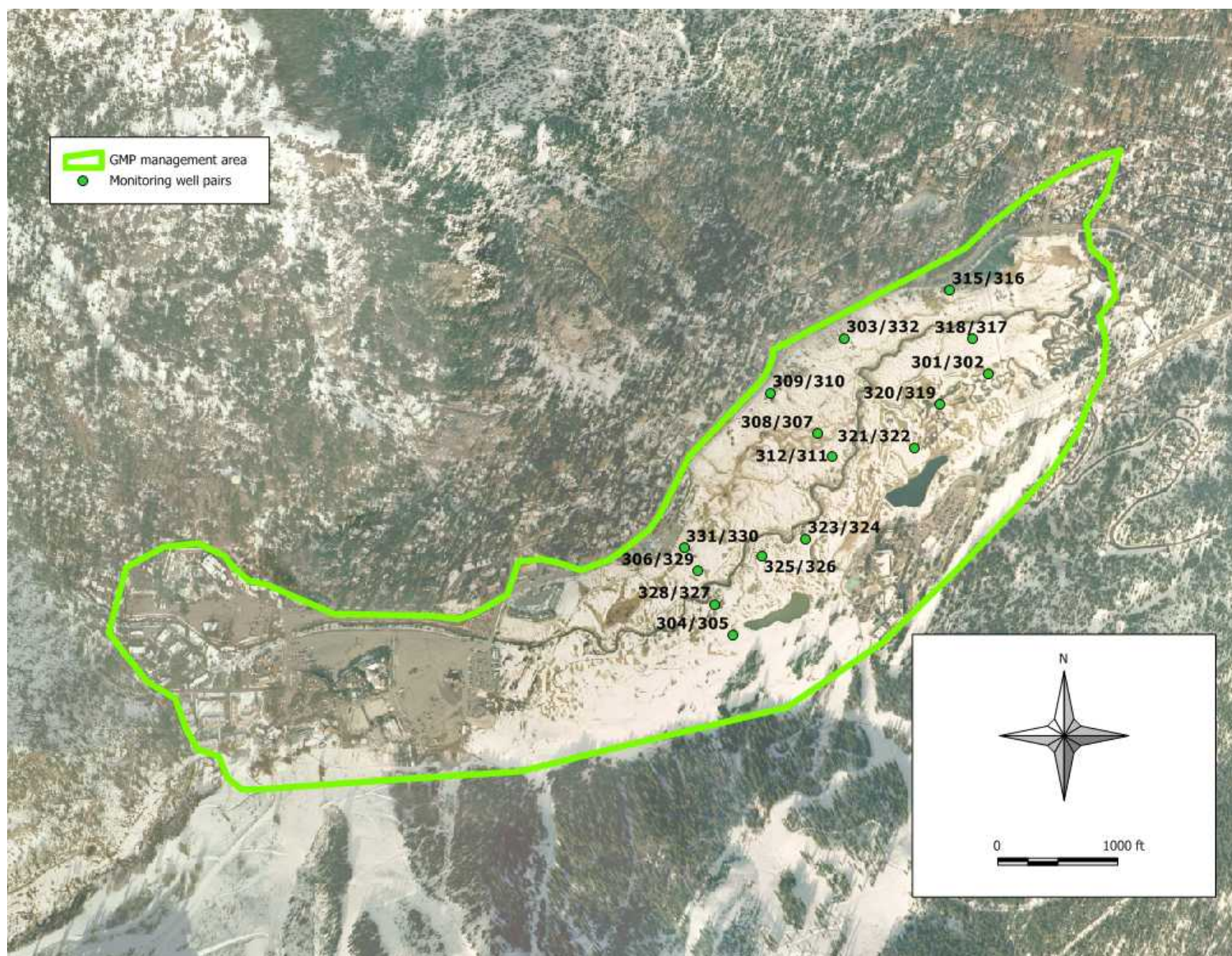


Figure 21: Meadow Well Locations

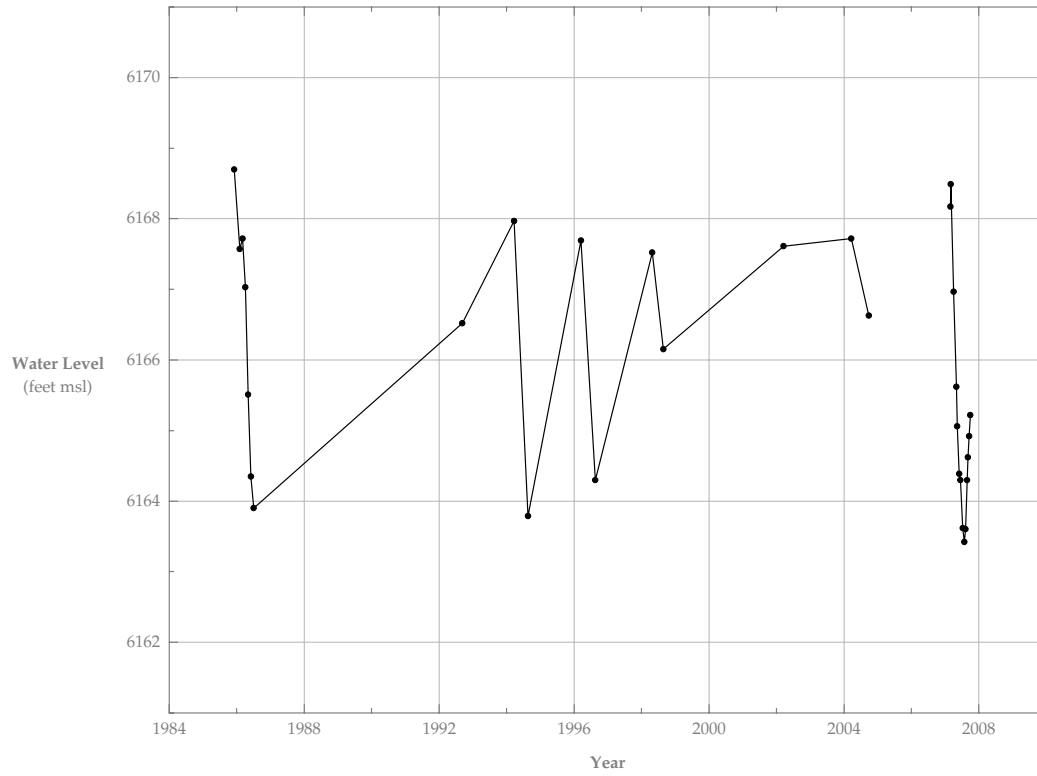


Figure 22: Meadow Hydrograph -- Well 318

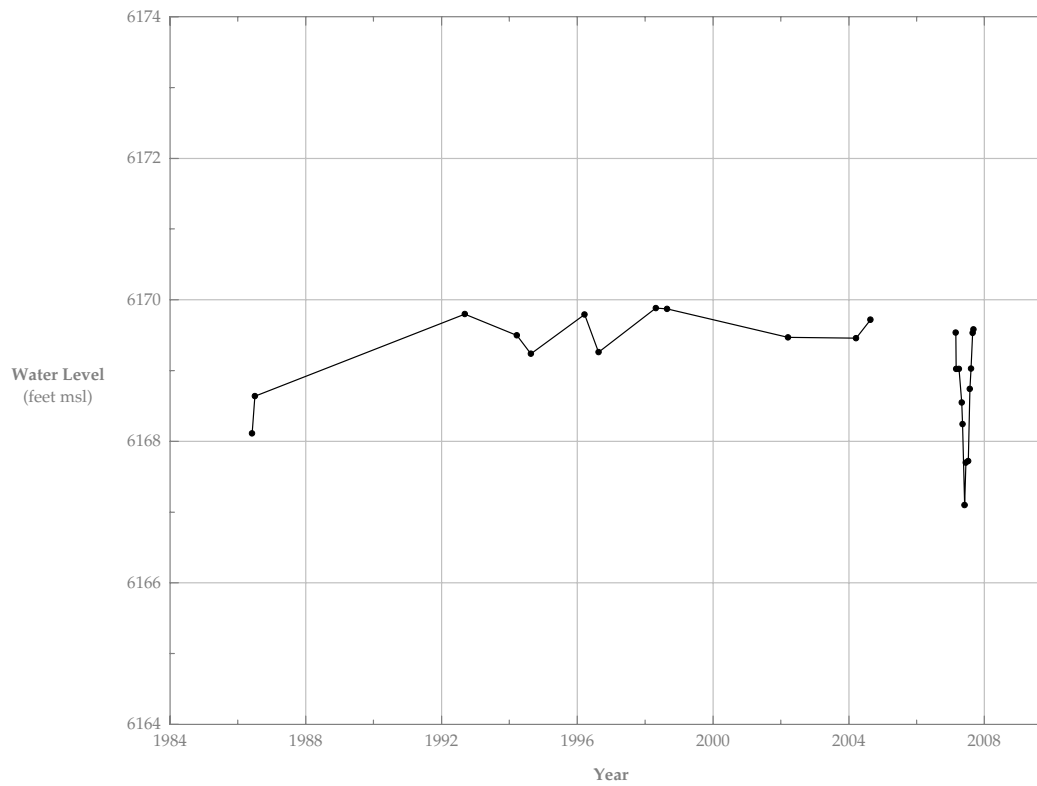


Figure 23: Meadow Hydrograph -- Well 315

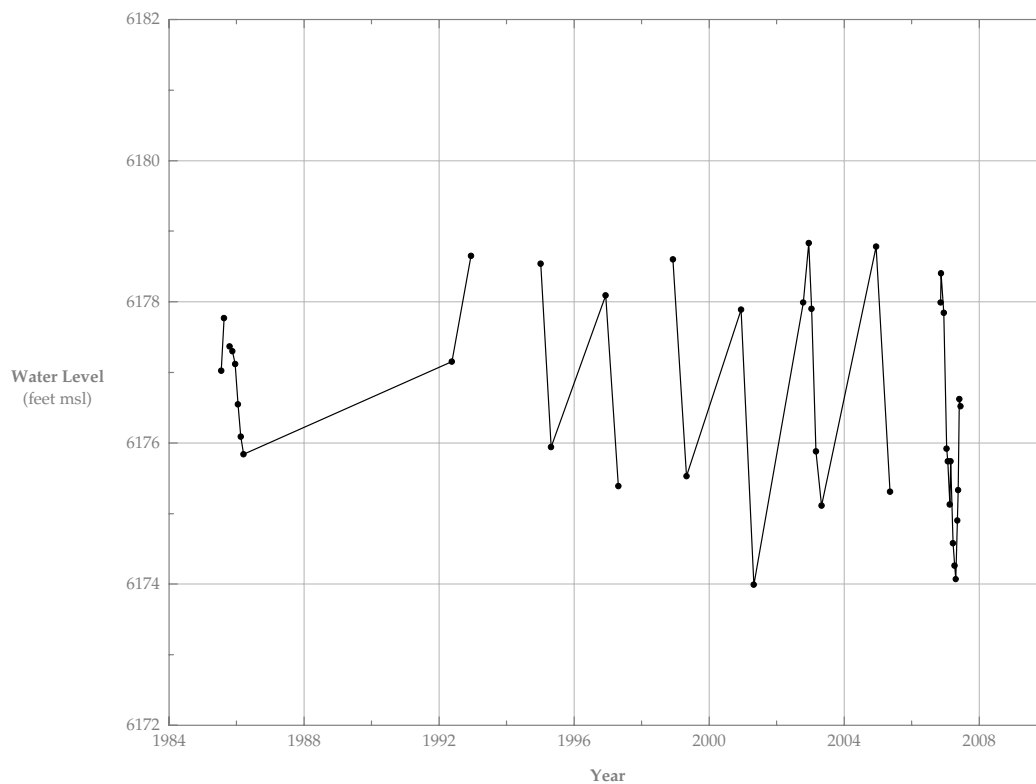


Figure 24: Meadow Hydrograph -- Well 328

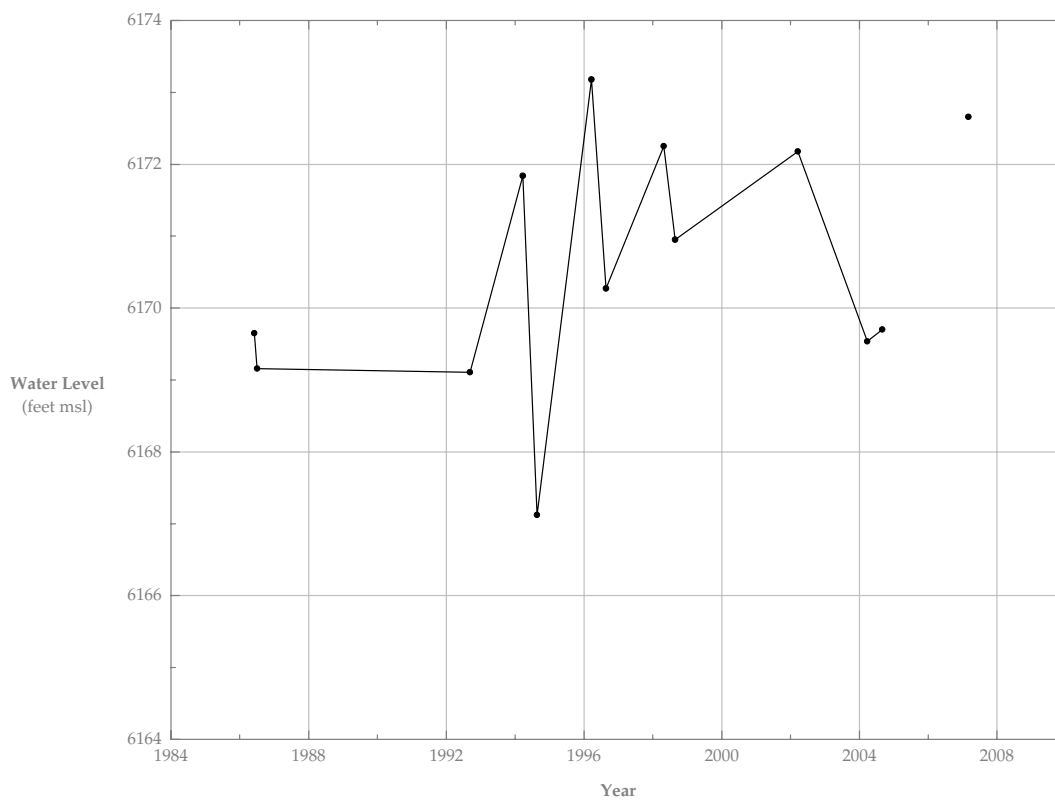


Figure 25: Meadow Hydrograph -- Well 312

### **3.4.2 WATER TABLE MAP**

A contour map of spring groundwater levels in the Olympic Valley basin is shown in Figure 26. Meadow area contours are contoured from shallow groundwater levels collected on May 1 and 2, 2007 during groundwater quality monitoring required under the CHAMP program (Kleinfelder & Associates, 2006, 2007a, 2007b, 2007c). The meadow contours, shown in blue, were taken developed by Kleinfelder & Associates. The water level data used by Kleinfelder & Associates for developing the contours are also posted on the map. The groundwater level contours show groundwater flow generally from west to east in the basin from high to low groundwater levels. The shape of the contours is suggestive of the idea that Squaw Creek is gaining water in the meadow area in the spring.

Insufficient data were available for producing an autumn water table map.

