

Technical Memorandum

To: Santa Clara Valley Water District
From: GEI Consultants
cc:
Date: June 6, 2022
Re: Reconnaissance-Level Study of Permanente (Lehigh) Quarry Site –
Summary Report
GEI Project No. 1906330

1 Introduction

At the request of Santa Clara Valley Water District (Valley Water), GEI Consultants, Inc. (GEI) was contracted to perform a reconnaissance-level desktop assessment of the Permanente Quarry (Quarry) site with respect to its ability to serve as a future raw water storage facility (or reservoir). Four individual Technical Memoranda (TM) were prepared, focusing on specific issues of this project, including:

- TM1: Hydrogeologic Setting and Water Quality
- TM2: Existing Conditions, Potential Environmental Issues, and Regulatory Requirements
- TM3: Hydrologic Setting and Flood Conditions
- TM4: Existing Valley Water Infrastructure and Water Supply Availability

GEI staff met with Valley Water staff to review annotated outlines of each of these TMs to identify additional data and information that could support the study. The TMs were updated to reflect the information needed to support this study. This report summarizes the information included in the TMs, provides conclusions regarding the project feasibility, and identifies next steps.

1.1 Valley Water

Valley Water is an independent special district/local agency that provides wholesale water supply, groundwater management, flood protection, and stream stewardship. Its service area includes all of Santa Clara County, which is located at the southern end of San Francisco Bay. The county encompasses approximately 1,300 square miles and has a population of about 1.9 million (Valley Water, 2019). Long-term average water use in Santa Clara County is approximately 310,000 acre-feet per year (AFY) (Valley Water, 2022). This water is used for domestic, municipal, commercial, industrial, institutional, and agricultural purposes (Valley Water, 2019).

The Quarry is located in Santa Clara County west of the city of Cupertino in the foothills west of Stevens Creek Boulevard. The Quarry is also adjacent to Permanente Creek (Valley Water, 2019 Permanente Quarry). The Quarry consists of an approximately 630-acre operations area within an approximately 3,500-acre parcel owned by Lehigh Southwest Cement Company (Lehigh). The Quarry produces cement-grade limestone and construction aggregates. Lehigh manages the site and will reclaim the site by approximately 2030 in accordance with the *Reclamation Plan Amendment for Permanente Quarry*

(Reclamation Plan) (Santa Clara County, 2011). Valley Water is evaluating the potential for converting the Quarry into a raw water reservoir (proposed project or project). As part of this project, Valley Water would be changing the future use of the Quarry from the current 2012 Reclamation Plan Amendment and instead develop the facilities necessary to use the Quarry as a reservoir to store and deliver raw water.

2 Background Information

2.1 Local Geologic and Hydrogeologic Setting

The Quarry is underlain by highly deformed and faulted rocks of the Franciscan Assemblage. The eastern portion of the Quarry, including portions of the cement plant and the East Materials Storage Area, are underlain by rocks of the Santa Clara Formation. On the eastern edge of the property modern alluvial deposits associated with Permanente Creek overly these formations.

The Quarry is located approximately two miles east-northeast of the San Andreas fault zone which is capable of a Richter Magnitude 8 earthquake. The Sargent Berrocal Fault Zone (SBFZ), part of the Santa Cruz Mountains front-range thrust fault system, parallels the San Andreas to the east and forms the eastern-most structural boundary of the area. Near the Site, the SBFZ consists of two northwest-trending, sub-parallel faults, the Monta Vista Fault Zone on the northeast and the Berrocal Fault Zone on the southwest (SFBRWQCB, 2018). This seismically active area experiences earthquakes that may result in landslides. Several large landslide deposits have been mapped by various investigators along the slopes flanking the Quarry. A recent landslide occurred in the crest of the north slope of the Quarry in January 2001 (Golder, 2011). The potential for landslides in the reservoir generating a tsunami will need to be considered in the design and operation of the reservoir.

Permanente Creek is located on the south side of the Quarry and is approximately 50 to 100 feet below the Quarry pit rim. The creek is separated from the Quarry by a natural ridge that may act as a natural dam. Additional studies will need to be conducted to evaluate the effectiveness of the ridge to perform as a dam and may determine the operating water surface elevation in the Quarry.

Limited amounts of groundwater occur in the fractured bedrock around the Quarry, however, the occurrence of groundwater within the Franciscan Assemblage is almost exclusively within secondary openings such as joints, fractures, shear zones, and faults, in contrast to primary porosity or pore spaces within the rock. Because of the limited amount of storage capacity and the relatively low permeability, the Franciscan Assemblage is considered by the Department of Water Resources (DWR) to be non-water bearing with respect to production of usable quantities of water.

The Santa Clara sub-basin (2-9.02) of the Santa Clara Valley Groundwater Basin (2-009.02) lies east of the Quarry. The western boundary of the Santa Clara Valley Groundwater Basin is generally considered to be the contact of the alluvial valley deposits with the consolidated bedrock formations in the Santa Cruz Mountains. The contact between the alluvial valley and the bedrock formations is the Monta Vista Fault Zone, which may limit hydraulic communication between the bedrock and alluvium.

2.2 Land Use and Environmental Conditions

The majority of the Lehigh property and area containing the Quarry basin is zoned as Hillside (HS)–Design Review Combining District, Santa Clara Valley Viewshed (d1) by Santa Clara County. This designation does not explicitly include reservoirs or similar infrastructure facilities. The Lehigh property contains the Kaiser Permanente Quarry Mining District, which is eligible for listing in the California Register and considered an historical resource. The 2012 Reclamation Plan Amendment ensures the

Quarry is compliant with State and local mining laws and includes backfilling the Quarry basin (where the reservoir would be located) by approximately 2030 with 60 million short tons of overburden rock currently stored onsite. With implementation of the reclamation plan, existing emissions of air pollutants and greenhouse gases and noise generation associated with mining activities would cease and fuel tanks and other hazardous materials containers would be hauled offsite.

Permanente Creek extends along the southern limits of the Quarry operations area and then flows to the north around the east end of the Quarry, eventually discharging into San Francisco Bay. Stevens Creek Reservoir is located nearby to the southeast of the Lehigh property and discharges to Stevens Creek, which also flows north to San Francisco Bay. The Lehigh property contains a variety of habitat and land cover types, including oak woodlands, riparian areas, and wetlands associated with Permanente Creek. California red-legged frog (*Rana draytonii*), a federal and state protected species, have been documented on the Lehigh property, and Permanente Creek near the Quarry provides aquatic habitat for this species. No habitat for special-status plants has been observed on the Lehigh property during past surveys. The present-day hydrology of the Permanente Creek watershed does not support anadromous fish. Stevens Creek contains Central California Coastal steelhead (*Oncorhynchus mykiss irideus*). Other special-status species including birds, bats, and mammals have the potential to inhabit the Lehigh property.

2.3 Water Quality Setting

Permanente Creek and Stevens Creek are on the 303(d) list of impaired waterbodies due to selenium, diazinon, toxicity, and trash (SWRCB, 2018). Prior to 2014, surface water quality sampling along Permanente Creek showed selenium concentrations above the benchmark established by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Basin Plan (CRWQCB, 2015). As a result, SFBRWQCB issued Cease and Desist Order No. R2-2014-0011 (later amended through Order No. R2-2017-0030) to Lehigh southwest cement company, which required treatment of effluent discharges into Permanente Creek to comply with required concentrations of selenium. In accordance with the order, an Interim Treatment System (ITS) began treating stormwater in the fall of 2014 to mitigate contaminant exceedances in water draining into Permanente Creek (Golder Associates, 2015). Results of weekly influent and effluent sampling for the constituents of concern are as follows:

- Selenium influent ranged from 40 to 97 µg/L, with an average concentration at 61 µg/L. After treatment, effluent concentrations averaged 5.1 µg/L. Sample results marginally met the benchmark value of 5; however, concentrations were below the maximum daily effluent limit (MDEL) of 8.2 µg/L stated in the NDPES permit.
- Nickel was also addressed in Golder's memorandum because approximately 67 percent was removed by the ITS. Influent concentrations averaged 67 and peaked at 110 µg/L. Effluent concentrations were 18 µg/L, which is well below the established benchmark of 82 µg/L.
- Hexavalent chromium, mercury, and settleable solids were also tested. Only negligible concentrations were detected in the influent.

To better understand the selenium exceedances, Golder conducted sampling during the 2016/17 wet season to investigate where the greatest selenium concentrations occur and develop a stormwater management plan. Results of the sampling program indicate that elevated selenium (concentrations greater than the National Toxics Rule criteria of 5 µg/L) is predominately found in the Eastern Material Storage Area and the swale that drains stormwater to Permanente Creek. Runoff and/or sheet flow samples collected from the slopes of the Quarry were generally less than 5 µg/L.

As of 2019, Lehigh installed the Final Treatment System to treat all facility discharges to remain in compliance with NDPES Permit No. CA0030210. Waste Order No. R2-2019-0024, adopted by SFBRWQCB on July 10, 2019, indicated that water quality conditions were in full compliance by October 1, 2017. As a result, the Cease-and-Desist Order was rescinded.

The Valley Water Urban Runoff Pollution Prevention Program performed water quality sampling from 2012 to 2021 along Stevens Creek. The average concentrations of the constituents measured such as salinity, pH, DO, and ammonia generally met benchmarks identified in the Basin Plan (CRWQCB, 2015), but measurements of inorganic parameters, such as metals, were not analyzed.

In addition to the Pollution Prevention Program samples, water quality testing was conducted on stormwater runoff and groundwater monitoring wells surrounding the Quarry. Groundwater samples from monitoring wells surrounding the Quarry show elevated concentrations of TDS (predominately sulfate), iron, manganese, and molybdenum. These constituents are commonly found in bedrock formations, particularly in stagnant groundwater samples.

2.4 Hydrologic Setting and Flood Protection

Permanente Creek watershed consists of 17.5 square miles of land with a main channel of 13 miles in length and discharges into the southern San Francisco Bay (South Bay) (Santa Clara County, 2011). The mean annual precipitation of the Permanente watershed ranges from 21 inches to 35 inches. The drainage area on Permanente Creek upstream of the West Branch Permanente Creek is 3.65 square miles. The design discharges are 757 cubic feet per second (cfs) for a 10-year flood event (with a 10% exceedance probability) and 1,350 cfs for a 100-year flood event (with a 1% exceedance probability) (Schaaf & Wheeler, 2016).

Stevens Creek watershed includes the Stevens Creek Reservoir and Stevens Creek, which runs easterly to Stevens Creek Reservoir, then northerly downstream of the reservoir to the South Bay. The drainage area of Stevens Creek upstream of the Reservoir is 17.26 square miles. Mean annual precipitation ranges from 29 inches to 41 inches. Calculated design peak flows found a 10-year flood event flow of 3,000 cfs and a 100-year flood event flow of 5,500 cfs (Valley Water, 2007).

Currently, there are no flood control structures upstream of Permanente Quarry. However, modifications were constructed on the Permanente Creek flood channel as of December 2018. Additional improvements were made to the Permanente Creek Diversion Channel into lower Stevens Creek to provide additional flood protection. The Rancho San Antonio County Park off-stream flood detention facility provides storage of 75 acre-feet to divert high flows from Permanente Creek to reduce flood risk (Schaaf & Wheeler, 2016). Additional information on the hydrologic setting and flood protection are included in Technical Memorandum No. 3- Hydrologic Setting and Flood Conditions.

3 Project Assumptions

While there is a considerable amount of very specific information available to evaluate the Quarry project, numerous assumptions were made to prepare this reconnaissance-level feasibility study. The following assumptions represent some high-level considerations to simplify the analysis to meet the project schedule. These focus on what are believed to be the most relevant features of the project that may affect the feasibility of using the Quarry for raw water storage.

3.1 Use of Permanente Quarry for Raw Water Storage

The Quarry is being considered to provide raw water storage for Valley Water. There are currently other uses being considered by Santa Clara County. The following assumptions were used regarding the condition and state of the Quarry for this study.

- The Permanente Quarry will be reclaimed with or without Valley Water using the site as a reservoir, as required by the *2012 Reclamation Plan Amendment* approved by Santa Clara County; therefore, the baseline conditions should be updated to reclaimed Permanente Quarry. The raw water storage facility could store up to 14,000 acre-feet of water in the existing Quarry basin.
- Construction impacts are not likely related to project feasibility. Larger construction-related impacts/issues should be acknowledged, and it should be mentioned that these issues will need to be further evaluated.

3.2 Use of Stored Water

At this time, there is not a single intended use of the water stored in the Quarry. The intended use of the water stored may influence the duration of water stored in the Quarry.

- **Short-Term Storage:** One option may include using the quarry for short-term storage that would be exercised on a regular basis (annually). Under this option, the water would be stored in the quarry for a relatively short time, on the order of months to a few years.
- **Long-Term Storage:** One option may include using the quarry for long-term storage that would be exercised on an emergency basis to deliver the stored water to a treatment plant for potable uses by Valley Water customers. Under this option, the water may be stored in the quarry for a relatively long period of time, on the order of years. This option may result in greater degradation of water quality from being stored in the Quarry. Losses from seepage and evaporation would be greater than the short-term storage option.

One specific end use of water stored in the Quarry could be to offset deliveries to the Semitropic groundwater banking program. This approach would divert a portion of the Central Valley Project (CVP) and State Water Project (SWP) water through the Stevens Creek Pipeline (SCP), which would normally be diverted to Semitropic Groundwater Storage Bank (SGSB) in Kern County and store it locally instead. This would provide direct access to this water instead of relying on in-lieu replacement of water through the groundwater banking program. The Quarry would provide much less storage (about 14,000 acre-feet) than the storage capacity at the SGSB (350,000 acre-feet), so it would not be considered a replacement for the SGSB storage, but it could provide more direct access both physically and temporally to Valley Water.

3.3 Water Supply Availability

Three potential sources of surface water were identified as a source of supply for this study and are labelled a through c as described below.

- (a) **Imported Water:** Water for storage in the Quarry may be provided from imported water from Valley Water's CVP or SWP contract supplies. The imported supplies would be conveyed to the Quarry from San Luis Reservoir and/or the South Bay Aqueduct through Valley Water's existing

infrastructure. The delivery of imported water to the Quarry through the SCP and would be based on the timing and available capacity of the Valley Water system.

- (b) **Local Watershed Diversions:** Water for storage in the Quarry may be provided from local watersheds including the Permanente Creek watershed or Stevens Creek watershed. Either of these sources would require a new or changed water right. Local supplies would have to meet downstream flow requirements for water quality and environmental flows, so only water in excess of these flow requirements would be available for diversion to storage. This option would likely divert water to storage in the Quarry during high-flow events. The operations may include frequent short-duration diversions during the winter months when larger storms are likely. New water rights would be required for any diversions for either watershed.
- (c) **Local Reservoirs:** Supplies from other Valley Water reservoirs connected to the SCP, namely Anderson and Calero reservoirs, may be another source of water for storing in the Quarry. This supply source would utilize the same facilities to deliver water to the Quarry as the SWP and CVP supplies.

4 Infrastructure Alternatives

Based on the project assumptions above, three alternatives were identified to provide raw water sources to the Quarry. The approximate alignments of pipelines are identified in Figure 1.

- **Alternative 1 – Stevens Creek Pipeline to Quarry.** Transfer of imported raw water from existing contracted entitlements for SWP or CVP [supply (a) Imported Water]. May also include raw water from Anderson and Calero reservoirs [Supply (c) Local Reservoirs] to supplement imported water. Water would be supplied to the new Quarry reservoir via a new pipeline and a pump station connecting to Valley Water’s existing infrastructure through the SCP in Cupertino. The pipeline would be constructed in roadways to the extent possible. A tunnel may be used instead of a pipeline for a portion of the alignment on the Quarry property in lieu of a shallow excavation and installation of pipeline.
- **Alternative 2 – Stevens Creek Reservoir to Quarry.** Diversion of currently unallocated streamflow from Stevens Creek [Supply (b) Local Watershed Diversions] and transfer of water in Stevens Creek Reservoir (from new diversion) to the new Quarry reservoir. Conveyance of water from Stevens Creek Reservoir to the new Quarry reservoir via a new pipeline and pump station. A tunnel may be used instead of a pipeline for a portion of the alignment in lieu of a shallow excavation and installation of pipeline.
- **Alternative 3 – Permanente Creek Diversion to Quarry.** Optional diversion of new streamflow from Permanente Creek [Supply (b) Local Watershed Diversions]. This source could be used to supplement either Option 1 or 2 but would not provide a mechanism to get water back into Valley Water’s conveyance facilities. A small diversion dam would be constructed on Permanente Creek to divert water into a pipeline that conveys water via gravity to the Quarry. Additional infrastructure would be needed for water to be returned to Valley Water’s system. Infrastructure identified in alternative 1 or 2 may be included with this alternative.

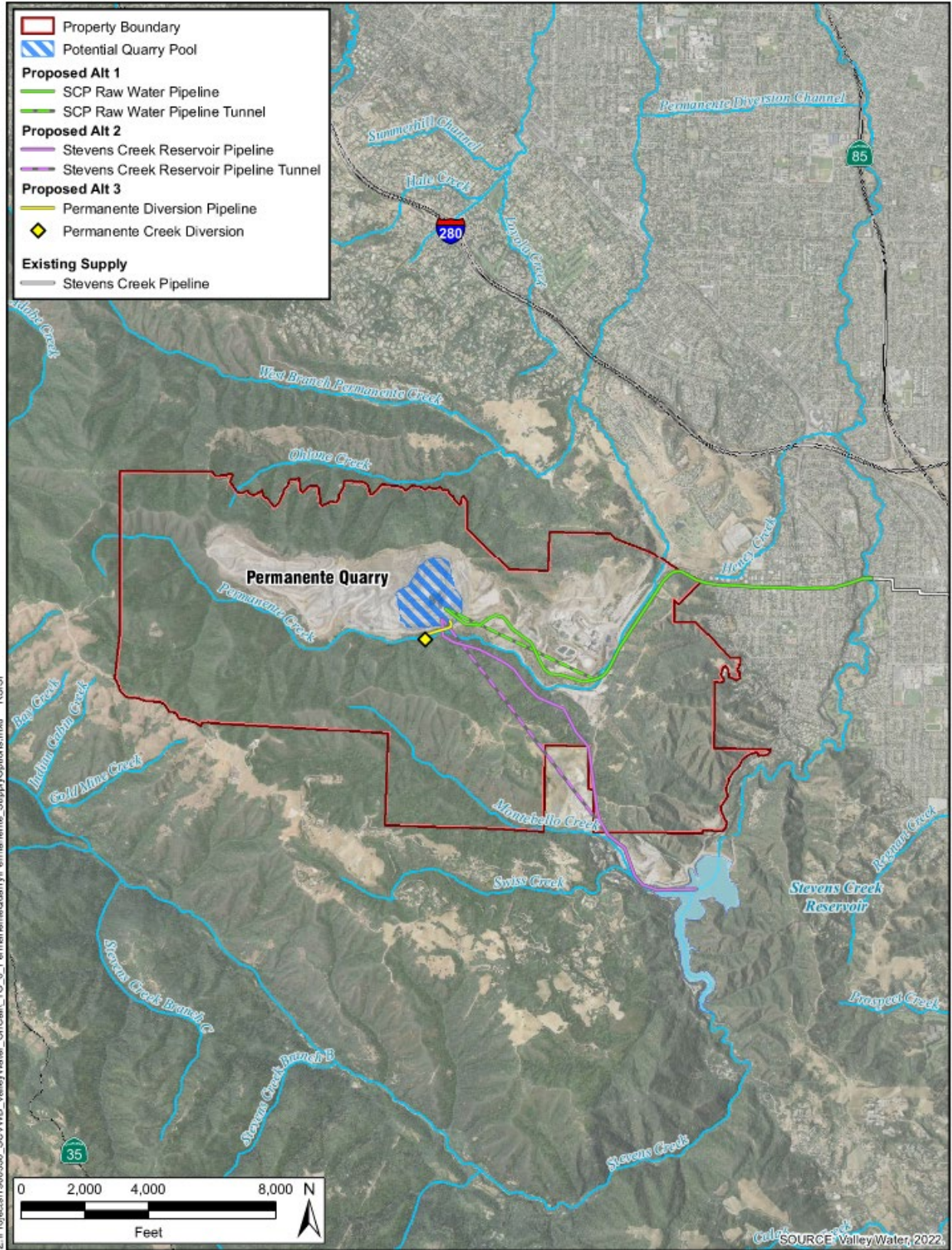


Figure 1: Water Supply Alternatives

4.1 *Alternative Water Availability*

Each of the above alternatives has different water sources, as noted, and different potential for providing water for storage in the Quarry. The average annual water available for each of these sources is described below.

- **Alternative 1**– Alternative 1 relies on SCP to convey water to the Quarry. Water supplies may be limited by either the capacity of the pipeline or the deliveries that could be provided to the pipeline. To determine an accurate estimate of the potential deliveries from SCP, additional system operations modeling would need to be run to calculate the potential deliveries from imported water sources [Supply (a) Imported Water] and Anderson and Calero reservoirs [Supply (c) Local Reservoirs]. For the purposes of this study, it will be assumed that raw water would be available at SCP at a flow rate of 20 cfs, for six months of the year, every three years. This calculates to approximately 2,400 acre-feet per year on average.
- **Alternative 2**– Alternative 2 leverages on any excess supplies not currently used on Stevens Creek [Supply (b) Local Watershed Diversions]. Stevens Creek currently operates under a pilot program based on the Fish and Aquatic Habitat Collaborative Effort settlement agreement, which requires minimum releases be made from Stevens Creek Reservoir based on time of year and storage in the reservoir. Valley Water also currently has an appropriative water right of 4,000 acre-feet, with a priority since 1931, for domestic and irrigation uses. The water right is put to beneficial use by storing water in Stevens Creek Reservoir, which has a total capacity of approximately 3,000 acre-feet, and by releasing it to the Stevens Creek for managed groundwater recharge. This alternative would require a new appropriative water right be acquired for Stevens Creek or modifying the existing water right by increasing its licensed amount and adding a new diversion point.
- **Alternative 3**– Alternative 3 leverages runoff from the relatively small 2.2 square mile Permanente Creek watershed [Supply (b) Local Watershed Diversions] upstream of the Quarry. The runoff at the Quarry was estimated using Natural Resources Conservation Service (NRCS) National Engineering Handbook SCS runoff equation and leveraging precipitation data from Valley Water precipitation gages. The average annual runoff in Permanente Creek upstream of the Quarry was estimated at 1,040 acre-feet. However, as noted earlier, Permanente Creek includes red-legged frog habitat, so additional analysis may be required to determine what, if any, flows need to be maintained to sustain that habitat.

4.2 *Quarry Water End Use*

As noted in Section 3.2, there is not a clear end use of the water stored in the Quarry at this time. This study assumes all alternatives provide a mechanism to convey water to SCP, which, with some potential modifications, could be pumped backward through the system to the Rinconada Treatment Plant or released into McClellan Percolation Ponds, Stevens Creek, and other creeks in the West Valley for groundwater recharge. The total annual groundwater recharge capacity of these recharge facilities totals about 15,200 AFY. The modifications required to reverse flow water through SCP will need to be studied to determine the specific infrastructure and operations requirements. Other end use options may be considered in future studies.

4.3 *Alternative Infrastructure Requirements*

This section identifies the major infrastructure requirements to convey water to the Quarry and tie the Quarry to the rest of Valley Water's conveyance system. Infrastructure requirements will be sized based on water supply availability and timing.

- **Alternative 1 – Stevens Creek Pipeline to Quarry:** To implement Alternative 1, the SCP will be extended to the Quarry. The same pipeline will be used to return water stored in the Quarry to the SCP. The static head at the Quarry is greater than 450 feet above the operating pressure of the existing SCP; therefore, a booster pump station is required to lift water to the quarry. A pump station at the Quarry is required to return flows to the SCP.
 - Pipelines: Approximately three miles of 24-inch steel pipeline will be installed from the existing turnout at Stevens Creek to the Quarry using an open trench method. This alignment requires that water is pumped above the Quarry rim. The 5,000 feet of the pipeline nearest to the Quarry could alternatively be installed in a tunnel. This would reduce the energy cost to pump water to the Quarry and enable the return flow to the SCP to take advantage of the reservoir head and reduce the pump station size at the Quarry when returning flow to the SCP.
 - Pump Stations: The operating pressure at the SCP should enable the booster pump station to be located beyond the residential area approximately one mile west of the current Stevens Creek turnout. A second pump station at the Quarry may be necessary to return water to the SCP depending on the minimum pool level to be maintained at the Quarry. The sizing of the potential pump stations considered the static head and pipe friction headlosses and minor (form) headlosses. Each pump station will require multiple pumps with electric motors in the range of 500 to 700 horsepower. For this study, we anticipated each pump station will consist of three (3) pumps.
 - Pressure Reducing Station: The return of flow to the SCP may create operating pressures greater than the operating pressure at the SCP turnout. Therefore, a pressure reducing station will be required.
 - Potential additional infrastructure to facilitate reverse flows: Additional check valves, gate valves, and surge pressure relief valves to protect the pipeline from hydraulic transients (water hammer) should be anticipated.
 - Other: The above requirements apply to use of Supply (a) Imported Water (from the SWP or CVP) only. Additional facility analysis should be conducted to determine if there are any additional infrastructure requirements for use of Supply (c) Local Reservoirs.
- **Alternative 2 – Stevens Creek Reservoir to Quarry:** To implement Alternative 2, a new pipeline will have to be constructed from the Stevens Creek Reservoir to the Quarry. The same pipeline will be used to return water stored in the Quarry to the Stevens Creek Reservoir. The static head at the Quarry is 480 feet greater than the reservoir. For this study, the delivery of water from the reservoir to the SCP is assumed to be accomplished with installation of a diversion off Stevens Creek at the SCP and installation of a pumpstation.
 - Pipelines: Approximately 2.5 miles of 24-inch steel pipeline will be installed from the Stevens Creek Reservoir to the Quarry using an open trench method. This alignment

requires that water is pumped above the Quarry rim. The 8,000 feet of pipeline nearest to the Quarry could be installed in a tunnel. This would reduce the energy cost to pump water to the Quarry and enable gravity return flow to Stevens Creek Reservoir.

- Pump Stations: A new pump station at Stevens Creek Reservoir will need to be constructed to deliver the available flows to the Quarry. A second pump station at the Quarry may be necessary to return water to the Stevens Creek Reservoir depending on the minimum pool level maintained at the Quarry. The sizing of the pump stations considered the static head and pipe friction and minor (form) headlosses. Each pump station will require multiple pumps with electric motors in the range of 500 to 700 horsepower. For this study we anticipated each pump station would consist of three (3) pumps.
- Potential additional infrastructure to facilitate reverse flows: Additional check valves, gate valves, and surge pressure relief valves to protect the pipeline from hydraulic transients (water hammer) should be anticipated.
- **Alternative 3 – Permanente Creek Diversion to Quarry:** Alternative 3 would divert water from Permanente Creek into the Quarry. Permanente Creek appears to be 50 to 100+ feet below the Quarry rim. A new diversion dam can be constructed across the creek to divert flow by gravity into the Quarry. The diverted water would not be returned to Permanente Creek but could be utilized as discussed in alternatives 1 and 2. The diversion dam height will enable the crest to be overtopped during large storm events.
 - Permanente Creek Diversion Dam: The dam can be earthen or a concrete weir structure to enable flow to be redirected into the Quarry. The height of the dam would be established to ensure required diversion flows, while minimizing the potential for inducing downstream flooding during high flows. The earthen dam would be hard-faced with reinforced concrete to allow overtopping of the dam during high flows. A small-diameter pipe could be installed to provide a minimum creek flow if needed for mitigation. If Alternative 3 is carried forward, an alternate design consideration could be installation of an inflatable rubber dam which could be lowered to allow flows in Permanente Creek to bypass the diversion if the Quarry were at full capacity.
 - Diversion off Permanente Creek: Water would be diverted into the Quarry in a 48-inch reinforced concrete pipe. The Quarry rim could be excavated to the proper elevation and backfilled to install the RCP, or the RCP could be run downstream to tie into a lower point on the Quarry rim. A reinforced concrete intake structure and outlet structure, including a coarse trash rack to mitigate animal or human access into the pipeline, would be constructed. The diversion pipe and dam will be located where the depth of the creek below the quarry road is least, to minimize the excavation depths for the diversion pipe.
 - Potential additional infrastructure to facilitate reverse flows: Additional infrastructure does not appear necessary, but this alternative does not provide a mechanism for water to be returned to Valley Water's existing infrastructure. Alternative 3 could complement Alternative 1 or Alternative 2.

4.4 Alternative Capital Cost Estimates

Reconnaissance-level (Class 5) cost estimates were developed for each of the above alternatives based on similar projects, standard cost estimating resources, and engineering judgement. For alternatives 1 and 2, the lower cost estimate represents construction of the conveyance pipeline using traditional trenching and installation while the larger value represents the estimate for boring a tunnel into the Quarry.

Table 1. Permanente Quarry Capital Cost Summary

Alternative	Amount
Alternative 1 - Stevens Creek Pipeline to Quarry	\$19 to \$31 Million
Alternative 2 - Stevens Creek Reservoir to Quarry	\$17 to \$40 Million
Alternative 3 - Permanente Creek Diversion to Quarry	\$1.8 Million

It is important to note that the costs identified above only address physical infrastructure costs and do not include the following additional costs, which could be fairly significant. Future studies should look at including these costs in future estimates. These costs could include:

- Site acquisition for the Quarry
- Right of way acquisition
- