Water Year 2008 Annual Review and Report Olympic Valley California

March, 2009

Prepared by:

HydroMetrics LLC

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ERRATA

ADDITIONS

The following groundwater management accomplishment should be added to Section 5 of the Water Year 2008 Annual Review and Report.

Squaw Valley Ski Corporation completed a number of projects designed to control runoff and promote healthy riparian vegetation. These projects include:

1. Headwall Lower Terminal project – Approximately 46,000 sq ft was revegetated and re-contoured to help promote sheet flow and soil stabilization. Particular aspects of this project included
    a. Re-contouring the slope above the Headwall lower terminal back to its natural grade. This area was originally the unloading ramp for the Cornice 1 chair lift (removed in the 70's). The old earthen ramp material was graded back to its original contour. Ground penetrating radar was used to determine the water flow line under the fill material. Determining the flow line will help the vegetation thrive. The fill material was used to fill 2 channels that were formed during the 1998 flood event.
    b. A wetland was created adjacent to the lower terminal. The area was re-contoured to promote overflow water storage and designed to sustain wetland vegetation.
    c. A second flood scarp was re contoured and soils were amended to promote growth on an area that exhibited no vegetation.
2. Two culverts were replaced with larger diameter culverts to ensure channel bank stabilization during large rain events.
3. Annual culvert and sediment basin cleaning was performed.
4. Several existing culverts were rock armored

The projects completed by Squaw Valley Ski Corporation address multiple BMOs including:

BMO 2-4: Identify and protect the recharge water quality and recharge capacity of groundwater recharge zones

BMO 3-4: Support ongoing stream restoration efforts

ADDITIONAL COMMENTS

Mr. Dave Brew provided the following comments on the Water Year 2008 Annual Review and Report after it was printed.

I was at Squaw Valley on March 24, 2009, and Rick Lierman gave me his copy of the subject report to look over. I have the following questions and comments, which may or may not appeal to you!

Pages 2 and 14: The concept of the valley fill being surrounded by bedrock is too simple. The bedrock is mantled by colluvium well up the sides of the valley. That colluvium merges with glacial till along the lower parts of the valley's sides. The till, in turn interfingers to some extent with the glacial, lacustrine, and alluvial material that fills the valley. Recharge from the melting snow pack travels along the contact of the bedrock with colluvium and till and through the colluvium and till, in addition to a very few places where the bedrock is actually in contact with the valley fill.

The stream gauge numbers make it clear that's there's a lot of water coming down the valley sides and not just into the head of the valley and the sides are where it's coming from (plus the hyporheic flow that doesn't get measured by the upstream gauges, but surfaces when it gets to the terminal moraine).

Pages 7 and 20: Regardless of exactly where the line is drawn delimiting the GW management are, I think it's a mistake to exclude the horizontal wells from the discussion. Some parties may object, but at least some of that pumped water would otherwise make it into the aquifer and contribute to its water budget. I think that you have enough wiggle room to include them in the discussion. But then, of course, I see the whole watershed as being part of the groundwater system!

Page 8 and 37: It's probably not time yet to include any mention of the coming changes in the sampling frequency of the Resort at Squaw Creek monitoring wells, but it's coming. The WDR and CHAMP material that is currently being discussed and is very likely to be implemented will result in more frequent measurements and, importantly, a series in the middle of the summer. Rick Lierman can fill you in on this--

Page 19, figure 6: This is great! Make it into a poster and hang it everywhere!

Page 23, figure (: This raises a question: Is the reduction in water use coming mainly from cutbacks by the biggest users, or is it spread over all of the users?

Pages 28 and 31: Two really important observations in here that deserve to be highlighted somehow: (1) The PSD well levels correlate directly with the precipitation amounts; and (2) Groundwater levels drop as the Squaw Creek level drops and the creek recharges the aquifer until its flow ceases. Hey, maybe the results of the Creek- Aquifer Interaction study are already out there!

Page 42: I was intrigued by the presence of perchlorate as potential contaminant. Is whatever is out there coming from the Ski Corp fireworks that occur every so often, or is it coming from the explosives used for snow safety? If it's the former, then there may be reason to go after the cessation of fireworks displays. If it's the latter, then there's probably nothing to be done.

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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
LLNL	Lawrence Livermore National Laboratory
MCL	Maximum Contaminant Limit
MG	Million Gallons
mg/L	milligrams/liter
MTBE	Methyl tertiary-butyl ether
ND	Non-Detect
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 second 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 2008 (October 1, 2007 – September 30, 2008) 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 2009.
- 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 the California Department of Water Resources (DWR) 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 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.

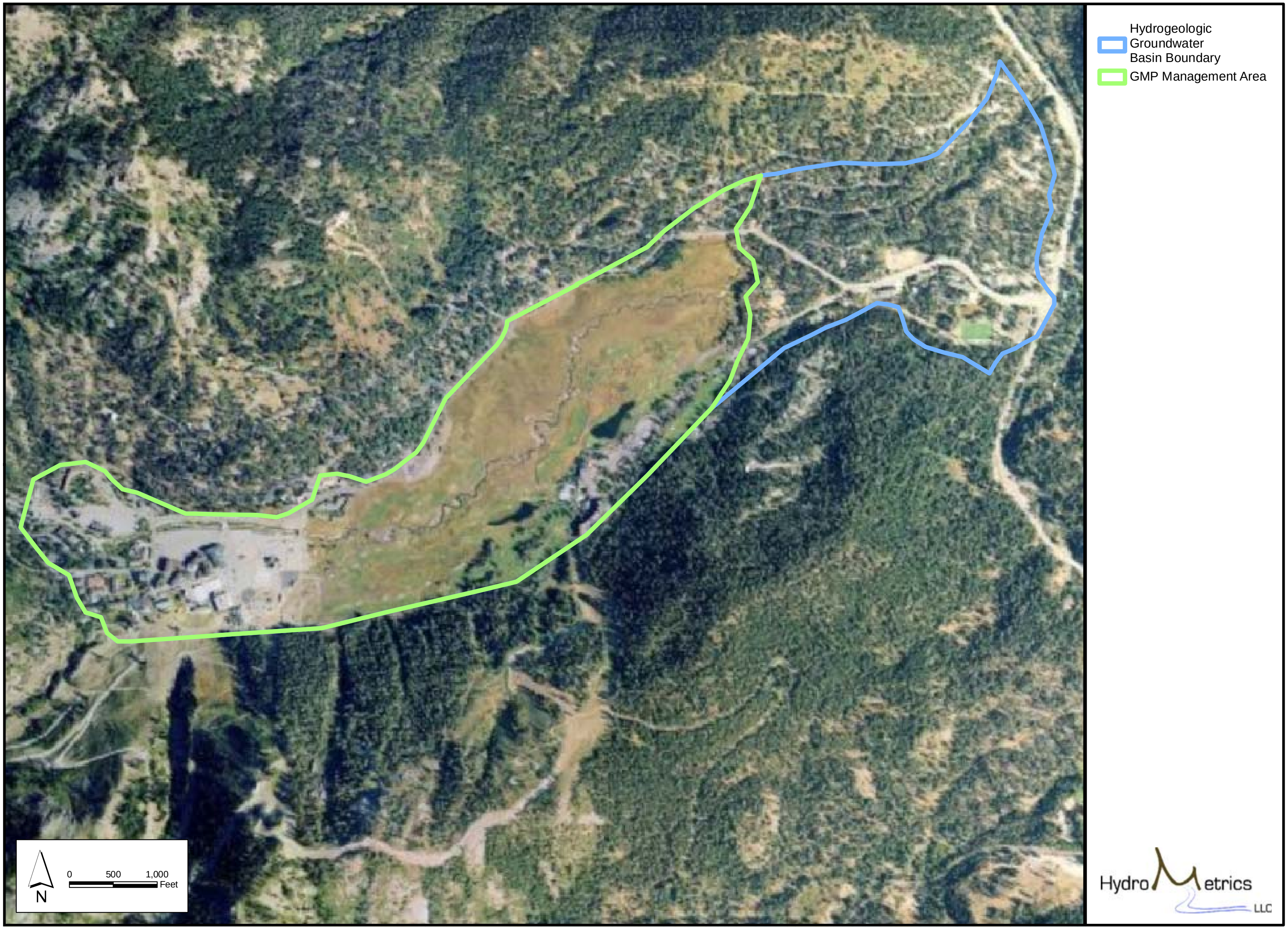

Figure 1: GMP Management Area Boundary

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 the 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, the sediments filling the Valley are generally 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 by a stream between periods of glacial lake deposition. HSU 3, the deepest unit, consists primarily of fine grained sediments of very low permeability which may represent glacial lake or glacial till 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 lesser amount is 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: SVPSD, 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 2008.

- SVPSD - 113 million gallons (MG) (348 acre-feet)
- RSC - 73.2 MG (225 acre-feet) for golf course irrigation and snow making.
- SVMWC – 30.4 MG (93.3 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 2008, 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. Daily precipitation data at the Old Fire Station is complete for the entire Water Year 2008. The accuracy of the precipitation gauge has been questionable in recent years. A new precipitation gauge has recently been installed.

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 2008.

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 2008 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 2008.

2.2.2 SVMWC PUMPING

During Water Year 2008 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 2008. Only total pumping data are available for October, November, and December 2007; data are not available by individual well.

2.2.3 RSC PUMPING

During Water Year 2008, 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 flow meter. Monthly flow data for Water Year 2008 were provided by RSC. Water Year 2008 snow making and irrigation data are complete.

RSC drilled, constructed and tested a new well, named the Perini well, in the Meadow near the intersection of Squaw Valley Road and Wayne Road. In Water Year 2008 this well was pumped only for development and testing. The amount of water produced is considered to be insignificant. Future groundwater production at this location is anticipated to supply water for irrigation and possibly snow making.

2.3 GROUNDWATER LEVEL DATA

During Water Year 2008 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 by SVPSD using level sensors with data loggers at wells SVPSD#1, SVPSD#2, and SVPSD#5. Groundwater level data from all of these wells is complete for Water Year 2008. Water levels were also logged at monitoring well 304; however these data appear questionable. Logging of water levels was attempted at wells SVPSD#3, 5S, 5D, and 4R. Collection efforts at these wells failed and no data was obtained for Water Year 2008.

2.3.2 SVMWC GROUNDWATER LEVEL DATA

Monthly static groundwater level measurements are collected by hand from wells SVMWC#1 and SVWMC#2. Groundwater level data for Water Year 2008 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) 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 2008 groundwater level data were collected during two sampling events: October 2007 and May 2008. In October 2007samples were collected from eight shallow wells (303, 305, 306, 320, 322, 323, 328, and 331). In May 2008 samples were collected from 7 shallow wells (301, 307, 309, 312, 315, 318, and 325).

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. Daily streamflow data is complete for Water Year 2008.

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 SVPSD and SVMWC municipal production wells are collected as required under CCR Title 22 requirements.

SVPSD

During Water Year 2008 groundwater quality data were collected at the SVPSD#1, SVPSD#2, SVPSD#3, and SVPSD#5 wells. These data are reviewed in Section 4.

SVMWC

During Water Year 2008 groundwater quality data were collected by SVWMC at SVMWC wells 1 and 2. These data are reviewed in Section 4.

2.5.2 Environmental Compliance Sites

During Water Year 2008, two sites within the GMP management area had open cases with the CRWQCB. Of the two sites, groundwater quality data was collected only at the PlumpJack site during Water Year 2008.

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 calendar 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 two sampling events in Water Year 2008: October 2007 and May 2008. In October 2007 samples were collected from eight shallow wells (303, 305, 306, 320, 322, 323, 328, and 331). In May 2008 samples were collected from 7 shallow wells (301, 307, 309, 312, 315, 318, and 325).

Section 3
GROUNDWATER SUPPLY ASSESSMENT

This section presents the status of the Olympic Valley Groundwater Basin during Water Year 2008 including an analysis of the stream flow, precipitation, pumping, and groundwater levels. Water Year 2008 hydrology is also compared to conditions of past years. In addition to a review of the basin's groundwater conditions, 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 Old Fire Station gauge equaled 25.0 inches during Water Year 2008. This precipitation is 48% of the average annual Water Year precipitation of 52.0 inches; and was the lowest total since Water Year 2001. Snow-water equivalent precipitation measured at the Squaw Valley SNOTEL station equaled 48.3 inches during Water Year 2008. This is 74% of the average precipitation of 65.7 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 for Water Year 1965 through Water Year 2008. 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 for Water Year 1981 through Water Year 2008.

