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Technical Memorandum
Review of Draft Environmental Impact Report for the Village at Squaw Valley Specific Plan

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Prepared for Sierra Watch
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SUMMARY

THE DRAFT ENVIRONMENTAL IMPACT REPORT OVERESTIMATES THE AMOUNT OF WATER IN SQUAW VALLEY AND UNDERESTIMATES DRAWDOWN FROM PROPOSED GROUNDWATER PUMPING

The Olympic Valley aquifer is small compared to the demand imposed on it. Recharge to the aquifer is approximately equal to the current demand, and pumping currently pulls water from Squaw Creek. Future development will increase the amount of water drawn from the creek and lower groundwater levels beneath meadows and riparian vegetation. The draft environmental impact report (DEIR) for the expansion of the Village at Squaw Valley acknowledges but grossly underestimates these impacts. The DEIR relies on an erroneous estimate of far more recharge to the aquifer than actually occurs because it uses a grossly incorrect estimate of precipitation in the valley. This excessive precipitation drives the numerical groundwater model which is used to estimate most of the other predictions discussed in the DEIR. The DEIR also underestimates drawdown because the modeling is based on nine pumping wells when the water supply assessment (WSA) assumes that just six well will be needed. The modeling spreads drawdown over a larger area than will actually occur. These problems with the hydrogeologic analysis will cause impacts to sensitive habitats to be much higher than predicted.

The conceptual flow model for the Olympic Valley aquifers includes recharge from rainfall on the alluvial valley, from runoff through streams on the alluvial valley, and from mountain runoff percolating into the aquifer at the mountain front. During runoff periods, the stream in the western part of the valley percolates water to the aquifer until groundwater levels rise level to the stream. Taking the form of runoff and stream flow, groundwater discharges into the creek as long as the groundwater level is above the stream level. Late in the summer season in most years, the groundwater level falls below the stream bottom so that groundwater discharge to the stream ceases. Current pumping in this area increases the rate that groundwater levels decrease and proposed future pumping will increase the length of dry stream segments and the time period during which the stream is dry. Climate change that increase the ratio of rain to snow and snowmelt to occur earlier will increase the length of the dry part of summer during which the groundwater does not discharge to Squaw Creek in the western part of the valley. 08a-1

East of the village, the meadow and a non-channelized, meandering, stream gains flow from groundwater discharge most of the time because groundwater levels remain high most of the year. There is little current or proposed pumping in the middle of the meadow to cause drawdown and affect

streamflow. Drawdown is concentrated in the western reach of Squaw Creek but does extend into the meadow just east of the parking area and increase critical low flow and drawdown conditions. O8a-1 cont.

THE DEIR USES AN ESTIMATE OF RECHARGE THAT IS GROSSLY TOO HIGH. THIS ERROR CAUSES MANY OTHER ASPECTS OF THE ANALYSIS TO MINIMIZE THE PROJECTED IMPACTS

Recharge depends on precipitation reaching the valley floor, but the high mountain precipitation reported in the WSA is grossly wrong, being estimated as 263 inches per year for 1993 through 2011 which at a 1:10 ratio equates to 219 feet of snow. The Snotel site for the valley shows that that the annual average for that period is 80.6 in/y. This erroneous precipitation estimate is prominent in DEIR references since 2011. Recharge used in the groundwater model increased from about 680 af/y in 2001 to about 3800 af/y because the precipitation estimate increased. Running much more water through the model caused the calibrated hydraulic conductivity to be increased by an order of magnitude which in turn decreases the predicted drawdown caused by pumping. The recharge overestimate also makes more water available to be pumped over a longer time period which offsets pumping demands and limits predicted drawdown. O8a-2

THE GROUNDWATER MODELING FOR THE PROJECT MINIMIZES THE PREDICTION OF PUMPING IMPACTS BY SPREADING PUMPING OVER MORE NEW WELLS THAN ARE PROPOSED TO BE CONSTRUCTED

The groundwater model used nine new municipal wells to simulate future water supply conditions and predict drawdowns even though the WSA determined that only six new wells would be constructed. Extra wells spread the predicted drawdown over a larger area and makes the vertical drawdown much less. In fact, simulated pumping of the expected 2040 demand from existing and proposed new wells caused the model to estimate less drawdown in areas than the current pumping causes. O8a-3

THE DEIR UNDERESTIMATES THE PROJECT'S DEMAND FOR WATER AND FAILS TO CONSIDER A RANGE OF LIKELY DEMAND DISTRIBUTIONS

Projected water demand could be incorrectly incorporated into other analyses in the DEIR for at least two reasons. The demand was based on occupancy during the economic recession from 2009 through 2011 and is therefore likely too low. Adjusting this to closer to full occupancy and a few demand factors could increase overall project demand as much as 80%. The second is the distribution of demand. More demand especially in late summer would cause even more drawdown lengthening dry periods and the length of dry stream. O8a-4a

Potentially underestimated demand drawn from more wells than necessary, too much recharge and aquifer parameters that are too transmissive because the model runs too much recharge through it, and ignoring climate change which could decrease the recharge period together cause the DEIR to underestimate impacts caused by the project. O8a-4b

The presentation of impacts in the DEIR are not as quantitative as they should be. The DEIR should include a much more quantitative assessment of drawdown at various locations. Rather than simple assessments of whether the drawdown takes the water level below a given threshold, such as ten feet beneath a stream or riparian area, the DEIR should present drawdown frequency graphs at each point of interest. This would show how much longer the project would draw the groundwater below certain levels, rather than simply assessing whether it goes below a threshold. The DEIR should also provide O8a-4c

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improved quantitative descriptions of the changes in flow to Squaw Creek. It should show the changes in flow for different time periods. O8a-4c cont.

THE DEIR FAILS TO ANALYZE ENVIRONMENTALLY SUPERIOR PUMPING PRACTICES

The DEIR analyzes just the alternative of increased pumping associated with increased development. An alternative that should be considered is pumping from certain wells based on the effects it would have on the creek. For example, pumping from wells near the creek has the largest impact on streamflow during the period which streamflow is decreasing from snowmelt runoff to being dry in the western portion of the project. An alternative would be to concentrate pumping near the creek during runoff to draw as much from the creek as possible and to pump as far from the creek as possible during baseflow. When the creek is dry, the effect of pumping near it is much less so the pumping distribution is less important at that time. O8a-5

THE DEIR DOES NOT ASSESS QUANTITATIVELY THE IMPACTS OF CHANNEL RESTORATION ON SQUAW CREEK. THE DEIR MAKES UNPROVEN CLAIMS ABOUT THE NEW CHANNEL DECREASING SUSPENDED SEDIMENT IN THE STREAM. ESTIMATES OF SEDIMENT TRANSPORT THROUGH THE PROJECT ARE TOO SMALL

The project proposes a restoration of the currently channelized section of Squaw Creek through the project site. The new channel will increase the flood conveyance and also increase the size of a floodplain that high flows can access. The channel will include a low-flow channel as well. The DEIR does not provide a substantial quantitative analysis of the new channel. However, the new channel will probably decrease the sediment transport through the reach by capturing some on the widened floodplains. This will decrease sediment entering the meadow reach which could increase the erosive capacity through the meadow and cause more erosion in the meadow. The DEIR has not considered these impacts, but could do so by including a water surface profile analysis that considers sediment transport O8a-6

The project will have little impact on sediment flowing off of the upstream watershed areas, but the DEIR predicts that transport from the developed areas will reduce from 200 to 175 tons/y. This is a small proportion of the almost 39,000 tons/y generated by the watershed. The DEIR has underestimated sediment production at high flows from all areas, therefore the overall estimates of sediment production may be too small.

