CEQA Impacts Analysis -- Hydrology and Water Quality:

Water Supply, Storm Water, and Waste Water for the

Bay Area Vipassana Center Project
9201 El Matador Drive, Gilroy

APN 756-30-024

PLN 20-003

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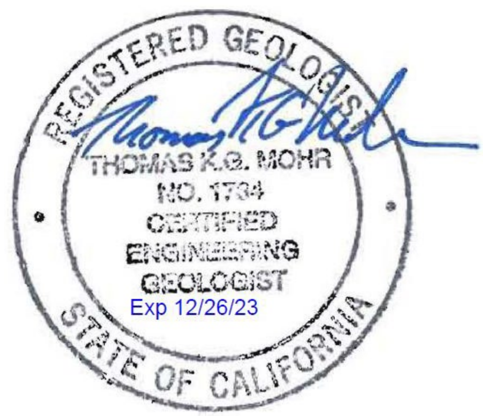

Prepared for: Bay Area Vipassana Center
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Hydrology and Water Quality

This report describes the existing hydrology and water quality in the Bay Area Vipassana Center (BAVC) project ("Project") area, and evaluates the potential hydrology and water quality impacts associated with construction and operation of the Project's water system. The setting and analysis set forth below are based on the Water Supply Assessment and WSA Addendum previously submitted to the County, FEMA flood maps, and data obtained from the Santa Clara Valley Water District (SCVWD).

Setting

The Project site is located in unincorporated Santa Clara County, about 1.5 miles west of the western limit of the City of Gilroy, and at approximately 300 feet above mean sea level (amsl) at the eastern most corner of the property (intersection of El Matador Drive and Redwood Retreat Road). The parcel is 54.6-acres,[1] about 40 acres of which is wooded uplands of relatively steep topography, which will not be developed. The northeast portion of the parcel is gently sloped and amenable to developing the Project.

The Project is located within the Uvas-Carnadero watershed. The Project site has historically received mean annual precipitation of approximately 22 inches of rainfall annually, with most precipitation occurring between October and April.[2] The summers are dry, with no significant rainfall between June and September. Annual rainfall at the Project site varies considerably. Interpolating SCVWD rainfall data from nearby rain gages[3], minimum recent rainfall at the site was 12 inches in the 2013-2014 rainfall year (July 1 to June 30), and 59 inches in the 2016-2017 rainfall year, a nearly 500% difference. Similarly, in nearby Gilroy, between 2000 and 2021, annual rainfall varied from 3.8 to 26.6 inches, a nearly 700% range.

The land uses surrounding the Project area include residential and agricultural. The Project site is zoned and neighboring parcels are zoned Hillsides, with the subject parcel zoned ***HS-sr*** (Hillsides-Scenic Roadway), while adjacent parcels are zoned ***RR*** *(rural residential)*, ***RR-sr*** *(rural residential,* Scenic Roadway, ***A-20ac*** *(agricultural)*, and ***A-20Ac-sr*** (agricultural, Scenic Roadway). Properties near the Project site are characterized by large rural residential lots, including some on which small-scale vineyards are maintained. About a quarter mile east of the site, east of Watsonsville Road, fields of irrigated row crops comprise approximately 90 acres.

[1] APN 756-30-024 (54.59 acres)

[2] Interpreted from SCVWD isohyetal map. An isohyetal map depicts lines of equal average rainfall interpolated from rain gages, in the same manner that a topographic map depicts lines of equal elevation interpolated from surveyed benchmarks.

[3] The rain gages in questions are Uvas dam, located 3 miles NW of the Project site, and Castro Valley, located 6 miles SE of the site.

Surface Water Features. The Project site is located within 700 feet of the confluence of Little Arthur Creek and Uvas Creek. Little Arthur Creek is approximately 280 feet north of the subject property boundary, and Uvas Creek is approximately 700 feet northeast of the subject property boundary. No permanent or mapped creeks cross the Project site. A seasonal drainage feature flows intermittently following rainfall, and during wetter years, low flow may be sustained for a few months by springs. The natural drainage runs into a ditch on the north side of El Matador Drive, which flows out to roadside ditches on Redwood Retreat Road, and ultimately to Uvas Creek. Smaller drainages carry rainfall runoff from the rocky upland sections of the site to the lower, flatter portion of the property, where alluvial soils percolate runoff to groundwater, or when saturated, promote runoff to the local engineered drainage network associated with Redwood Retreat Road.

Surface Water Quality. Surface water quality data from Little Arthur Creek and Uvas Creek is available from studies related to steelhead fish habitat[4], a study for a proposed county equestrian park on Little Arthur Creek, and a SCVWD study of groundwater recharge water quality. Little Arthur Creek drains a nine square mile watershed extending to the crest of the Santa Cruz Mountains. Creek water quality data is presented in **Appendix 1**. In general, water in Little Arthur Creek is low in nitrate, well oxygenated, runs relatively clear, and is sufficiently cool to support anadromous fish (below 16°C) at most locations until June. However, flows in Little Arthur Creek are limited to the rainy season, and generally revert to pools and base-flow by mid-June, and sometimes earlier.

