Rainfall to Groundwater

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Santa Clara County Department of Planning & Development

Attn: Robert Salisbury, Senior Planner
transmitted via email attachment to:
sgtquarry.comments@pln.sccgov.org

RE: Sargent Ranch Quarry DEIR SCH # 2016072058

Dear Robert,

I am concerned that the County's evaluation of impacts of the proposed project on the federally threatened South-Central California Coast Steelhead is inadequate. My intention is to explain, with literature documentation, why that is so, including a potential impact for which sound documentation only became available after this draft document was released for public comment. The specific determination that concerns me, along with related determinations, is:

> Impact 3.4-3: Project activities would result in adverse effects on special-status fish and their habitat. (Less than Significant with Mitigation)

The overarching impact of concern is the **permanent loss of subsurface water detention storage** supporting Pajaro River baseflows through the removal of water detaining substrates that is the objective of the mine project. Removal of detention storage will impact Pajaro River baseflows supporting steelhead in a manner not considered in the DEIR. I begin with a summary, followed by literature support for my comments, integrated with discussion.

Summary

The discussion of Impact 3.4-3 in the main document, along with that in Appendix I.2 by Todd Groundwater focuses on the project's annual ***consumptive water use***, completely disregarding the **detention storage** that will be permanently lost through removal of water-detaining substates that are currently recharged each rainy season.

I do appreciate that Todd Groundwater even considered the project's impact on baseflows pertinent to steelhead, since that is a too-often overlooked relationship. However, their evaluation of solely the project's consumptive uses surely reflects a blind spot, if not willful misdirection. Unfortunately, this is a blind spot for many in both surface and groundwater hydrology who are so immersed in their focal topics that they fail to consider the vadose zone between surface and groundwater where their disciplines' standard equations have no applicability. For a snapshot comparison, please see my page, Retention vs Detention Storage.

In summary, precipitation infiltrated, then percolated through the ground in *detention storage* is gradually making its way, via gravity, toward its connected drainage path, typically in temperate regions toward the water table, which itself is in continual, gravity-driven flow, eventually emerging as surface water in stream baseflows, estuaries and/or the ocean. That extended-time process prolongs baseflows into California's dry season and, moreover, ensures **cold** baseflows, which are, by definition, fed by groundwater and thus typically cold, as certainly has been the case on historical steelhead streams such as the Pajaro River. Baseflows also support hyporheic zones that can be vital components of aquatic ecosystems. Note that I labeled the hyporheic zone in the diagrams on my page, Stream Networks vs Watersheds/ Catchments (click diagram to enlarge).

Streambank storage occurs in intact (well vegetated) riparian zones that receive subsurface flows from upslope, among the components of catchment detention storage. "Effects of bank storage and well pumping on baseflow, Carmel River, Monterey County, California"(Kondolf and colleagues 1987) documented the ability of bank storage to sustain flows on this regulated river "during May and

June, months of critical importance to the downstream migration of steelhead trout smolts (Kelley et al. 1982) and probably to the success of willow seedlings" (Kondolf and colleagues 1987).

In contrast, land uses that promote overland flow, such as the impervious surfaces that typically accompany urbanizing land uses, cause seasonal storm hydrographs to peak sharply and early, sending more precipitation rapidly onward to drainage, without time to soak into the ground, nor feed late-season baseflows.

And this is why, especially in the regional context of the DEIR's description of the proposed Strada Verde Project, in 3.1.6.2, the proposed Sargent Ranch Quarry project's elimination of catchment detention storage will result in **cumulative impacts** to cold baseflows supporting Pajaro River steelhead and other aquatic species. Perhaps the project proponents may care to take a stab at estimating the fraction of detention storage in the Pajaro River watershed that will be consumed by the project, as has been their tack in this document – as though those estimated low percentages of impacts don't matter. But isn't that the point of assessing cumulative impacts??? Those small percentages add up and become especially significant in the case of species whose populations are already threatened. So add the project's *consumptive* use of water to that prematurely lost to drainage through **permanent loss of detention storage**.

[Another potential cumulative impact on Pajaro River steelhead is that posed by the proposed Pacheco Reservoir Expansion, including their purported aids to steelhead, whose populations they've decimated elsewhere within their domain, but since ***this DEIR appears biased in favor*** of that project, I'll set that aside for now.]

Whereas the Todd Groundwater comments point to existing degradation of the river – seemingly as a rationale for diminishing the proposed quarry's impacts – I say it's the other way around. This river is barely supporting its steelhead population and other sensitive fish species and removing detention storage will constitute one more, of many past and proposed future, blows against the federally threatened species pertinent agencies are striving to recover. **A cumulatively significant impact!**

Furthermore, the quarry project's proposed impacts to detention storage supporting Pajaro River baseflows that, in turn support cold aquatic habitat features hosting the steelhead life cycle are irreversible. Clearly, the removal of substrates currently supporting detention storage constitutes a **permanent and irreversible loss**.

Therefore, please add the following to these pertinent sections:

5.2 Significant and Unavoidable Impacts,

Loss of watershed detention (catchment) storage supporting baseflows integral to the Pajaro River population of federally threatened South-Central California Coast Steelhead

5.3 Irreversible Impacts

Loss of watershed detention (catchment) storage supporting baseflows integral to the Pajaro River population of federally threatened South-Central California Coast Steelhead

Literature Support and Discussion

The following freely accessible report is highly recommended to the County as a foundational tool for understanding my comments, as well as for improving the County's comprehension of the subject in general:

Winter, T. C., J. W. Harvey, O. L. Franke, and W. M. Alley. 1998. *Ground Water and Surface Water: A Single Source.* U.S. Geological Survey Circular 1139, Denver, Colorado. https://pubs.usgs.gov/circ/circ1139/

As easily deduced from the date, these interrelationships are hardly new information, yet this knowledge remains murky, if not opaque to most planners, among other land and natural resource professionals, including many, if not most, civil engineers practicing as hydrologists/hydraulicists. In fact, the intent of this document is to serve as a public education too, supporting sound public policy decisions, so please take heed!. From the Foreword:

> Its intent is to help other Federal, State, and local agencies build a firm scientific foundation for policies governing the management and protection of aquifers and watersheds. Effective policies and management practices must be built on a foundation that recognizes that surface water and ground water are simply two manifestations of a single integrated resource. It is our hope that this Circular will contribute to the use of such effective policies and management practices.

Pertinent excerpt from the Preface, p VII, under heading, "Characteristics of Aquatic Environments"

> Mixing of ground water with surface water can have major effects on aquatic environments if factors such as acidity, temperature, and dissolved oxygen are altered. Thus, changes in the natural interaction of ground water and surface water caused by human activities can potentially have a significant effect on aquatic environments.
>
> The flow between surface water and ground water creates a dynamic habitat for aquatic fauna near the interface. These organisms are part of a food chain that sustains a diverse ecological community. Studies indicate that these organisms may provide important indications of water quality as well as of adverse changes in aquatic environments.

I consider this entire document incorporated by reference, so I absolutely encourage county staff to review the entire contents for application to other situations beyond the current context, but the figures offer helpful overviews. Figures 3-5 offer conceptual diagrams pertinent to the County's scale of concern and Box A. "Concepts of Ground Water, Water Table, and Flow Systems" offers a hybrid overview.

The section, "Interaction of ground water and streams", page 9, along with Box B " The ground-water component of streamflow", page 12 and Box F " The interface between ground water and surface water as an environmental entity", page 28, are especially pertinent to the Sargent Ranch Quarry DEIR. Note the discussion of the hyporheic zone there. And Figure 20." Water from precipitation moves to mountain streams along several pathways", page 34, provides especially helpful insight to the case at hand – assume that the proposed quarry will be removing materials from both the soil and unsaturated, as well as ground-water zones depicted in those diagrams.

While Winter and colleagues' (1998) consideration of the "Effects of human activities on the interaction of ground water and surface water" did not include surface mining, extrapolation may be made by considering the aforementioned figures, sections and boxes, along with the below excerpt from, "Removal of natural vegetation", page 69:

> To make land available for agriculture and urban growth, development sometimes involves cutting of forests and removal of riparian vegetation and wetlands. Forests have a significant role in the hydrologic regime of watersheds. Deforestation tends to decrease evapotranspiration, increase storm runoff and soil erosion, and decrease infiltration to ground water and base flow of streams. From the viewpoint of water-resource quality and management, the increase in storm runoff and soil erosion and the decrease in base flow of streams are generally viewed as undesirable.

More recently, scientific journal articles have considered subsurface hydrology to be a woefully unexplored "frontier":

Grant, G. E. and W. E. Dietrich. 2017. The frontier beneath our feet. *Water Resources Research* 53:2605-2609. https://doi.org/10.1002/2017WR020835 (free access)

This work offers an overview of current understanding facilitated by ongoing "Critical Zone Observatory" research. Their Figure 2 is especially worth reviewing. Their final line: "The critical zone is critical because it is not only where we live, but affects most of what we depend on to live."

Close on the heels of that article and citing it, is this brief overview of how traditional "paired catchment" studies have almost universally overlooked subsurface storage in their water balance calculations. It is not open access but the pdf may be downloaded at the second URL below.

McDonnell, J. J., J. Evaristo, K. D. Bladon, J. Buttle, I. F. Creed, S. F. Dymond, G. Grant, A. Iroume, C. R. Jackson, J. A. Jones, T. Maness, K. J. McGuire, D. F. Scott, C. Segura, R. C. Sidle, and C. Tague. 2018. Water sustainability and watershed storage. *Nature Sustainability* 1:378–379.
https://doi.org/10.1038/s41893-018-0099-8
https://par.nsf.gov/servlets/purl/10083537

Some excerpts:

> … perhaps the biggest and least-studied effect on response variability is subsurface storage. This belowground storage is defined as the water in the rooting zone, or affected by it, that influences how precipitation is partitioned between transpiration and streamflow.
>
> … The age of water that leaves that storage and enters into the streamflow varies from years to decades — hinting at considerable reservoirs of stored water in soil, weathered rock and glacial deposits that paired watershed studies often ignore.
>
> … And the water used by trees can be many decades old [15], well beyond the timescale of the paired watershed annual water balance calculation. The ability of deep-rooted trees to access stored water has fundamental implications for the sensitivity of streamflow to forest management. However, relatively little is known about how forest access to these different water storages evolves following disturbance.
>
> 15. Zhang, Z. Q., J. Evaristo, Z. Li, B. C. Si, and J. J. McDonnell. 2017. Tritium analysis shows apple trees may be transpiring water several decades old. *Hydrological Processes* 31:1196-1201.
> https://doi.org/10.1002/hyp.11108
> https://onlinelibrary.wiley.com/doi/am-pdf/10.1002/hyp.11108
>
> (McDonnell and colleagues 2018)

Stepping back into the early 20th century, we find that this subsurface "frontier" of contemporary times had actually begun to be explored decades earlier regarding water resource relationships – notably by forest hydrologists, who, prior to the later heyday of tree removal for "water yield", had initiated scientific investigations into this frontier, using the tools of their time to great advantage.

Charles R. Hursh was noteworthy among these, approaching the establishment of the Coweeta Hydrological Laboratory in the Appalachian Mountains of western North Carolina from a notably ecological perspective (U.S. Forest Service 1991) (actually he was a "proto-ecohydrologist") and articulating some of the first conceptions of the role of subsurface flows in the water cycle, such as in Hursh (1936), Hursh and Brater (1941) and Hursh (1944). This is just a sampling of papers by Hursh, but my all-time favorite is especially pertinent to the present context:

Hursh, C. R. and P. W. Fletcher. 1942. The soil profile as a natural reservoir. *Proceedings Soil Science Society of America* 7:480-486. https://doi.org/10.2136/sssaj1943.036159950007000C0082x

Since it has only recently once again become available on the regular internet, I encourage downloading while it remains available – especially given its pertinence in supporting my points.

This 1942 paper articulates **detention storage** as such, and much more, including a quantitative analysis of catchment storage.

There is much more I could share about Hursh's insights but this is not the place, and in fact, I am working up a review article to be submitted to a peer-reviewed journal on my greater topic, so look for that in the future. To be sure, it points to Hursh's leadership, among others.

As for why such leadership has not been followed up by practicing hydrological and hydraulic professionals in ensuing decades, it is a long story about which I've developed some hypotheses, but, again, this is not the place for that. Suffice it to say that practicing hydrological and hydraulic professionals in the U.S., at least, have, nearly without exception, not been trained in, or elected to ignore the holistic insights of the forest catchment hydrologists. Instead, they have split into surface versus groundwater hydrology. In between has been a "no hydrologists zone".

"Hydrologists' equations for surface flows are hyperbolic, while those for groundwater are elliptical" (paraphrased from Professor V. M. Ponce, personal communications). I've repeated that on at least a couple of my Rainfall to Groundwater pages, including Stream Networks vs Watersheds/ Catchments and Surface-Groundwater Systems in a Holistic Water Cycle. As especially suggested on the latter page, biology has as much, if not more, influence on the vadose zone – that "no hydrologists zone" between surface and groundwater– as it does on surface hydrology.

But, perhaps especially for that reason, hydrologists functioning in civil engineering capacities put all their energies into an overarching, strictly physical science/mechanistic **"plumbing" paradigm** that responded to the 20th century public demand for perceived "control" over natural hydrologic systems. In fact some even admit that. At a Stanford meeting of water professionals a few years ago that emphasized Flood-MAR (Managed Aquifer Recharge), one attendee was quoted as quipping that recharge is "just a matter of plumbing and pipes" – completely oblivious to how Nature manages to accomplish recharge on **intact catchments** with no more than natural infrastructure. See my 2019 blog post, How Does Groundwater Get There? Some Basics

So, there you have it, county planners – aren't your hydrological/hydraulic engineering consultants among the most expensive? They command exorbitant rates by mystifying other disciplines with fancy (reductionistic) calculations (using computer programs) and somehow their (plumbing paradigm) solutions tend to be the most expensive, employing hard, carbon-emitting gray infrastructure and mandating ongoing costly maintenance and successive engineering "fixes" to correct the mistakes arising from past "assumptions". The plumbers need these mined materials to keep generating and repairing the gray infrastructure. [Caveat: I exclude Todd Groundwater's (2020) regional groundwater modeling from this perhaps cynical hyperbole, as my quick review found it reasonably comprehensive.]

Yet, presumably out of ignorance rather than avarice, most of these consultants tend to completely overlook the natural functions of catchments, how they've become degraded through historical human land uses and how those functions may be restored, as a far less costly approach using green infrastructure. As long as the public and their representatives remain captive to this plumbing paradigm, we will be paying increasingly more for our developed water resources. The proposed Pacheco Reservoir Expansion is a prime local example – paying a ***LOT*** more to store the same amount of water, while proposing a mechanistic Disneyland for steelhead. The local Plumbers.

California's Natural Resources Agency and Department of Water Resources fare no better on this score and that is among the motivations for the review paper I'm working up. They are simply blind to the vast opportunities to restore historically degraded watershed detention storage, so their best shot is Flood-MAR. 'Think that will do it?

I don't believe Todd Groundwater intended to mislead by overlooking detention storage. The vadose zone simply lies outside their skill set so they probably don't think about it much.. In fact, their analysis does point to the loss of detention storage – they just haven't described it in those terms. More on that follows.

If you happen to poke around on my Rainfall to Groundwater website, you should quickly learn that I emphasize restoration of especially woody, along with other native perennial plant species to degraded watersheds/catchments now dominated by nonnative annual grasses. I recognize that such nonative annual grasses dominate much of the substrates to be directly removed through the proposed mining process. If the Sargent Ranch site was farther inland, that land cover type might be a concern with respect to infiltration and detention storage capacity of the land.

However, the near proximity of the site to the Monterey Bay and Pacific Ocean–oceanic atmospheric source of our precipitation and high relative humidity – does much to mitigate the impacts of the annual grasses on infiltration and percolation. Furthermore, Table 3.7-1 Soil Types at Project Site, indicates that all soils on the site are "Well-drained". That point is reiterated at several points in the DEIR.

While existing site conditions likely cause more rapid subsurface drainage than would likely occur if the site was clothed with its original oak woodlands/ forest, these substrates nevertheless are clearly subject to subsurface flows that essentially prolong the rainy season by routing precipitation through the soil, from which it takes some amount of time (yet to be determined) to reach baseflows supporting steelhead habitats.

In searching for the 2015 Draft Northern San Benito County groundwater model update and enhancement cited by Todd Groundwater as a "calibrated regional groundwater flow mode" in Appendix I.2, I found only the 2020 update by Todd Groundwater. There, in section 2 .Boundaries of the Basin, Model and Watershed, they state,

> The basin consists of unconsolidated to slightly consolidated sediments **with primary porosity that store and transmit significant quantities of groundwater**. (emphasis added)

In discussing the rainfall-runoff-recharge model they developed for the region, section 7.4. Runoff and Infiltration, page G-9, they state,

> The infiltration percentage for excess rainfall ranged from 55 percent in commercial and industrial areas to **87 percent in large turf areas and upland natural vegetation.**
> Todd Groundwater 2020 (emphasis added)

That only further supports my point that the infiltration capacity of the site's substrates is fairly high, despite the predominant cover of nonnative annual grasses. Additional comments on the Todd Groundwater analysis follow.

An objective of Rainfall to Groundwater is to encourage water agencies to pay rangeland owners/managers (including public agencies and nonprofits) for the restoration and management of the watersheds/ catchments that feed their local groundwater – as a much more cost-effective storage approach that will only improve over time, in contrast with expensive engineered approaches like new surface water reservoirs that require expensive ongoing maintenance. This approach will benefit both human users of groundwater and ecosystems supported by it.

In the case of the Sargent Ranch site, a proposed **alternative future** might see Valley Water and perhaps other agencies concerned with the greater Pajaro River watershed and its groundwaters supporting the restoration and management of catchment functions on the land, in which restoration of native plant species, especially oaks and other locally native woody species, would increase the infiltration and detention storage capacity of these lands, helping to further extend the site's subsurface contributions to Pajaro River baseflows longer into the dry season – enhancing groundwater supplies as well as steelhead habitat conditions and cumulatively helping to reduce flooding on the watershed. This was mentioned in my doctoral dissertation abstract, *Watershed Restoration for Baseflow Augmentation* (Jigour 2008-11).

While even scientific research conducted in the U.S. has been slow to examine subsurface water relationships since the time of the forest hydrologists [although elsewhere in the U.S. and in the world, some have been ahead of the game – see my January 31st blog post, Who Values Catchments More Than CA?] some progress is being made in the National Science Foundation-funded Critical Zone Observatories research referred to by Grant and Dietrich (2017) that includes sites in California's southern Sierra Nevada (Anderson and colleagues 2008) (see also Kirchner and Bales, undated). Most of the papers published to date from that research deal with the forested foothill and higher elevations, but a few have published some insights from the instrumentation they've installed in the lower elevation (around 1,000 feet) San Joaquin Experimental Range, long managed by the U.S. Forest Service.

This site is described as oak savanna. "Vegetation consists of scattered blue oak *(Quercus douglasii* Hook. & Arn.) and interior live oak *(Quercus wislizeni* A. DC.) with naturalized annual grass" (O'Geen and colleagues 2018). Further details are provided on the soil type. This paper certainly supports the notion of subsurface storage, emphasizing the entire regolith and especially storage afforded by weathered bedrock, but primarily at their higher elevation, forested sites.

Surprising to me, however, was that, "In the oak savannah (San Joaquin) site, similarities in water content at all depths in 2015 and 2017 show that this site has little water storage." (O'Geen and colleagues 2018) 'Took me a while to digest that and while they do acknowledge that their sensors were placed below the rooting zone of the annual grasses and perhaps that merits closer examination, their net assessment, including a shallower regolith there, actually supports my contention of the degradation of catchment functions through long-term impacts of human land uses on these rangeland catchments – especially the decimation of woody plant species and the replacement of native cover by the exotic annual grasses that quickly consume precipitation early in the wet season, then die out with the end of spring rains. So far, I've not seen the issue nor comparison of impacts of historical human land uses among sites mentioned in the California Critical Zone Observatory research I've reviewed to date and I've reviewed most of it by now.

However, research conducted on another inland site, on Sierra Nevada rangelands farther north, "Catchment-scale soil water dynamics in a Mediterranean-type oak woodland" (Swarowsky and colleagues 2011) found catchment water balance depended on considering soil water storage, subsurface flows and constraints to flow. This work offers a more comprehensive evaluation than any others I've seen regarding California rangeland catchments to date. Since that woodland site has a fairly healthy distribution of oaks, compared with a much sparser savanna, it offers an example of what might be with restoration of the millions of acres in the state currently covered by nonnative annual grasses – much of that now treeless.

More on Todd Groundwater Report, Appendix I.2 and related DEIR sections

As Todd Groundwater summarize, In their 2016 report, page 2,

> Rainfall recharge within the watershed flows downslope until the water table intersects a creek channel where groundwater can discharge as surface flow. …

I agree with their statement on page 3, Overview of Changes to Groundwater Flow System During and After Mining,

> Changes in groundwater flow in the mining pit areas are roughly proportional to the depth of the pit and area of disturbance.

I understand that the phasing of the proposed pits has changed since that 2016 report, as is made clear by Todd Groundwater's Figure 2. Locations of Sargent Creek Watershed Features. So rather than confuse this discussion, it seems best to refer to their summation of changes to the groundwater flow system from all four pits. But please do note their comment in the section, Groundwater and Surface Water Inflow to Phase 1 Pit, top of page 4:

> … groundwater seepage—which varies less than rainfall due to the attenuating effects of subsurface flow …

You see there that they have made my point about how subsurface flows essentially extend the rainy season by attenuating, or slowing, the influx of cold groundwater flows into their receiving surface waters. And remember that, despite Todd Groundwater having worked up what appears to be a sound model of groundwater fluxes in the region, they have not claimed to know the residence time of any naturally recharged subsurface flows – which could vary significantly among different areas of the watershed. Site-specific tracer studies of each drainage path are necessary to estimate the spatial and temporal parameters of such fluxes.

The section, Need for Pit Dewatering during Mining, beginning on page 5, tallies the estimated detention storage lost, albeit in different terms.

> Groundwater and surface water inflows would generally increase as the pits become deeper and broader. Thus, the maximum dewatering requirement would arrive as each pit reaches its final dimensions and would approximately equal the post-mining inflow amounts presented above. Based on the foregoing inflow estimates, the annual dewatering requirements could be on the order of:

- Phase 1 pit: 53 AFY average, and up to 86 AFY in wet years (equivalent to 33-53 gallons per minute (gpm))
- Phase 2 pit: 0 if pit bottom is graded to drain to Sargent Creek
- Phase 3 & 4 pit: 117 AFY average, 198 AFY in wet years (72-123 gpm)

These tallies of annual needs for pit dewatering essentially serve as estimates of the total detention storage lost once the pits have been fully excavated. But do realize that, while the total amount removed annually will increase over time until excavation is complete, after that point the detention storage lost must continue to be viewed as **an annual loss in perpetuity**. That is, the lost detention storage is estimated as ranging from:

53 AFY + 117 AFY = 170 AFY in average years to
86 AFY + 198 AFY = 284 AFY in wet years

In other words, upon completion the proposed quarry project will total an estimated 170 to 284 acre-feet lost detention storage every year thereafter in perpetuity, with smaller amounts lost each year preceding that point, from inception of the project, and this does not include project consumptive uses.

No matter what method(s) the project proponents choose for dewatering the pits, none of them can ever accomplish the specific functions of natural detention storage. Routing drainage directly to Sargent Creek cannot mitigate this impact because what is lost in that case is the subsurface residence time of these formerly detained waters, along with the influx of cold baseflows.

Todd Groundwater suggests three dewatering approaches for the northern pits. The first, evapotranspiration, represents an obvious loss of subsurface flows. The second, allowing seepage to accumulate in pit bottoms, exposes it to solar heating and evaporation, along with potentially additional transpiration (although see my subsequent note on that issue), while increasingly limited infiltration occurs in such pit bottoms that become choked with fine sediments unless their bottoms are continuously cleaned. That issue is acknowledged by Todd Groundwater on page 5 in their discussion of Groundwater and Surface Water Inflow to Northern Pits, where they state,

> Also, percolation rates tend to decline over time unless they are actively restored by scraping or disking the percolation area. A long-term maintenance program of that type has not been proposed.

Their next sentence describes a third method of disposal of groundwater seepage that, in my opinion, demonstrates their ignorance of relationships between vegetation and infiltration, so I'll not repeat it here, but the subsequent sentence is revealing:

> In wet years, this would also potentially generate groundwater recharge that would reduce impacts on the regional groundwater balance.

So, while the Todd Groundwater analysis doesn't evaluate the impacts of groundwater seepage on the regional groundwater balance elsewhere, they bring it up in terms of mitigating impacts here. Clearly, they understand the impacts are greater than zero.