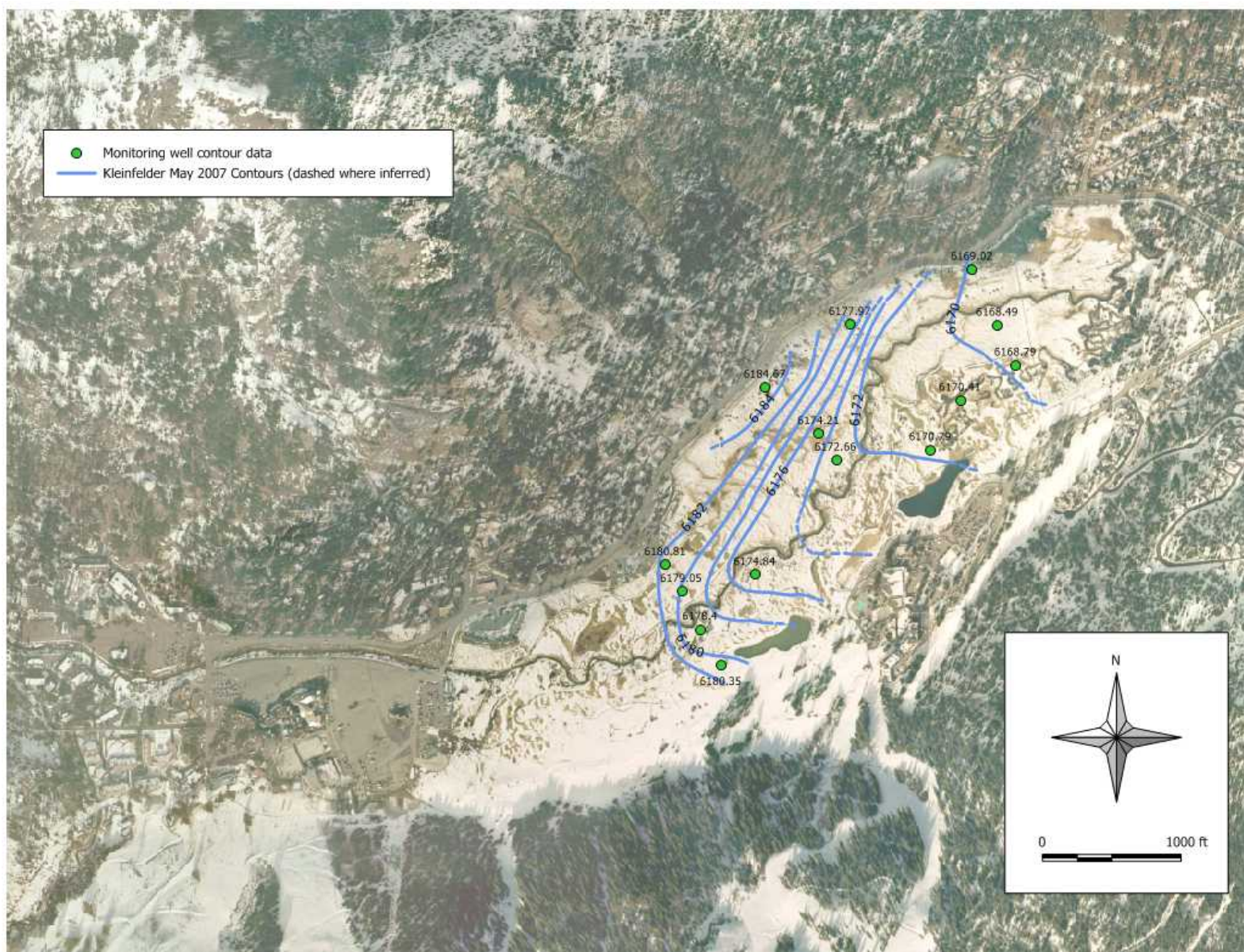


Figure 26: Spring 2007 Groundwater Level Contours

### **3.4.3 GROUNDWATER LEVEL LIMITATIONS ON GROUNDWATER PRODUCTION**

Low groundwater levels have the potential to create operational difficulties or even limit groundwater production capacity of wells used to supply groundwater in Olympic Valley. The groundwater level at which these problems can occur are defined by two characteristics of the wells:

1. Elevation of the top of the screened interval
2. Elevation of the pump intake

Wells are usually designed so that groundwater levels in the well do not drop below the top of the screen. Drawing groundwater levels into the screened interval can potentially cause problems including: falling water which can entrain air bubbles in the produced water, corrosion of the screen, and loss of specific capacity. Drawing groundwater levels down to the pump intake will cause the pump to break suction, lose capacity, draw air into the water, and damage the pump.

Although groundwater levels in production wells were at or near historical lows during Water Year 2007, both the SVPSD and SVMWC apparently produced adequate groundwater to meet their service needs.

## Section 4

# GROUNDWATER QUALITY SUMMARY

This section reviews analytical results from groundwater quality samples collected during Water Year 2007. As noted earlier, because of time and budget constraints SVWMC data were not analyzed as part of the current report.

### 4.1 MUNICIPAL WATER SUPPLY GROUNDWATER QUALITY

SVPSD and SVMWC routinely test their untreated groundwater to determine the water quality of the basin. Groundwater quality parameters analyzed by SVPSD and SVMWC include general minerals, general physical parameters, and organic/inorganic compounds. Analyses for these are conducted in accordance with the requirements of the California Code of Regulations (CCR), Title 22. Complete Title 22 samples were not collected during Water Year 2007. Results from samples that were collected are summarized below. Additional sampling of well SVPSD#3 occurred as part of the Opera House spill site activities, these results are summarized in section 4.3.1.