Uvas Creek water quality was sampled and analyzed as part of a groundwater recharge study completed by SCVWD. A compilation of data from three sampling events is presented in **Appendix 1.**

Flood Hazard Areas. The Federal Emergency Management Agency (FEMA) designates areas that a 100-year storm may inundate as a Flood Hazard Area "Zone A." The Project is not located within a FEMA-designated Flood Hazard Area. The north corner of the Project site is within 50 feet of the Flood Zone A boundary; however, the site is elevated above the flood zone by 5 or more feet.[5]

Groundwater. The Project site is underlain by alluvial deposits in the eastern area (~15 acres) and by shallow soils overlying bedrock in the upland portions of the property. The alluvial deposits are of variable thickness, and were deposited by Uvas Creek, Little Arthur Creek, and possibly by Pleistocene Lake San Benito. The Project site is located outside the boundary of the California Department of Water Resources Boundary of the Llagas Subbasin of the Santa Clara Groundwater Basin. SCVWD has mapped areas it deems as located

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[4] *Onorhynchus mykiss* (steelhead trout)

[5] Interpretation from inspection of the online SCC Map tool.

within the *Zone of Benefit*, where well owners benefit from SCVWD operations of reservoirs, recharge facilities, and pipelines. The mapped Zone of Benefit includes properties northeast of Redwood Retreat Road, but does not include the Project site.

The Project site is located within the Uvas-Carnadero watershed, which is drained by Uvas Creek and its tributaries, including Little Arthur Creek. Uvas Creek empties to the Pajaro River, and ultimately to Monterey Bay. The dominant feature of the Uvas-Carnadero watershed is the Uvas Reservoir, located three miles upstream of the Project site. Uvas Reservoir captures runoff from a 47 square-mile watershed, and stores nearly 10,000 acre-feet when full.[6] Uvas Reservoir is operated by SCVWD. SCVWD is bound by a legal agreement with the California Department of Fish and Wildlife to manage releases from Uvas Reservoir to sustain populations of anadromous fish that migrate in Uvas Creek. Accordingly, SCVWD seeks to release water from Uvas Reservoir slowly throughout the year, to sustain continuous flow until the next substantial rains arrive. SCVWD's has consistently sustained flow in Uvas Creek for decades, as detailed in the Water Supply Assessment.

Based on surface topography, groundwater at the Project site is expected to generally flow east to southeast, toward Uvas Creek. Water level data measured in an on-site irrigation well located in the southeast corner of the Project site indicates a depth to groundwater ranging from 27 to 40 feet. The annual water level fluctuation is influenced by rainfall recharge and increased flows in Little Arthur and Uvas creeks during the wet season, and by agricultural pumping from wells east of Watsonville Road during the growing season. As illustrated in the WSA Addendum, Uvas Creek is instrumental in providing sustained recharge to the local alluvial aquifer. Other sources of recharge include rainfall runoff, springs, irrigation returns, and domestic wastewater returns.

Regulatory Setting: Applicable Regulations

This section reviews federal and state statutes that have a bearing on developing the Project site.

Clean Water Act (CWA). The CWA (33 U.S.C. Section 1251 et seq.), also known as the Federal Water Pollution Control Act of 1972, was enacted with the intent of restoring and maintaining the chemical, physical and biological integrity of the waters of the United States. The CWA requires states to set standards to protect, maintain and restore water quality through the regulation of point source and certain non- point source discharges to surface water. Those discharges are regulated by the National Pollutant

[6] An acre-foot is the volume of water standing one foot deep covering one acre, i.e. 325,828 gallons.

Discharge Elimination System (NPDES) permit process (CWA Section 402). In Santa Clara County groundwater basins south of Cochrane Road, NPDES permitting authority is delegated to and administered by the Central Coast Regional Water Quality Control Boards (CCRWQCB).

- **Section 402** of the CWA authorizes the California State Water Resources Control Board (SWRCB) to issue the NPDES General Construction Storm Water Permit (Water Quality Order 99 08 DWQ), referred to as the "General Construction Permit." The General Construction Permit includes the following requirements:
    - Develop and implement a Storm Water Pollution Prevention Plan (SWPPP), which specifies Best Management Practices (BMPs) that will prevent any construction pollutants from contacting stormwater and with the intent of keeping all products of erosion from moving off site into receiving waters;
    - Eliminate or reduce non-stormwater discharges to storm sewer systems and other waters of the state; and
    - Perform inspections of all BMPs.

  Projects that disturb one or more acres are required to obtain NPDES coverage under the Construction General Permit.

CWA requirements also address wetlands and stream crossings, neither of which is applicable to the Project site.

National Flood Insurance Program (NFIP). The NFIP, established by Congress in 1968, enables participating communities to purchase flood insurance. Flood insurance rates are set according to flood-prone status of property as indicated by Flood Insurance Rate Maps (FIRMs) developed by FEMA. FIRMs identify the estimated limits of the 100-year floodplain for mapped watercourses, among other flood hazards. As a condition of participation in the NFIP, communities must adopt regulations for floodplain development intended to reduce flood damage for new development through such measures as flood proofing, elevation on fill, or floodplain avoidance.