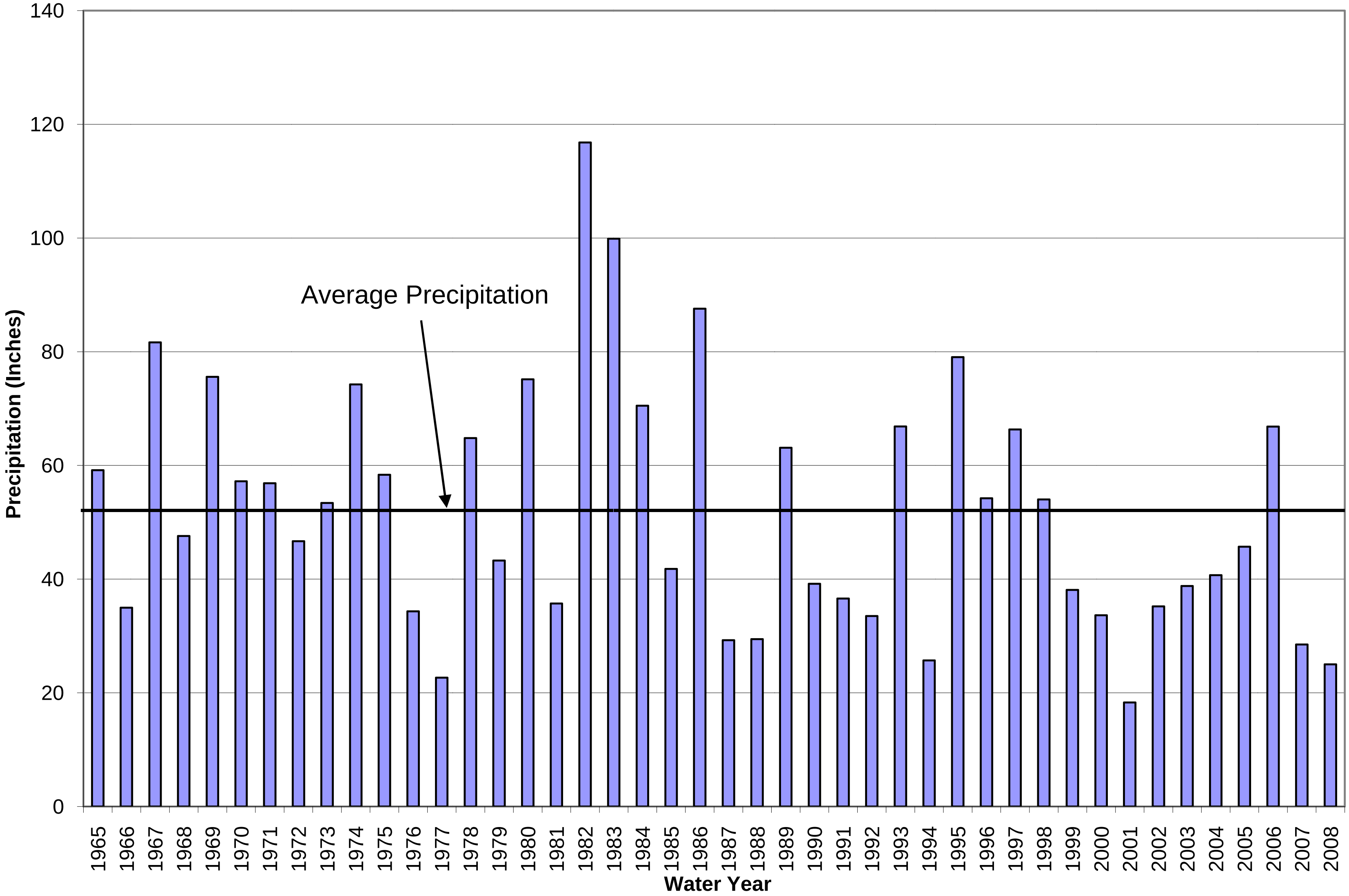

Figure 2: Olympic Valley Precipitation by Water Year: Old Fire Station gauge

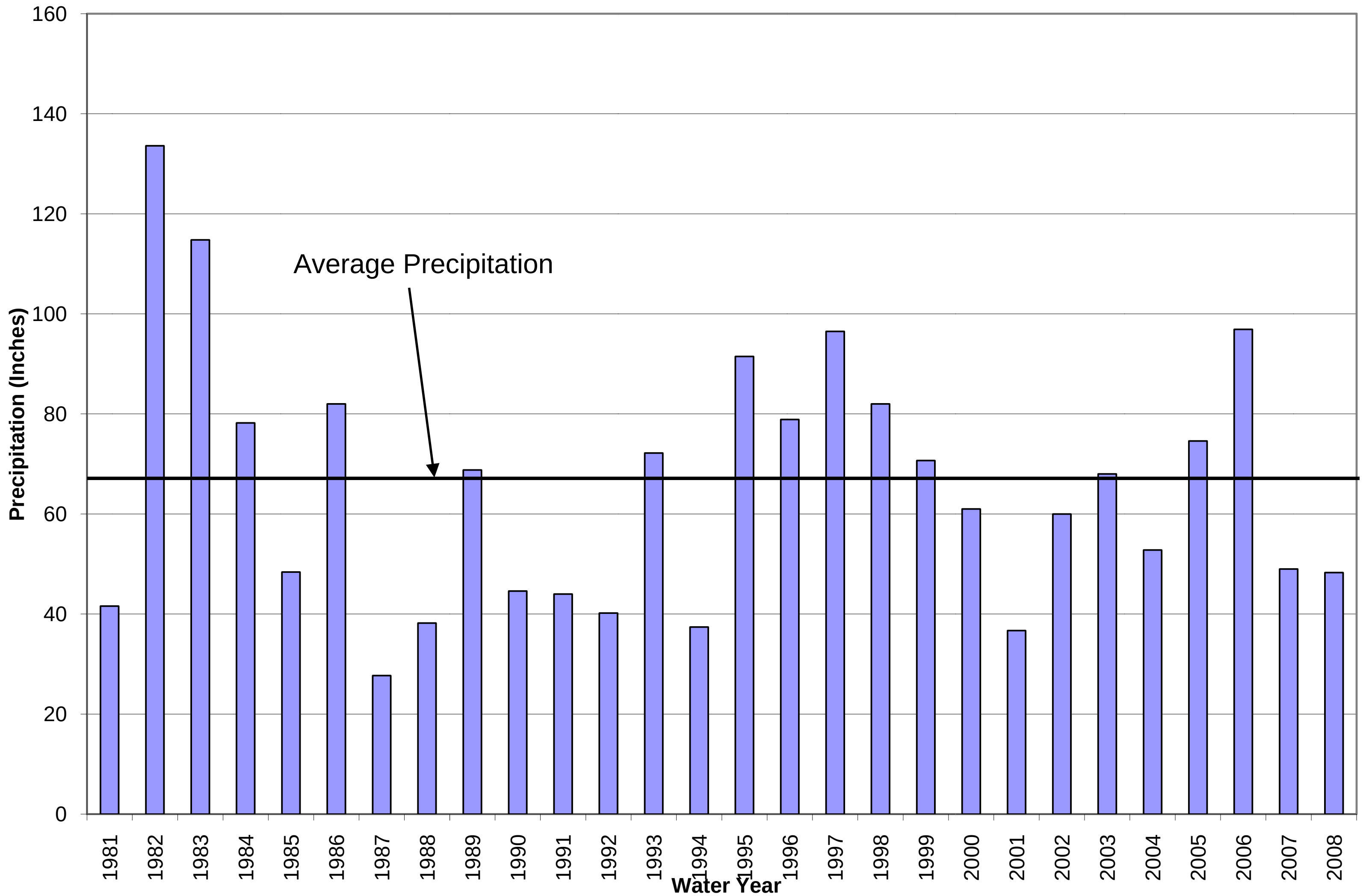

Figure 3: Olympic Valley Precipitation by Water Year: SNOTEL Station

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 in Shirley Canyon Creek and the southern gauge, QV2, measures flow in the South Fork of Squaw Creek. Gauge QV3 measures flow downstream of the terminal moraine, east of the GMP management area boundary.

Total annual volumes of flow in Squaw Creek at the three gauges for Water Years 2003 through 2008 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 2008 than during any of the previous five years. Total discharge at gauges QV1 and QV2 was lower than any of the preceding five Water Years and total discharge at QV3 was the second lowest of the six years.

Table 1: Total Water Year Discharge at Squaw Creek Gauges

Water Year[1]	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
2008	5,443	3,587	9,030	12,540

[1]Water Year 2003 and 2004 data from West Yost & Associates 2005
Water Year 2005 through 2008 data provided by Watermark Engineering

Table 1 shows that there is a net gain to Squaw Creek within the GMP management area every year, indicating that more water flows out of the GMP management area through Squaw Creek than flows into the area through the Creek. During Water Year 2008 the GMP management area was a net source of 1,144 MG (3,511 acre-feet) of water to Squaw Creek.

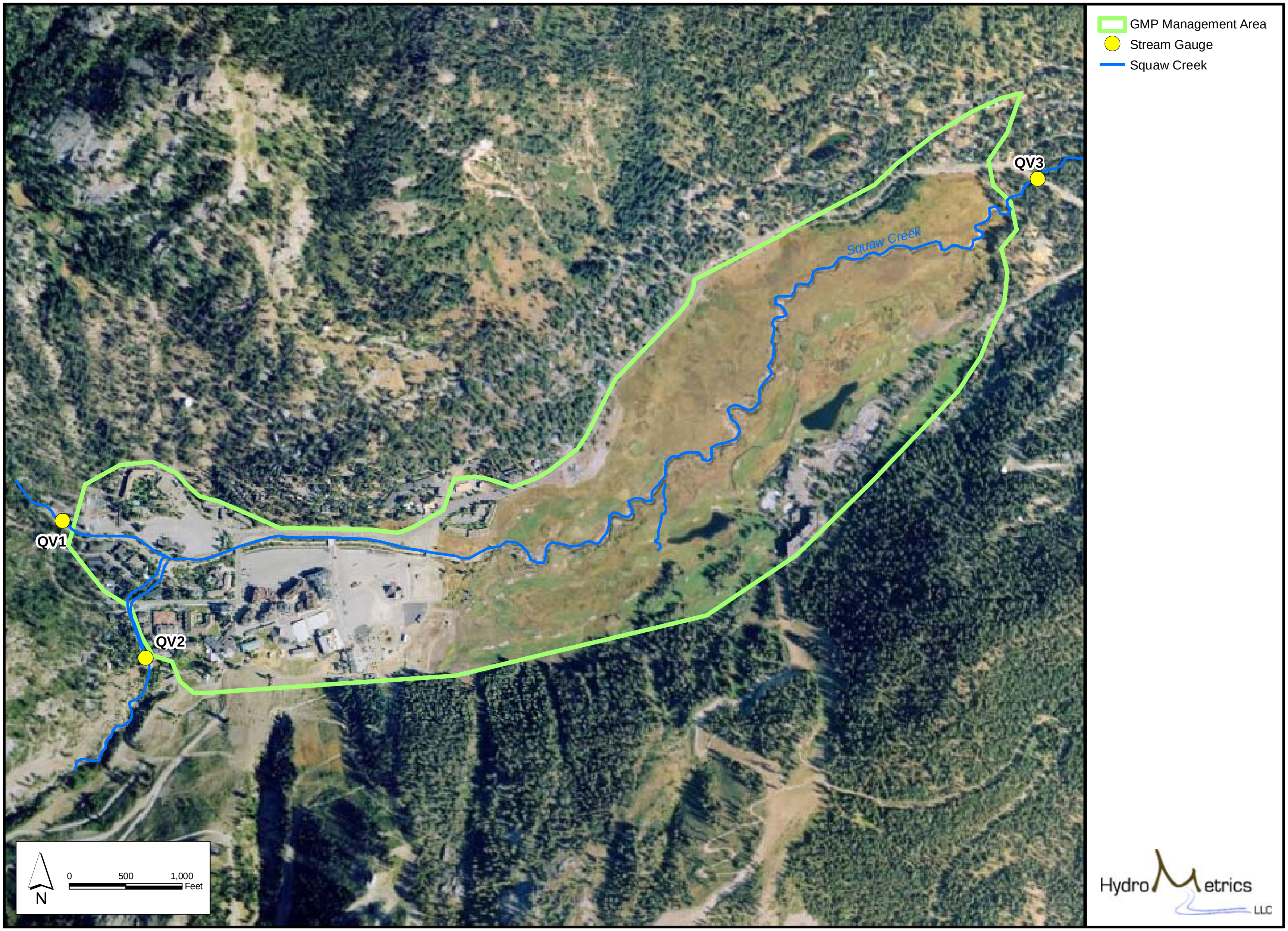

Figure 4: Stream Gauge Locations

Mean daily streamflow in Squaw Creek at each of the three gauges during Water Year 2008 is presented in Figure 5. Intermittent flows in Squaw Creek begin in October, with sharp spikes during storms and low flows in between storms. Beginning around March the hydrograph character changes at the three gauges; the daily discharge increases and is continuously higher. This more continuous flow starting in March is due to the contribution of snowmelt to stream flow.

Mean daily streamflows at gauge QV3 for Water Years 2005, 2006, 2007 and 2008 are presented in Figure 6. The daily discharge in Squaw Creek was much lower in Water Years 2007 and 2008 than in the preceding two Water Years. This lower discharge reflects the lower precipitation during these 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 Years 2007 and 2008 was 87 and 179 cfs respectively.

The upper two graphs in Figure 6 show flow at gauge QV3 during Water Years 2005 and 2006 approaching zero in early August. The bottom graph shows flow during Water Years 2007 and 2008 approaching zero in early to mid July. The flow at QV3 became effectively zero approximately one month earlier in Water Years 2007 and 2008 than in the previous two Water Years. This shift in timing of the start of zero streamflow reflects the lower precipitation during the two most recent 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 six Water Years was 22,630 acre-feet (7,370 MG). Water Year 2008 QV3 discharge volume was 12,540 acre-feet (4,085 MG); approximately 17 times the average annual volume of 725 acre-feet (236 MG) pumped from the GMP management area.