Nitrate levels were tested at wells SVPSD#1R, SVPSD#2, SVPSD#3, and SVPSD#5R during Water Year 2007. The results from these four wells were:

- SVPSD#1R, Non-detect
- SVPSD#2, 0.28 milligrams/liter (mg/L)
- SVPSD#3, 0.41 mg/L
- SVPSD#5R 0.29 mg/L

All nitrate concentrations were below the Maximum Contaminant Limit (MCL) of 10 mg/L. The MCL is the level adopted by the US Environmental Protection Agency (EPA) that should not be exceeded in drinking water.

Manganese is closely monitored because it is found in high levels in some wells in the basin, even though levels have remained below drinking water MCLs in the municipal production wells. During Water Year 2007 SVPSD#1R was tested for manganese in three sampling events with results of 26, 34, and 37 micrograms/Liter ( $\mu\text{g/L}$ ). All of these results are below the secondary MCL of 50  $\mu\text{g/L}$ .

Wells SVPSD#1R and SVPSD#5R were sampled for gross alpha radioactivity. Results were below the detection limit for reporting at both wells. Arsenic levels were measured at well SVPSD#1R and were not detected. Wells SVPSD#1R and SVPSD#5R were tested for purgeable volatile organic compounds (VOCs). This

test was done three times at well SVPD#1R and once at well SVPD#5R. No VOCs were detected in either well.

## 4.2 RESORT AT SQUAW CREEK CHAMP PROGRAM

The CHAMP groundwater quality monitoring program includes sampling 32 monitoring wells (Figure 21). These wells are divided into shallow and deep wells according to Kleinfelder's stratigraphic description (Kleinfelder & Associates, 1987). The shallow monitoring wells are divided into two groups: wells sampled in even years and wells sampled in odd years. The deep wells are also divided into two groups: wells sampled every two years and wells sampled every four years.

There were two scheduled rounds of sampling from these wells in Water Year 2007; the first round was conducted in October 2006 and a second round of sampling was conducted in May 2007. The October 2006 event collected samples from eight shallow and seven deep monitoring wells and the May 2007 event collected samples from seven shallow monitoring wells. The samples were analyzed for 10 constituents: nitrate, nitrite, total nitrogen, total kjeldahl nitrogen (TKN), total phosphorous, iron, total dissolved solids (TDS), sulfate, and chloride. An additional sampling event occurred in December 2006. The purpose of this sampling event was to resample nine wells which had analytical results from the October sampling event fall outside historical concentration ranges.

Analytical results from the October 2006 sampling event (Kleinfelder & Associates 2006) are compared to Title 22 MCLs in Table 2. This table shows the number of sampled wells that exceeded MCLs.

Table 2: CHAMP Sampling Results

Constituent	MCL (mg/L)	Oct. 2006 Wells above MCL/Total Samples	Dec. 2006 Wells above MCL/Total Samples	May2007 Wells above MCL/Total Samples
Nitrate	10	0/15	0/5	0/7
Nitrite	1	0/14	0/2	0/7
Iron	0.3	13/14	5/5	5/7
TDS	500	3/15	1/1	1/7
Sulfate	250	4/15	0/0	1/7
Chloride	250	0/15	0/0	1/7
Total N	No MCL	--	--	--
TKN	No MCL	--	--	--
Phosphorus	No MCL	--	--	--

Iron levels remained within historical ranges in all of the sampled shallow wells, but in five of the deep wells iron levels exceeded historical highs. Additionally, wells 316, 325, 326, 327, and 329 had nitrate concentrations exceeding the historical highs. Wells 309 and 312 showed nitrite concentrations exceeding historical highs, and well 329 showed TKN and total nitrogen levels exceeding historical highs.

The December 2006 sampling event resampled nine monitoring wells. Four of the five wells that produced historical high iron concentrations again produced iron concentrations higher than any samples collected prior to the October sampling event. Two of the five wells with historical high nitrate levels in October produced nitrate concentrations higher than historical levels prior to the October sampling event. The nitrite concentration in the resample of well 312 fell within the historical range. Concentrations of TKN and total nitrogen in well 329 remained above the historical high prior to October. The high concentrations observed in October 2006 samples were therefore likely representative of groundwater conditions.

The May 2007 analytical results (Kleinfelder & Associates 2007b) for shallow groundwater samples are shown on Table 2. The results showed nitrate and chloride below Title 22 MCLs in all but one well. Sulfate was detected above the MCL at well 305. Iron concentrations exceeded the MCL at five out of seven wells, but were within the historical range of concentrations. Three wells showed detectable concentrations of nitrite for the first time since 1996 and well 320 showed detectable nitrates for the first time since 1995. All detected nitrite, however, was below the MCL.

Kleinfelder & Associates (2007b) concluded from the analytical results that the, "...predominant trends of parameter/constituent values are in general not significantly changing." They furthermore concluded that, "...activities of The Resort have not significantly impacted the surface water quality or groundwater quality in the shallow aquifer.", and that these results appear, "generally consistent with pre-construction" analytical data.

While the Water Year 2007 CHAMP results are not significantly higher than historical results, it is noteworthy that constituents in a number of monitoring wells were detected at the highest recorded concentrations. Concentrations of nitrate, nitrite, total nitrogen, TKN, and iron all rose above historically measured highs: although similar to previous sampling events, only iron was above the MCL. The Technical Review Committee (TRC) is monitoring these results in accordance with its charge.

## **4.3 REGULATED CONTAMINATION SITES**

Three regulated contaminated sites existed in the GMP management area during Water Year 2007. There were no new cases opened during Water Year 2007, and one existing site was closed. These sites are regulated by the CRQWCB.