Porter-Cologne Water Quality Control Act. The Porter-Cologne Water Quality Control Act of 1967, Water Code Section 13000 et seq. regulates surface water and groundwater within California and assigns responsibility for implementing CWA Sections 401 through 402 and Section 303(d). It established the SWRCB and divided the state into nine regions, each overseen by a RWQCB, and requires each RWQCB to develop a Basin Plan, in which water quality criteria to protect State waters are specified (Water Quality Objectives). Those criteria include the identification of beneficial uses, narrative and numerical water quality standards, and implementation procedures. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, but implementation for the project site location is carried out by the CCRWQCB.

The CCRWQCB defines beneficial uses to include all of the resources, services and qualities of aquatic ecosystems and underground aquifers that benefit the State. In most cases, the RWQCB seeks to protect these beneficial uses by requiring the integration of water quality control measures into projects that will result in discharge into waters of the State. For most construction projects, the RWQCB requires the use of construction and post-construction BMPs. In many cases, proper use of BMPs, including bioengineered detention ponds, grassy swales, sand filters, modified roof techniques, drains, and other features, will delay runoff from impervious surfaces. Development setbacks from creeks are also required by County Zoning and County Environmental Health statutes, and are necessary to prevent disruption of creek habitat and impairment of creek water quality. The proposed Project will employ several post-construction BMPs, and is located outside the setbacks from Little Arthur Creek and Uvas Creek.

Compliance with Water Quality Standards and Waste Discharge Requirements

The proposed Project is not expected to violate applicable water quality standards. There are two areas of potential impact that the Project owners must ensure are prevented:

- Significant impacts to streams from runoff of sediment, fertilizers, pesticides, automotive fluids, or other common chemicals
- Significant impacts to groundwater quality through the operation of an on-site wastewater treatment system (OWTS)

Neither of these potential impacts is anticipated to occur; however, incorporation of certain measures into the Project, particularly for the OWTS, will ensure that any potential impacts are below a level of significance. These measures are described below.

A. Run-off Control

The majority of the runoff generated from the Project property is natural, wooded uplands. No synthetic chemicals are expected to be present in stormwater draining the uplands. The planned structures include a parking lot, in which vehicles belonging to retreat participants, instructors, volunteers, and facility caretakers will be parked. Deposition of small amounts of automotive fluids, typically oils, brake, transmission, and radiator fluids, may occur at a small rate, e.g. a slow drip occurring over the 10 days a participant vehicle is parked. No on-site vehicle maintenance or fueling will be allowed. BAVC will nonetheless maintain a spill response plan, with materials and equipment maintained on site to remove spilled or leaked automotive fluids if necessary.[7]

To limit the generation of dust, the parking lot will be paved using a porous material that promotes infiltration of rainfall. When rainfall intensity exceeds the infiltration capacity of the porous paving surface, runoff will result. Plans for site development include the use of planted bioswales to slow the rate or runoff. The grasses and other plants growing in the bioswales are selected for their capacity to act as sediment filters. To gage the quality of rainfall runoff water leaving the parking lot following a downpour, BAVC staff will inspect stormwater samples collected in jars for the presence of a surface sheen, indicative of hydrocarbon contamination. If a sheen is observed, staff will engage a stormwater consultant to

[7] A spill response kit would include absorbent material stored in watertight 5-gallon containers and a shovel.

determine whether a sediment trap or other device to capture hydrocarbons and metals commonly generated in parking lots is warranted. The Project parking lot will fill and empty only once every 10 days, thus minimizing the potential impact of vehicle fluids on stormwater quality. With bioswales and periodic inspection of indirect water quality indicators, the potential impact is expected to be negligible.

The Project does not plan any applications of insecticides or herbicides. Because the landscape design has emphasized selection of natural, drought-tolerant plant species, the Project does not anticipate any fertilizer applications. Likewise, once established, native plant species are generally resistant to insect pests and plant diseases, so storage and application of insecticides, fungicides, and other chemicals will not be necessary. However, should an infestation require critical intervention to save BAVC's investment in landscaping from destruction by pests or disease, BAVC will contract with a professional service to eradicate the pest or disease, thereby avoiding on-site storage of pesticides.

B. On-Site Wastewater Treatment (OWTS)

Conventional septic systems are generally sufficient to prevent the accumulation and migration of pathogens and nitrate in groundwater when sized appropriately. The Project's OWTS design will prevent the possibility of groundwater quality degradation, which is also protective of aquatic habitat in Little Arthur Creek. Because the OWTS will have treatment capacity to serve up to a maximum of 150 people, enhanced treatment features, including pretreatment for total nitrogen reduction, will be employed. The OWTS has been designed by Questa Engineering with a high margin of safety, to prevent deterioration of groundwater quality and any impact on the HAMWC well or Little Arthur Creek.