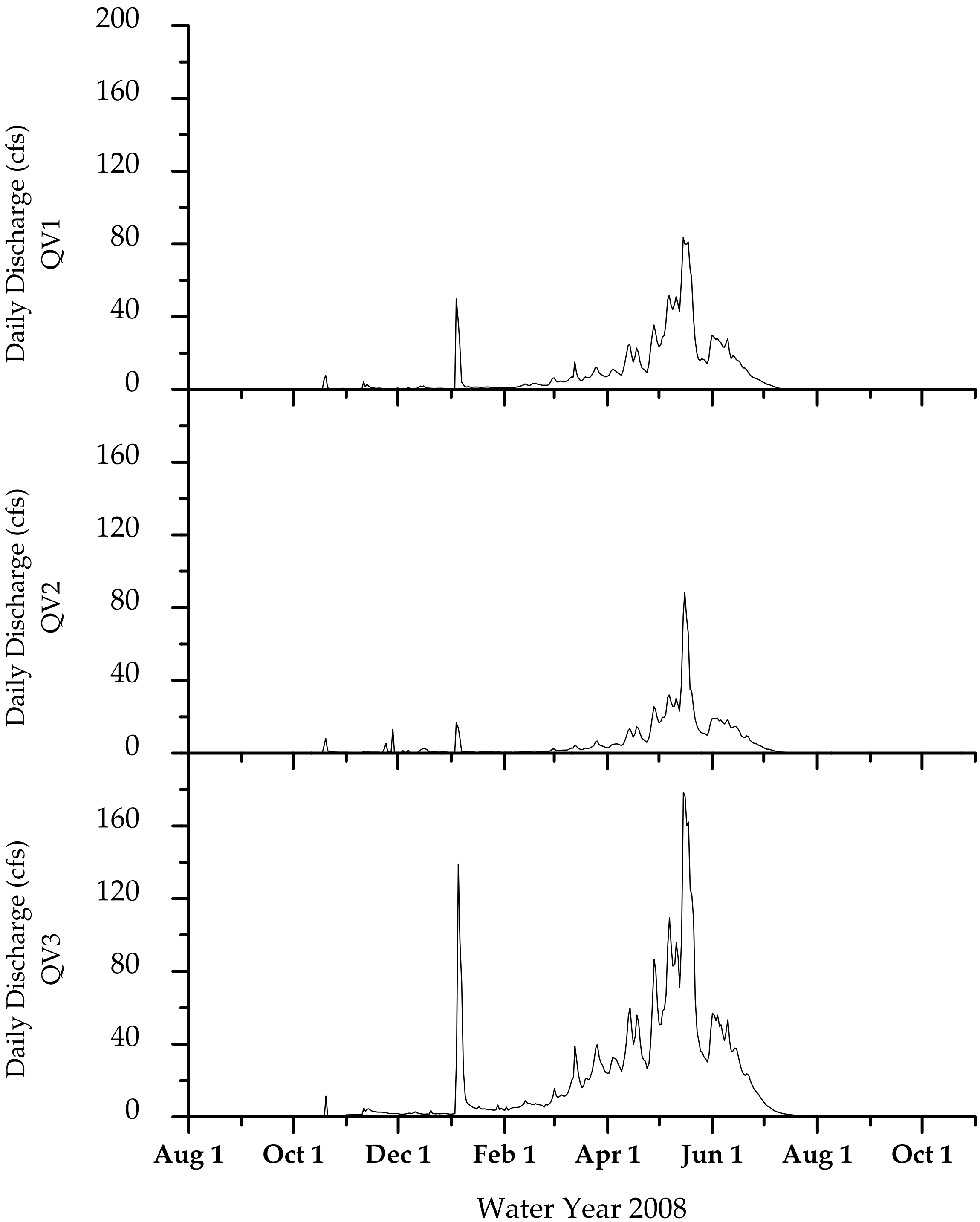

Figure 5: Water Year 2008 Mean Daily Stream flow

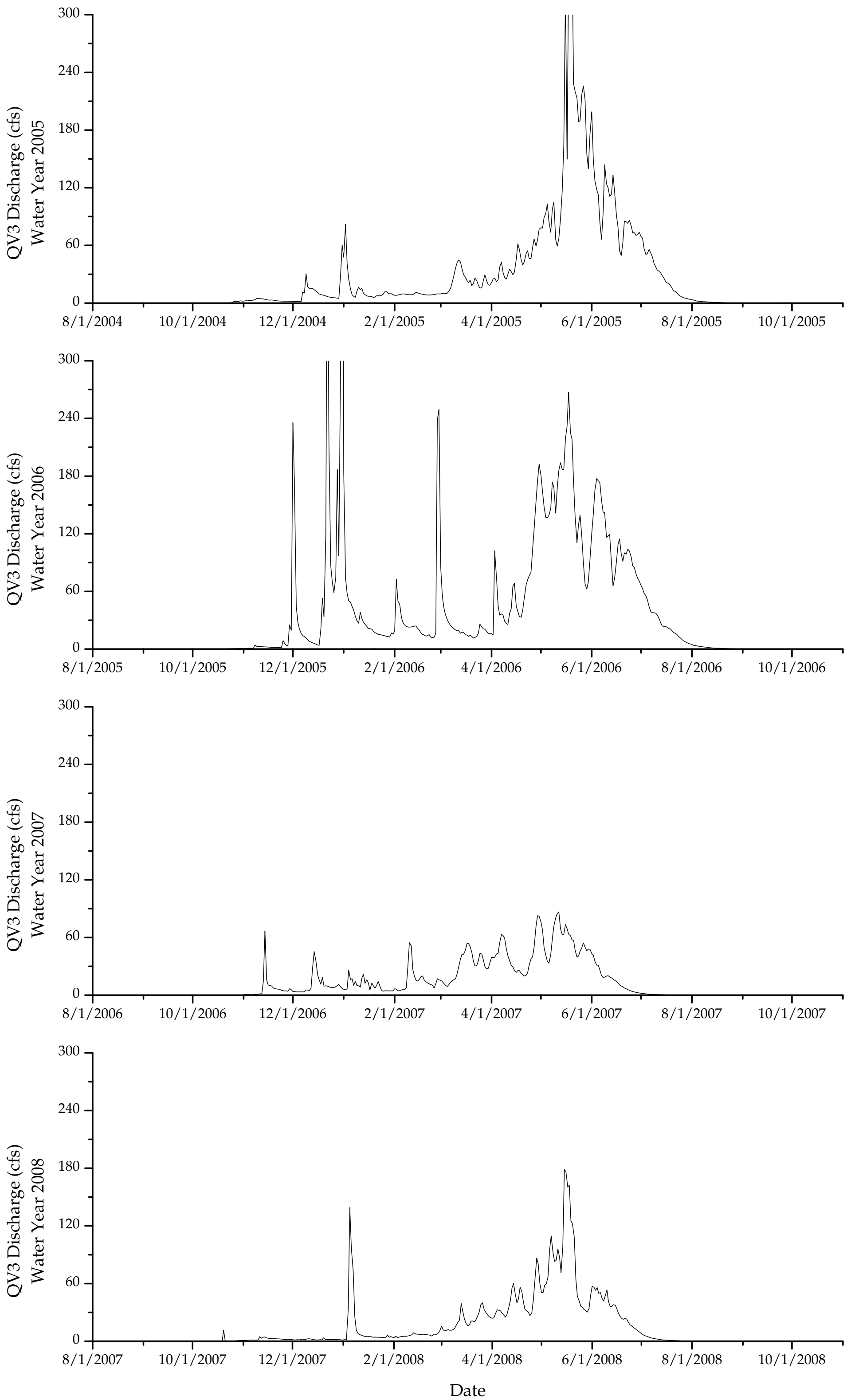

Figure 6: Mean Daily Streamflow at QV3 during 2005, 2006, 2007, and 2008

3.3 GROUNDWATER PUMPING

Groundwater is extracted from the GMP management area by SVPSD, SVMWC, RSC, PlumpJack Squaw Valley Inn, and 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 SVWMC, 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 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 7 shows the locations of the known active production wells in the GMP management area. The vertical bars at each well represent the relative volume of pumping at each well during Water Year 2008. The Resort at Squaw Creek does not monitor pumping at each individual well. The distribution of water pumped by RSC's 18 series wells was based on estimates provided by AMEC for pumping from May through October, between 2002 and 2006. The average pumping percentage for each RSC well was applied to the Water Year 2008 pumping to develop the distribution shown on Figure 7.

3.3.1 PUMPING TRENDS

Historical pumping by Water Year is shown in Figure 8. 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; incomplete data records are shown in red on the Figure 8. 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 2008 (excluding 2005 and 2006), SVPSD, SVMWC, and RSC pumped an average of 236 MG (725 acre-feet) per year. The average pumping for each entity is approximately:

- SVPSD - 128 MG (393 acre-feet)
- SVMWC - 32 MG (98 acre-feet)
- RSC - 76 MG (233 acre-feet).

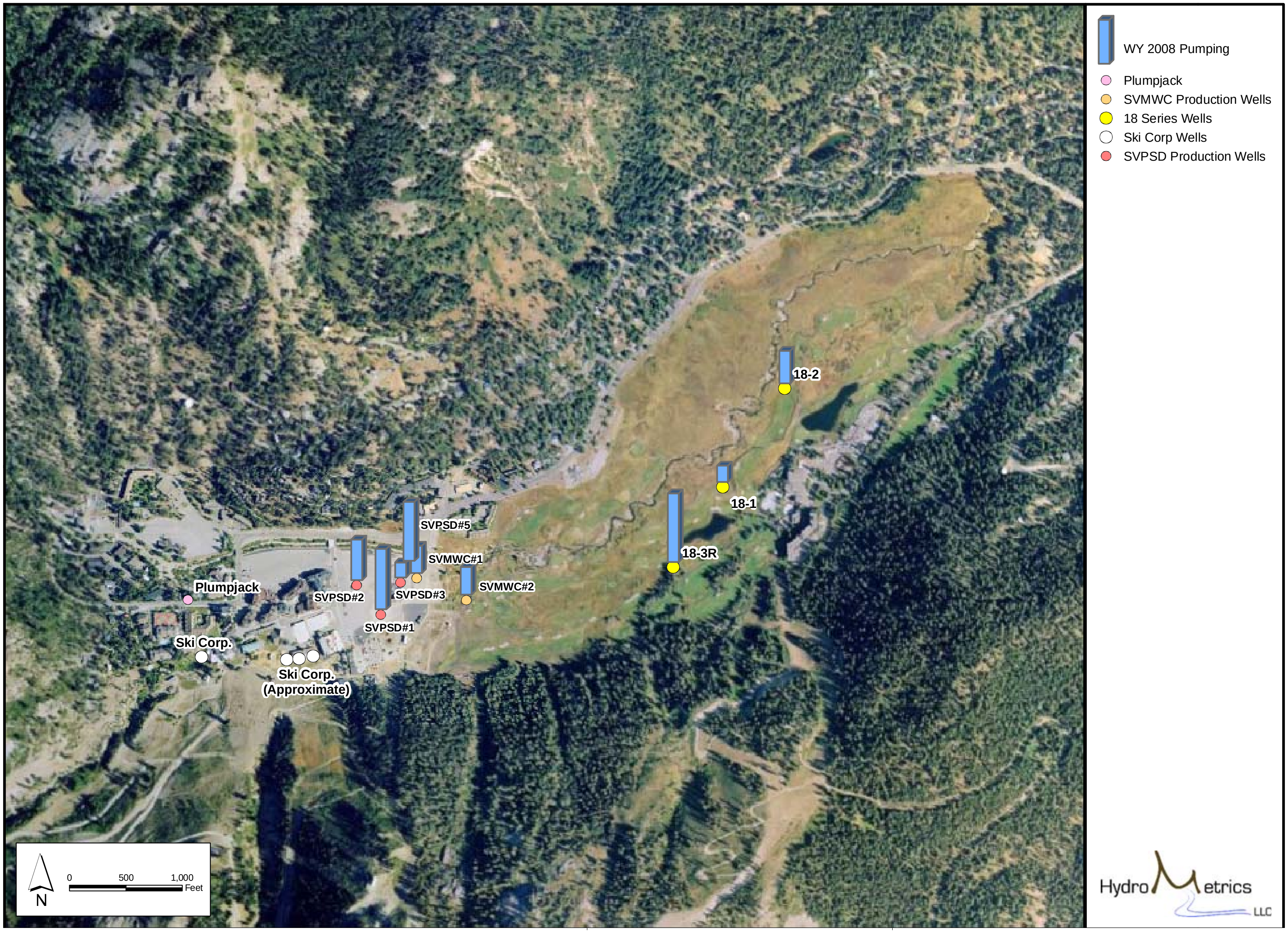

Figure 7: Production Well Locations and Relative WY 2007 Pumping Quantities

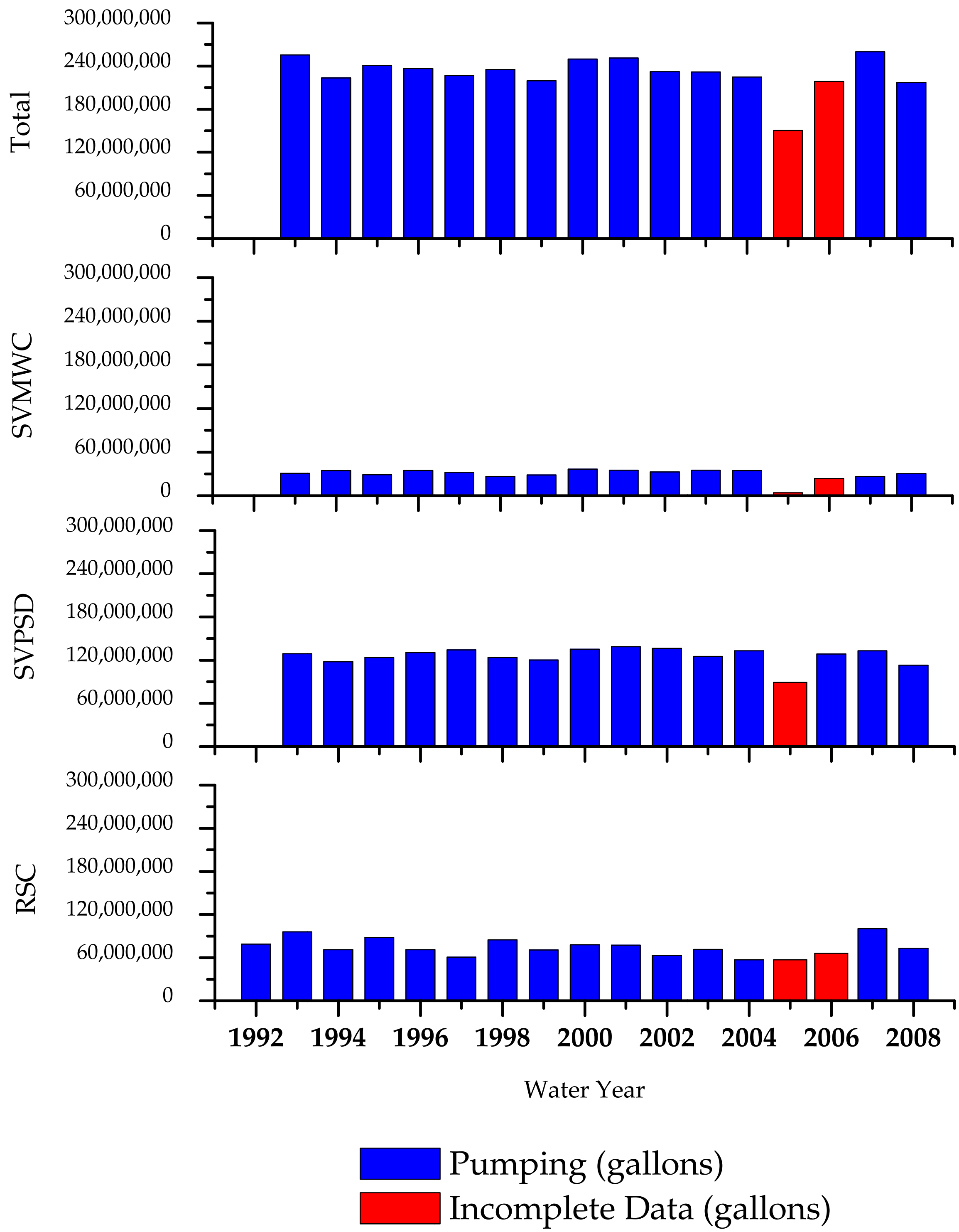

Figure 8: Annual Pumping by Water Year

The total pumping recorded for Water Year 2008 was 217 MG (666 acre-feet). This pumping was 8% lower than the long term average pumping. No clear long-term trends are seen in the annual pumping for SVMWC, SVPSD, or RSC.