### **4.3.1 OPERA HOUSE SITE**

The Opera House site had a 5000 gallon heating oil Underground Storage Tank (UST) which was removed in 1998. Fuel had leaked and contaminated the site. Remedial activities at the site included removing contaminated soil and dewatering the excavation in order to excavate contaminated soil below the water table. (Kleinfelder & Associates, 1999) This UST lay within 30 feet of well SVPSD#3 (Kleinfelder & Associates, 1999)

During Water Year 2007 groundwater samples were collected during four quarterly sampling events from nine monitoring wells at the site and from well SVPSD#3. The highest TPH (as diesel) reported during these four sampling events were:

- Fourth Quarter 2006 sampling event      0.41 mg/L
- First Quarter 2007 sampling event      0.29 mg/L
- Second Quarter 2007 sampling event      0.14 mg/L
- Third Quarter 2007 sampling event      0.22 mg/L

These results are all above the water quality objective of 0.1 mg/L. Samples were also tested for the presence of methyl tertiary-butyl ether (MTBE), a gasoline additive in common use during the 1990s. No MTBE was detected in any sample. Well SVPSD#3 was tested for TPH and VOCs. No TPH or VOCs were detected in this well (McGinley & Associates, 2007a, 2007b, 2007c).

The site was closed by the CRWQCB in August 2007. The closure means that no further action is required at this site.

### **4.3.2 PLUMPJACK SITE**

At the PlumpJack Site, a heating oil UST was found to have leaked in 1987. The case is currently open with the CRWQCB. No sampling occurred at this site during Water Year 2007.

### **4.3.3 SQUAW VALLEY MUTUAL WATER COMPANY SITE**

Low concentrations of diesel fuel have been detected at this site. The TPH detected at this site occurs at levels too low for effective remediation. The case is

currently open with the CRQWCB. No sampling or regulatory activity occurred during Water Year 2007.

## **Section 5**

# **GROUNDWATER MANAGEMENT ACCOMPLISHMENTS**

### **5.1 GMP ADOPTION AND AMENDMENTS**

The major groundwater management accomplishment during Water Year 2007 was the adoption of a Groundwater Management Plan. The GMP was developed in an open process with public participation, consistent with CWC §10750 *et seq.* The GMP was developed with significant public outreach and public input.

In accordance with CWC §10750 *et seq.* as well as other guidance documents, the GMP included management goals, specific basin management objectives, and elements (programs and policies) for achieving the basin management objectives. The GMP furthermore included an implementation plan designed to allow all stakeholders some input into future groundwater management decisions.

There have been no amendments to the GMP in the past Water Year.

### **5.2 GROUNDWATER ADVISORY GROUP FORMATION**

In accordance with the implementation plan of the GMP, a groundwater advisory group was formed. This group provides a structure by which stakeholders or other interested parties can influence groundwater management decisions without accepting the responsibility and liability associated with funding and overseeing the GMP implementation. The Groundwater Advisory Group currently consists of:

- Mr. Tom Murphy - Squaw Valley Ski Corporation (chairman)
- Ms Margot Garcia – SVMWC
- Mr. Rick Lierman – SVPSD
- Mr. Cam Kicklighter – RSC
- Mr. Mike Murphy – PlumpJack Squaw Valley Inn
- Mr. Russell Poulsen – Poulsen Family Representative
- Mr. Chuck Curtis – CRWQCB
- Ms Jill Pahl – Placer County Environmental Health Department

### **5.3 ANNUAL REPORTING**

The GMP implementation plan requires an annual report on the state of the Olympic Valley groundwater basin. This ARR constitutes the initial state of the basin report.

## **5.4 MODIFICATION OF SVPSD LEAK DETECTION PROGRAM**

To promote conservation and public awareness, SVPSD modified its existing leak detection program. The program is now set up to allow both residential and commercial properties to identify and remedy leaks, saving water and reducing demand. Monthly commercial water usage is now posted on the internet, allowing commercial properties to compare trends in water usage and potentially identify leaks. The SVPSD tracks residential water use and sends notices to residential properties that show anomalous usage spikes, alerting them to the fact that they may have a water leak.

## **5.5 UPDATED AND MODIFIED SVPSD IRRIGATION CONSERVATION ORDINANCE**

The Irrigation Conservation Ordinance was updated and modified by SVPSD and incorporated into the SVPSD Water Code. The ordinance promotes conservation through a number of activities including:

- Establishing block rate structures;
- Requiring dedicated landscape metering on new development
- Requiring dedicated landscape metering for customers with high water use;
- Requiring pressure regulators on all landscape systems
- Identifying water conservation actions for Stage 1 (normal), Stage 2 (significant water shortage), and Stage 3 (critical water shortage) periods.

The conservation activities in this ordinance are designed to reduce excessive demand, thereby reducing and managing pumping from the groundwater basin.

## **5.6 MONTHLY SVPSD AUDITS**

During Water Year 2007, SVPSD began auditing its distribution system to identify system losses. Audits are conducted monthly. Identifying system losses will allow the SVPSD to rapidly address leaks, conserving water and reducing pumping from the groundwater basin.

## **5.7 STATUS OF BMOs**

This section reviews status of BMOs during Water Year 2007. Each BMO in the GMP is listed, along with any accomplishments that address the BMO.