The peak wastewater flow is estimated at 6,850 gpd, with the average daily flow being approximately 80% of peak flow (5,480 gpd) (Questa Engineering, 2021). Wastewater generation will be less than might be expected for a maximum capacity of 150 persons, due to several water use patterns unique to Project operations, including:

- Only two mealtimes per day
- No high-intensity exercise requiring extra showering; students meditate 10 hours per day
- No on-site laundry for guests; only linen washing in the three day break between 10-day retreats
- Facility use limited to meditation retreats; no special events or rentals

The OWTS includes features common to most similar systems, and a few enhanced features. OWTS design features identified in Questa Engineering's 2021 feasibility report include:

- **Pretreatment system**: A pre-treatment system will be used to treat the effluent to a suitable level for use in the proposed sub-surface drip disposal system. A recirculating textile filter system by Orenco will serve as the pre-treatment system. The Orenco textile pre-treatment system is NSF-tested[8] to provide a minimum 50-percent reduction in nitrate and achieve treatment levels of <10 mg/L of BOD and TSS.[9]

- **Septic Tanks and Pump Tanks**: All of the tanks are buried and have watertight and airtight access manholes for maintenance. There are no smells, since the tanks are airtight and there is no noise, since all of the pumps are underground. There are nine watertight tanks, sized to three times the daily flow volume for each facility served, ranging from 2,000 gallon to 5,000-gallon capacity, for a total capacity of 30,000 gallons. Septic tanks are intentionally over-sized to allow for adequate nitrate, TSS and BOD reduction by the pretreatment system. One of the nine tanks is a 3,000-gallon grease interceptor receiving wastewater from the dining hall. In addition to the nine tanks, there will be an additional 5,000-gallon dosing tank ahead of the drip fields.

- **Telemetry**: The OWTS will be operated with a telemetry control panel to notify the service provider of any malfunctions and can be monitored remotely to observe daily operations.

- **Disposal Fields**: After the wastewater has been treated, it is delivered to three proposed sub-surface drip disposal fields. Sub-surface drip disposal fields consist of irrigation tubing buried 8-inches below grade and placed along contour, typically on two-foot centers; emitters are typically spaced every two feet. The emitters drip the wastewater into the soil at rates varying from 0.5 to 1.0 gallon per hour and are time dosed from a pump to spread the effluent out over the whole 24-hour day. Consequently, due to the many emitters and the timed dosing, there is a very even distribution of the wastewater over the area, maximizing the ability for the soils to provide further treatment of the wastewater in the shallow soil zone, where there is significant biological activity.

  The three drip field locations were selected following a soil survey and percolation testing in six areas. The soils in the three areas selected for drip field construction are described as well-drained sandy loam, under which sandy to gravelly clay loam is encountered, and in some locations, a thin (6-inch) horizon of clay was found overlying weathered sandstone. No evidence of high groundwater or perched groundwater was encountered in the test pits, which were nine feet deep. The average percolation rate for soils within the proposed disposal areas ranged from 5.2 to 12.4 minutes per inch. Questa Engineering concluded that, "based on the test results, all areas tested demonstrate excellent percolation rates for shallow subsurface drip dispersal systems, with effluent dispersal at a depth of 8- inches below grade" (Questa Engineering, 2021).

Nitrate impacts were assessed for the proposed OWTS. Unless properly designed, OWTS's in general can potentially degrade groundwater supplies with nitrate and contribute to nutrient enrichment of surface water bodies. Where development and leachfield sites are widely dispersed, nitrate effects are rarely a significant concern. However, where sewage disposal is concentrated (e.g., in clustered leachfield areas), localized nitrate impacts on groundwater are more likely. Questa Engineering evaluated the proposed

[8] NSF = National Sanitation Foundation, an organization that develops standards and tests products for sanitation systems; www.nsf.org
[9] BOD = biochemical oxygen demand; TSS = total suspended solids

wastewater system for the Bay Area Vipassana Center for possible effects on groundwater nitrate levels in accordance with procedures and criteria in the Santa Clara County Onsite Wastewater Treatment Systems Manual. The analysis included the projected loading from the proposed new wastewater disposal fields. Cumulative impact analysis shows that with the combined use of an alternative secondary pre-treatment system and sub-surface drip disposal fields, the proposed system will have final nitrate concentration values well below the 7.5 mg/L criterion.

Water Supply Impacts to Groundwater Basin Management

This section examines whether the proposed water supply for the Project site would "*substantially deplete groundwater supplies or interfere substantially with groundwater discharge, such that there would be a net deficit in the aquifer volume or a lowering of the local groundwater table level (i.e., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)"*.

The Project site has an existing agricultural well located in the southeast corner of the property, at the intersection of El Matador Drive and Redwood Retreat Road. The existing well currently produces 110 gallons per minute (gpm), and is currently used to establish landscaping at the Project site. Anecdotal information from the original owner of the property indicates the well operated at 250 gpm in the 1970s, and that this well was used to provide water to neighbors further up Redwood Retreat Road whose wells ran dry during the 1977, a severe drought year. However, the existing well was not constructed to meet drinking water well standards; hence, a new well is needed.

Two test wells have been drilled on the Project site: one toward the northeast property boundary, 150 feet west of Redwood Retreat Road, and the second about 50 feet north of El Matador Drive and 200 feet south-southwest of Redwood Retreat Road.[10] The northern test well was found to be low-yielding and insufficient to serve as a supply well.[11] The southern test well produced sufficient amounts of water during drilling to warrant a 3-day pumping test to verify supply, as described below.