THE DEIR DOES NOT ACCOUNT FOR THE EFFECTS THAT CLIMATE CHANGE WILL HAVE ON THE PROJECT'S ABILITY TO MEET DEMAND WITHOUT CAUSING ADDITIONAL IMPACTS

The DEIR has a chapter concerning climate, but it mostly deals with greenhouse gas emissions from the project. The chapter notes potential changes in snowfall and runoff due to climate change, but there is no consideration in the groundwater model simulations of future conditions of climate change causing more precipitation to fall as rain or for snowmelt occurring earlier in the year. Climate change is also likely to lengthen the dry, or no-recharge, period of a year so there will likely be longer periods during the summer when the stream is dry and no recharge is occurring. O8a-7

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INTRODUCTION

The draft Village at Squaw Valley Specific Plain EIR (DEIR) reviews plans to develop the proposed Village at Squaw Valley Specific Plan (VSVSP), an expansion of hotel and residential development in Squaw Valley CA. The expansion would include a substantial increase in the amount of groundwater pumped for residential and commercial uses in the valley. A separate water supply assessment (WSA) (Farr West et al. 2014) was prepared to evaluate whether there is sufficient water available for the project. The DEIR attaches the WSA as Appendix C and refers to it throughout the water supply discussions.

This technical memorandum reviews hydrogeology and water resources aspects of the DEIR. I completed a separate review of the WSA and attached the review to this memorandum as Attachment 2. The DEIR refers to many hydrogeology studies done as part of the WSA, so my review of the WSA supplements this DEIR review. There are overlaps in review comments because of the similarity of the analysis in each document.

DEIR Chapter 13 contains the primary discussion on hydrogeology, but other chapters add to or rely on the hydrogeology section. Chapter 6 considers the impacts that changes to the hydrogeology have to biological resources. Chapter 14 discusses how changes in public services affect water resources and chapter 18 discusses cumulative impacts which includes the hydrologic and water resources impacts of full development in Squaw Valley. O8a-8

The DEIR compares the project-induced conditions to baseline conditions. Because the project would occur along with other local growth, the 2040 WSA scenario is with project along with cumulative development in the valley. Baseline is "a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published …" (DEIR, p 1-3). The DEIR determines baseline groundwater conditions as those that would occur due to pumping at the level of development that existed when Placer County issued the notice of preparation, or October 10, 2012, not the groundwater conditions as exist on that date.

The format of this technical memorandum follows that of the DEIR. There are major sections on biological and hydrogeological resources, following the Chapters 6 and 13 in the DEIR. Discussions of public utilities and cumulative impacts are included in the relevant sections. Subsections include the impact and mitigation features as specified in the DEIR.

BIOLOGICAL RESOURCES

The biological resources chapter describes and analyzes project impacts to ecosystems on and around the project site. From a hydrologic perspective, the ecosystems of most importance are those associated with the streams, specifically the main channel and North and South Forks of Squaw Creek, and the Olympic Channel. Squaw Creek flows through the project site and a meadow east of the site. Also of importance are riparian areas, wetlands, jurisdictional or not, and seeps. The hydrologic issues primarily pertain to groundwater development for the proposed project, to sediment transport to and through the project site, and to stream habitat issues as affected by grading and proposed stream restoration. Increased groundwater pumping (over existing or baseline conditions) will lower the water table which would change groundwater flows to and from the stream and lower groundwater levels below meadows and riparian areas. Stream channel restoration of Squaw Creek will change streamflow and sediment transport through the reach and into the meadow. O8a-9

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Land cover maps 1 and 2 show the ecosystem, or land cover, types through the project area. They include various sensitive habitats, such as intermittent stream and seeps. DEIR descriptions of the sensitive habitats (DEIR, p 6-10 – 6-14) are insufficient and inaccurate because they do not explain their dependency on groundwater and runoff. For each habitat, the description should include how the vegetation gets its water – whether it survives on snowmelt and rainfall with groundwater too deep to supplement late in the summer or whether it is partially dependent on groundwater. It should also describe the average depth to groundwater in spring and fall. This type of description is necessary because the availability of groundwater controls these habitats and the proposed project would affect groundwater more than just about any other development factor. O8a-10

The same suggestions regarding groundwater dependence applies to DEIR Tables 6-2 and 6-4. The description of habitat in Table 6-2 notes soil moisture and the presence of seeps and springs, but to understand the effects groundwater management could have it is necessary to know the groundwater conditions for the species. Table 6-4 lists the area of specific wetlands and other waters of the U.S., but should also provide the depth to groundwater to assess the impacts of groundwater management. Additionally, the DEIR should add a table of special status species potentially on the site (Impact 6-8) showing their groundwater requirements, both required and as existing on the site. O8a-11

The description of Squaw Creek states that there are "deeper pockets of water … behind boulder clusters within the stream channel" (DEIR, p 6-11), referring to stream segments in the meadow east of the proposed project. Deep pockets may contain water perennially and can be quite valuable habitat, and GANDA (2014) considers the impacts of lowering groundwater on this habitat. The DEIR should better describe this deep pool habitat because of its importance. A detailed map of the intermittent stream reaches (DEIR, p 6-10, -11) is also necessary, including a detailed map of the reach over which Squaw Creek is channelized. O8a-12

Impact 6-1: Removal or degradation of sensitive habitats (jurisdictional wetlands, wet meadows, and riparian vegetation)

Impact 6-1 concerns the direct removal of wetland, meadow, and riparian habitat by construction and ancillary effects of the project that can affect these habitats. Ancillary effects are those caused by groundwater drawdown or changes in surface or groundwater flows. Simulated monitoring wells in the groundwater model are used to track the groundwater level under the stream and sensitive wetlands, as described and critiqued below in the section regarding Impact 13-5. The effects of groundwater drawdown on sensitive habitat are assessed using simulated monitoring wells in the groundwater model. The hydrogeologic effects contribute to other impacts discussed in the biology chapter, including most directly Impact 6-2 (Disturbance or loss of Sierra Nevada yellow-legged frog habitat), Impact 6-3 (Disturbances to nesting raptors and special-status birds), and Impact 6-8 (Disturbance or loss of special-status plants). With respect to hydrogeology, the comments herein regarding Impact 6-1 apply to the habitat being affected for the other biological impacts. O8a-13

<u>Meadow Vegetation</u>

Groundwater management will lower groundwater levels below the various thresholds specified for specific vegetation types more frequently than currently happens (DEIR, p 6-42). However, the DEIR does not specify, based on model results, the increased periods over which these effects will occur. In other words, under the baseline condition, water levels may drop below the threshold for several O8a-14

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weeks, but under the WSA 2040 or project conditions this period groundwater levels being below the threshold may be longer. The DEIR does not discuss this impact. For example, regarding meadow vegetation, under WSA 2040 conditions, the driest years "would have seasons where groundwater levels drop below the threshold of meadow functionality for the majority of the growing season" but because this die off is a "regular part of ecosystem function," the DEIR claims that meadow vegetation will return during wetter years and concludes the "reduction in meadow vegetation or vegetation productivity during dry years would be minimal and temporary" (DEIR, p 6-44) However, the DEIR does not explain or provide evidence in support of this conclusion.

