Big Springs Creek near Klamath Marsh
Hydrologic Field Study

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Summary

Big Springs Creek is an occasionally ephemeral stream originating from springs and seeps near the edge of the forest on the Chemult pumice plain east of Crater Lake. From its origins the creek flows a short distance over low relief terrain to the southwestern edge of Klamath Marsh where the channel disappears. The creek is a groundwater discharge area for recharge occurring in the highlands of northwestern portion of the Klamath basin, but is also exhibits unusual flow characteristics for a groundwater sourced stream on sub–daily to decadal time frames. Synoptic discharge measurements made on August 13th and 21st of 2002 and stream gaging data, along with historical miscellaneous measurements, precipitation, snow water equivalent (SWE), groundwater, and geologic data provide insight into the creek's hydrology and support the conceptual hydrologic model of the area.

Miscellaneous measurements (1914–1982), annual precipitation, and groundwater data and observations demonstrate that discharge in the creek is typically dependent on the water table elevation relative to that of the spring vents, as noted by Newcomb and Hart (1958). Groundwater levels respond to annual variations in precipitation from climatic cycles, but at times are poorly correlated to streamflow. The regional groundwater elevation relative to the spring vents dictates the lag time between water–year precipitation (and/or longer climate trends) and the corresponding response in baseflows. For example, a single wet year may not relate to an increase in stream baseflows if the water table is below the elevation of springs after successive dry years.

Streamflow along with precipitation data demonstrate that Big Springs Creek at times has dramatic peak flows (> 100 cfs) that occur in response to precipitation or snowmelt events. This runoff signal is not typical in short creeks whose flow originates from spring vents. The hydrologic response is likely caused from locally saturated overland or shallow subsurface flow during snowmelt or rain events, but is also influenced by the elevation of the regional water table. This hydrologic runoff signal is at times similar to that of nearby runoff dominated streams, such as Cottonwood Creek.

A seepage run performed in 2002 indicated that groundwater inflows occurred throughout the creek upstream of the stream gage. About half of the 23.1 cubic feet per second (cfs) of groundwater discharged into the creek came from ubiquitous springs and seeps in the first half–mile of the creek in the forested pumice plateau. Groundwater also discharged to the creek as it exited the forest onto the marsh (or pasture area), but from less frequent isolated springs next to the creek. Lenz Creek, one of only two tributaries to the creek, was dry except near the mouth, where a flow of 1.5 cfs was measured. From the USGS quadrangles; it look as if any channel, spring, or flowing well above an elevation of approximately 4535 feet above mean sea level (msl) was dry on the seepage run date.
A total of 26 cfs was being used to irrigate lands in the immediate vicinity of the creek. Of this total, 11 cfs was being diverted directly from the creek with the other 15 cfs being pumped from irrigation wells. The overall impact of irrigation on the gage record during irrigation season is likely to be on the order of 15–20 cfs, due to local groundwater pumping impacts on the nearby springs.

The seepage run and observations coupled with well log data indicate that the aquifer in the pumice plain is mostly unconfined, but confined (at least locally) by a lower permeable sedimentary layer upon entering the edge of the marsh. The presence of artesian wells in the lower watershed near the creek supports this conceptual model.

Objective

The objective of the study was to quantify diversions, and investigate groundwater–surface (GW/SW) interactions and the hydrology of Big Springs Creek. This last objective was part of the broader hydrologic investigation associated with the USGS/OWRD cooperative Klamath groundwater study. Big Springs Creek is of interest because the creek is thought to be part of the regional groundwater discharge zone for precipitation in the Cascades west and northwest of Klamath Marsh.

Background

Big Springs Creek originates from springs in the forested pumice plateau near the southwestern edge of Klamath Marsh and south of Military Crossing (Figure 1). The creek is located about 14 miles due east of Crate Lake (Mt. Mazama), and about 19 miles due west of Yamsey Mountain. A large spring identified as "Big Springs" marks the headwaters of the creek at an approximate elevation of 4535 feet (ft) above mean sea level (msl). Several other large springs, as well as ubiquitous diffused bank seepage occur within a mile of the headwaters. From the headwaters, the creek flows southeast approximately 1.4 miles out of the forested plateau to the confluence of ephemeral Lenz Creek, one of only two named tributaries. From this confluence, the creek flows south–southeast across flat pasture land another 6 miles before disappearing into Klamath Marsh (~ 4515 ft msl). Located both west and east of the creek are artesian flowing wells and springs. These wells and springs are responsive to climatic cycles and, at times, cease to flow as does the creek (Newcomb and Hart, 1958). The actual length of the creek changes with marsh water elevation which can vary in elevation between 4509–4516 (msl), depending on the year and season.

Like most spring fed streams, the real drainage area of the creek is difficult to determine. Typically the topographic divide (basin boundary) for groundwater dominated stream systems does not represent the true drainage area. These stream systems usually gain groundwaterfrom areas outside of their topographic boundaries. However, the Big Springs Creek watershed likely loses water via groundwater outflows from its topographic drainage area. This is due to precipitation patterns combining with the highly permeable pumice soils, the general low relief of the central and eastern basin, and the lack of a well–developed drainage network. Based on these basin attributes, the conceptual hydrologic framework of the watershed is that groundwater flows west and northwest from the recharge area (the Cascade Mountains and other highlands) to a dispersed groundwater discharge zone represented by Klamath Marsh (Newcomb and Hart 1958, Leonard and Harris 1974). Big Springs Creek represents just one of these groundwater discharge areas. Larger springs and groundwater discharge further south of the marsh (e.g., Spring Creek), and the groundwater head gradient indicates that there is significant groundwater flow south past the marsh as well.

As previously mentioned, the topography of the basin is relatively flat several miles from the creek in all directions. Klamath Marsh lies to the east, northeast, and directly south of the creek (Figure 1). To the west and northwest lies an extensive pumice plain (Chemult Plateau) that includes the Antelope desert and Beaver Marsh. The plateau rises dramatically at the base of Mt. Mazama (Crater Lake), Thielsen and the other peaks of the Cascade crest. Numerous creeks (e.g., Miller, Sink, Cottonwood) draining the eastern steep slopes of the Cascade range infiltrate completely as they descend into the flat pumice plain of the Antelope Desert west of highway 97 and west and northwest of Big Springs.