Project Water Supply Demand

Analysis of water supply demand for the Project was conducted by examining the water consumption records for two other affiliated California Vipassana meditation centers operating 10-day retreats, in a pattern identical to the Project. As a result, the Average Day Demand (ADD) for the Project is 6,160 gallons per day (GPD). This is the full build-out demand, and will not increase over the next 20 years. BAVC will neither expand the Project facilities nor increase the number of student participants attending its courses, thereby

[10] The locations of both boreholes were selected to intersect the maximum thickness of alluvial material on the Project site and to comply with minimum setback requirements from Project sanitary features (septic/storm water system components) and well head control zone requirements per the State Water Resources Control Board, Department of Drinking Water (DDW) and the Santa Clara County Department of Environmental Health (SCCDEH)

[11] Although the Water Supply Assessment Addendum predicted that the alluvium would be high yielding, based upon passive observations of the on-site irrigation well response to pumping in neighboring wells, the geology of alluvium deposited by creeks such as Uvas is often quite heterogeneous, i.e. the nature and continuity of sand and gravel deposits is variable. This proved to be the case as the north test well was completed almost entirely in clayey sands, clayey gravels, and mudstones.

limiting water demand.

The estimated Maximum Day Demand (MDD) is 8,440 gallons per day. The MDD is calculated using indoor water demand for only the days that students are present, i.e. 240 days per year (24 ten-day sessions). The basis for estimated ADD and MDD is water use records from an affiliated meditation center already operating in the Central Valley.[12] Based on similarity of the design of the student accommodation halls, number of students, and on the daily schedule for 10-day meditation retreats, the operating water demand of the California Vipassana Center provides a reliable basis for estimating MDD and ADD.

Peak demand for fire flow will leverage the 97,000-gallon storage facility that BAVC plans to construct to operate pressurized fire hydrants. Water storage and the gravity-pressurized hydrant will be constructed to satisfy the Santa Clara County Fire Department standard details and specifications for water supply tanks and fire hydrants.

[12] Data used to develop the ADD and MDD is presented in the Water Supply Assessment Addendum

Water System Impact to Existing Supplies and Groundwater Recharge

A. Impacts to Existing Supplies

BAVC plans to use the south test well for the Project water system. The south test well was drilled to a depth of 140 feet by Guardino Drilling, under the direction of Luhdorff and Scalmanini Consulting Engineers (LSCE). The well was constructed with 6-inch diameter PVC casing, and screens in two intervals, from 70 to 110 feet below ground surface, and from 130 to 150 feet below ground surface. The screened intervals were set entirely within coarse, quartz-rich sands and poorly indurated sandstones.[13]

The well was developed using airlift techniques, prior to installing a temporary pump to conduct a 72-hour pumping test. The pumping test was completed to assess the long-term pumping water level and sustainable yield of the well. To gage the impact of pumping the test well on neighboring wells, permission was obtained and arrangements were made to measure four neighboring wells during the test, using well sounders and pressure transducers. In addition, the first test well and the irrigation well were equipped with pressure transducers for continuous water level monitoring throughout the test.

LSCE's description and interpretation of the 72-hour pumping test data finds the following:

- The pumping rate during the 72-hour test was 15 gallons per minute.
- During the pumping test, the water level declined at a relatively constant rate for approximately the first seven hours, after which the pumping water level remained constant between approximately 81 and 82 feet below ground surface for the reminder of the test.
- There were no discernable impacts on water levels in the aforementioned monitored wells due to pumping of the test well.
- Approximately eight hours after pumping ended, the water level in the pumped test well recovered to 36.69 ft bgs, representing a 96% recovery of the pretest water level. The static water level in the well before pumping began was 37.75 ft below the top of the well casing.
- Approximately 21,600 gallons of water was pumped from the well each of day of the three-day test, which equates to 2.5 times the Project's projected Maximum Daily Demand of 8,440 gallons.
- At a pumping rate of 15 gpm, the Project's projected Maximum Daily Demand would be satisfied with 9.4 hours of pumping;
- Based on the lack of any response in the monitored wells to pumping in the south test well for 72-hours, no impacts to water levels in the monitored wells are expected due to pumping at the south

[13] Poorly indurated sandstone means friable sandstone rock that breaks apart easily in one's hand, due to dissolution of the cement that binds the sand grains, i.e. a highly weathered sandstone.

test well location to meet the Project's projected demands.

Based on the results of the 72-hour pumping and LSCE's findings, it is clear that pumping the test well to satisfy Maximum Daily Demand for the Project will *not* significantly deplete groundwater supplies, or interfere significantly with groundwater discharge (i.e. neighboring pumping). The proposed pumping would *not* produce a net deficit in the aquifer volume, and would *not* lower the local groundwater table level in a manner that limits the production rate of pre-existing nearby wells. In particular, the absence of a drawdown signal lowering water level in the neighboring Happy Acres Mutual Water Company well demonstrates that the proposed water supply well, operating at 15 gpm for 9 to 10 hours per day, will not produce a significant or measurable impact on HAMWC's operations. The sustainability of pumping the proposed well at the Project site is discussed further below.