The DEIR should specify how long simulated drawdown exceeds the threshold during baseline conditions and during WSA 2040 conditions. The DEIR should include a map showing the areas in which groundwater levels will drop beneath certain thresholds for specified time periods.

O8a-14 cont.

Riparian Vegetation

The DEIR discussion concerning riparian vegetation has the same issues as for meadow vegetation. The DEIR claims that cottonwoods can be found where groundwater tables are up to 29 feet below ground surface (bgs) and that cottonwoods and willows can be found in the western channel of Squaw Creek where "groundwater elevations can reach 15-17 feet below the ground surface" (DEIR, p 6-42). Deep roots as observed near Squaw Creek indicate that the groundwater level lowers to these levels as often as annually (Id.). These statements should have a reference. The DEIR notes however that "long-term survival and productivity of established and young trees in cottonwood and willow forests appears to typically require groundwater less than 10 feet from the surface and any rapid declines in groundwater depth are not greater than 3.3 feet from lowest annual baseline levels for more than a few weeks or year to year" (Id.). The various studies referenced (see DEIR p 6-42) are for areas other than Squaw Valley. The fact that cottonwood and willow roots in Squaw Valley are substantially lower than the 10-feet threshold specified by the many studies cited in the DEIR indicates strongly that groundwater conditions already stress the existing riparian vegetation. It is probable that existing conditions would not allow new riparian trees to become established in areas where the groundwater levels already drop below ten feet bgs. The DEIR should consider a threshold at the depth of the existing roots in addition to the 10-foot threshold (DEIR, p 6-43).

O8a-15

The establishment of seedlings requires "groundwater depth from surface <3.3 feet" (DEIR, p 6-43), therefore the DEIR should provide graphs or analysis comparing the time the water table is within 3.3 feet of the surface for both baseline and WSA 2040 conditions. Pumping will cause the water level to be more than 3.3 feet below baseline for much more than a few weeks in many years. The DEIR's argument that this causes no problem (DEIR, p 6-42) is obviously wrong. The DEIR should assess the additional time the WSA 2040 condition water level is more than 3.3 feet below baseline by year to show a quantitative analysis. Additionally, germination of seeds requires the ground surface to be saturated (see biologists report reviewing the DEIR), so the DEIR should report similarly the frequency of the water table being at the ground surface for baseline and project conditions.

O8a-16

There are at least three significant thresholds affecting riparian vegetation – 3.3 ft bgs, 10 ft bgs, and 15 to 29 ft bgs, as described in the previous two paragraphs. The water table in many model cells drops below these threshold in some years under baseline conditions but under WSA 2040 conditions the groundwater level will drop below the thresholds for longer time periods in more years (I review the accuracy of the graphs analyzing the groundwater levels below in the groundwater review section). To

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quantitatively assess the increased times the groundwater level is below the thresholds, the DEIR should present a drawdown frequency analysis for each monitored model cell showing the actual time groundwater levels go below various levels. The DEIR should also provide a graph showing the amount of time the drawdown exceeds a given drawdown to compare to known root depths. O8a-17 cont.

The bullet point statements on p 6-43 could be quantified using the graphics suggested in the previous paragraphs. The DEIR does not present sufficient evidence to support its conclusion that "groundwater withdrawals ..., if managed as currently modelled, are unlikely to result in mortality to established perennial riparian vegetation within the western channel or upper meadow reach" (DEIR, p 6-43, -44). The analysis was qualitative, and the preceding paragraphs specified several graphical analyses which would allow a quantitative comparison among scenarios, especially between WSA 2040 and baseline conditions. O8a-18

Additionally, modeling of groundwater management underestimates the actual drawdown because the modelers used more wells than projected by the WSA. The modeling spread drawdown over a larger area and caused some predicted water levels to actually be higher than for the baseline. This is discussed in more detail below in the groundwater section.

Groundwater drawdown causes much of the impacts to the ecosystem, but the DEIR does not show a drawdown map. To show potential impacts, these land cover **maps should be shown with the minimum groundwater saturation at several time periods, such as after drought periods.** This would allow visual consideration of which habitats could be harmed by drawdown and where. O8a-19

Water Quality (DEIR p 6-45)

The DEIR claims that "operation of the Specific Plan" would not create adverse impacts to water quality ... related to stormwater management from any changes to creek peak flow, total volume, velocity, or TMDL" (DEIR, p 6-45). The DEIR acknowledges that groundwater impacts to vegetation and snow storage could cause water quality issues (Id.).

Groundwater drawdown could kill some riparian or meadow habitat, as discussed above, which would cause streambank instability because Squaw Creek's banks are sensitive to reductions in vegetation (DEIR, p 6-46). Although acknowledging the impact could be significant, the DEIR does not quantify the potential pollution. O8a-20

The project will not change total suspended sediment or other quality parameters flowing the through site substantially because there will be little change in impervious area. Storm runoff from the project site will only change by small amounts, mostly decreasing (Shaw and Roberts 2013). The project will not substantially change operations for the watershed above the project site but will pass flows through the site as at present. The biggest change will be a restoration of the trapezoidal channel. Details are reviewed below in the hydrogeology section, but it must be noted that the DEIR discusses that the restoration should decrease sediment transport but does not quantify the amount.

Proposed Mitigation

Mitigation measure 6-1c ensures the "adoption of performance standards, thresholds, and recommendations from the WSA for well system operation, and requiring consistency with applicable groundwater plans" (DEIR, p 6-49). Project-induced drawdown will probably cause vegetation to O8a-21

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respond over time, so monitoring of the vegetation (both meadow and riparian) health is essential. Because the impacts manifest slowly, this monitoring could trigger management changes that will help prevent bad effects on the vegetation. Five years of monitoring beyond project build-out is grossly insufficient because of the slow manifestation of vegetation change and because of the potential for unusually wet years to temporarily compensate for project impacts. Riparian vegetation monitoring should continue until a significant drought has occurred with full project buildout conditions with ongoing monitoring.

A potential compensation for lost riparian vegetation is "irrigation of riparian vegetation to maintain existing habitat" (Id.). This is not a good mitigation strategy because it typically removes more water from the same source to mitigate the loss and ultimately exacerbates the problem into the future. O8a-21 cont.

Mitigation measure 6-1c suggests they substitute modeling for monitoring if the groundwater "modelling indicates that changes in groundwater conditions under the proposed groundwater management regime would not result in a significant adverse effect to riparian and meadow habitat" (DEIR, p 6-50). This is inappropriate because monitoring is required to verify the modeling is yielding accurate predictions. Modeling is not a substitute for monitoring but rather a means of making choices regarding management – choices that may be changed due to monitoring.

Points in mitigation measure 6-1d are from groundwater mitigation measures and will be reviewed below. O8a-22

Impact 6-11: Construction phase water quality degradation impacts to fish and aquatic resources.