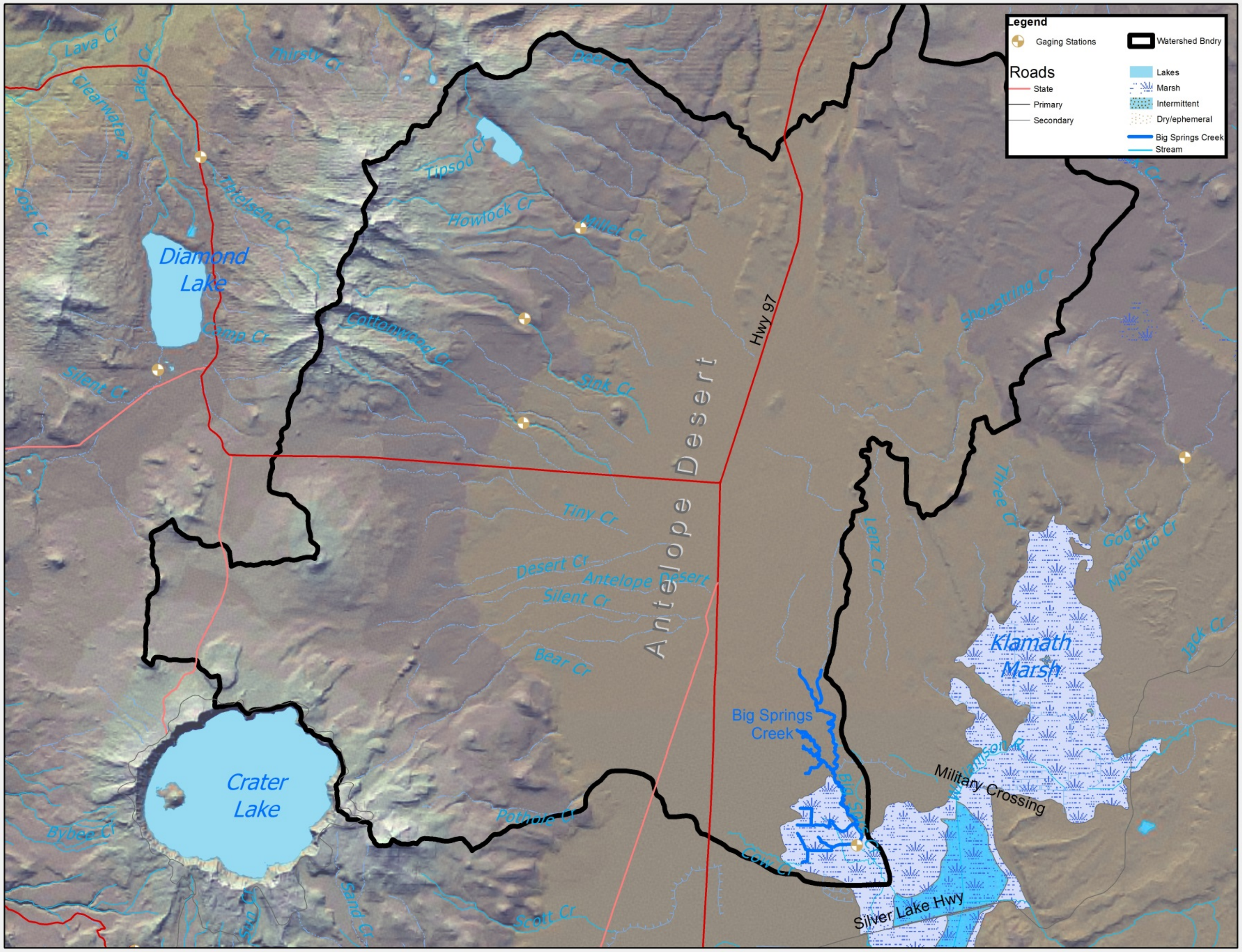

Figure 1: Big Springs Creek location and watershed boundary.

Further north is the low topographic divide between the Klamath and Deschutes basin at an elevation of 4,770 feet near the town of Chemult. Walker Mountain is the highest point of the divide between the two basins (~7083 feet msl). Walker Rim, a north–south trending fault block mountain (including Walker Mountain), is the most prominent geologic feature in this area. To the east and southeast of Walker Rim lies the divide between the Jack Creek and the Big Springs drainage, defined by the uplands between Skookum Butte (~6067 feet msl) and String Butte. Lost Creek and Shoestring Creek are the only named surface drainages from the west side of these uplands and flow only a short distance west before infiltrating into the pumice plain. To the south of these creeks are Round Butte and the elevated lands separating the northwest side of Klamath Marsh and the Big Springs Creek watershed.

Even though the watershed boundary does not represent the hydrologic boundary, it still provides a starting point to examine the hydrologic setting. The watershed area of Big Springs Creek is just over 450 square miles, with a mean annual precipitation of about 31 inches (Daly et al., 1994). This represents an average of approximately 750, 000 acre–feet (af) of precipitation falling on the watershed annually. The mean watershed elevation is 5290 feet, with a maximum relief of 4260 feet and an average slope of 5.4 degrees. The climate is semi–arid with mild dry summers and wet cold winters. Precipitation increases with elevation with the highest amounts occurring along the eastern slopes of the Cascades (Crater Lake 67.3 inches per year), decreasing towards Klamath Marsh. The majority of precipitation occurs during the winter as snowfall. The mean annual temperature is roughly 41°F. The estimated monthly median discharge based on miscellaneous measurements (Cooper, 2004) are shown in figure two, and translates to 1.5 inches of runoff for the basin (about 36,000 af) or a runoff precipitation (R/P) ratio of only .048 (4.8%). For comparison, the runoff precipitation ratio for the Williamson River (above Sheep Creek, and due east of Big Springs) is 20%. The vegetation characteristics of the two watersheds (a rough surrogate for watershed evapotranspiration losses) are fairly similar, so the very low R/P ratio of the Big Springs Creek watershed likely represents precipitation leaving the watershed at locations other than the stream network (i.e., GW outflow).

Vegetation within the basin is a mixture of Montane coniferous forest, Ponderosa and Lodgepole pine forests, grasslands, and shrub lands. Ponderosa and Lodgepole Pines forest occupy the majority of the land in the basin, with Montane coniferous forests and sub–alpine grasslands towards the highlands of the Cascades. A coarse resolution vegetation map from the USGS Gap vegetation analysis (Kagan and Caicco, 1992) is provided in figure 3.

The general geological map by Walker and MacLeod (1991) demonstrates that most of the basin is covered by Mazama Pumice (Qmp) and Ash (Qma) (figure 4). This formation has high infiltration and permeability rates, resulting in low or non–existent runoff and low stream network densities. Streams originating in the high steep elevations of the Cascades commonly infiltrate as they descend into the flat pumice plain. The headwaters of Big Springs Creek and nearby springs occur near the boundary of the Mazama Ash formation and the Lacustrian and Fluvial sedimentary rocks of the Pleistocene era (Qs) in and around Klamath Marsh. The description of the geology underlying these formations are beyond the scope of this study, but are thought to generally consist of basalt and andesite flows, and alluvial material deposited by streams prior to the Mazama eruption that formed Crater Lake. Further details can be found in the Walker and MacLeod publication (1991).

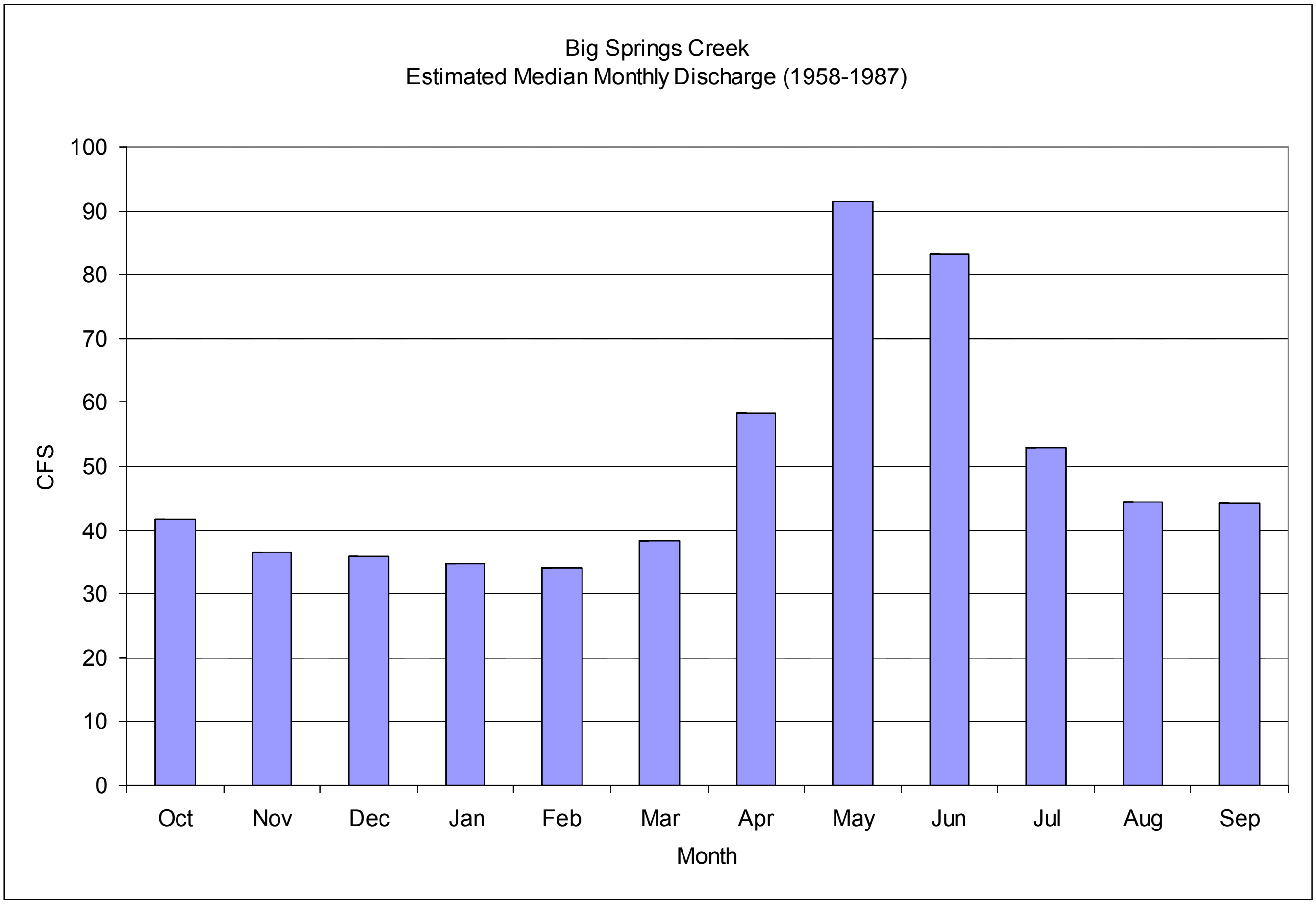

Figure 2: Estimated median monthly discharge for Big Springs Creek (Cooper, 2004)

Irrigation diversions occur on Big Springs Creek, at the confluence with Lenz Creek, and on Lenz Creek itself approximately 1 mile upstream. At least three surface water diversions were abandoned downstream of the confluence with Lenz Creek when additional land was acquired for Klamath Marsh Refuge (1958), and as wells were drilled to provide a more consistent supply of irrigation water (early 1950s). Several high capacity wells exist east of Lenz Creek and provide water for irrigating pasture land between the forest land and the wetted perimeter of the marsh. Some of the high capacity wells, yielding about 6200 gallons per minute (gpm) {13.8 cfs}, replaced surface water diversions during the drought period of the early 1990s. The reported yield from the wells drilled in the 1950s was reported as roughly 1100 gpm (2.4 cfs).

Some continuous (Figure 5a and 5b) and miscellaneous data (Figure 6) exist for Big Springs Creek. The general hydrologic response of the creek is quite variable for a spring fed system, and contrasts to the median flow estimates provided in figure 2. The continuous data shows a strong snowmelt signal, not typically seen in spring dominated systems. This data is discussed in detail later in the report.

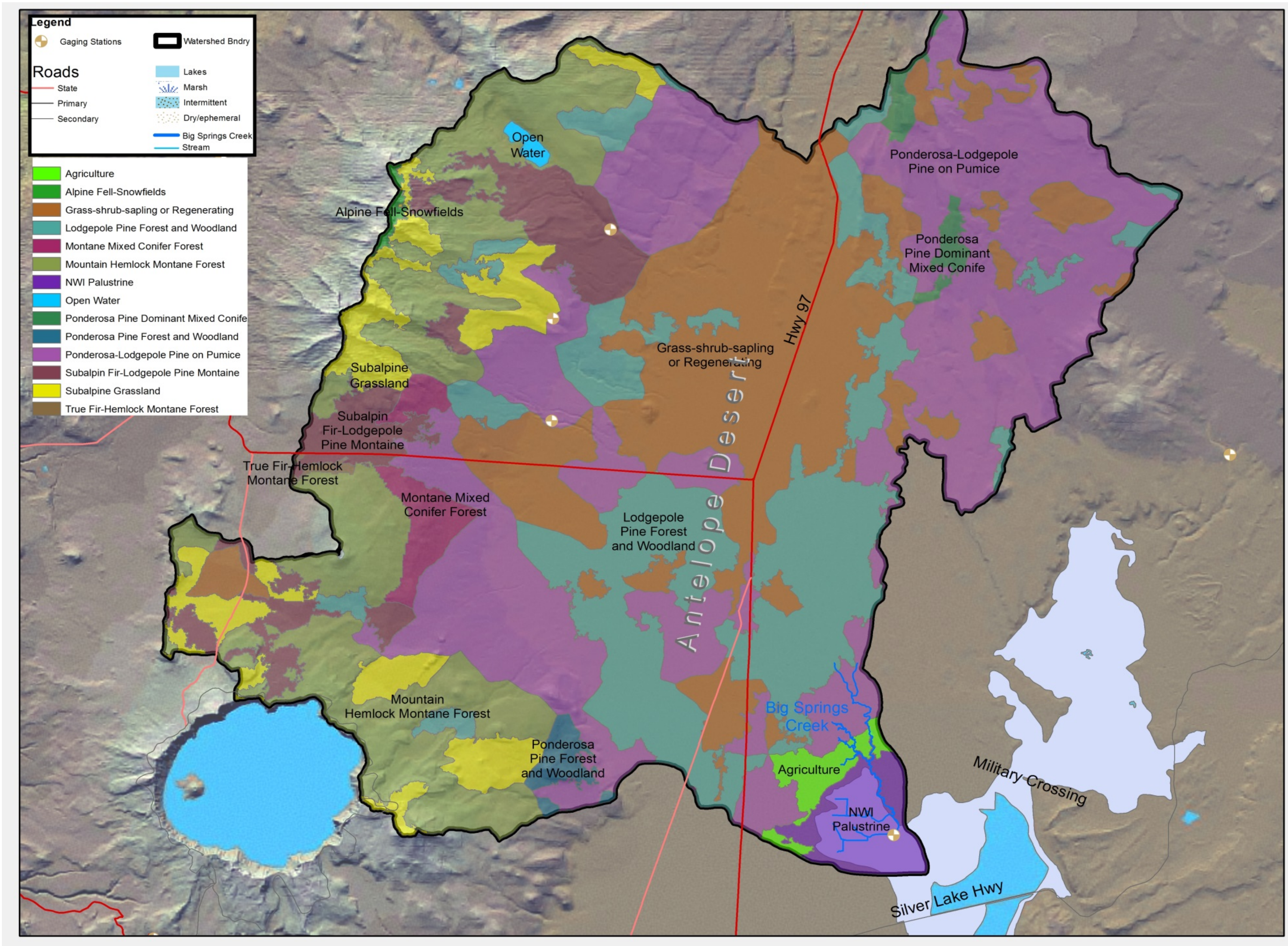

Figure 3: Vegetation Map (Kagan and Caicco, 1992)

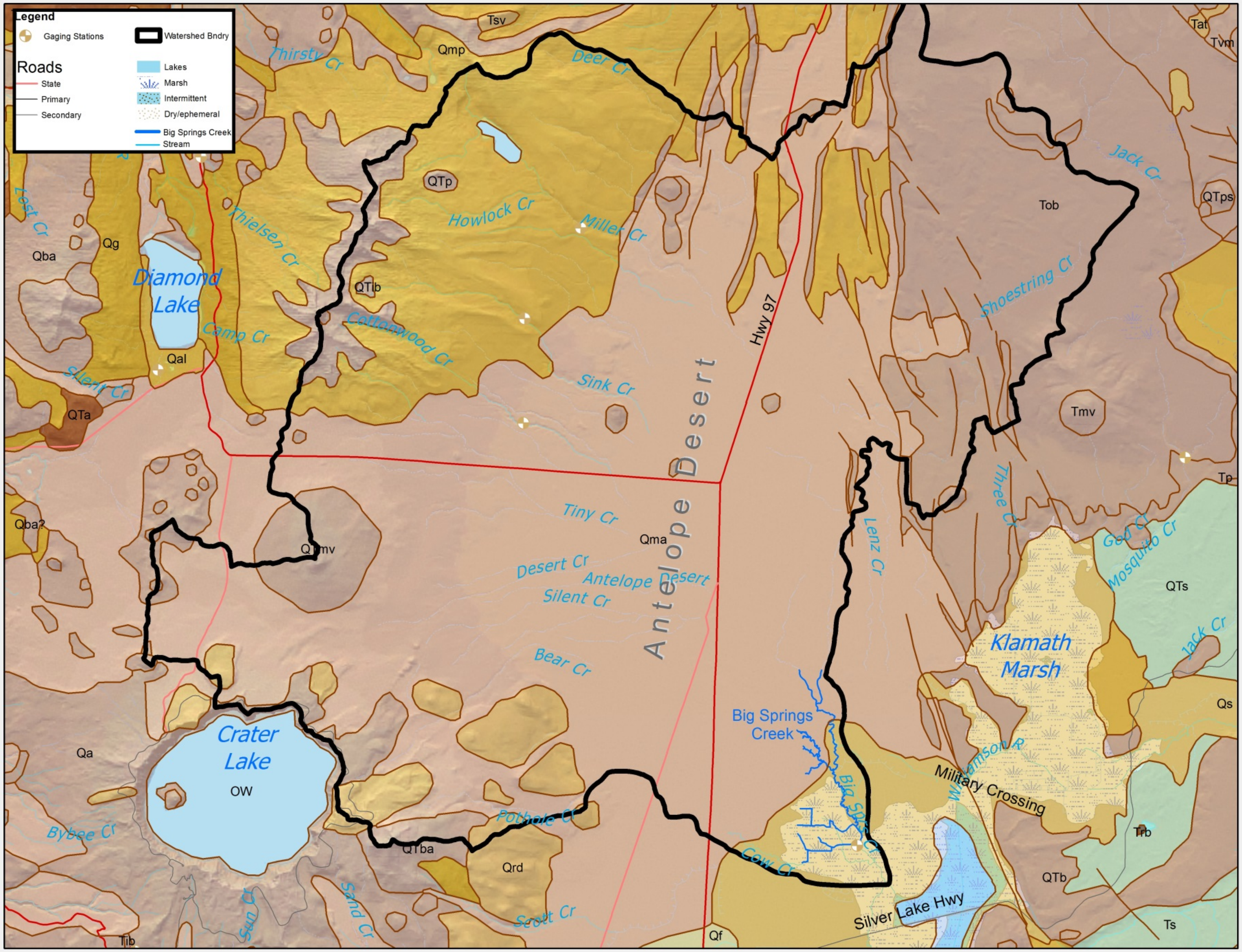

Figure 4: General Geology of Big Springs Area (Walker & MacLeod, 1991)

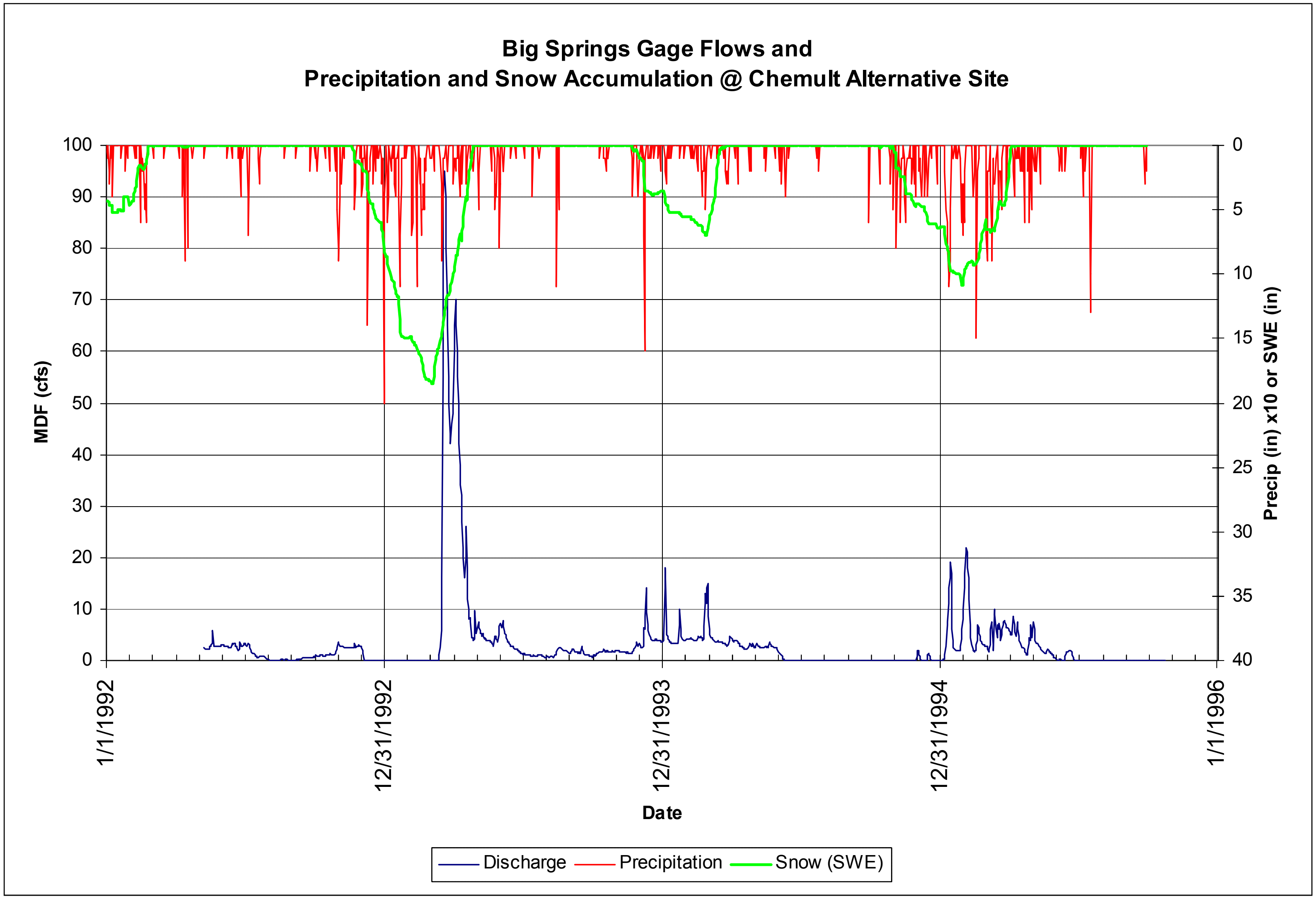

Figure 5a: Discharge from USGS Gage #11492400 along with Precipitation and Snow Water Equivalent (SWE) at Chemult Alternative.

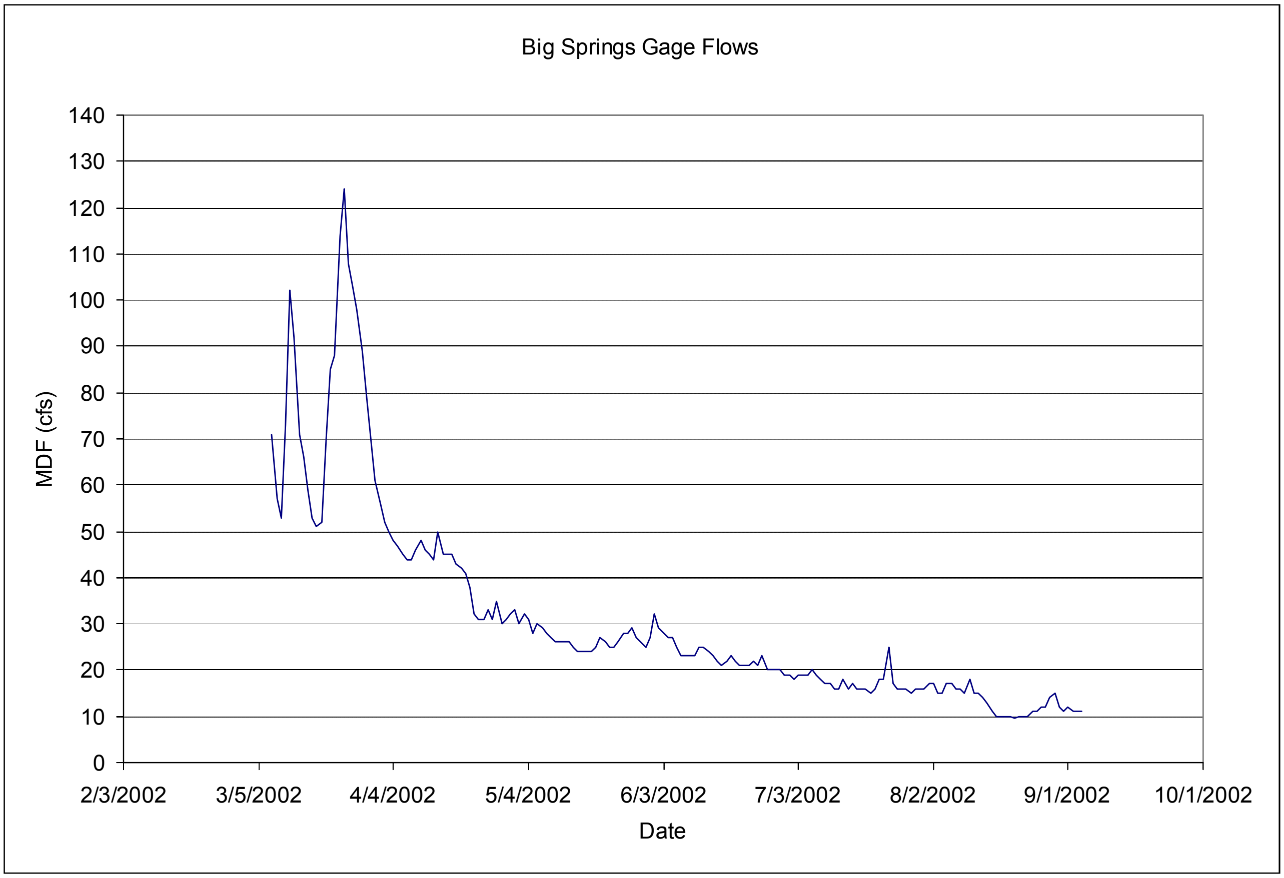

Figure 5b: Daily Discharge from OWRD gage #11492400 for water year 2002.

In previous studies (Newcomb and Hart 1958; Leonard and Harris 1974) miscellaneous streamflow measurements taken over several decades, precipitation data, and groundwater level data demonstrated that flows in the creek can lag precipitation trends, sometimes by years, but that flow in the creek was generally related to the underlying groundwater elevation. An updated graph based on their analysis is shown in figure six. *[Note that when the cumulative departure from average precipitation (CDFAP) line has a negative slope, drier than average conditions exist. Conversely, when the slope of the CDFAP line is positive, wetter than average conditions exist.]*

The Newcomb and Hart study demonstrated that baseflows in the creek ceased after successive dry precipitation years during the drought of the 1930s. Streamflow began again after successive wet years were sufficient to raise the water table high enough to intersect the spring vent elevations along the creek. At about the same time (1950s), irrigation wells started artesian flow (Leonard and Harris, 1974). Note that since the Newcomb and Hart (1958) analysis was based on miscellaneous discharge measurements, it is not known if no streamflow occurred year round (as cited in the report) or the report was just in reference to summer/fall baseflows. In other words, winter runoff during snowmelt or rain events may still have occurred in the creek during this time period noted as dry in the Newcomb and Hart report (written communications, Marshall Gannett USGS, 2002).

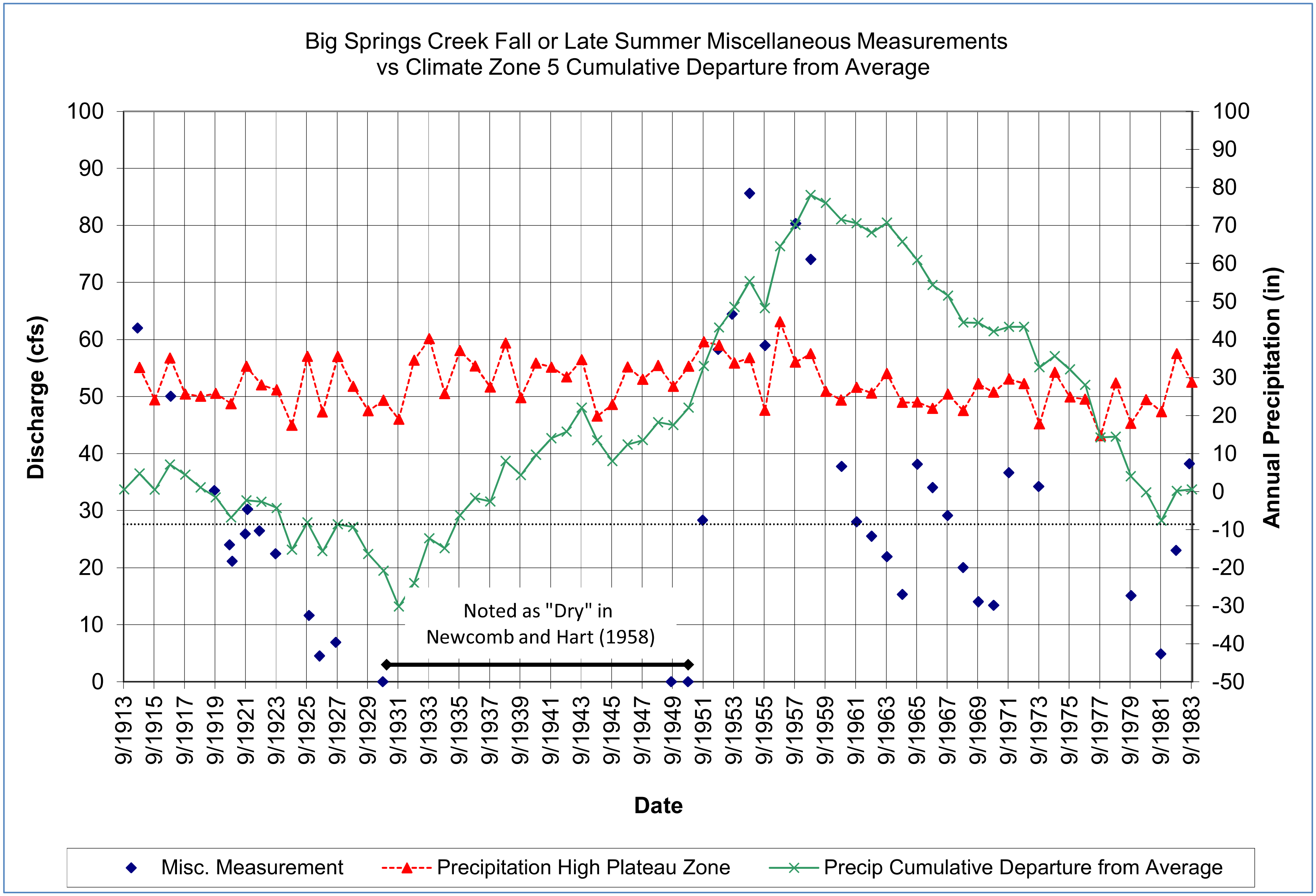

Figure 6: Discharge of Big Springs Creek versus Accumulated Deviation from Annual Precipitation for Oregon High Plateau Division Zone 5 (Precipitation Data Oregon Climate Service)

Seepage Run

In mid–August 2002, synoptic discharge measurements were made by OWRD personnel using standard USGS protocols and equipment at various locations on Big Springs Creek, its tributaries, and ditches near Klamath Marsh. The measurement along with observation sites are shown in Figure 7. Measurements generally were rated as good with an estimated uncertainty of ± 5%. At several locations, channel configurations were such that the measurements could only be rated as fair with a measurements uncertainty of ±10%. All measurements and observation sites were GPS located. Groundwater accretions were calculated by taking the difference between adjacent flow measurements. Additional measurements were made one week later on Big Springs Creek above the confluence with Lenz Creek. Ideally, synoptic measurements in this type of study would have been performed on the same day. However, this was not possible due to resource limitations. Since the system is spring dominated during the non–runoff season, this should not have affected the gains calculations. No precipitation fell between the measurement dates and irrigation remained relatively constant except for a noted increase in a surface water diversion site, which was accounted for in the analysis.

The old USGS gage site (#11492400) was reactivated March 8th of 2002 by OWRD, and provided 15–minute streamflow data for the creek during the study. The gage showed a small difference in flows between the two synoptic measurement dates, with the difference attributable to a slight increase in surface diversions upstream. Hydrographic data was also available for water year 1992 to 1995 at the gage site and was compared to hydrographs from two nearby streams—Cottonwood Creek to the northwest of Big Springs and the Williamson below Sheep Creek almost due east of Big Springs Creek (figure 1). This information was used in conjunction with precipitation and snow accumulation data at the USDA Chemult Alternative SNOTEL site (USDA, 2002) to examine the hydrologic response of Big Springs Creek to precipitation events. Well log information provided insight to general groundwater levels and stratigraphy near the creek as well as daily groundwater hydrographs.

Synoptic measurements were taken on August 13th and 21st, 2002. On both dates, the weather was sunny and hot. Conversation with the ranch manager revealed that the surface diversion had increased by 4 cubic feet per second (cfs) between the two measurement dates. This increase was apparent as a decrease in discharge at the gage site. Well pumping rates, however, remained constant between the two dates. No clouds were apparent on either days and no precipitation occurred between the measurement dates. Figure seven details the measurement and observation sites along with the gains between measurement sites.

During the measurements, Lenz Creek was dry except just above the confluence with Big Springs Creek (site #7). At this location, 1.45 cfs was measured. All other locations were dry (sites 10, 15, 16). The channel at these sites was meandering, poorly defined, with no substrate and grass growing in the channel (figure 8). At site 8, a small dam across the creek held a few acre–feet of water that is provided intermittently by a pump and well upstream (site 9).

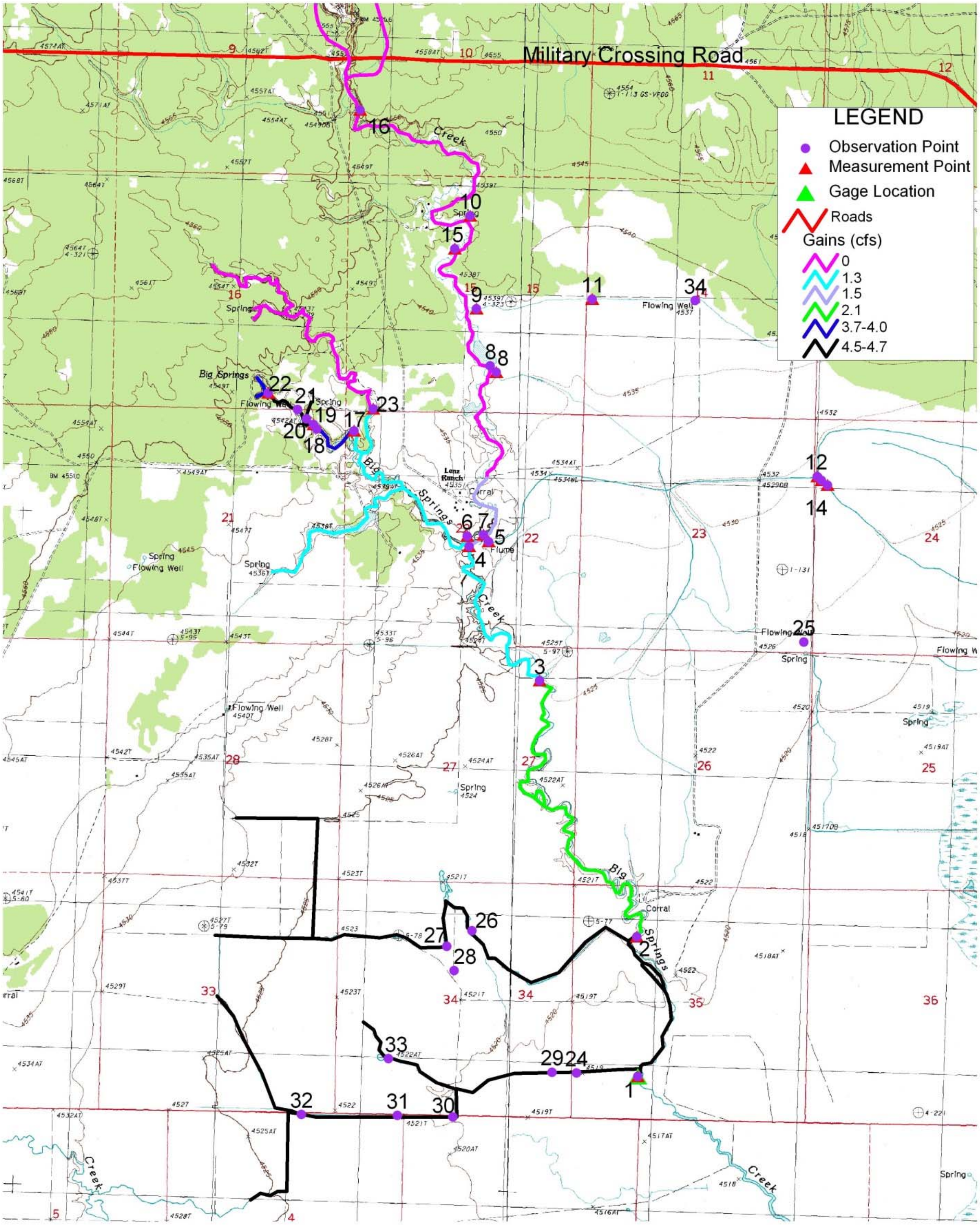

Figure 7: Big Springs Creek Synoptic Measurement Locations

Approximately 5.4 cfs (T = 45 F) was being pumped from this well into an irrigation ditch. A half–mile to the east another well (site 11) was being pumped by at a rate of 6.75 cfs (T = 43 F). Another half–mile to the east, a flowing–well was dry (site 34, water elevation 4532.5 ft). A final well just over a mile southeast of site 11 was being pumped at 2.85 cfs (water temp 45F). All pumps were powered by 60 hp General Electric motors, and the total withdrawals rate was 15 cfs during the seepage run.

On Big Springs Creek just below "Big Springs" and another large spring to the south, 3.95 cfs was measured (site 22). These springs are formed by large depressions approximately 15–20 feet deeper than the surrounding Lodgepole covered pumice plain (figure 9). Water seeps in from every side of the large depression forming the spring. About 700 feet downstream of site 22, was a flowing well with water exiting about 3–feet high from a 6–inch diameter pipe (figure 10, depth 90 ft, temp 45F), located in the creek bed. According to the ranch manager this well was drilled when the creek was dry in the early 1950s. Further downstream at site 19, 8.46 cfs was measured. At a horseshoe bend in the river, 1500 feet further downstream (site 17), the creek gained an additional 3.74 cfs. A tributary just downstream of horseshoe bend was dry at the road crossing (site 23). Total flow of Big Springs Creek just above the confluence with Lenz Creek was 13.5 cfs (site 6). Seeps were continuously apparent along the stream banks between the headwaters and the horseshoe bend, as were several large depressions indicating springs in the area. The channel substrate consisted of pumice–silt/sand with minute portion of gravel–sized material. Dead conifer saplings were still standing in the creek bed, some as high as three feet, indicating a dry creek bed over a sufficient time to allow conifer saplings to grow.