*BMO 1-1: MAINTAIN GROUNDWATER SUPPLIES SUFFICIENT TO PROVIDE WATER FOR CURRENT AND FUTURE DOMESTIC, MUNICIPAL, COMMERCIAL, PRIVATE, AND FIRE PROTECTION USES DURING SUMMER AND AUTUMN OF THE SECOND CONSECUTIVE YEAR OF LOW RAINFALL.*

- Groundwater levels were regularly measured at SVPSD and SVWMC municipal supply wells.
- Groundwater levels were measured regularly as part of the RSC CHAMP monitoring program.
- The annual SVPSD Capacity and Reliability Study Update (Ecologic, 2008) examined trends in total water consumption and per capita demand factors. These trends and the capacity of the District's existing water supply wells were used to determine the District's ability to meet future demand. The report concluded that the current wells will allow the District to meet average annual demand through 2010 and maximum day demand through 2012.
- SVPSD modified the leak detection program to more efficiently identify excessive water leaks.
- SVPSD modified and updated the irrigation and water conservation ordinance that includes:
  1. Implementation of a Maximum Applied Water Allowance (MAWA).
  2. Tiered water pricing to encourage efficient water use.
  3. Development of drought response plans.
- SVPSD began monthly audits of its system to identify system losses

*BMO 1-2: MINIMIZE DRAWDOWN AND MAXIMIZE USE OF BASIN STORAGE*

No action towards this objective was taken this year.

*BMO 1-3: ENCOURAGE WATER CONSERVATION, AND MANAGE OR REDUCE WATER DEMAND*

- SVPSD modified the leak detection program to more efficiently identify excessive water leaks
- SVPSD modified and updated the irrigation and water conservation ordinance that includes:
  - Implementation of a Maximum Applied Water Allowance (MAWA).
  - Tiered water pricing to encourage efficient water use.
  - Development of drought response plans.
- SVPSD began posting customer water usage numbers on the internet. This information allows customers to identify potential leaks and manage their water consumption.

- SVPSD began monthly audits of its system to identify system losses

*BMO 1-4: ESTIMATE AND ACKNOWLEDGE LIKELY FUTURE WATER DEMANDS IN MANAGEMENT DECISIONS*

- The annual SVPSD Capacity and Reliability Study Update (Eco:Logic, 2008) examined trends in total water consumption and per capita demand factors. These trends and the capacity of the District's existing water supply wells were used to determine the District's ability to meet future demand.

*BMO 2-1: COMPLY WITH EXISTING WATER QUALITY STANDARDS*

- Drinking water from SVPSD wells was tested according to Title 22 requirements. Water Year 2007 testing found no constituent levels exceeding standards.
- The RSC CHAMP program sampled surface and groundwater quality in the meadow area.
- Groundwater quality sampling occurred at the Opera House site each quarter of Water Year 2007. During each of these sampling events monitoring wells at the site were sampled for TPH and MTBE. Additionally, well SVPSD#3 was tested each quarter of Water Year 2007 for TPH and VOCs. MTBE was not detected in any samples. The maximum TPH concentrations found during Water Year 2007 sampling were: 0.41, 0.29, 0.14, and 0.22 mg/L for the 4<sup>th</sup> quarter 2006, 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> quarters of 2007 respectively. No contaminants were detected in well SVPSD#3.

*BMO 2-2: MINIMIZE THE RISK OF GROUNDWATER CONTAMINATION*

- Neither the County nor the State of California has proposed any new ordinances for well construction and abandonment. The GMP stakeholders continue to support any changes that strengthen groundwater quality protection.

*BMO 2-3: IMPROVE GROUNDWATER QUALITY WHERE FEASIBLE*

- As a repository of relevant documents from the State of California, the SVPSD continued to track the status of a number of groundwater contamination sites in the Valley.

*BMO 2-4: IDENTIFY AND PROTECT THE RECHARGE WATER QUALITY AND RECHARGE CAPACITY OF GROUNDWATER RECHARGE ZONES*

- No relevant activities have occurred during Water Year 2007

*BMO 3-1: PROTECT THE STRUCTURE AND HYDRAULIC CHARACTERISTICS OF THE GROUNDWATER BASIN BY AVOIDING WITHDRAWALS THAT CAUSE SUBSIDENCE*

- No relevant activities occurred during Water Year 2007

*BMO 3-2: PROMOTE VIABLE AND HEALTHY RIPARIAN AND AQUATIC HABITATS BY AVOIDING OR MINIMIZING FUTURE IMPACTS FROM PUMPING ON STREAM FLOWS*

- The SVPSD has an ongoing stream monitoring program in place to measure flows at three sites on Squaw Creek.
- Groundwater levels were regularly measured at SVPSD and SVWMC municipal supply wells.

*BMO 3-3: MINIMIZE FUTURE IMPACTS FROM PUMPING ON IDENTIFIED WETLANDS*

- The SVMWC monitored groundwater levels in two production wells adjacent to the Olympic Valley meadow
- The RSC collected groundwater level data from the Olympic Valley meadow as part of their CHAMP groundwater level monitoring program.
- The RSC collected semi-monthly groundwater level data from the Olympic Valley meadow beyond the required CHAMP monitoring.

*BMO 3-4: SUPPORT ONGOING STREAM RESTORATION EFFORTS AS THEY RELATE TO GROUNDWATER MANAGEMENT*

- No projects were undertaken during Water Year 2007. Proposals for two grants focusing on Squaw Creek were submitted after Water Year 2007.

## **Section 6**

# **CONCLUSIONS AND RECOMMENDATIONS**

## **6.1 CONCLUSIONS**

### **6.1.1 GROUNDWATER PUMPING**

Groundwater pumping in Olympic Valley was similar to previous years during Water Year 2007. Pumping does not vary much from year to year. No clear trends in annual pumping are seen in the data, although peak summer pumping appears to be increasing. Total Pumping for the entire basin was one of the highest pumping totals of any Water Year, despite incomplete pumping data in Water Year 2007, totaling 246 MG (755 acre-feet). However, this pumping represented only a modest 4.5% increase over historical average pumping of 235 MG (721 acre-feet).

### **6.1.2 GROUNDWATER LEVELS**

Important trends and groundwater levels observed during Water Year 2007 include the following.

- In the SVPSPD production wells, both annual groundwater level highs and lows are at or near historically measured lows.
- No groundwater level trends are observed in data collected from monitoring wells in the Meadow. This area seems relatively unaffected by the low precipitation in Water Year 2007, although the data are sparse.
- Near historical lows in groundwater levels measured in production wells did not impact well operations or the ability to supply water
- Low groundwater levels near the SVPSPD and SVMWC production wells were apparently caused by flow in Squaw Creek ceasing earlier in Water Year 2007 than in Water Year 2006.

### **6.1.3 GROUNDWATER QUALITY**

Important trends in groundwater quality observed during Water Year 2007 include the following.

- Tests of SVPSPD production wells revealed no constituents above MCLs
- The RSC CHAMP monitoring revealed no impact of golf course operations on groundwater quality. However spring 2007 shallow monitoring showed three wells with detectable concentrations of nitrite for the first time since 1996 and well 320 showed detectable nitrates for the first time since 1995. Furthermore, concentrations of nitrate, nitrite, total

nitrogen, TKN, and iron all rose above historically measured highs: although similar to previous sampling events, only iron was above the MCL. The Technical Review Committee (TRC) is monitoring these results in accordance with its charge.

- The CRWQCB closed the Opera House site. No further action is necessary at this location.
- There are two active CRWQCB sites in the Olympic Valley GMP: the PlumpJack site and the Squaw Valley Mutual Water Company site. No activity was recorded at either of these sites during Water Year 2007.
- No new hazardous waste sites were identified during Water Year 2007.

#### **6.1.4 GROUNDWATER MANAGEMENT**

A number of significant groundwater management activities were completed during Water Year 2007. The most significant of these was the development and adoption of the GMP. The GMP guides future groundwater management activities in Olympic Valley. Additional groundwater management activities that occurred during Water Year 2007 include

- A Groundwater Advisory group was formed. The group is led by Tom Murphy from Squaw Valley Ski Corporation.
- The SVPSD leak detection program was updated and modified to more readily identify and remedy leaks, thereby reducing groundwater demand.
- The SVPSD irrigation conservation ordinance was updated and modified to reduce excessive irrigation water use, thereby reducing groundwater demand.
- This ARR was produced

### **6.2 RECOMMENDED AMENDMENTS TO THE GMP**

There are no recommended amendments to the GMP.

### **6.3 RECOMMENDED ACTIONS FOR WATER YEAR 2008**

Based on the analyses and conclusions presented above, the following recommendations are made for future groundwater management activities. Our recommendations are grouped by priority.

#### **6.3.1 HIGH PRIORITY RECOMMENDATIONS**

High priority recommendations are those that should be initiated within the next six to twelve months. The high priority recommendations include:

- Coordinate existing monitoring program (GMP Element 1.2). The three existing groundwater monitoring programs should be combined into a single, coordinated groundwater monitoring program. This unified program will be designed to monitor both groundwater levels and groundwater quality throughout the GMP management area. Coordinating the existing monitoring plans will have the advantage of producing a single, consistent data set that can be used for basin analysis.
- Monitoring programs should be expanded to monitor both static and pumping groundwater levels at all production wells. This will allow future management of pumping in relation to screen levels and pump settings. This may impact future estimates of pumping capacity.
- Continue to pursue state funds that have been applied for and implement stream-aquifer study if funds are obtained (GMP Element 2.2)
- Coordinate with, and support, Friends of Squaw Creek's efforts at stream restoration (GMP Element 2.2).

### **6.3.2 MEDIUM PRIORITY RECOMMENDATIONS**

Medium priority recommendations are those that should be completed within the next year to two years. These recommendations are important for long-term groundwater management.

- Update the groundwater model with data from ASR investigation and recently collected RSC data. Update the groundwater model with recently collected groundwater levels and pumping data (GMP Element 8.1).
- Monitor groundwater levels in wells near Squaw Creek at wells SVP5D#5S and SVP5D#5D. This data may improve understanding of stream-aquifer interaction (GMP Element 1.3).
- Expand groundwater level data collection to monitoring wells in the meadow (GMP Element 1.3).

### **6.3.3 LOW PRIORITY RECOMMENDATIONS**

Low priority recommendations are those that could be initiated within the next twelve months, but could be deferred. These include.

- Encourage residential water use audits and other conservation efforts. (GMP Element 7.2)
- Develop a coordinated database of groundwater level and groundwater quality data (GMP Element 8.3).
- Develop a plan and approach for investigating the impact of the horizontal wells on groundwater in the GMP management area (GMP Element 5.5)

## Section 7

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