This impact concerns the potential for sediment and other pollution to reach Squaw Creek as a result of active construction activities. The DEIR implies that best management practices (BMPs) would be used to avoid erosion and sediment problems, and acknowledges that if the BMPs fail the project could cause substantial pollution (DEIR, p 6-76). This is a big "if", especially in the sensitive environment of Squaw Valley. The DEIR should analyze the effectiveness of proposed BMPs as part of this DEIR. O8a-23

The hydrogeology chapter describes mitigation measure 6-11, so these will be reviewed below. O8a-24

Impact 6-13: Potential long-term impacts to fish and aquatic resources related to increased groundwater extraction …

This impact addresses impacts to fish and aquatic resources related to groundwater management, including the potential for flow changes and the consequent effects on streambank stability (which relates to riparian vegetation, as discussed above). The decreased groundwater levels due to groundwater management will decrease flows and impact vegetation, potentially destabilizing banks. As noted for Impact 6-1, I review the hydrogeology details below. O8a-25

The DEIR makes an important acknowledgement discussing this impact: "However, if the wellfield is not configured and operated as indicated in the WSA, longer and more frequent drying periods could occur, which could threaten the ability of the creek reaches near the well field to maintain a fish community. In addition, vegetation loss resulting from reduced groundwater could lead to potential erosion and adverse impacts to fish and fish habitat" (DEIR, p 6-79). This effectively acknowledges that if the plan is not followed, the impacts could be much worse. The wellfield will not be configured and operated as modelled for the WSA because the modeling has more wells than the WSA expects to be required; the

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WSA estimated a certain number of wells be added to meet demand but simulated several more. See the discussion below on the model and the review of the WSA in Attachment 2. The DEIR should also note that if the groundwater model predictions are not accurate, the impacts could be much worse as well. O8a-25 cont.

Impact 6-14: Long-term changes to fish and aquatic resource habitat in the main Village reach of Squaw Creek due to creek restoration.

In general, the plan intends to restore the channelized portion of Squaw Creek through the main Village area. The DEIR concludes this would be a beneficial impact. I review details of the hydrogeology below, but some of the suggested biologic impacts may be overstated. It suggests that the areas of deep pools at low flow will increase, but this could be countered by the additional drawdown. If the stream bottom is lowered substantially, the increased shallow groundwater could actually increase the groundwater discharge from the streambed. However, increased surface water storage volume in the pools could increase the flows in the stream. The claim that geomorphic restoration would reduce fine sediment supply and transport, increase average substrate size, and decrease embeddedness requires verification. The hydrogeology review (DEIR, p 13-76) notes that if not done properly, the "creek restoration may not provide the anticipated benefits" (Id.). O8a-26

HYDROGEOLOGY AND WATER RESOURCES

The hydrogeology chapter starts with a general description of the watershed and climate, which is generally accurate except there is a **major error with the precipitation shown for Squaw Valley** in Exhibit 13-3 and it carries through the DEIR. The error was also in the WSA (see the review of the WSA in Attachment 2). The suggestion is that annual precipitation at the Squaw Valley Snotel site equals 263 in/y (DEIR, p 13-7). If true, this would be the highest precipitation in the country, excepting a spot or two in Hawaii. Records show that only on the coast of Oregon and Washington does annual precipitation exceed 100 in/y in the continental United States (http://www.currentresults.com/Weather-Extremes/US/wettest.php). Attachment 1 shows the monthly precipitation data for the Squaw Valley Snotel Site. The annual average for 1993-2011 is 80.6 in/y, and since 1981, the average is 71 inches. This is snow-melt equivalent. The 263 inches at a 1:10 ratio would be 219 feet of snow. This erroneous precipitation estimate is prominent in documents and analyses since 2011, except for Shaw et al. (2014, p 5) who indicate the Snotel site gives an average annual precipitation of 65.2 inches. O8a-27

This error leads much of the DEIR analysis and discussion to underestimate the impacts of the water development. This is because the precipitation drives the recharge estimate for the project. This will be discussed in detail below but it means that every estimated impact due to groundwater production has been underestimated.

The DEIR and some of the groundwater reports claim that groundwater levels fully recover even in dry years. However, data presented in the DEIR contradicts that statement. Groundwater levels fluctuate 10 to 15 feet seasonally and recover to within 10 feet in half of the years. (DEIR, p 13-13). It is not appropriate to say that "even in years with below average precipitation groundwater levels rose to "near the maximum elevations" (DEIR, p 13-13) in a basin that only recovers to a fraction of the annual fluctuation in half of the years. Exhibit 13-8 demonstrates clearly that the average groundwater annual maximum fluctuates up to at least seven feet (J-93 to J-01). The aquifer is generally no more than 150 O8a-28a

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feet thick (Hydrometrics 2014, West-Yost 2003), so the maximum levels fluctuate almost 10%. The overall average fluctuation is almost 15 feet.

The DEIR also relies on the WSA's conclusion that recharge is rejected because it is available when the basin is already full. It is not correct to state that runoff is "rejected as recharge" (DEIR, p 3-17) due to the aquifer being full. DEIR Exhibit 13-9 does not support this conclusion but shows the aquifer is 100% saturated at most in small parts of two years. In other years, the maximum percent saturation is always a few percent less than full. Exhibit 13-8 shows up to ten feet available in an aquifer that fluctuates from 10 to 15 feet. During snowmelt and significant rain events, substantial runoff may occur because the snowmelt or rainfall rate exceeds the ability of the soil to accept it as infiltration or because the soil has become saturated and cannot accept more infiltration. This is different from saying that the aquifer is full and rejecting recharge. O8a-28a cont.

The DEIR erroneously claims that "pumping from existing wells during periods when Squaw Creek is flowing … captures only a small amount of extracted water from the creek" (DEIR, p 13-18). The claim then that "current groundwater pumping does not substantially alter stream flow" (Id.) is wrong. The WSA estimates that a municipal well pumping at a "customary 8-hour pumping cycle" would capture only 2% of its flow from Squaw Creek. The estimate of the amount of water drawn from Squaw Creek is likely too low because the calculation does not account for cumulative effects because it assumes that at the beginning of any pumping cycle the amount being drawn from the creek is zero. Hydrometrics used a standard formula (Hunt 1999) to estimate the amount of water that the pump test draws from the creek (Hydrometrics 2013a, p 17). Assuming they applied the method properly, they estimated that after 51 hours of pumping (test #1, see Hydrometrics 2013a), 17% of the amount being pumped was being drawn from Squaw Creek. Hydrometrics minimized the importance of this by estimating the amount drawn from the creek over the entire 51-hour period as less than ½ percent of the creek's total flow during that period. Over an eight-hour pumping cycle, the amount captured was much less. The WSA analysis assumes that no more water is drawn from the creek after pumping stops, but this does not account for water drawn from the creek due to drawdown that remains when pumping stops. This drawdown replenishes the aquifer by pulling water from storage elsewhere in the aquifer and from the creek, either by reversing discharge to the creek or by directly drawing from the creek. Ultimately changes in streamflow are necessary to fill the drawdown because all pumping is a new discharge from the aquifer which must be taken from another discharge from the aquifer. **This analysis error leads the DEIR and WSA to underestimate the amount of water that pumping draws from the creek.** O8a-28b

Surface Water Quality

Total suspended sediment (TSS) is the primary water quality issue for Squaw Creek, although the DEIR also mentions nitrates and phosphorus. Squaw Creek is on the 303(d) list for sediment load (DEIR, p 13-25). DEIR Table 13-7 specifies the TMDL sources and loads and Table 13-8 specifies the target reductions in sediment load. Total sediment production from the watershed is 37,900 tons/y with dirt roads, graded ski runs, and undisturbed areas producing the highest sediment delivery; undisturbed areas are considered uncontrollable so the future reductions must come from other areas. Dirt roads and ski runs are to be reduced by 60 and 50%, respectively. Residential and commercial area sediment loads are to be reduced by 25% but the TMDL is just 200 tons/y from these sources; the project would primarily affect this source. Interestingly, alluvial channel erosion inputs 2100 tons/y and is considered O8a-29

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uncontrollable, but the geomorphic restoration of the trapezoidal channel may reduce erosion and therefore sediment (DEIR Chapter 6, Shaw et al. 2014, reviewed below).

TSS from the site is grossly underestimated because the relations developed to estimated TSS underestimate TSS at high flow rates. This occurs because sediment production is highly nonlinear in this watershed. The error applies to baseline and with project conditions.

The errors may be seen in Shaw and Roberts (2013) Figure 3, which relates TSS flux (kg/day) and discharge (cfs) at the confluence of the north and south forks of Squaw Creek, the Olympic channel, downstream of the existing village, and for runoff from the urban area (determined as the difference in measurements above and below the site) (Shaw and Roberts 2013, p 6-7). At higher flow rates, most data plots above the regression line (Shaw and Roberts Figure 3). This indicates the regression (a log-log regression) line is biased to give results that are too low for flows higher than certain rates. At the confluence of the north and south forks, at flow rates higher than 100 cfs, at least eight points are higher than the regression line while just three are below the line; similarly for the site downstream of the project site, at least twelve points are above while just three are below the line for discharge exceeding 100 cfs. For runoff from the urban areas, at least five points plot above the line and none below it for discharge exceeding 20 cfs. These regression lines will underestimate the sediment flux for flow rates higher than the flow rate at which the actual data plots above the regression line. O8a-29 cont.

At high flows, the sediment discharge equations grossly underestimate TSS. This error carries into the sediment hydrographs for the site for the 100 year event (Shaw and Roberts 2013, Figure 6) and any other return interval event for which flows exceed the values for which the relations are accurate (Shaw and Roberts 2013 Figure 7).

Other sources of error in the sediment runoff estimates include:

- The discharge and TSS/discharge relations (Shaw and Roberts Figures 1 and 3) do not consider whether the flow is on the rise or falling leg of the hydrograph. TSS is usually much higher on the rising leg of the hydrograph as the runoff flushes sediment from the watershed, but none of the analyses account for this issue. O8a-30
- Based on the shape of the simulated storm event hydrographs (Shaw and Roberts Figures 5 and 7, for example), the simulation did not consider snowmelt. To the extent the sediment/discharge relations resulted from flows that were partially snowmelt, the simulated TSS hydrographs are based on the wrong assumptions. O8a-31
- The sediment/discharge relations may be combining points literally drawn from different populations; some points occur during snowmelt runoff, some are likely during baseflow, and some are just rainfall/runoff. The discharge data (Shaw and Roberts Figure 1) clearly range throughout the year, and although many occur in the spring there are also some in the fall. Considering the low flows, some are clearly baseflow (which may have almost no sediment and should not be included in statistics with runoff events). O8a-32
- The relations for the urban area were developed by taking the difference between below and above the site. Due to measurement error, low estimates for urban flow should not be included because they are primarily just measurement error. O8a-33

In summary, total suspended sediment from the site for both existing and with-project conditions for high flows is significantly underestimated. This could lead to faulty design of the channel through the O8a-34

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site because more sediment than designed for could settle thereby decreasing the conveyance capacity. The loss of sediment settling in the channel could lead to cleaner water reaching the meadow which could cause erosion. Failing to consider these sediment budget issues for the channel restoration portion of the project could lead to an incorrect underestimate of the project impacts to the stream channel in the meadow east of the site. O8a-34 cont.

The report also estimates nitrate and phosphorus loads. The same concerns as expressed for TSS probably apply, although the rating curves are not provided. Shaw and Roberts (2013) expects slightly lower loads due to the project, primarily due to slightly decreased flow rates from the project. Those conclusions are probably accurate, even if the predicted loads are grossly wrong, as they probably are due to the way the quality/discharge data were collected. O8a-35

Impact 13-2: Construction phase degradation of surface and groundwater quality

Most of the issues here are addressed with BMPs, which will protect water quality if they work. This impact includes construction dewatering, but the DEIR does not assess how much dewatering will be necessary. Working in the stream while it is flowing would require diversions and dewatering, but that would be mitigated by working during dry periods. A potentially bigger problem is construction where shallow groundwater could flow into the construction works. This could lower the water table and be a source of water that would have to be disposed of in some way. The DEIR requires a dewatering and discharge plan (DEIR, p 13-51), but absolutely fails to discuss what could cause this type of dewatering, where and how often it would occur, and overall what the potential impacts are. The plan for dealing with dewatering has not been made available for review and there is no estimate the type of pollutants the water could contain. Because the depth to water is mostly known around the site, the DEIR should discuss where there will be temporary dewatering and how the water will be disposed. Failing to estimate the quantity and frequency of dewatering is a failure to disclose a potentially significant impact of this project. O8a-36

Impact 13-4: Long-term land cover changes and increased groundwater production effects on groundwater patterns, recharge, and aquifer storage in the Olympic Valley Groundwater Basin

This impact considers two vastly different issues. One is the change in recharge, which is simply due to the change in impervious area over the site. The second is the impacts of increased groundwater production, which is a primary huge impact of the entire DEIR, with impacts on hydrologic and biologic resources. O8a-37

<u>Land-cover changes on recharge</u>

The site is developed now so the impervious area changes on west portion of the project are not substantial. The DEIR concludes any change is less than substantial (DEIR, p 13-53). This is probably correct, although the DEIR fails to actually estimate the recharge rate. Only in the groundwater model portion of the WSA and DEIR analysis is recharge considered. The groundwater modeling completed for the WSA and this DEIR ignores the impervious land cover and simulates a recharge zone all across the west basin, including on impervious developed areas; see the groundwater model review below. This clearly is in error. The recharge rates from this recharge zone did not reflect the fact the area is covered with impervious asphalt and buildings. It may be argued that the overall amount of recharge is the same O8a-38

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but because of impervious area it should have been input to the model differently. However, the amount of recharge estimated is grossly too high because of the high precipitation estimates. O8a-38 cont.

Changes to the East Parcel, which is currently undeveloped, could be important and the DEIR fails to consider them. The project would add "approximately 4.24 acres of impervious surfaces" (DEIR, p 13-53) in that area, but the DEIR dismisses this as not being "in a groundwater recharge zone of importance to the OVGB" (Id.). It is however a tributary to the Truckee River and this lost recharge will be lost to the Truckee River system. While it may just be runoff earlier during the season when the recharge would have occurred, the change in pervious area could change the timing of flow from current conditions; it could decrease baseflow in the Truckee River during the time of year that groundwater discharge to the river is most important. This could be manifestly important in years like this one (2015). Instead of considering it, the DEIR ignores this critical groundwater flow by stating it is not important. O8a-39

<u>Groundwater production effects</u>

Groundwater management is the major groundwater impact of the project because the increased pumpage due to the development would be 234 af/y on top of the existing water use in the valley of 841 af/y, (DEIR, Table 18-11), for a total 1075 af/y. The valley will grow in other ways adding 131 af/y so the total projected demand in 2040 is 1205 af/y. This significant change represents a substantial draw on the aquifer and could substantially impact many biological factors as well. There are substantial issues with how this demand could be distributed through the year. O8a-40