B. Impacts to Groundwater Recharge

Projects that add substantial areas of impervious surfaces may accelerate stormwater runoff and decrease the net groundwater recharge at the Project site. The impervious surfaces added by the Project, and measures that will be incorporated in response, include the following:

Impervious Surfaces	Planned Response Measures
16 Buildings (67,088 ft² impervious surfaces)-prevents rainfall recharge in the building footprints	BAVC plans to capture rainfall from roofs and direct the water into dry wells for groundwater recharge. This is feasible because groundwater level generally remains more than 20 feet below ground surface. Where structures will be built atop bedrock, rainfall capture will be directed along flowline swales toward the El Matador Drive ditch and toward a stormwater treatment and retention area with a minimum capacity of 5,070 cubic feet (38,000 gallons), as detailed in the approved grading plan. Rainfall capture and flow in flowline swales is expected to promote groundwater recharge.
Roads (59,900 ft² of impervious surface)-generates runoff.	The roads will be equipped with storm sewer grates, which will capture rainfall runoff into storm sewers that convey stormwater to the stormwater treatment and retention area.
Parking Lot (110 spaces in lot fronting Redwood Retreat Road)-generates runoff under certain conditions.	Although BAVC plans to construct the parking lot with porous pavement, and does not include the parking lot as an impervious surface in the grading plan, high rainfall intensity events will nevertheless generate runoff. A bioswale in the larger, northwest half of the parking lot will serve to filter runoff and promote groundwater recharge. Storm sewers draining the parking lot will convey parking lot runoff to the stormwater treatment and retention area.

Overall, BAVC's plans to leverage stormwater BMPs will serve to preserve a substantial portion of the natural groundwater recharge that will be disturbed by the addition of impervious surfaces. The impervious surfaces added by constructing the Project total 127,000 ft² (2.9 acres). The portion of the Project site that will remain landscaped or in its original, natural vegetated land cover, is approximately 14.2 acres. Accordingly, impervious surfaces will comprise 17.1% of the Project area, and much of the runoff from the impervious surfaces will be directed to facilities that promote groundwater recharge (dry wells, flowline swales, and bioswales).

Because groundwater recharge involves percolating rainwater through soils, it is generally a slow process, except where dry wells (or injection wells) bypass clayey soils and introduce rainwater directly to underlying sands and gravels. The extent to which these facilities produce groundwater recharge will vary with rainfall intensity. For example, the entire volume of a light rainfall event may be captured for groundwater recharge, whereas a high-intensity rainfall event would cause most of the runoff to be directed off-site. Further opportunities to capture stormwater runoff from impervious surfaces, for the purpose of optimizing groundwater recharge, may be evaluated in the future.

A further feature of groundwater recharge that is inherent to the Project is septic returns. Septic leach fields convey water through a biologically active soil zone, which filters out pathogens and removes residual nitrate before percolating through about 25 to 35 feet of soil to the water table. As most of the annual Project water demand is routed to the septic leach fields, there is already a significant return of water to the aquifer.

Water Supply Sustainability Groundwater Basin Management

This section examines whether sufficient water supplies are available to serve the Project, during normal, dry and multiple dry years.

As described above, the Project will rely on an on-site well to provide drinking water supply, and the existing agricultural well will be used for landscape irrigation and to supplement fire-fighting supply in the event of wildfire. The ability of the new well to serve the Project under normal, dry year, or multiple dry year scenarios is best interpreted from long-term, on-site water level measurements obtained at or near the location of the new well. As the property was acquired in the last five years, a long-term record of on-site water levels is not available. Data from the nearby HAMWC Well #1 would be useful for this assessment; however, HAMWC has not agreed to share data.

In the absence of on-site or nearby water level data, an understanding of the water balance at the Project site can yield insights into the long-term sustainability of water system performance. The May 2021 Water Supply Assessment and the December 2021 Water Supply Assessment Addendum provide an examination of sources of groundwater recharge. The sources of recharge to the local alluvial aquifer tapped by the proposed supply well, in order of volumetric importance, include:

- Uvas Creek recharge
- Little Arthur Creek recharge
- Rainfall recharge
- Groundwater discharge from fractured bedrock into the alluvial aquifer
- Deep percolation of irrigation water applied to the 90 acres of row crops east of Watsonville Road
- Deep percolation from treated wastewater from septic leach fields
- Springs

As explained in the Water Supply Assessment Addendum, the breakdown of groundwater recharge sources to the alluvial aquifer within a mile of the Project site is as follows:

- Recharge from Uvas and Little Arthur Creeks: 920 acre-feet/year (83%)
- Recharge from rainfall infiltration: 156 acre-feet/year (14%)
- Recharge from irrigation returns: 34 acre-feet/year (3%)
- Groundwater discharge from fractured bedrock: unknown, but likely small [14]
- Groundwater recharge from springs and septic: negligible

There are no built facilities for managed aquifer recharge near the confluence of Little Arthur Creek and

[14] the quantity of water stored in a cubic foot of fractured rock aquifer is about one hundredth of the groundwater storage in an equivalent volume of alluvium; consequently, recharge from bedrock to the alluvium is likely negligible.

Uvas Creek. However, SCVWD leverages Uvas Creek itself as a means to manage groundwater supply in aquifers replenished by Uvas Creek recharge, by operating Uvas Reservoir for continuous flows in Uvas Creek. Uvas Reservoir is located three miles upstream of the Project site.