At the confluence of Big Springs and Lenz Creek a pump was diverting 7.8 cfs (increased to 11 cfs the next week) into a ditch (site 5) leaving 7.73 cfs in the creek (site 4). The river picked up 1.3 cfs between the confluence and site 3, the next measurement point less than a mile downstream. This location was just downstream of the confluence with a small tributary spring. The creek gained an additional 2.1 cfs to the next measurement (site 2), a mile downstream. This location was just upstream of a spring fed tributary. Although this tributary was not measured, the change in flow between measurement site 2 and site 1 indicates that the combined flow of the two tributaries was 4.7 cfs. Visual inspection of flow in both tributaries indicated that the majority of the flow came from the upstream tributary near site 2. Large springs with substantial flow were seen at the head of the tributary (site 26, 27).

Other sites of interest (observation sites) are shown in Figure 7. At location 28, water was observed in several "cracks" in the ground approximately 1–1.5 feet below land surface. Water was flowing from a springs at location 27, with substantially more water flowing in the channel below another spring at location 26 (visual estimate 4–5 cfs). Additional small springs were located on the last tributary before the gage at location 33, and to the northwest and southwest of location 32. Several culverts at locations 24, 29, 30 and 31 appear to drain standing water on the lands southeast of the gage into the tributary (Figure 7). All of these culverts were dry and there was very little water flowing in this tributary (visual estimate < 1 cfs) on the measurement date. On the east side of the creek at location 25 a flowing well with water exiting a 6" diameter pipe about 1.5–2 feet above land surface. Further to the north (site 34) a "flowing well" had a water depth 4.5 feet below land surface.

Figure 8: “Channel” at Site # 15. Typical Lenz Creek Channel Upstream of Site #9.

Figure 9: Large Depression forming “Big Springs” at the head of the Creek.

Figure 10: Flowing Well in Big Springs Creek

Discussion

The seepage run measurements show groundwater gains occurred along the entire length of Big Springs Creek in August of 2002. The largest gains occurred between the lowest two measurement sites located upstream of "horseshoe bend" (site 17) near the headwater of Big Springs creek (figure 7). Seeps and springs were ubiquitous along the creek near the headwaters, but decreased to isolate locales with channels to the creek progressing downstream towards the gage.

Although Lenz Creek was dry on the synoptic measurement date, the ranch manager reported seeing standing water several feet deep near site #10 in the 1980s and during other above average precipitation years. From the quadrangle map, Lenz Creek appears to be slightly higher elevation than Big Springs Creek upstream of the confluence. On the synoptic measurement date; any wells, springs or tributaries above an elevation of about 4535 ft msl were not flowing, while those below this elevation were flowing. Water level at well site 34 was about 4532.5 ft msl. The well at site 25 and the nearby spring at elevations 4520–4525 ft msl were both flowing. Springs near sites 26, 27, and 33 were all flowing. As previously mentioned Lenz Creek above elevation 4535 ft msl was dry as was the unnamed tributary at site 23. Thus the regional water table elevation was likely around 4533 ft msl in August of 2002.

The data supplied in figure 5a and 5b demonstrate that snowmelt (spring freshet) can translate to a fairly rapid flow response in the creek. Figure 11 shows the precipitation and SWE at Chemult Alternate SNOTEL site as well as discharge of Big Springs Creek during the spring of water year 1993; a wet year with a large snow pack. As shown in Figure 11, Big Springs Creek discharge increased dramatically between March 16th and March 19th of 1993 after several days of snowmelt (starting 10 days prior, blue line in figure 11) and a rain event (same day). As snowmelt and precipitation tapers off, so does discharge. Discharge again increases in late March after a couple of days of snowmelt and precipitation, but then again tapers off— even with the occurrence of additional snowmelt and rainfall.

This response indicates that both storm flow (saturated overland and/or shallow subsurface flow), and localized response of the regional water table is likely contributing water to the creek during the spring freshet and storm events. The quicker flow response to rain (the second flow peak in figure 11) is indicative of storm flow processes contributing water to the creek. However, the delayed response to the onset of snowmelt shown by the first flow peak in figure 11 is indicative of water contributions from the rising regional water table, and a corresponding increase in flow from the springs and seeps along the creek; provided that the water table elevation is close to or above the elevation of the spring vents and seeps. Later as the water table drops from continuous discharge into the creek (and the onset of evapotranspiration in the marsh) the system becomes unresponsive to new additional runoff or precipitation events (see May 4th, 1993 precipitation event on figure 11).

There was concurrent water level data for a well (KLAM609) near Lenz for water year 2002 when the stream gage was reactivated (figure 12). This well was initially completed to 75 feet deep, approximately the same depth as the pumice/ash layer in the area. However, at some point the well caved in and is presently about 18 feet deep (written communications, Marshall Gannett USGS, 2002). When plotting concurrent discharge at Big Springs Creek with water level data from the well, it is apparent that both the creek and well water levels respond in a similar time frame (figure 12). The water level in the well was in decline due to dry conditions in water years 2000 and 2001. During the spring snowmelt, water levels cease to decline and leveled off at 16.75 feet (ft) below land surface (4533–34 msl), before starting to decline again later in the spring. It should be noted that the water level in the well is about the same elevation (4535 msl) as "Big Spring" at the headwaters of the creek. In this case it appears that an increase in the water table from snowmelt or rain would have translated quickly to an increase in creek discharge. The creek discharge peaked at about the same time as the stabilization of water levels in the well. However, creek discharge declined rapidly while the water level in the well remained steady, indicating the peak flows were also coming from storm flow processes discussed in the previous paragraph.