DEIR page 3.4-54, Stormwater Management in Quarry Areas, states,

> … All four mining pits would intercept groundwater and surface runoff that otherwise would have flowed on or below the surface of the area to be occupied by the pits. During mining, that water would concentrate in pools/ponds within each pit (with separate pools in Pit 3, Pit 4, and Pits 1 and 2 combined). The water that concentrates in the pits would otherwise have continued downslope to contribute hydrology to creeks such as Tar Creek and Sargent Creek. During mining within a given pit, either in-water mining will take place, or if water needs to be pumped out of active mining areas, this water will be pumped to an adjacent stormwater retention basin within the pit area, where it would be allowed to percolate into the ground from the basin. Some of the water that has collected in the pits during mining operations would also percolate to groundwater, as there would be no impervious surfaces. This groundwater infiltration would continue to contribute hydrology to creeks or riparian habitats downgradient of the pits.

How creative of the DEIR preparers to conclude that the lack of "impervious surfaces" in the pit bottoms would allow percolation of waters that drain there, given Todd Groundwater's and my own point about the fine sediments that build up in such pits, rendering them nearly to completely impervious.

As for pumping the seepage out of the pits and directing it to percolation sites, there would still be a loss of subsurface residence time and the groundwater produced by such off-season artificial percolation would likely not achieve the cold temperatures and perhaps chemical composition of naturally infiltrated seasonal precipitation. Care to elaborate on the benefits of Valley Water's numerous percolation ponds to salmonids in Santa Clara County – where steelhead are nearly gone now and sightings of Chinook salmon in valley waterways cause a sensation?

My December 2019 blog post, Native Fishes Seek Cool Pools discusses conditions documented on northern Sacramento River tributaries in "Impact of environmental factors on fish distribution assessed in rangeland streams" (Thompson and colleagues 2006), published in *California Agriculture*, so freely available online. Their findings illustrated the impacts of irrigated rangelands on downstream fishes. Basically these off-season influxes of groundwater draining from irrigated pastures raise downstream water temperatures enough to make them inhospitable to steelhead and other native fish species.

This example should serve to illustrate that once naturally infiltrated groundwaters no longer reside in the ground, they lose the qualities that render them sound baseflow support for steelhead habitat needs.

Another issue that merits flagging in the Todd Groundwater report is their reductionist assumption that the role of plants, including upland and riparian vegetation, in the hydrologic cycle is solely one of **loss** through transpiration/evapotranspiration. This is really an antiquated viewpoint harkening back to the days, decades ago, when the fashion was first, removal of forest trees for additional "water yield", followed by a focus on eliminating phreatophytes, i.e., riparian and other wetland vegetation, for the same reason. This perspective completely ignores the role of plant root systems, along with their associated soil ecosystems, in facilitating infiltration and detention storage – in both uplands and wetlands. Please refer to my pages Plants in an Ecohydrology Context and "Water Yield" vs Baseflow Augmentation for more on this topic.

I find this reductionist view expressed in a few places in their report including on page 11:

> The amount of rainfall consumed by plant evapotranspiration would decrease, and a larger amount would become groundwater recharge.

This statement is false because detention storage of recharge will decrease as the pits are excavated and that formerly recharged water will result in the need for dewatering the pits, which, as previously discussed, is unlikely to result in additional recharge benefitting baseflows supporting steelhead (although it may help the regional groundwater basin) and is more likely to result in increased evaporation from pit-bottom pool surfaces.. So in the water balance described in the above statement, evapotranspiration related to vegetation may decrease but will be balanced by additional evaporation from collection ponds and a net loss of recharge.

This reductionist perspective is reiterated in the Todd Groundwater 2019 Memorandum, page 1 bottom:

> … the increase in consumptive use of groundwater at the pits would likely be offset by a small decrease in the extent of existing riparian vegetation canopy along Sargent Creek between the pits and the Pajaro River. In that case, the overall impact to downstream water users along the Pajaro River would be much less than the increase in consumptive use at the pits.

Balderdash! – For the reasons noted above.   This memo seems to suggest that the quarry project could have a net benefit to regional groundwater by eliminating plants. While Todd Groundwater's regional groundwater modeling process appears sound, they really need to bring their contextual paradigm into the 21st century, wherein they have things to learn from ecohydrology.