Recharge from Uvas Creek is of primary importance to the BAVC and HAMWC alluvial wells, as it generally flows year-round. For example, between August 4 and October 25, 2021, during a severe drought year, groundwater levels at the old irrigation well on the Project property rose six feet in response to continuing recharge from Uvas Creek, and curtailment and cessation of agricultural pumping east of Watsonville Road. This speaks to the strong influence that flows in Uvas Creek have on sustaining supply in the alluvial aquifer.

SCVWD manages Uvas Reservoir with the objective of extending stream flows as late as possible into the year before the next rainy season. SCVWD is bound by a legal agreement with the California Department of Fish and Wildlife to operate Uvas Reservoir in a manner that sustains anadromous fish habitat in Uvas Creek during critical phases of their life cycle. The agreement is known as the Lake or Streambed Alteration Agreement (LSAA or "permit"), and was issued by the California Department of Fish and Wildlife in 2012. [15]

The permit requires reservoir releases and minimal habitat flows to ensure that rare and endangered species such as the South-Central California Coast Steelhead are supported, consistent with the federal Endangered Species Act (ESA) Recovery Plan. This plan calls for additional water releases to improve access to spawning and rearing habitats, and instream habitat conditions as the principal recovery actions needed to increase local steelhead populations. During the summer, SCVWD operates the reservoirs by controlling releases to recharge the aquifers underlying Uvas Creek. SCVWD's goal is to continue minimal releases from Uvas Dam as long as possible until significant rainfall returns. This requires anticipating the timing of the return of significant rainfall that will fill the reservoir.

SCVWD has been successful at maintaining continuous significant flow in Uvas Creek since 1996 (i.e., continuous releases from Uvas Reservoir greater than 1 cubic foot per second, or 450 gallons per minute.[16] Between 1990 and 1996, there were several occasions during which flow in Uvas Creek was allowed to drop below 1 cfs; however, SCVWD's operational objectives at that time included operating the Uvas-

[15] The Uvas Reservoir LSAA was first executed in May 2012, amended in 2013 and extended in 2016; an additional renewal is under consideration.
[16] During dry years, many reaches of Uvas Creek experience "dry back", i.e. there is no visible flow in the creek; however, substantial baseflow continues in the creek bed, as indicated by the groundwater level patterns reported in the Water Supply Addendum.

Llagas pipeline, to transfer water from the wettest watershed, Uvas, to the drier Llagas watershed, to affect groundwater recharge. Uvas Creek was allowed to dry in the severe drought of 1976/77. SCVWD has managed to keep water flowing in Uvas Creek since the 1976/77 drought, i.e. 45 years, including the current severe drought (October 2019 to present). At the time this report was under preparation, late August 2022, flow in Uvas Creek was 13.6 cfs (6,100 gallons per minute), and Uvas Reservoir level had 3,867 acre-feet remaining (40% of capacity), i.e., 1.26 billion gallons.

2022 is another severe drought year, and the second consecutive La Niña year, in which rainfall tends to remain well below normal. Flow into Uvas reservoir in late August 2022 is only 0.3 cfs, so the reservoir is emptying at a rate of 13.3 cfs or less. At this rate, and considering evaporation, the reservoir would be empty by or before January 11, 2023. However, SCVWD usually scales back releases to Uvas Creek in the fall. For example, in November 2021, flow was reduced to below 5 cfs. Nevertheless, the current drought is very severe, and if the current pattern continues for multiple additional years, may limit continued operation of the many wells dependent upon the Uvas Creek alluvial aquifer, including the proposed well for the Project site and the neighboring wells. The current drought, which began in October 2019, is unusually severe, in view of the following metrics:

- In 2022, California has had its driest start to a calendar year on record;
- The El Niño/Southern Oscillation (ENSO) indicators forecast an unprecedented 3rd year of La Niña conditions.
- The Palmer Drought Severity Index for southern Santa Clara County is “extreme drought”
- The seasonal forecast for this region is for drought to persist into 2023.[17]

Despite this possibility, which is speculative, the pumping test for the proposed water system for the Project site took place in the third year of one of the most severe droughts on record. Even with these challenging hydrologic conditions, the pumping test nevertheless showed no impacts to neighboring water systems. Therefore, the pumping test supports a finding that sufficient water supplies will be available to serve the Project during normal, dry and multiple dry years.

Future Droughts

It is not possible to reliably predict future hydrologic conditions; however, it is nonetheless valuable to consider possible future hydrologic scenarios. The consensus among climate scientists is that human-caused climate change is occurring now, and is likely to produce drier and hotter summers, and more

[17] Sources: https://www.drought.gov/location/95020%2C%20Gilroy%2C%20California
https://www.drought.gov/drought-status-updates/california-nevada-drought-status-update-8-19-22
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml

intense rainfall when it occurs (Ackerly, et al., 2018). Even without anthropogenic climate change, past mega-droughts in the southwest have persisted for multiple decades.[18] In the event that Uvas Creek goes dry following multiple years of protracted drought, alluvial and bedrock wells operated by both BAVC and HAMWC are likely to go dry. A longer-term protracted drought would create a water supply crisis for the entire Uvas Creek valley, not just the Project site. If the current severe drought continues or worsens, all water users could find themselves in the same situation, and the Project's minor water use, relative to overall aquifer use, would not exacerbate the resulting water supply crisis to any measureable degree. The magnitude of the Project's pumping is insignificant in contrast to the much larger pumping in the nearby row crop irrigation wells.