Historical monthly SVPSD pumping is presented in Figure 9. The monthly pumping peaks on this graph occur in the summer due to increased irrigation demand. The annual peak in monthly pumping decreased sharply in Water Year 2008, from 20.8 to 16.0 MG, breaking from the trend of increasing annual peak monthly pumping.

Figure 10 presents a plot of total precipitation and total pumping by Water Year. The plot shows that there is no strong 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 partially due to lower winter demands during droughts, when ski seasons are shortened.

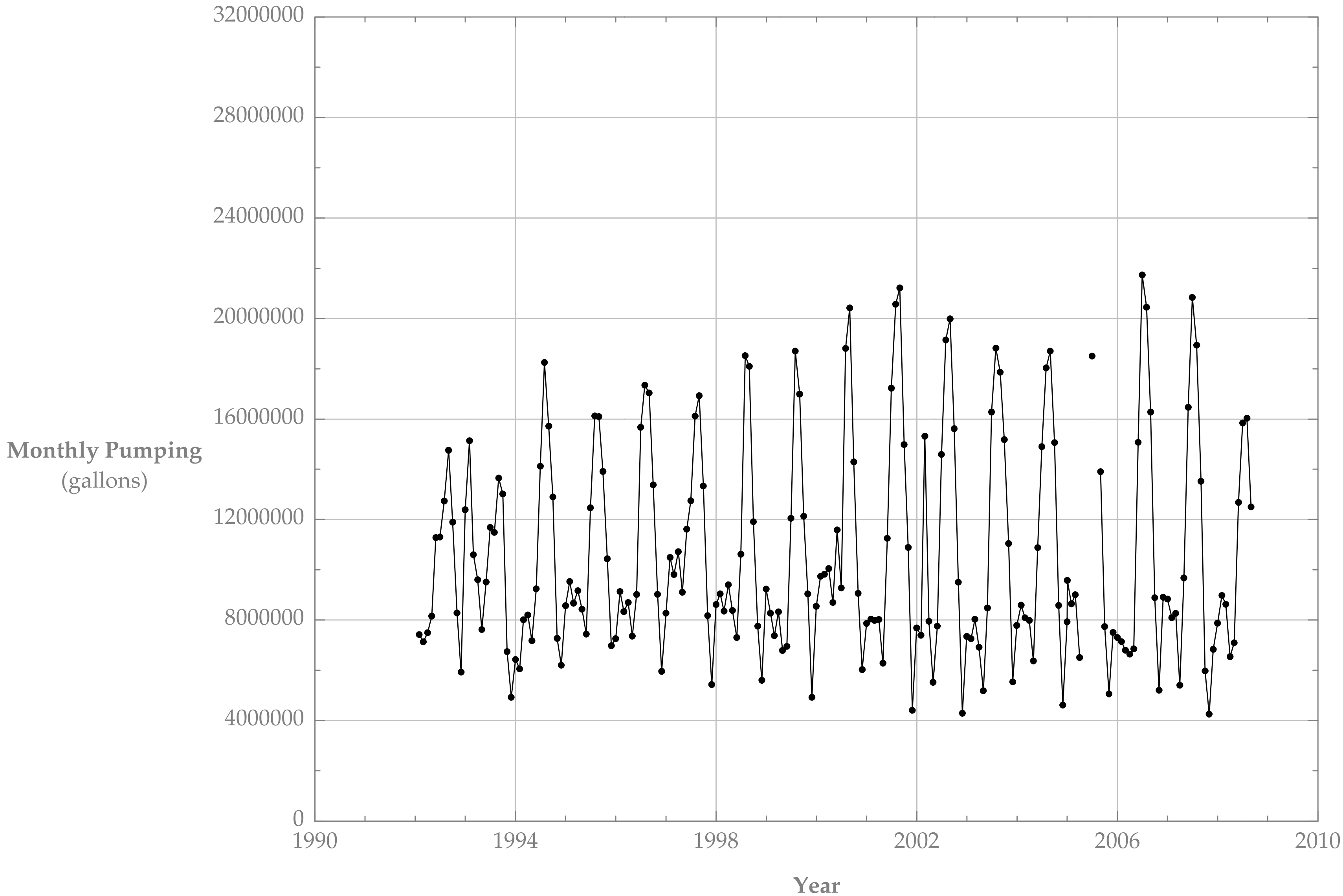

Figure 9: Historical Monthly SVPSD Pumping

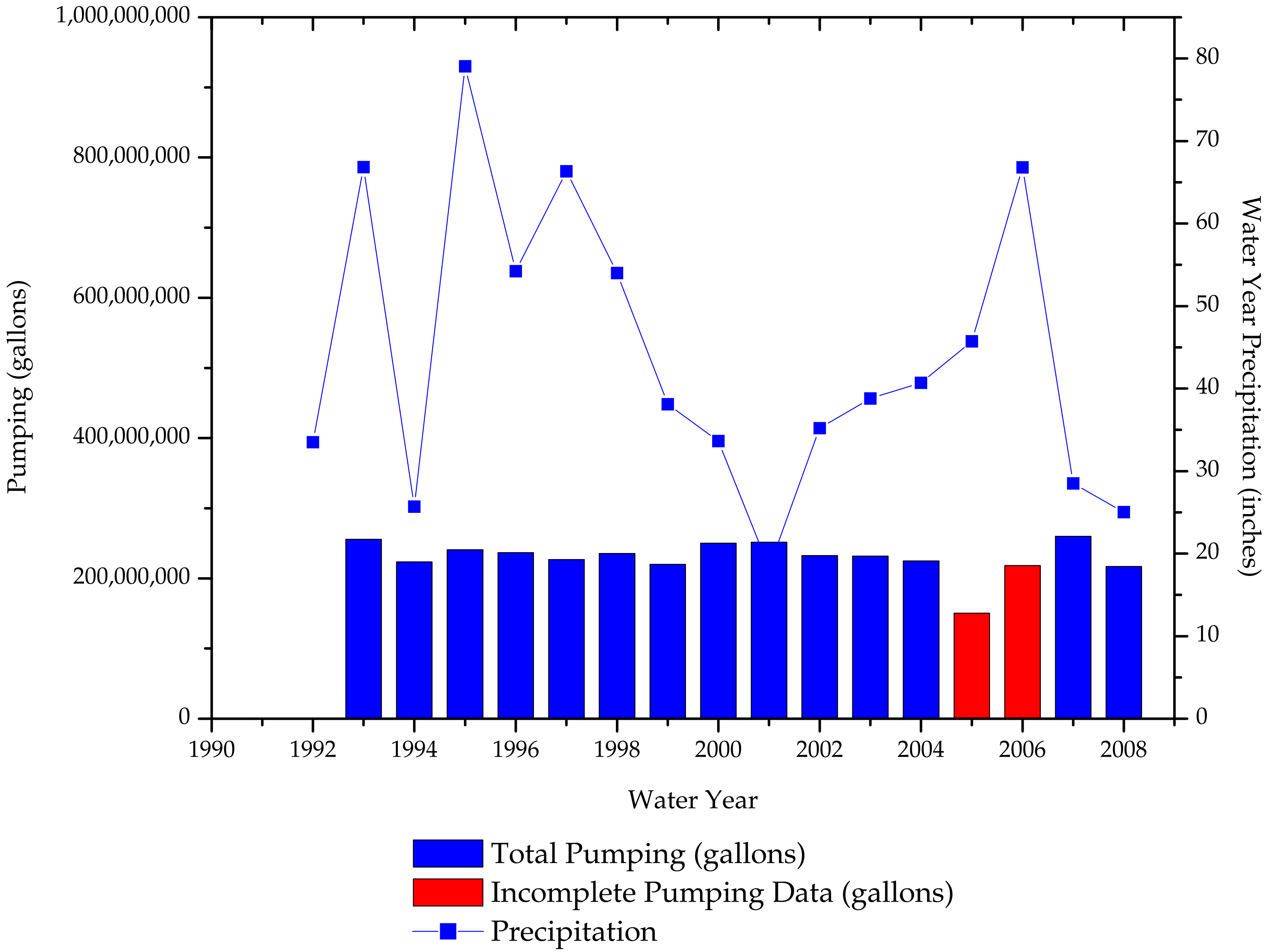

Figure 10: Historical Water Year Precipitation and Water Year Pumping

3.3.2 WATER YEAR 2008 MONTHLY PUMPING DISTRIBUTION

Monthly pumping volumes for Water Year 2008 are presented in Figure 11. 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 2008. The greatest pumping volume occurred in July. This peak in pumping is due to increased irrigation demand by SVPSD and SVMWC customers as well as peak irrigation pumping by RSC. The smaller 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 7 shows the relative distribution of pumping throughout Olympic Valley. Only SVPSD, SVMWC and RSC pumping is shown on Figure 7. The height of each bar on this figure is proportional to the total pumping at each well. Since only total pumping volumes are known for the RSC wells, the volumes pumped separately from each of these wells were estimated based on an analysis by AMEC for the RSC Phase II expansion.

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.

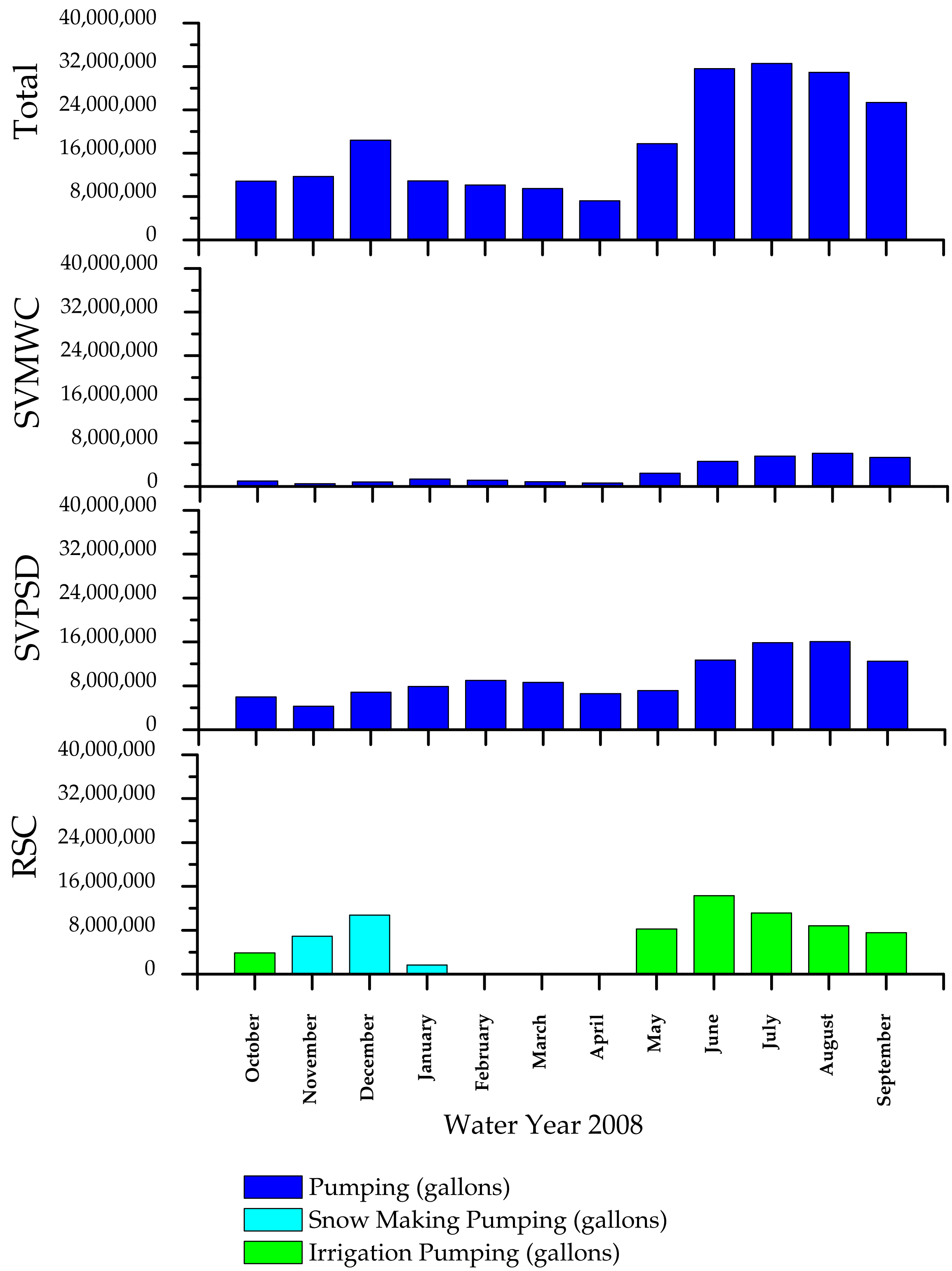

Figure 11: 2007 Water Year Monthly Pumping Distribution

3.4 Groundwater Levels

3.4.1 Hydrographs

Hydrographs in this report are grouped by location. Most of the pumping is concentrated in the west end of the basin and consequently 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 SVPSD#1, SVPSD#2, and SVPSD#5 are presented in Figure 12 through Figure 14. These hydrographs show that groundwater levels in the west end of the groundwater basin were generally higher in Water Year 2008 than in Water Year 2007, but lower than all previous years with the exception of Water Year 2001. The lowest groundwater levels during Water Years 2007 and 2008 in all three of these wells were lower than all previous years with the exception of Water Year 2001 on the SVPSD#2 hydrograph. The low water levels of Water Years 2001, 2007, and 2008 correspond to the Water Years with lowest precipitation. In well SVPSD#2 the highest groundwater levels measured in Water Year 2008 recovered approximately to the level of highs seen during the late 1990s and 2005 and 2006, when there was average or above average precipitation.