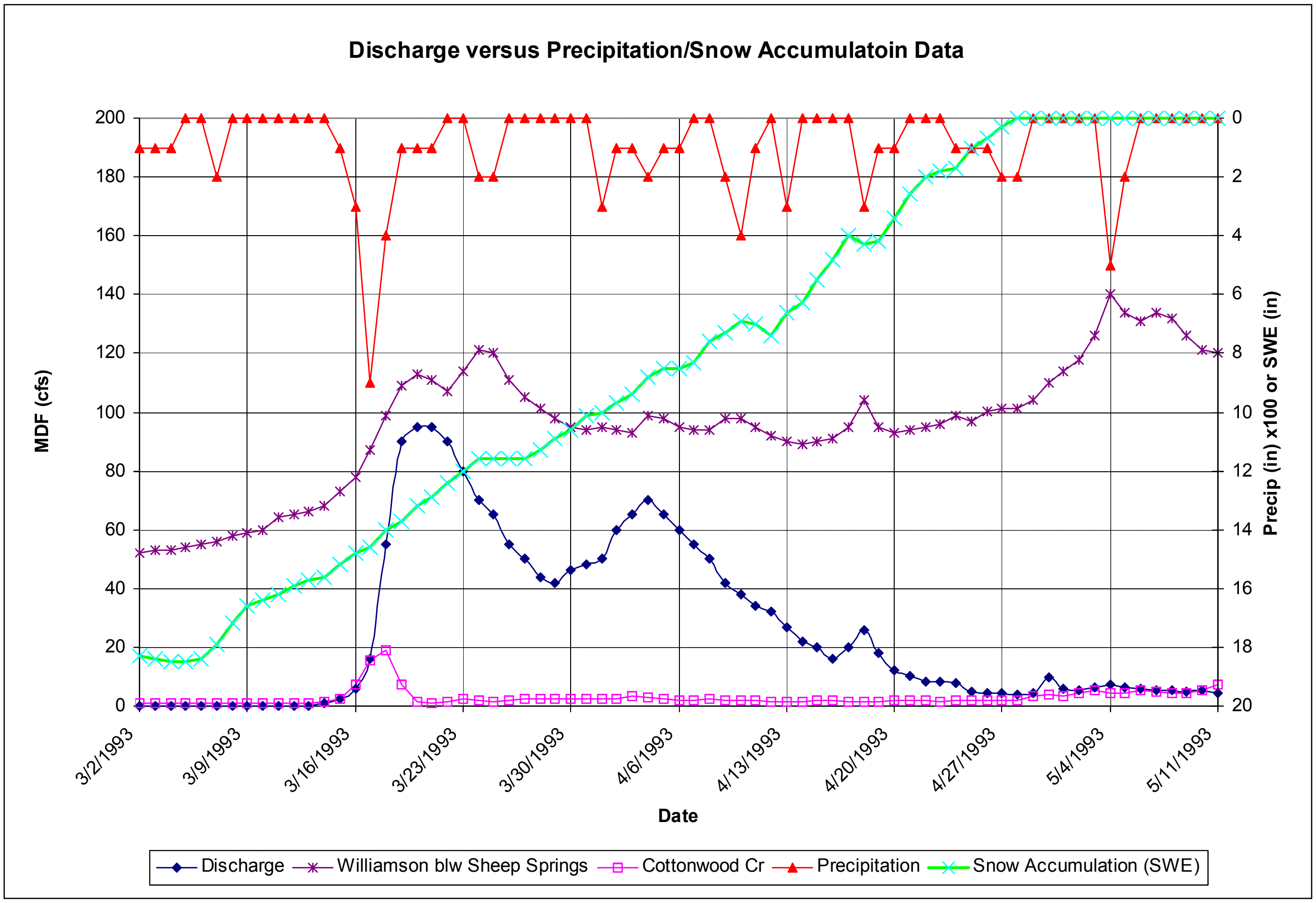

Figure 11: Hydrographs for Big Springs Creek (#11492400), Williamson below Sheep Springs (#11491400), and Cottonwood Creek (61420101) with Precipitation and Snow Data site at Chemult Alternative for Spring of WY 1993.

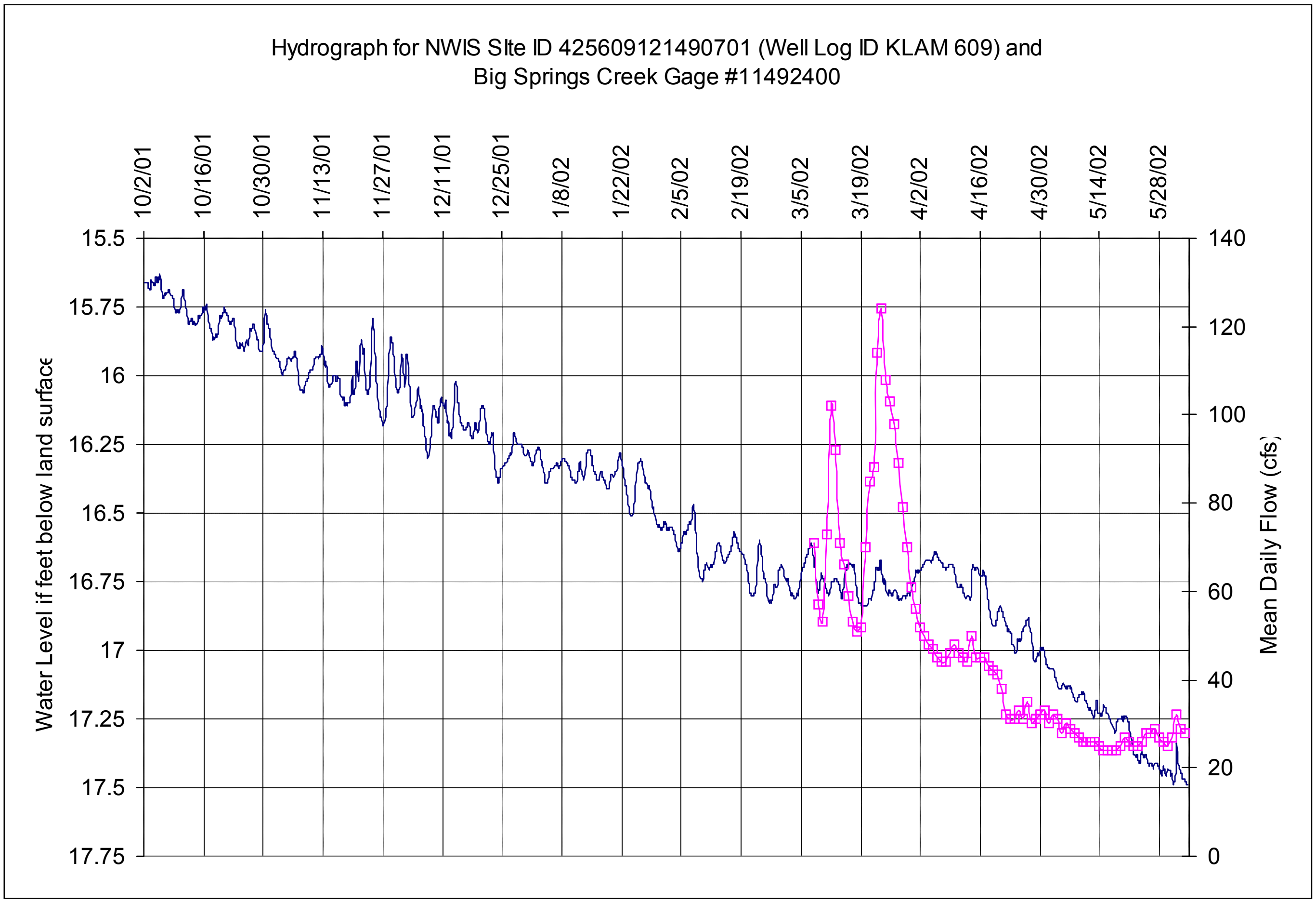

Figure 12: Well Hydrograph for KLAM 609 near Lenz (blue line) and Big Springs Creek discharge (red line). Gage was installed in March.

Conclusion

Although Big Springs Creek is a spring fed system with baseflows dependent on the local elevation of the regional groundwater table, daily hydrographs show surprisingly flashy peak flows during the spring snowmelt. It is thought that this response is from snowmelt and/or precipitation causing a temporary saturation of the topsoil and thus local runoff and/or shallow subsurface flow to the drainage network. However, there is evidence that rapid rise in the regional water table (at least locally) caused be the extremely high infiltration rates associated with the pumice plain during the spring freshet also contributes to higher flows during spring runoff and a quick response to precipitation events during the runoff period.

Synoptic measurements along Big Springs Creek and its tributaries demonstrate that the creek gains continuously from groundwater discharge between the headwaters and the stream gage. Over half of the gains occur from ubiquitous springs and seeps within the first 0.6 miles of the headwaters while the creek is still in the pumice plateau and the regional groundwater system is likely unconfined. he remaining gains occurred at discreet springs vents spread out along the remaining stream network upstream of the gage. This area also has flowing artesian wells, indicating the groundwater system is at least locally confined. Total gains to the creek on the measurement date were 23.1 cfs.

From field observations, the elevation of the local water table during the seepage run was approximately 4535 feet (msl). The majority of Lenz Creek is above this elevation. Total withdrawals from both ground and surface water were 26 cfs, with 11 cfs coming from the creek. A rough estimate of the combined groundwater surface water diversions on streamflow is on the order of 15–20 cfs during the irrigation season, depending on aquifer conditions and return flows. This estimate could be refined through the use of analytical tools to evaluate the groundwater withdrawal effects on streamflow.

Comparison of groundwater data in a nearby well and discharge in the creek demonstrates that relationship between flows and the regional water table. As described in previous reports (Newcomb and Hart, 1958; Leonard and Harris, 1974), streamflow (baseflows) in the creek are dependent on groundwater elevations, which fluctuate in response to water year precipitation types (e.g., dry, wet, average, etcetera), and longer decadal climate trends. This dependency can introduce multi–year lags in the response of the creek to precipitation/snow trends when the groundwater elevation is far below the elevation of the springs and seeps in the creek.

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