A potential large source of error in the demand is the occupancy rate, which I discuss in greater detail in the review of the Water Supply Assessment in Attachment 2. Occupancy could be up to 80% higher than the estimated rate because the WSA assumes annual occupancy is 55.2% based on observed rates from 2009 through 2011, a significant recession period. Full occupancy would be 80% higher than the recession-era occupancy, therefore the water supply sufficiency estimates should be based on much higher potential demand even if the underlying estimates are accepted as accurate. Actual occupancy will likely be temporally variable, therefore the water supply sufficiency analysis, and analysis of environmental impacts for the DEIR, should consider future demand in a variable fashion. This means that the simulation of future demands should consider periods with occupancy much closer to full. O8a-41

Another issue regarding demand is seasonal timing, as in which seasons the demand is higher and lower. The projections in the WSA rely on past distributions and on the monthly occupancy rates from 2009 through 2011 (Hunt and van Dyne 2014). The projected demand peaks in July and August (Figure 1), which during most years is after recharge has decreased and ceased. The primary issue is that more of the future demand will occur during a period of the year when less water is available. Climate change, which will decrease recharge during late summer, will exacerbate this issue. . O8a-42

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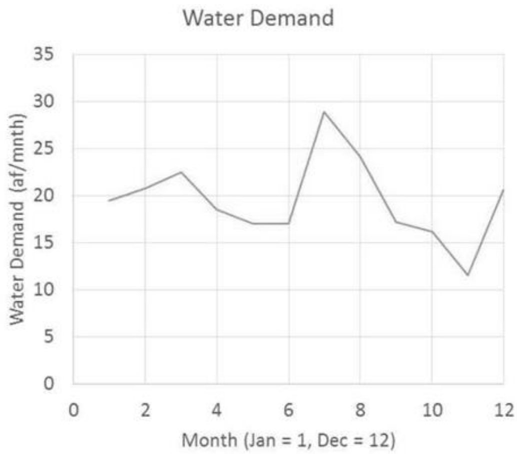

Figure 1: Monthly full-development, 2040, demand for the Village at Squaw Valley. The total is 234 af.

SVPSD uses a MODFLOW-based groundwater flow model to simulate groundwater conditions in the project area (DEIR, p 13-55). Therefore, impacts presented in the DEIR depend on the efficacy of this groundwater model, as do the value of mitigations. The WSA review attached to this memorandum as Attachment 2 reviews some of the earlier hydrogeology studies that go into the groundwater model. I additionally review aspects of the groundwater model as discovered by review of the model input files below. The following comments are of aspects of the analysis that depend on the model or affect the model output. O8a-43a

The WSA concluded six new wells would be necessary "to meet both project and new non-project demands" (DEIR, p 13-55), but they simulated nine potential new well locations in the groundwater model to "better show how the basin as a whole would function with increased demands" (Id.). Taylor et al. (2014) Table 2 shows nine proposed new municipal wells and their Table 3 shows that all of the wells, existing and new with one exception, were simulated to pump the same rate, 54.7 af/y; other entities' wells pump at other rates based on their specific conditions but mostly at rates proportional to their historic pumping. DEIR Exhibit 13-17 shows nine wells labeled as new (07/11, 09/14, 10/12, 15/07, 15/09, 16/10, 23/12, 38/54, and 45/53). The impacts shown in DEIR Exhibits 13-18 through 13-21 are also for all nine wells. The estimated drawdown would be less than if just six wells had been simulated. The simulation of this scenario with more pumping wells than will actually be used is that it spreads the impacts over more wells (Taylor and Reilly 2014). O8a-43b

The DEIR compares with-project conditions to baseline conditions. The WSA refers to baseline conditions as the "maximum saturated thickness values at specific locations do not change, and were **derived from model simulations representing historical actual pumping conditions**" (Taylor et al. 2014, p 14, emphasis added). The DEIR describes baseline as follows: "An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published ..." (DEIR, p 1-3). This implies that groundwater baseline would be the actual water levels that existed when Placer County issued the notice of preparation, or October 10, 2012, but O8a-44

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that is not what the DEIR nor WSA use as baseline. Baseline as used in the DEIR and WSA is a 20-year time series of simulated groundwater levels as determined based on simulated pumping in the groundwater model at rates that pertain to the year prior to the baseline date. Baseline as shown on DEIR Exhibits 13-18 and 13-20 is a 20-year time series of water levels at various well locations in the project area.

At locations with wells, baseline is a time series of water levels at those wells as affected by the pumping, and seasonal and annual variability in recharge. Between the wells, baseline is the groundwater level resulting from seasonal and annual recharge and as affected by the overlapping drawdown from the various pumping wells. This creates unusual comparisons among baseline and with project or 2040 WSA conditions because the pumping distribution is different. In some locations, the baseline conditions does not have a pumping well. Because the with-project or 2040 WSA conditions have more wells and less pumping per well, the future conditions at some locations have less drawdown than occurs at present due to spreading the effects over more of the valley. Comparison of the differences between with project and baseline conditions shown on DEIR Table 13-11 shows there is more decline (difference between conditions caused by existing pumping and with-project pumping) at the new wells than at the existing wells (average decline for average, max, and min for the new wells is 1.75, 1.11, and 3.65 and for the existing wells is 1.23, 0.71, and 2.33 feet). An additional factor spreading the effects over a larger area is that the DEIR underestimates simulates pumping over nine new wells rather than the planned-for six new wells. O8a-44 cont.

The maximum saturated thickness "occurs when water levels are the highest" (WSA, p ES-3, p 6-5, Taylor et al. 2014, p 14) for the baseline conditions. This occurred in J-93 (DEIR Exhibit 13-18). Table 13-12 also shows the Max saturation to be 99 or 100% for most of the listed wells. The percent saturation is the percent that aquifer saturated thickness is of the saturated thickness occurring at the maximum water level in J-93 (Exhibit 13-20).

The DEIR specifies that maintaining 65% is acceptable (see the next paragraph) for water supply in the valley. Simulations as shown for project-only conditions (DEIR Exhibit 13-19) show the average saturation remains above 80% and only for a few wells in a few years falls below 80%. Their significance criteria based on 65% saturation are not reached. This of course depends on the model being accurate.

The 65% saturation criteria is an operational threshold for maintaining the ability to pump the water from the wellfield and has nothing to do with maintaining any environmental conditions. Taylor et al. (2014) decided on 65% after a literature search because that was the deepest drawdown recorded in the past at existing wells onsite and it did not cause a problem at any wells as far as they knew. 65% is simply the necessary saturation to maintain well pumping efficiency and is meaningless with respect to basinwide groundwater management. The guidance has nothing to do with maintaining a yield or not causing other deleterious impacts to the basin, such as lowering discharge to streams and springs. It also does not consider the cumulative effects of overlapping drawdown cones. In other words, the drawdown from one well will affect nearby wells so that the drawdown at any point is a summation of drawdown from each well. It is possible that the saturation could fall below 65% due to these overlaps. O8a-45

The DEIR cites the WSA in concluding that the increased groundwater pumping "would not cause any of the wells to drop below 65 percent saturation thickness for more than three consecutive months or more than four times during the study period" (DEIR, p 13-55). As noted, this has little to do with environmental effects and it also depends on the simulation pumping from nine rather than the

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proposed six wells. The implication is that if development occurs as proposed in the WSA, the impacts would be less than significant, and only if "different wellfield construction or operations are ultimately implemented, groundwater availability and wellfield operations could be adversely affected" (DEIR, p 13-63). By design, if the WSA well construction plans are followed, they will be different from those simulated in the model. O8a-45 cont.

Mitigation measure 13-4 is designed to assure that development occurs "consistent with the system analyzed in the WSA" (DEIR, p 13-63). If there are development changes, the mitigation is to ensure the effects are similar; essentially the model would be run based on proposed new conditions and the results compared with the saturated thickness requirements and to not cause drawdown that will "cause substantially more refugia pool drying" than shown in GANDA (2014) (DEIR, p 13-64). Other requirements are that the pumping meet criteria identified in the applicable groundwater plans. New wells would be added to the existing monitoring system, and new data would be used to update existing groundwater plans (DEIR, p 13-64). O8a-46

The drawback of this mitigation is the assumption that the hydrogeology that went into predicting the with-project conditions is accurate. It assumes the groundwater model accurately predicts the future conditions. I review the model in detail below, but one big problem is that any groundwater model used to predict conditions for pumping in excess of rates used for calibration, or in excess of rates ever observed at the site, is that the aquifer may respond differently at higher pumping rates than it does during the calibration conditions. In other words, the further beyond the range of conditions used for calibration the system is stressed, the more inaccurate predictions may well be.

Impact 13-5: Groundwater pumping changes to groundwater and surface water interactions and water quality within and downstream of the plan area

The DEIR considers the drawdown beneath model cells used to simulate Squaw Creek. The DEIR does not estimate flow into or from Squaw Creek along its reach because the model was not calibrated to do so (my review on the groundwater model suggest they should have calibrated flow to the creek because they have sufficient data). The DEIR presents stream boundary cells through the project domain along Squaw Creek (DEIR Exhibit 13-22). It divides the boundary into seven reaches with simulated groundwater monitoring wells at 24 points along the creek (counted from the exhibit). The simulated water levels in the groundwater monitoring wells is not the water level in the stream, which depends on the flow depth in the stream. If the groundwater level is higher than the flow depth, groundwater will flow from the groundwater into the stream; if it is lower than the stream, stream water will flow into the aquifer. The DEIR should present simulated flux to/from the seven reaches rather than to the stream as a whole. O8a-47

The qualitative observations of the simulated water level hydrographs (DEIR, p 13-67) are generally accurate, but may not go far enough. These simulations reveal significant issues with the proposed pumping. Under all conditions, there are "strong seasonal ranges in groundwater elevations" (DEIR, p 13-67) and "year-to-year variations" (Id.) which are "slightly less than the seasonal range in any given year" (Id.). The greatest reductions are in the far west cells, and the magnitude of decrease is less in the east nearing and through the meadow. DEIR Exhibits 13-23 to -27 provide the water level hydrographs. Interestingly, there are many years (DEIR Exhibit 13-23) during which the groundwater levels in the far west cells do not rise above the streambed. These graphs suggest the pumping is not a problem because groundwater only rarely reaches the stream. Because the stream flows every year regardless of O8a-48

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drought conditions (Hydrometrics 2013b and c), either the groundwater is not connected to the surface water or the model conceptualization is wrong for the west portion of the site. Possibly the model inaccurately simulated recharge from the stream channel in this area (see the model review). O8a-48 cont.

The area within which the groundwater levels are drawn the furthest below the streambed is the "area where the most new wells are planned" (DEIR, p 13-67). Exhibit 13-17, snapshotted into Figure 2, shows that seven of the nine proposed new wells are in the west end of the project area. The DEIR should consider an alternative of putting some of the new wells further east, but still within the proposed development area, to estimate impacts and compare them to the proposed project.

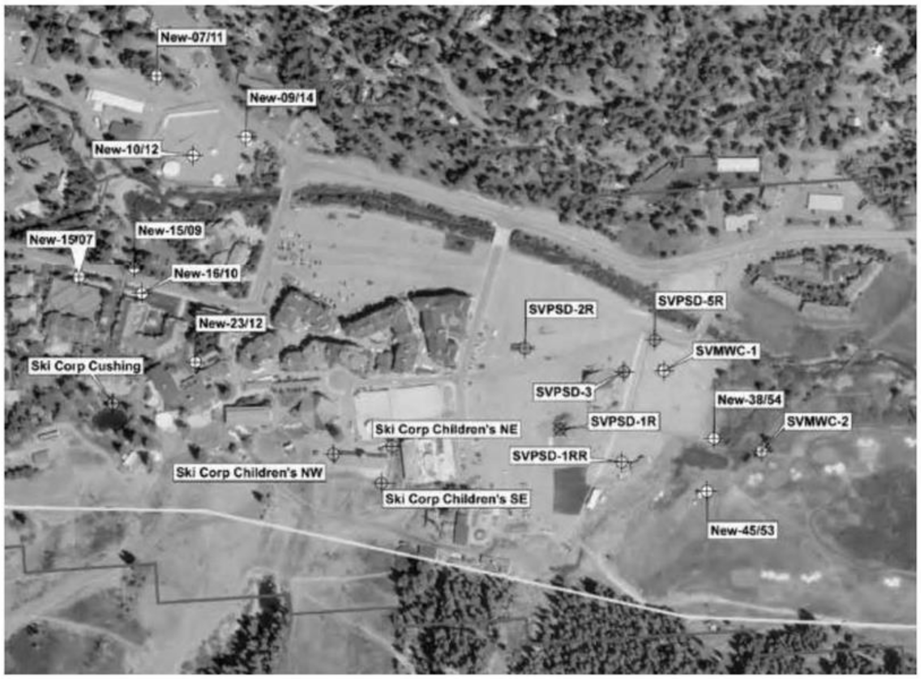

Figure 2: Snapshot of a portion of DEIR Exhibit 13-17 showing the west project area and the location of existing and proposed new wells.

O8a-49

Actual impacts depend on the final locations for the groundwater wells and how they are operated (DEIR, p 13-65). The DEIR provides no rationale for the locations of the proposed new wells. The DEIR suggests that wells near the creek will have little impact during the winter when the stream is full or in the late summer when the stream is empty, but that pumping from wells near the creek during mid-summer when the flow is receding from snowmelt runoff to baseflow will have a significant effect. As noted above in the biology section, this pumping will increase the length of stream that is dry and the time period over which it is dry, along with increased depths to water near the stream. That the DEIR recognizes this suggests that it should consider a project alternative that includes pumping from wells either to the south or east of the creek during mid-summer conditions to limit the impacts to the creek.

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It also suggests that the new well locations may not be optimal with respect to minimizing the effect on the creek. O8a-49 cont.

Further east, during most years the simulated groundwater level is above the stream bottom for parts of most years (DEIR Exhibit 13-24 - -26). The length of time the level is below the stream bottom is longer during many years at many points, but the graphs are too coarse to make any definitive observations. The water level drops below the stream bottom as much as 10 feet further for the 2040 WSA conditions than for baseline. To assess the effect of lengthened dry periods and of the time the groundwater level is below various depths, the DEIR should present depth/frequency plots for each point. Simply, the plot should show the proportion of time the water level is below various depths. For example, there would be a percent time the water level is below various levels. Such graphs would improve the assessment of the time the water level is below various critical depths, as may be important for riparian species or other species requiring wet refugia. O8a-50

Interestingly, Exhibits 13-25 and -26 show the existing stream bed and the proposed level of the restored streambed. For three of the four model cells, the restored bed will be lower than the existing streambed, but in one cell (West Cell I), the restored bed is about 2 feet higher than existing. The groundwater model only uses the existing streambed elevation, so it is not appropriate to make conclusions from these graphs regarding changes in water level due to restoration. Simply because the streambed will be lower does not mean the stream will more frequently be wet. More information regarding the restoration is needed to know whether the stream bottom will be wet. O8a-51

Finally, water level hydrographs for the east cells (DEIR Exhibit 13-27) are above the streambed much more frequently, both for baseline and with project conditions. Groundwater therefore discharges to the stream most years, but there are a few dry years with substantial time periods during which the groundwater is below the stream bottom. These sites are in the western third of the meadow area. The DEIR should present similar results further east in the meadow to verify that groundwater levels are likewise generally higher than the streambed. O8a-52

Impact 13-5 would be mitigated by implementing Mitigation Measure 13-4. I discussed above that this mitigation essentially assumes the hydrogeology and modeling completed for the WSA are correct and appropriate for this analysis. O8a-53

Impact 13-6: Reconfiguration of Squaw Creek and the Olympic Channel

The DEIR portrays the geomorphic restoration of the Squaw Creek and the Olympic Channel as a positive impact unless it is not properly done, so the mitigation is to simply assure that it is done properly. The DEIR makes various claims but provides no analysis to support those claims.

The DEIR assumes the design objectives (DEIR, p 13-75) will be met therefore the project will be positive. The objectives concerning sediment transport and conveyance are difficult to verify and fail to consider some downstream impacts. A broader channel with various flow-slowing snags will capture sediment and allow the stream floodplain and banks to grow naturally. In concept this is correct, as analyzed by Shaw et al. (2014). O8a-54

Squaw Creek bed load was approximately 80% of the total sediment load in 1988, a year with above-average flow (Shaw et al. 2014, p 9). They recognize that the proportion could change during drier years. Sediment load is divided relatively equally between north and south forks, but 25 to 30 percent O8a-55

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of total sediment load is from Olympic Channel (Shaw et al. 2014, p 10). The even split between north and south forks seems inconsistent with the fact that the south fork contains geology with more erodible volcanics than the north fork.

The current trapezoidal channel efficiently passes sediment to the downstream meadow which causes sedimentation problems there (Shaw et al. 2014, p 12). There is also some deposition above the north and south fork confluence (Id.). Capturing sediment in the restored channel will decrease sediment entering the meadow reach, which could increase the erosive capacity through the meadow. Flow with lower sediment content can be considered "hungry" for additional sediment and disturbed sections of the channel in the meadow could more easily erode to satisfy that additional sediment transport capacity. If the restoration increases the flood conveyance capacity, less water will be temporarily detained so that flow rates through the meadow could be increased. Thus, increased flow rates with lower sediment concentration could cause more erosion in the meadow. The DEIR has simply not considered these impacts. O8a-55 cont.

Impact 13-7: Long-term management of runoff volumes, peak flows, and snow storage, and risks of potential degradation to water quality.

Stormflow from the site would decrease slightly due to different flow paths through the site. Flows from above travelling through the site would change very little due to only minor influence of the project offsite (DEIR, Table 13-14). These estimate flows were used with the TSS relations to estimate TSS loads for various storm return intervals. Analysis above of Shaw and Roberts (2013) showed how the TSS loads may be grossly underestimated due to the misapplication of statistical methods. However, the project will not have large effects on the sediment entering the site. According to the TMDL analysis, the annual sediment delivery from (uncontrollable) undisturbed sources is 14,000 t/y and from (controllable) dirt roads and graded ski runs is 9300 and 9000 t/y, respectively (DEIR, Table 13-8). This sediment loading is from sources that would be allowed to pass through the site as "upstream clean" runoff through the Mountain Interception and Conveyance System (DEIR, p 13-77). The residential/commercial area generates a sediment flux of just 200 t/y (Id.), so the existing development is not a significant cause of the 303(d) listing nor a significant source in the TMDL. Predicted TSS from the main village area (DEIR, Table 13-7) is of similar order of magnitude to the TMDL calculations (DEIR, Table 13-8), which indicates the site will have little effect on the TMDLs for the valley. In fact, the DEIR touts the mountain system as preventing the offsite water from entering the onsite LID systems (DEIR, p 13-79) so that it can treat onsite water better. Paradoxically, this may have the effect of allowing more sediment to pass through the site and into Squaw Creek because the offsite runoff will not receive any treatment and therefore may reach the Creek with less sediment removed than there is currently. The DEIR does not consider the ancillary benefits of allowing some offsite water to mix with the onsite system. O8a-56

The DEIR mentions low impact development (LID) stormwater quality protection measures but, other than in passing does not list the measures nor provide any substantial description of an LID measure. It is therefore difficult to review the value of the LID measures and, therefore, the DEIR fails to adequately disclose the measures being used to assure that poor water quality does not run off the site. O8a-57

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Cumulative Impacts

Chapter 18 considers cumulative impacts for the project, primarily considering the effect of additional development in Olympic Valley on water resources because groundwater development beyond the local valley would have no impacts on the water levels within the valley. The existing water use in the valley is 841 af/y, and the Village at Squaw Valley project would add 234 af/y to the use by 2040 (DEIR, Table 18-11). Other cumulative projects would add 131 af/y by 2040 for a total of 1205 af/y (Id.). Simulations of the additional pumping increases the groundwater declines over baseline by an additional several feet, but the reduction in percent saturation never goes below 65%, so the DEIR concludes the impacts of pumping for the cumulative condition is less than significant, as long as the previously mentioned mitigation measure is observed. The WSA discussed many of the water resources' issues regarding the 2040 demand, and my review of that document covers those issues. O8a-58

Groundwater Model

The DEIR uses a numerical groundwater model (Hundt and Williams 2014, Hydrometrics 2013, West-Yost 2003, Williams 2001) to assess the environmental impacts of meeting demand in the Squaw Valley. The WSA used this model to assess the ability of the aquifer to meet demand by determining how proposed pumping will affect the percent saturation of the aquifer. The review of the WSA describes the conceptual flow model for the area. Williams (2001) developed the model initially; there have been several updates since then (Hydrometrics 2014, 2013a, 2007a and b). The model is difficult to review because no one report thoroughly documents its current structure and accuracy. However, the important aspect is how well it performs today.

Hydrometrics provided MODFLOW input and output files for three scenarios for review. The scenarios were baseline, calibration, and WSA runs. I read the MODFLOW files into GWVistas™ to visually review the models. Hydrometrics set hydraulic conductivity equal to 100 for all model cells so it was not possible to actually run the model. The output files were .hds and .cbb files, or head save and cell by cell flow files. Head save files have the water table or potentiometric surface for each cell and cell by cell flow files have flows through the six sides of the cell and change in storage for that cells. Having read the MODFLOW files, I could read the hds and cbb files and look at the results graphically. I could also use features in GWVistas™ to consider mass balance analyses, to plot profiles along any transect, and to plot flow or flux hydrographs. For example, I could determine the model recharge for any time step over any section of the model. O8a-59

The calibration model runs had 237 time step, with the first one being steady state. The 236 transient time steps totaled 7184 days, or 19.68 years. Based on the location of a 28 day period, for February, the first transient period is May 1993. Starting with the fourth February, leap days were considered. The last month was December 2011. The Baseline and WSA runs did not start with a steady state simulation. The baseline and WSA runs were transient using 228 transient periods.

<u>Model Structure</u>

Figure 3 shows layer 1 and a cross section of the model at column 17, on the west end of the model. The green line through the middle of the grid is a stream boundary for Squaw Creek including the North and South Forks in the far west and a tributary in the meadow. It is actually divided into numerous Stream segments not identified on the figure. O8a-60a

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