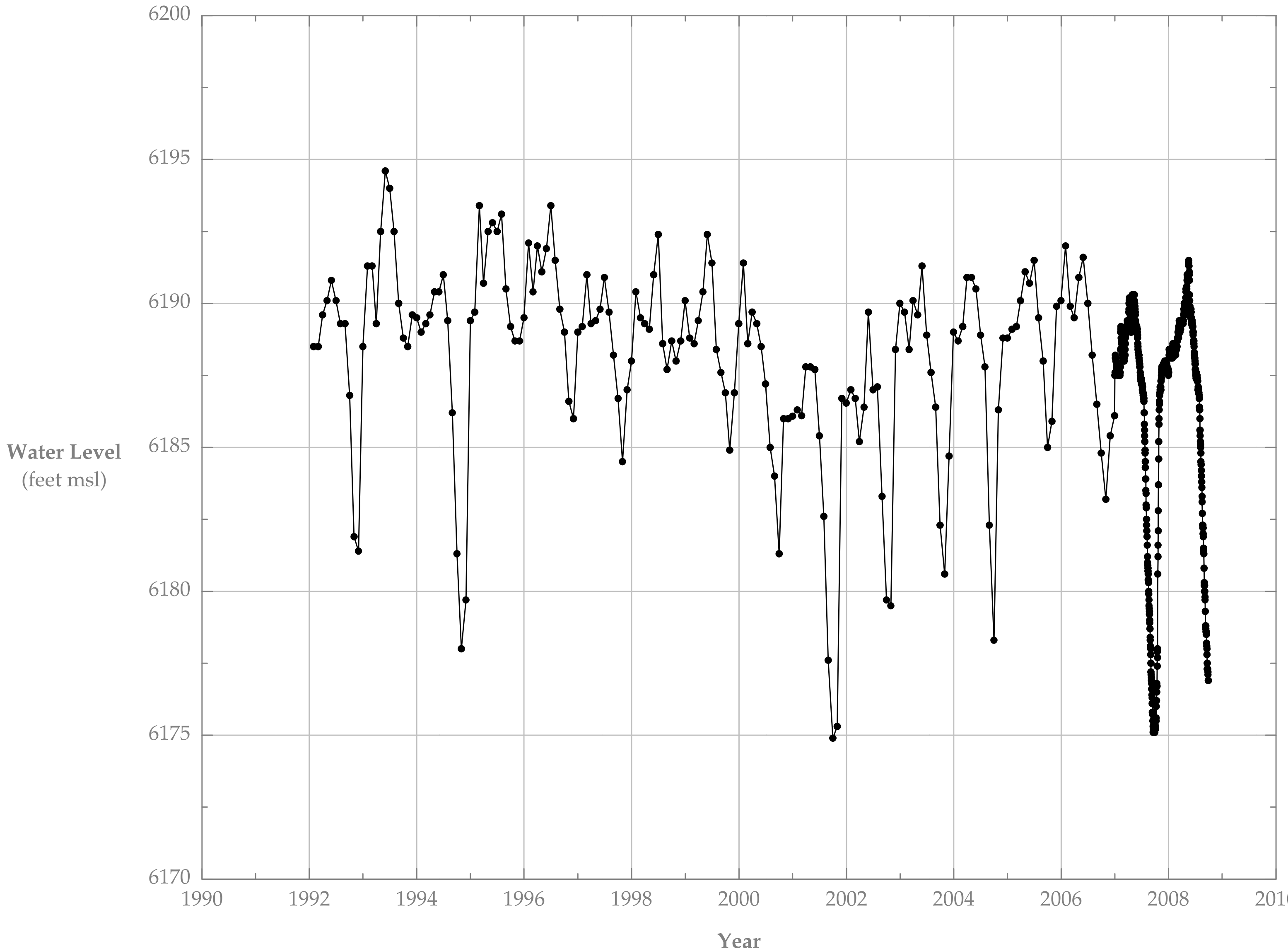

Figure 12: SVPSD #2 Groundwater Level Hydrograph

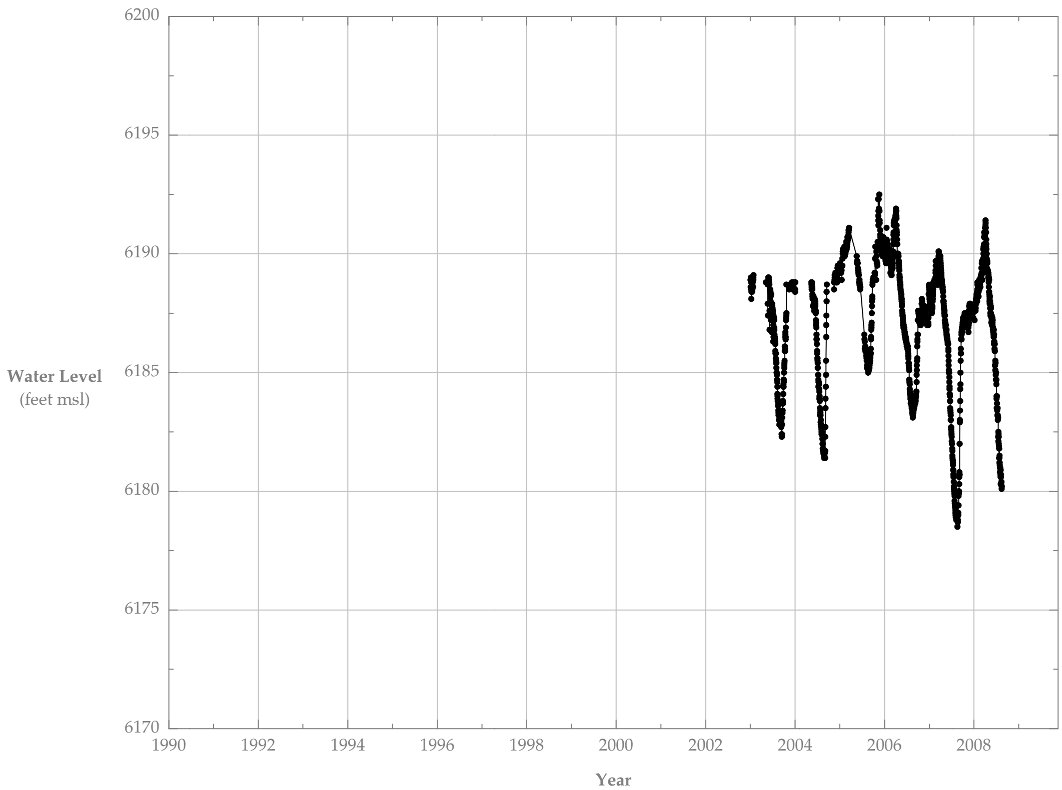

Figure 13: SVPSD #1 Groundwater Level Hydrograph

Figure 14: SVPSD #5 Groundwater Level Hydrograph

Hydrographs of historical groundwater levels in wells SVMWC#1 and SVMWC#2 are shown in Figure 15 and Figure 16. The hydrograph of well SVMWC#1 shows that annual peak groundwater levels has displayed little variation historically, and there is no long-term rise or fall in peak groundwater levels. Similarly Figure 16 shows that annual peak groundwater levels in well SVMWC#2 have displayed little variation until the last two years, during which there were historically low peak water levels.

Figure 17 compares daily groundwater levels in well SVPSD#2, stream flow in Squaw Creek, and SVPSD total pumping for Water Year 2008. The well SVPSD#2 hydrograph at the top of Figure 17 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 17. 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 2008. This first drop in groundwater levels is due to three potential mechanisms:

1. Groundwater levels drop in response to reduced recharge as stream flows in Squaw Creek drop;
2. Groundwater levels drop in response to increased pumping that occurs during this period; and
3. Groundwater drains into the trapezoidal channel as streamflow and water levels drop in the Creek.

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 around well SVPSD#2. 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.