In addition to drought, changes to the soil conditions in the 47 square mile Uvas Creek watershed could accelerate runoff, and change storage dynamics in Uvas Reservoir. A severe fire may result in a significantly altered runoff pattern, to the detriment of sustained releases from Uvas Creek to Uvas Reservoir. There have been multiple, large wildfires in the Uvas Creek watershed, most recently the Loma fire in 2016, which burned 7 square miles, or 15% of the watershed area; however, a still larger scale conflagration that hardens soils throughout the watershed has not yet occurred. Accelerated runoff during the rainfall season and hardened soils with lower capacity for soil moisture retention could prevent the current pattern of sustained reservoir releases, resulting in a dry creek bed and dry wells in the later part of the year.

Evaluating these extreme, unprecedented hydrologic scenarios with any certainty is not reasonably feasible, given their speculative nature. As such, the possibility that the Uvas Creek watershed could be visited by extreme multi-year drought or a very large fire, either of which could cause wells to go dry throughout the Project area, is beyond the scope of required project-level CEQA analysis. Moreover, all existing and future land uses would be equally affected.

[18] Past mega-droughts recorded in tree-ring data. Conversely, we should also remember that Governor Leland Stanford in 1862 was rowed in a boat to his inauguration, due to massive flooding of the entire Sacramento Valley, following 40 days of nearly continuous rain.

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Table A1-1 – Little Arthur Creek Water Quality Analysis, June 28, 2001, US EPA Environmental Monitoring and Assessment Program

Analyte	Unit	Result	MDL	Water Quality Objectives
Turbidity, Total	NTU	0.22		
Temperature	Deg C	14.6		
Oxygen, Dissolved, Total	mg/L	9.5		> 5 mg/L; >7 for fish spawning
pH	none	8.14		≥ 7 and ≤ 8.5
Specific Conductance, Total	µS/cm	321.5		
Sulfate, Dissolved	mg/L	31.15	0.09	
Nitrogen, Total, Total	mg/L	0.221	0.01	
Phosphorus as P, Total	mg/L	0.004	0.002	
Ammonia as N, Dissolved	mg/L	0.005	0.002	
Nitrate as N, Dissolved	mg/L	0.17	0.01	
Total Suspended Solids, Particulate	mg/L	1.1	0.1	
Dissolved Inorganic Carbon, Dissolved	mg/L	30.69	0.1	
Dissolved Organic Carbon, Dissolved	mg/L	0.65	0.1	

Table A1-2 – Water Quality Measurements, May and June 1993, Little Arthur Creek: Watershed Profile

Station	Date	Stream-flow	pH (units)	Temp. (°C)	Specific Conductance uS/cm, field	Specific Conductance uS/cm, lab	NO_3-N (mg/l)	NH_4-N (mg/l)	PO_4-P (mg/l)	Remarks
At Redwood Retreat Rd	5/6/1993	2-3 cfs	--	14	300	380	0.2	--	0.07	upstream of N. tributary
	6/10/1993	0.2-0.5 cfs	7.7	**16.3**	320	385	0.26	0.16	--	
N. tributary at Rdwd Rtrt Rd	5/6/1993	20 gpm	--	14.8	610	760	1	--	0.07	drains vineyard
	6/10/1993	8-10 gpm	7.6	19.8	690	765	<0.05	--	- -	
At Mt. Madonna Rd	5/6/1993	2-3 cfs	--	13.5	380	490	0.8	--	0.02	
	6/10/1993	1 cfs	--	**19.8**	440	490	--	--	--	
2nd bridge above County Park 5/6/1993		--	--	--	--	--	1.4	--	0.07	
At County Park	5/6/1993	2-3 cfs	--	13	385	505	-	-	--	middle
	6/10/1993	0.97 cfs	8.2	**20.4**	448	490	< 0.05	0.09	--	west
	6/10/1993	1 cfs	8.4	**19.6**	442	495	< 0.05	0.09	<0.01	east
N. tributary, just east of County Park	5/6/1993	10-15 gpm	--	**17.5**	442	520	--	--	< 0.01	at RR Road, M.P. 2.75
	6/10/1993	<0.5 gpm	6.9	**19**	490	555	<0.05	0.06		
N. tributary at Ferreira	5/6/1993	30 gpm	--	16	530	645	< 0.05		--	M.P. 1.58
At Pickel Dam	5/6/1993	--	--	14	385	490	--	--	--	
At bridge just above mouth		--	--	--	--	--	1.2	--	0.02	
Near mouth	5/12/1993	0.5 cfs	--	**16.8**	388	460	1.1	0.3	0.1	

Data Source: Balance Hydrologics, 1993.

Balance Hydrologics, 1993. Nitrogen Contributions to Little Arthur Creek Associated with the Use of the Proposed Equestrian Park. Report to Santa Clara County Office of County Counsel. December 30, 1993.