Impact Evaluation and Pertinent Significance Criteria

Tying this discussion back to the DEIR evaluation of impacts and the significance criteria set forth in section 3.4.4.1 , I find the following criteria pertinent, as highlighted:

> a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;
>
> d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

As previously noted, the residence time of groundwater flows on the site remains unknown. Also unknown is precisely where/when subsurface flows may emerge in downstream baseflows. As Todd Groundwater's report noted, the Pajaro River is used by steelhead primarily as a migration route enabling them to fulfill their anadromous life cycle. But they don't necessarily stop eating while migrating, so not only are cold water temperatures necessary, but also the hyporheic exchange that accompanies those cold baseflows. In other words, the Pajaro River serves both migratory and habitat functions.

While the DEIR evaluated the impacts of solely the estimated consumptive use of groundwater during the period of mine operation, on steelhead, I have shown that the actual impacts on subsurface flows supporting baseflows are far greater and absolutely permanent/ irreversible.

Add to the 53 AFY consumed annually during project operations, the estimated **170 to 284 acre-feet of lost detention storage every year thereafter in perpetuity.**

Given the uncertainties regarding where/when the currently detained flows emerge as baseflow noted above, how can the County of Santa Clara claim that impacts to South-Central California Steelhead are less than significant??? And again, a reminder regarding my comments on DEIR 5.2 Significant and Unavoidable Impacts, and 5.3 Irreversible Impacts on page 4 of this letter.

Documentation for one additional issue was only published during the review period for this DEIR, but the county should definitely be aware of this issue and require suitable mitigation where applicable, including for the proposed Sargent Ranch Quarry project. Please see the following news release, which links the pertinent scientific paper:

Roadway Runoff Known to Kill Coho Salmon also Affects Steelhead, Chinook Salmon • August 24, 2022 • Last updated by Northwest Fisheries Science Center on September 07, 2022
Simple filtration columns along roads can remove toxic substances and save fish.
https://www.fisheries.noaa.gov/feature-story/roadway-runoff-known-kill-coho-salmon-also-affects-steelhead-chinook-salmon

Rather than simply accept Todd Groundwater's interpretation of how the South-Central California Coast Steelhead Recovery Plan (National Marine Fisheries Service 2013) applies to this proposed quarry project, the County is encouraged to refer to that document itself, paying attention to the following excerpts, especially those highlighted in red.

I intend no disrespect in reminding you that the National Marine Fisheries Service considers "Santa Clara County" to be among its "Partners" listed in the recovery plan. I do wonder what the county may have done to date, as well as what it intends for the future, to fulfill its partnership role in the recovery process – ? Taking the foregoing issues seriously would be a far better representation of commitment than has been true of this DEIR.

In Chapter 9. Interior Coast Range Biogeographic Population Group, please refer to Table 9-2. Threat source rankings in each component watershed in the Interior Coast Range BPG, where "Groundwater Extraction", is ranked as "Red = Very High threat" on the Pajaro River. Then note the following:

> 9.5. Summary
> Dams and water diversions (including groundwater extractions) on the major rivers of the Interior Coast Range BPG (Salinas and Pajaro Rivers) have had the most severe adverse impacts on steelhead populations, reducing and degrading mainstem habitats (including spawning and rearing habitats), cutting off access to upstream spawning and rearing habitats, and altering the magnitude, duration, and timing of flows necessary for immigration of adults and emigration of juveniles throughout the watersheds.

Please understand that removal of detention storage results in essentially the same result as groundwater extraction in that it alters the magnitude, duration, and timing of groundwater flows, thus associated baseflows, and furthermore, degrades groundwater quality in terms of both baseflow temperature and the viability of hyporheic ecosystems that offer migratory habitats.

Finally, I just have to comment on the following statement from Todd Groundwater's 2016 report, page 12, section, Impact: Depletion of Baseflow in the Pajaro River and Possible Reduction in Steelhead Habitat, in which they seem to suggest that existing degradation of the Pajaro River renders proposed project impacts less consequential. Referring to the recovery plan,

> … of the 31 recommended "recovery actions" for the Pajaro River watershed, only two related to groundwater, and those called for studies (an analysis of groundwater extractions and monitoring of groundwater conditions) rather than a reduction in groundwater pumping.

Really, Todd Groundwater should understand that the professionals involved in developing the recovery plan do not necessarily possess expertise in hydrology. So it is up to professionals who do have such expertise to **step up** and enlighten the process when applicable. I shudder to think what other pertinent projects Todd Groundwater has lent their reductionist perspective to, perhaps acting on behalf of other "Partners" in the South-Central California Steelhead recovery process.

Thank you for considering my comments,

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