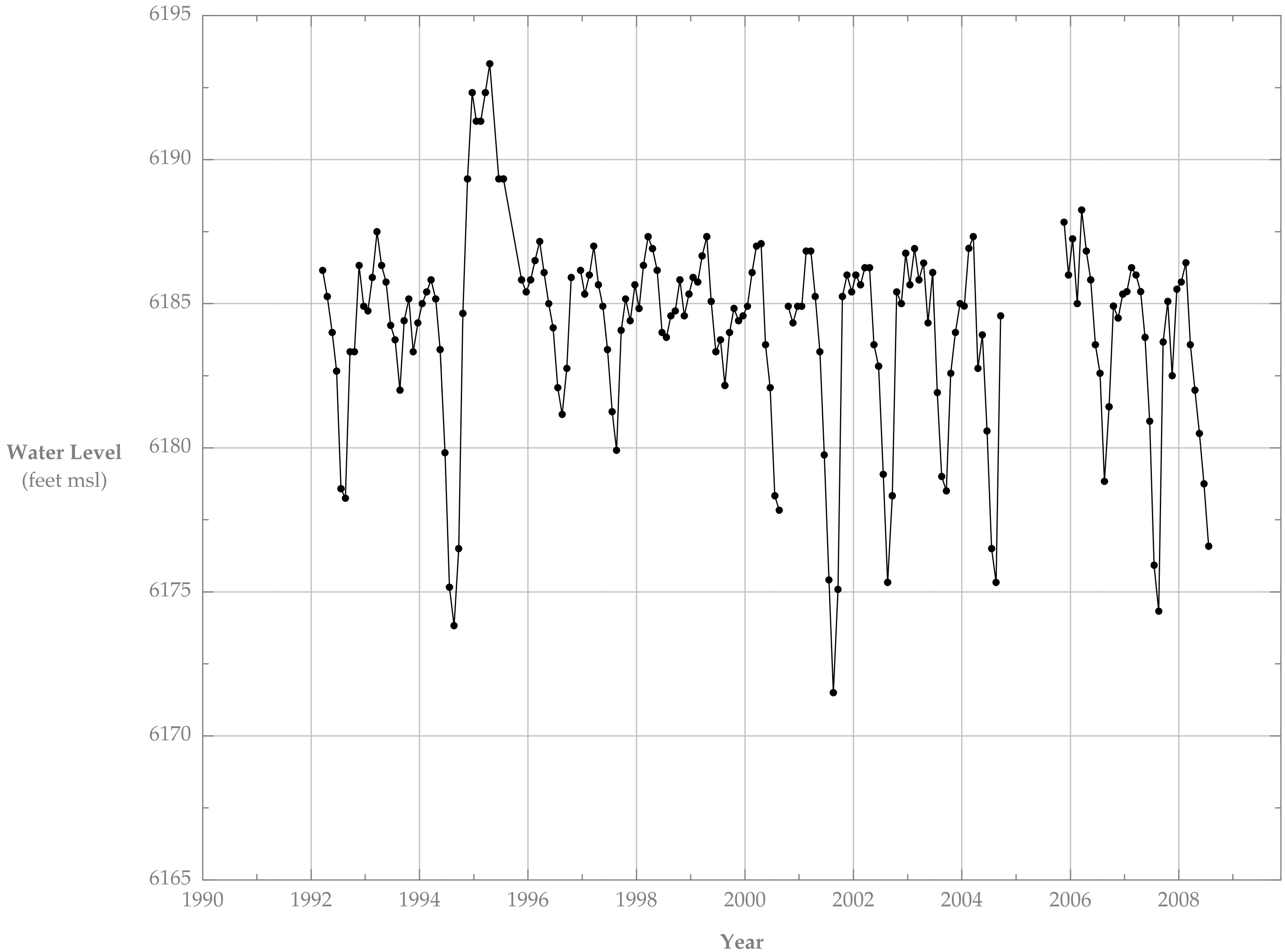

Figure 15: SVMWC #1 Groundwater Level Hydrograph

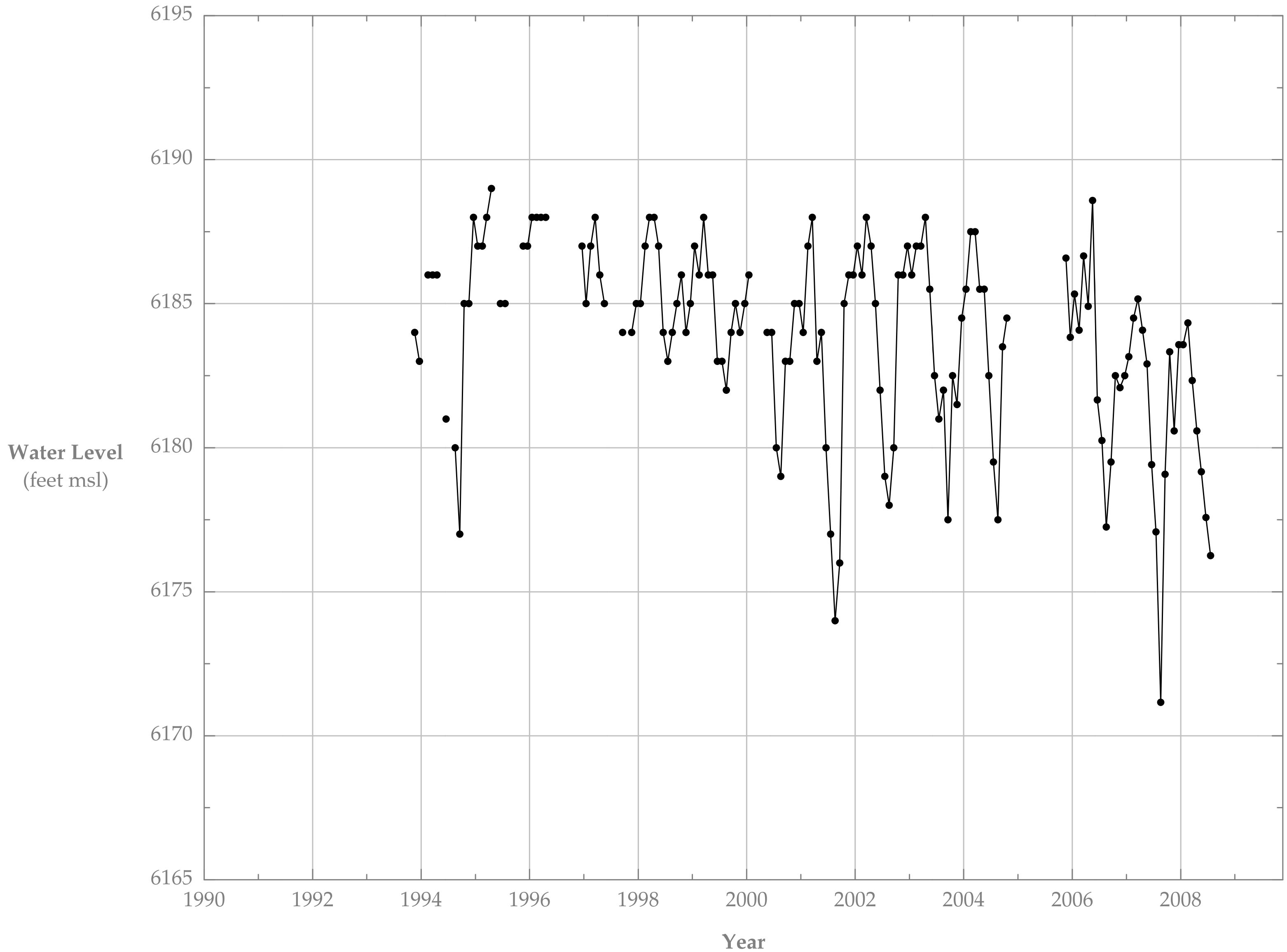

Figure 16: SVMWC #2 Groundwater Level Hydrograph

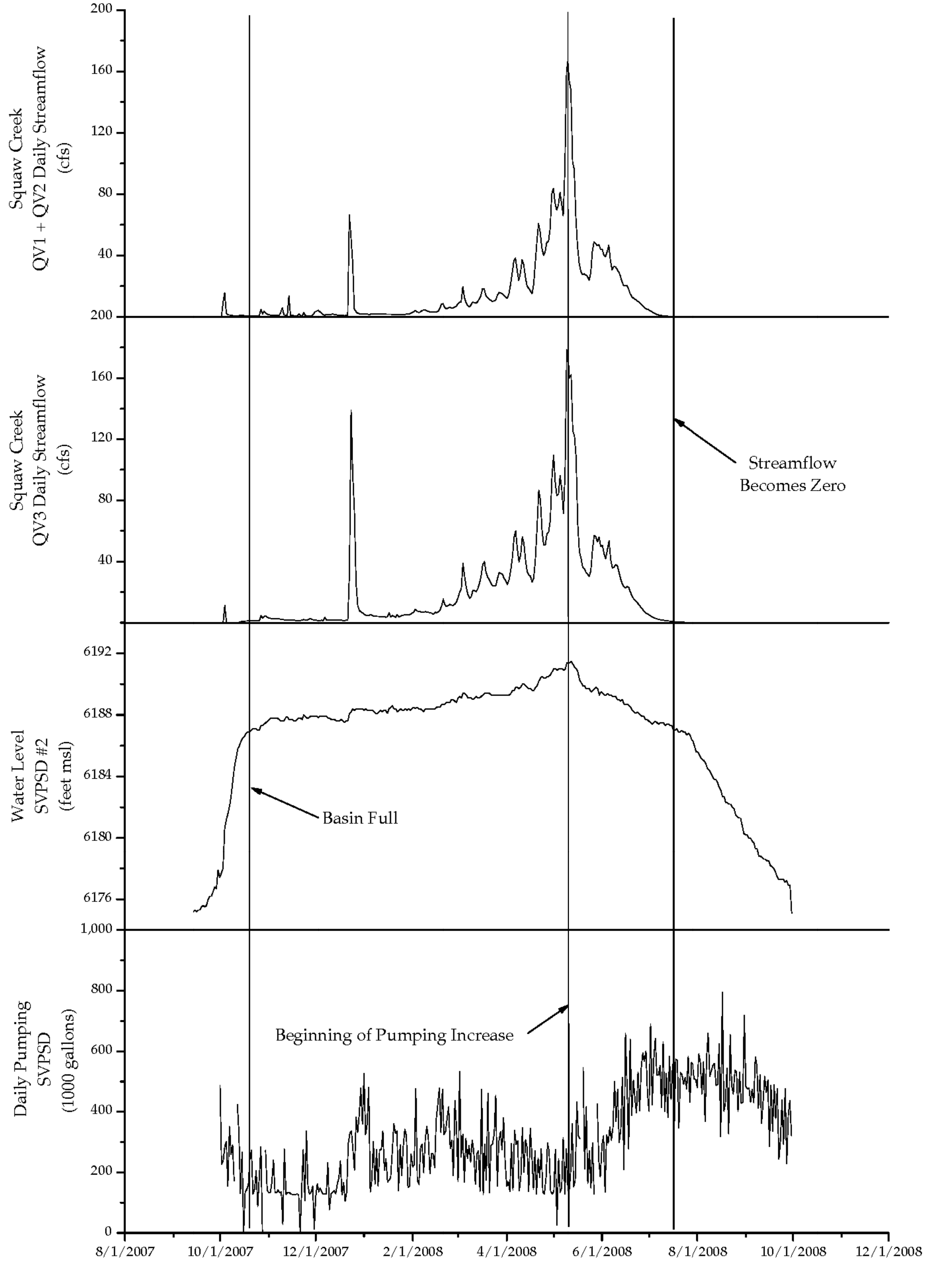

Figure 17: Water Year 2008 Groundwater Levels, Stream flow, and Pumping

Figure 18 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, 2007, and 2008 correlate with years of low precipitation. The early cessation of stream flow in Squaw Creek due to low snowpack is the cause of the lower groundwater levels. The proposed relation 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 17. The basin 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 related to the amount of snow pack in the previous winter. The lowest precipitation years have a small snow pack which finishes melting 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.

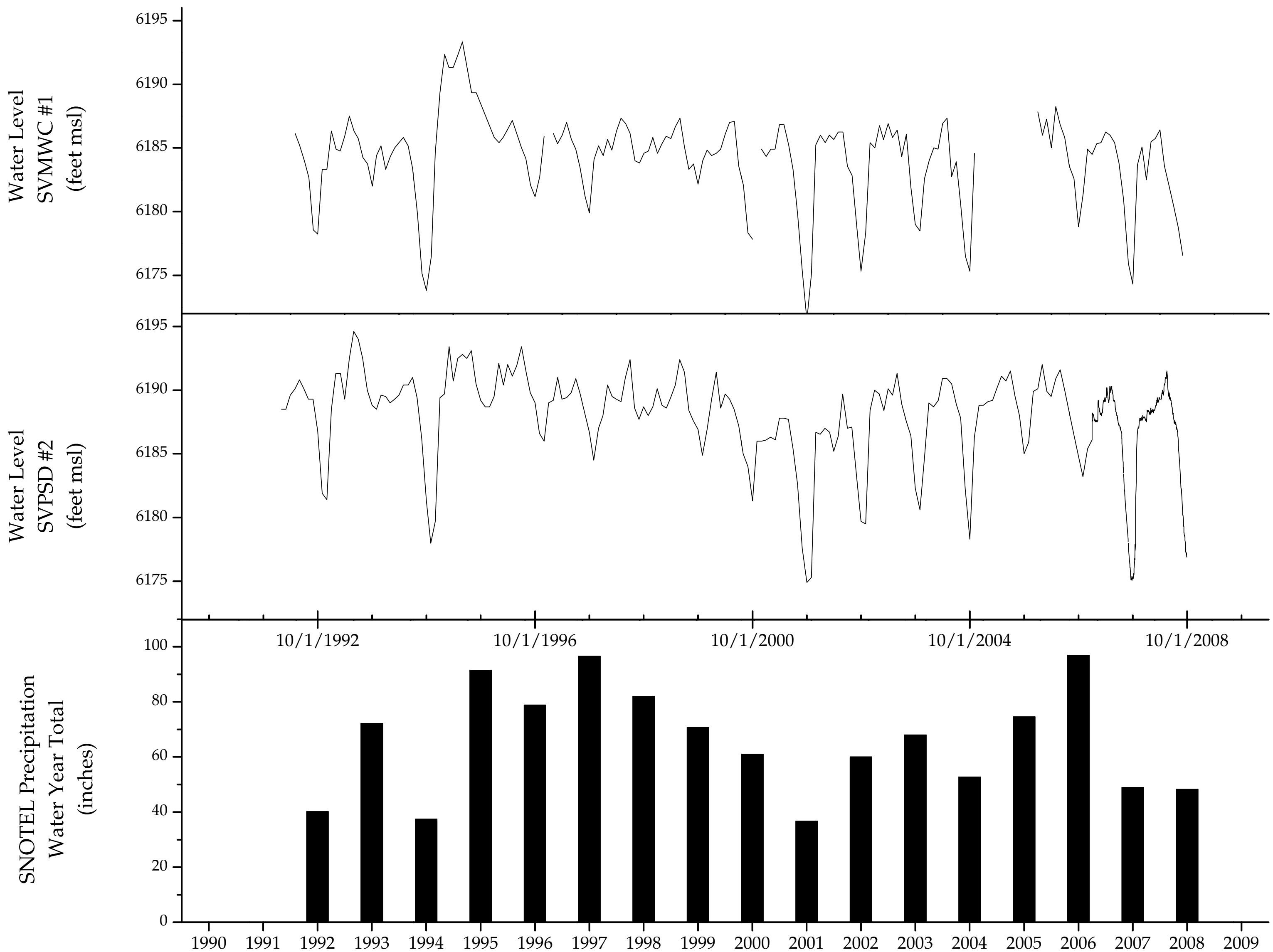

Figure 18: Monthly Precipitation, Groundwater Levels, and Pumping

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 19. Hydrographs from representative wells were selected based on location and completeness of data. These hydrographs are shown in Figure 20 through Figure 23. 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 six feet are seen in the meadow hydrographs. Under the CHAMP schedule, data are not collected frequently enough to see the annual water level fluctuations in the wells. However during Water Year 2007, data were collected bimonthly in a subset of the meadow wells by RSC, frequently enough to see annual fluctuations. It is unknown if bimonthly data were collected from these wells during Water Year 2008.

There was no simultaneous measurement at any shallow and deep well pair during Water Year 2008 so vertical gradients in the meadow could not be calculated.

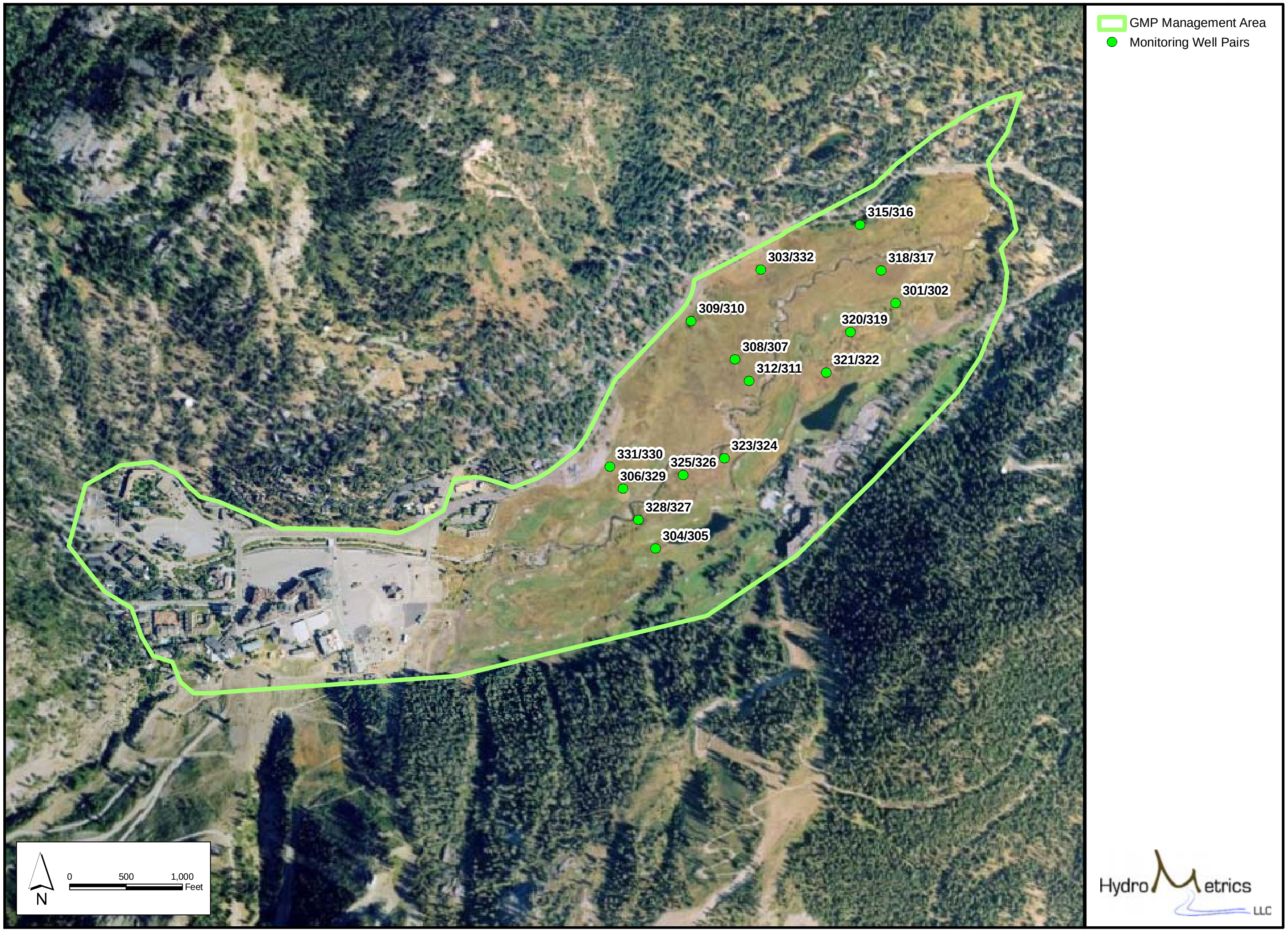

Figure 19: Meadow Well Locations

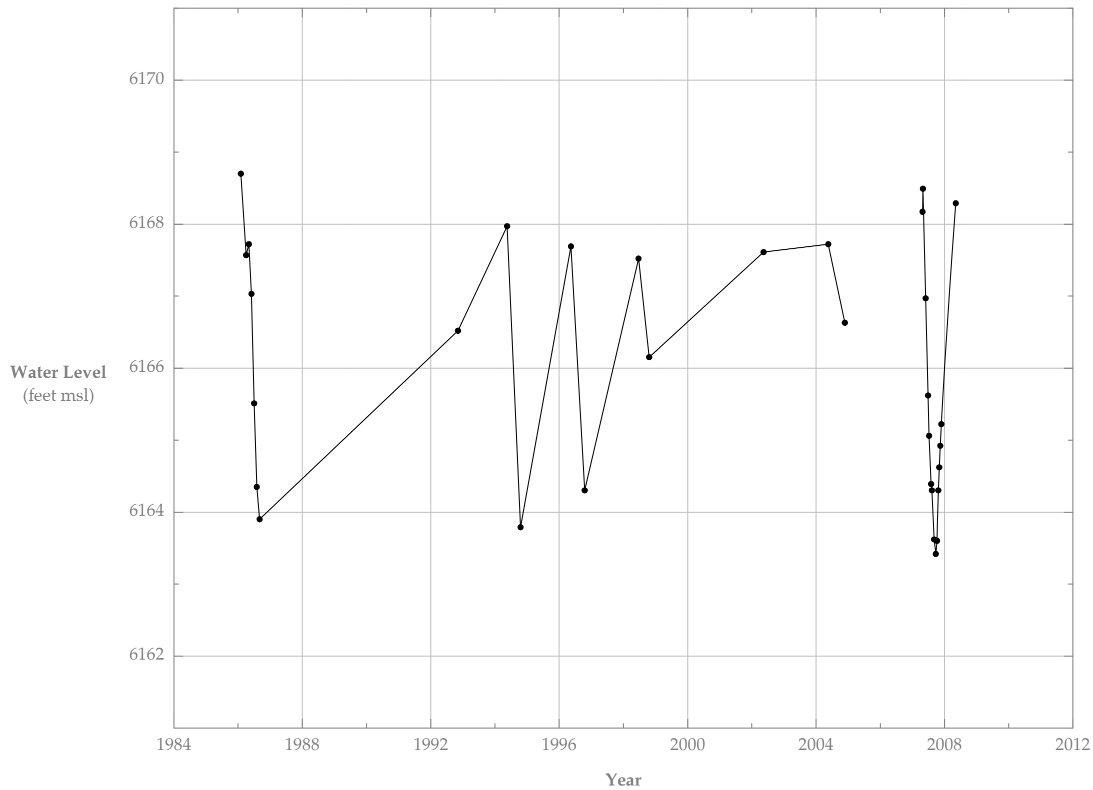

Figure 20: Meadow Hydrograph -- Well 318

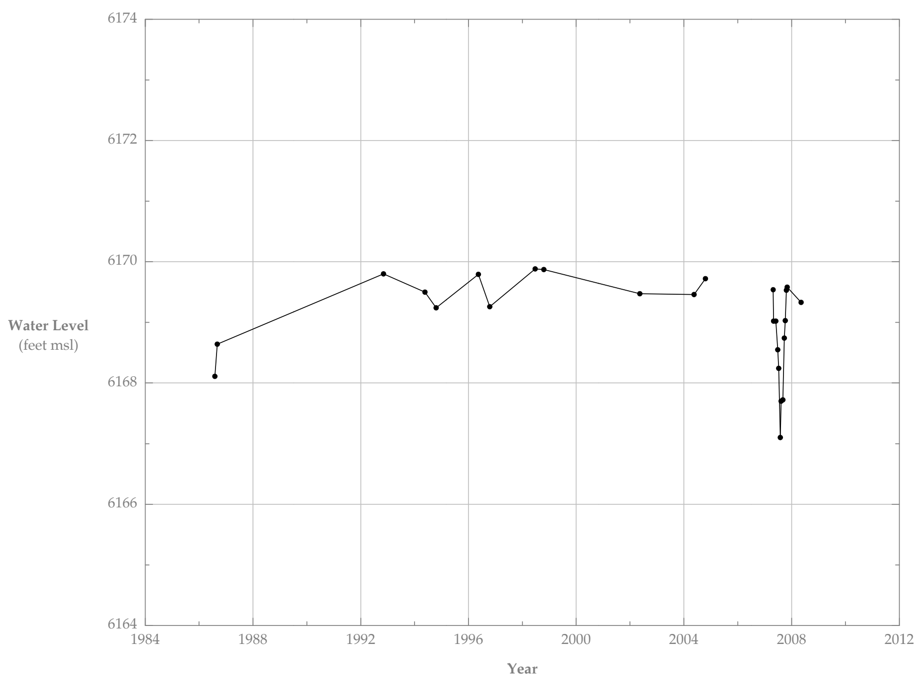

Figure 21: Meadow Hydrograph -- Well 315

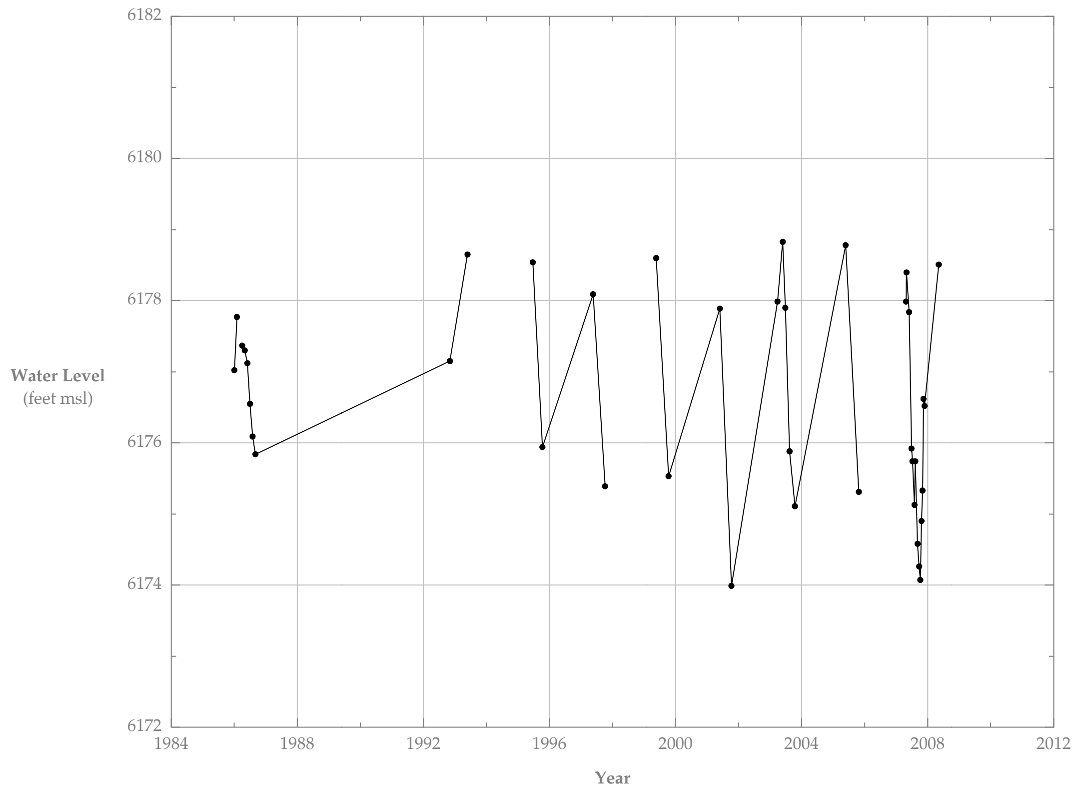

Figure 22: Meadow Hydrograph -- Well 328

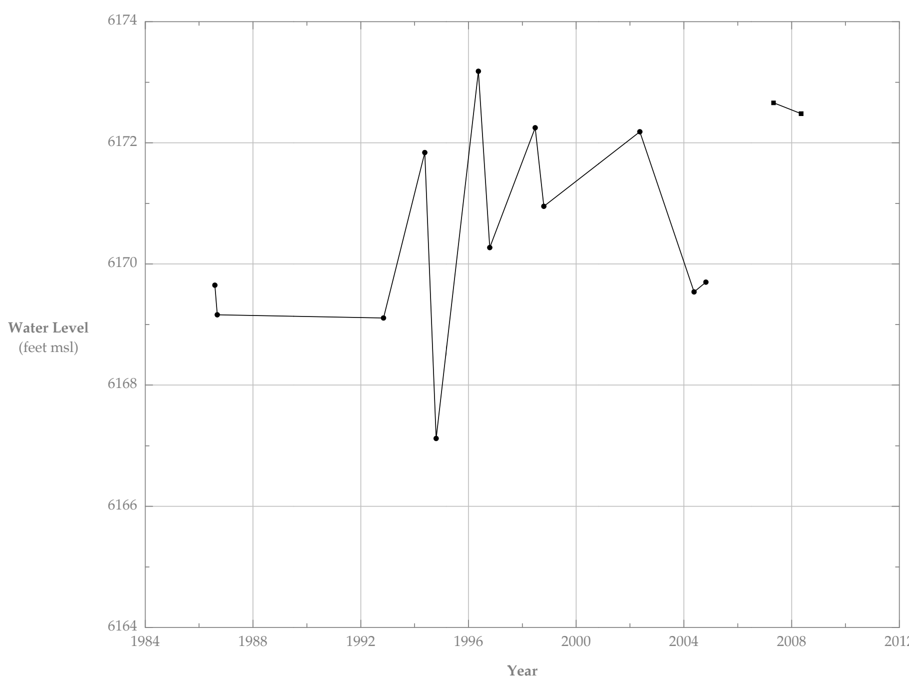

Figure 23: Meadow Hydrograph -- Well 312

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 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 loss of specific capacity, falling water which can entrain air bubbles in the produced water, and corrosion of the screen. 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. Table 2 presents Water Year 2008 low water levels and top of screen elevations for production wells. During Water Year 2008 water levels in both SVMWC wells and in wells SVPSD#1, SVPSD #2, and SVPSD #5 remained above the top of the screened interval.

Table 2: Water Year Low Water Level and Top of Screen Elevations

Well	Top of Screen	Water Year 2008 Low Water Level
SVMWC#1	6135	6174
SVMWC#2	6155	6171
SVPSD#1	6123	6178
SVPSD#2	6169	6175
SVPSD#5	6129	6179

Section 4
GROUNDWATER QUALITY SUMMARY

This section reviews analytical results from groundwater quality samples collected during Water Year 2008.

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 required by the State of California during Water Year 2008. Results from samples that were collected are summarized below.

4.1.1 SQUAW VALLEY PUBLIC SERVICE DISTRICT

Perchlorate levels were tested at wells SVPSD#1R, SVPSD#2, SVPSD#3, and SVPSD#5R during Water Year 2008. The results from these four wells were:

- SVPSD#1R, 2 sampling events: both Non Detect (ND)
- SVPSD#2, 3 sampling events: two ND, one 4.8 mg/L
- SVPSD#3, 2 sampling events: both ND
- SVPSD#5R 2 sampling events: both ND

The one detectable concentration of perchlorate from well SVPSD#2 of 4.8 mg/l was above the Maximum Contaminant Limit (MCL) of 0.006 mg/L. This well was subsequently resampled for perchlorate, and the resample showed no detectable perchlorate. The MCL is the level adopted by the US Environmental Protection Agency (EPA) that should not be exceeded in drinking water. It seems likely that the anomalous detection was due to a quality control error.

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 2008 well SVPSD#1R was tested for manganese in one sampling event, with a result of 49 micrograms per liter (μg/L). This is below the secondary MCL of 50 μg/L.

Additional sampling results from SVPSD wells obtained during Water Year 2008 are summarized in Table 3. None of the results exceeded the primary or secondary MCL.

Table 3: SVPSD Water Year 2008 Sampling Results

SVPSD Well	Constituent	Result	Primary/Secondary MCL
1	Barium	37.6 μg/L	1000 μg/L
1	Cadmium	1.2 μg/L	5 μg/L
1	Chloride	4.7 mg/L	250 mg/L
1	Iron	41 μg/L	300 μg/L
1	Sulfate	49 μg/L	50 μg/L
1	TDS	143 mg/L	250 mg/L
3	VOCs	ND	Detect
5	Asbestos	ND	7 MFL

4.1.2 Squaw Valley Mutual Water Company

Groundwater quality testing at SVMWC wells during Water Year 2008 consisted of testing well SVMWC#1 for perchlorate during two sampling events. Perchlorate was not detected in either sampling event.

4.2 Resort at Squaw Creek CHAMP program

The CHAMP groundwater quality monitoring program includes sampling 32 monitoring wells in the Meadow (Figure 19). There were two scheduled rounds of sampling from these wells in Water Year 2008; the first round was conducted in October 2007 and a second round of sampling was conducted in May 2008. The October 2007 event collected samples from eight shallow monitoring wells. The May 2008 event collected samples from seven shallow monitoring wells. The samples were analyzed for 9 constituents: nitrate, nitrite, total nitrogen, total kjeldahl nitrogen (TKN), total phosphorous, iron, total dissolved solids (TDS), sulfate, and chloride.

Analytical results from the October 2007 and May 2008 sampling events (Kleinfelder & Associates 2008) are compared to Title 22 MCLs in Table 4. This table shows the number of sampled wells that exceeded MCLs. Total N, TKN, and Phosphorus have no MCL, and are not shown on the Table.

Table 4: CHAMP Sampling Results

Constituent	MCL (mg/L)	Oct. 2007 Wells above MCL/Total Samples	May2008 Wells above MCL/Total Samples
Nitrate	10	0/8	0/7
Nitrite	1	0/8	0/7
Iron	0.3	4/8	7/7
TDS	500	0/8	0/7
Sulfate	250	0/8	0/7
Chloride	250	0/8	0/7

In the report summarizing the October 2007 sampling event Kleinfelder & Associates (2007) concluded that "In general, the trends for total Kjeldahl nitrogen, total nitrogen, total phosphorous, chloride, sulfate, total iron and TDS concentrations show no significant change". Kleinfelder & Associates also noted, however, that nitrate at wells 303 and 320 and chloride at well 322 show possible increasing trends. Nitrate in well 320 remained at approximately the same level as the May of 2007 concentration: a historical high and the first detectable concentration since 1995.

The May 2008 CHAMP results were for the most part within the ranges of historical results. The one result above historical highs was iron concentration at well 309. This well was resampled in June, and the results showed a concentration well within historical levels. Iron was above the MCL in all wells sampled. All other constituents were within the historical range and below MCLs. Kleinfelder & Associates (2008) noted a "possible increasing trend for nitrate concentration in wells 309, 312, 315, and 325 may be developing".

4.3 REGULATED CONTAMINATION SITES

Two regulated contaminated sites existed in the GMP management area during Water Year 2008. These sites are regulated by the CRQWCB. There were no new cases opened during Water Year 2008, and one of the two existing sites was closed.

4.3.1 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. Sampling of monitoring wells occurred at this site during Water Year 2008. One monitoring well contained 300 μg/L of Total Petroleum Hydrocarbons as Diesel (TPHd). All other wells contained less than 100 μg/L TPHd. The CRWQCB plans to close this site (Lundquist, personal communication).

4.3.2 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. This case was closed by the CRQWCB in Water Year 2008. No sampling occurred during Water Year 2008.

Section 5
GROUNDWATER MANAGEMENT ACCOMPLISHMENTS AND BMO STATUS

5.1 Coordinate Groundwater Data Collection Activities

At a March 11, 2008 meeting, the Olympic Valley Advisory Group agreed to coordinate groundwater level collection efforts. This action implements a high priority recommendation from the Water Year 2007 ARR. This agreement additionally implements section two of Element 1: Groundwater Monitoring from the GWMP. As mentioned in the GWMP, this element addresses multiple BMOs including:

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

BMO 1-2 – Minimize drawdown and maximize basin storage

5.2 Coordinate Data Sharing

At a March 11, 2008 meeting, the Olympic Valley Advisory Group agreed to coordinate data sharing by establishing a single database of groundwater level data. This single database will contain data necessary for groundwater management. This action implements a high priority recommendation from the Water Year 2007 ARR. This agreement additionally implements section two of Element 8: Enhance Groundwater Basin Management Tools from the GWMP. As mentioned in the GWMP, this element addresses multiple BMOs including:

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

BMO 1-2 – Minimize drawdown and maximize basin storage

5.3 Obtain Funding for, and Initiate Creek/Aquifer Interaction Study

The SVPSD obtained funds to conduct a Creek/Aquifer interaction study through the California Department of Water Resource's Local Groundwater Assistance program. This action implements a high priority recommendation from the Water Year 2007 ARR. It additionally addresses and implements BMO 3.2 - Promote viable and healthy riparian and aquatic habitats by avoiding or minimizing future impacts from pumping on stream flows.

5.4 Water and Sewer Service Agreement Between SVPSD and RSC

A water and sewer service agreement was established between SVPSD and the Resort at Squaw Creek. The terms of this agreement must be fulfilled prior to issuing building permits for RSC's Phase II development. Important aspects of the agreement that relate to groundwater management include the following:

ESTABLISH A COMMUNITY BENEFIT FUND:

The Resort at Squaw Creek will establish a Community Benefit Fund. This fund will be set aside for mitigating impacts to Squaw Creek, if any, from development in Squaw Valley. This fund will address BMO 3.2 - Promote viable and healthy riparian and aquatic habitats by avoiding or minimizing future impacts from pumping on stream flows.

LIMITS ON RSC OVERLYING WATER RIGHTS:

The Resort at Squaw Creek agreed to cap its future irrigation pumping, effectively subordinating the Resort's right to pump water from Squaw Valley. This will provide control and surety on the amount of groundwater pumping in Squaw Valley. This action will address BMO 1-1 - Maintain groundwater supplies sufficient to provide water for current and future domestic, municipal, commercial, private, and fire protection uses.

LIMITS ON RSC GROUNDWATER PUMPING NEAR SQUAW CREEK:

The Resort at Squaw Creek agreed to limit future pumping at the two irrigation wells adjacent to Squaw Creek: wells 18-1 and 18-2. This will limit groundwater pumping impacts on Squaw Creek, and will address BMO 3-2 - Promote viable and healthy riparian and aquatic habitats by avoiding or minimizing future impacts from pumping on stream flows.

DISTRIBUTE GROUNDWATER PUMPING:

The Resort at Squaw Creek will transfer ownership of well 18-3R to the SVPSD. Well 18-3R is not located near other SVPSD municipal wells. This will effectively distribute SVPSD pumping over a larger area, addressing BMO 1-2: Minimize drawdown and maximize use of basin storage.

5.5 Cost Sharing Agreement for Monitoring Sediments, Flow, and Invertebrates

An agreement was reached between Intrawest Corporation, Squaw Valley Ski Corporation, Placer County, and RSC to share the cost of monitoring Squaw Creek for sediment, benthic macro invertebrates, and flow. This addresses BMO 3-4: support ongoing stream restoration efforts as they relate to groundwater management.

5.6 Treatment of Parking Lot Runoff

Squaw Valley Ski Corporation completed their project for treating runoff from their parking lot prior to discharging the water to Squaw Creek. This addresses BMO 3-2: promote viable and healthy riparian and aquatic habitats.

5.7 Lawrence Livermore National Laboratory Isotopic Tracer Investigation

Lawrence Livermore National Laboratory (LLNL) conducted an isotopic tracer investigation of groundwater in Squaw Valley. The purpose of this investigation was to study the recharge mechanisms and residence times of groundwater in alpine aquifers. A draft report was released in October 2008. The conclusions of this report suggested that a reasonable percentage of the recharge to Squaw Valley comes from fracture flow and mountain front recharge. Particular findings that support these ideas include:

- Upwelling from deep fracture systems was indicated in wells 304, 305, 327, and 329; in the vicinity of Valley Fault 3. This is the area known as the Upwelling.
- Carbon isotope compositions of water in production wells are consistent with the incorporation of soil CO_2, indicating recharge to these wells through soil rather than streambeds.

5.8 SVMWC MASTER WATER PLAN

The Squaw Valley Mutual Water Company hired Auerbach Engineering Corporation to develop a Master Water Plan. The draft plan was presented at the Mutual Water Company Annual Meeting in August and the final Report was present to the SVMWC Board of Directors in December 2008. The plan lays out five phases of infrastructure improvement that will assist the SVMWC in better serving its members. The total price, including rehabbing Well No. 1 and Well No. 2, is estimated at 3.4 million dollars.

5.9 STATUS OF BMOS

This section reviews status of BMOs during Water Year 2008. 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.
- SVPSD continued monthly audits of its system to identify system losses

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

- SVPSD obtained an agreement for future access to well 18-3R, allowing them to distribute pumping throughout the basin more effectively.

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

- SVPSD continued posting customer water usage numbers on the internet. This information allows customers to identify potential leaks and manage their water consumption.
- SVPSD continued monthly audits of its system to identify system losses
- SVPSD sent leak notification letters each month to every customer with a suspected leak

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

- RSC conducted a significant study to estimate demands for their Phase II development and golf course irrigation

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

- Drinking water from SVPSD wells was tested according to Title 22 requirements. Water Year 2008 testing found perchlorate in SVPSD#2 exceeded the MCL. Subsequent sampling of this well resulted in a non-detect result for perchlorate.
- Bothe SVMWC wells were tested fro perchlorate during Water Year 2008. No perchlorate was detected in either well.
- The RSC CHAMP program sampled surface and groundwater quality in the meadow area.

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

- SVPSD obtained funds for a Creek/Aquifer interaction study that will provide information on the recharge characteristics of the trapezoidal channel.
-

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 initiated Creek/Aquifer investigation.
- 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.

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

- Friends of Squaw Creek initiated a stream restoration planning process that included input from all stakeholders.
- An agreement was reached between Intrawest Corporation, Squaw Valley Ski Corporation, Placer County, and RSC to share the cost of monitoring Squaw Creek

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 2008. Pumping does not vary much from year to year. No clear trends in annual pumping are seen in the data. Total Pumping for the entire basin decreased from the previous Water Year's total of 246 MG (755 acre-feet) to 217 MG (666 acre-feet). Water Year 2008 pumping was 8% below the historical average pumping of 236 MG (725 acre-feet).

6.1.2 GROUNDWATER LEVELS

Important trends and groundwater levels observed during Water Year 2008 include the following.

- In the SVPSD production wells, both the highest and lowest measured groundwater levels were higher than comparable data from Water Year 2007, which had water levels 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 Years 2007 and 2008,
- Relatively low minimum groundwater levels in the SVPSD production wells were caused by flow in Squaw Creek ceasing earlier in Water Year 2008 than in most Water Years. This was a result of the low annual precipitation total for Water Year 2008.
- Peak groundwater levels in well SVMWC#2 were historically low for a second consecutive year.

6.1.3 GROUNDWATER QUALITY

Important trends in groundwater quality observed during Water Year 2008 include the following.

- Tests of SVPSD production wells revealed only one constituent at one well above MCLs. At SVPSD#2 perchlorate exceeded the MCL; however subsequent sampling at this well resulted in a non-detect for perchlorate. It seems likely that the anomalous detection was due to a quality control error.

- Water Year 2008 CHAMP results were generally within the ranges of historical results. The May 2008 sampling event produced one result above historical highs, iron at well 309, but when resampled in June the concentration was within historical levels. In October 2007 well 320 showed detectable levels of nitrates. This was the second consecutive water year in which detectable nitrate levels were seen. Previous to this nitrate was not detected since 1995.
- Kleinfelder & Associates (2008) noted a "possible increasing trend for nitrate concentration in wells 309, 312, 315, and 325 may be developing".
- The CRWQCB closed the Squaw Valley Mutual Water Company site. No further action will be required at this location.
- There was one remaining active CRWQCB site in the Olympic Valley GMP management area at the end of Water Year 2008: the PlumpJack site. Sampling of monitoring wells occurred at this site during Water Year 2008.
- No new hazardous waste sites were identified during Water Year 2008.

6.1.4 GROUNDWATER MANAGEMENT

A number of significant groundwater management activities were completed during Water Year 2007. These include:

- The Groundwater Advisory Group began implementing the recommendations from the Water Year 2007 ARR. Specific actions taken by the Groundwater Advisory Group included:
    - Agree to coordinate groundwater data collection activities by installing data loggers in various production and monitoring wells
    - Agree to coordinate data sharing by developing a centralized database for groundwater level data.

- The Water and Sewer Agreement between the SVPSD and the Resort at Squaw Creek included many important groundwater management agreements, including:
    - Establishing a Community Benefit Fund for Creek Restoration;
    - Limiting groundwater extractions;
    - Limiting pumping from wells adjacent to Squaw Creek;

- Providing for more widely distributed groundwater pumping;
- Limiting the amount of annual golf course irrigation.

- The SVPSD applied for and obtained funding to conduct a Creek/Aquifer interaction study through the California Department of Water Resource's Local Groundwater Assistance program.

6.2 RECOMMENDED AMENDMENTS TO THE GMP

We recommend that the Advisory Group review the recent Local Groundwater Assistance Grant application. Any points deducted from the application for inadequate GMP should be addressed if possible.

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). Included in this recommendation are buying and installing data loggers for production and monitoring wells. This recommendation will have the advantage of producing a single, consistent data set that can be used for basin analysis.
- Continue to develop a unified database of groundwater level data that can be used for managing the aquifers in Squaw Valley.
- Continue the Olympic Valley Creek/Aquifer interaction study.
- Coordinate with, and support, Friends of Squaw Creek's efforts at stream restoration (GMP Element 2.2).
- Compare Old Fire Station precipitation data from the old gauge, the new gauge, and other nearby gauges. Adjust historical data if necessary to produce a consistent record of precipitation.

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.

- Continue to monitor groundwater levels in wells near Squaw Creek at wells SVPSD#5S and SVPSD#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).
- Evaluate the flow data that is collected as part of the TMDL monitoring.
- Encourage further LLNL investigations of the recharge mechanisms in the Olympic Valley groundwater management area.

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 plan and approach for investigating the impact of the horizontal wells on groundwater in the GMP management area (GMP Element 5.5)
- Establish a baseline for subsidence as part of surveying for the monitoring program.

Section 7
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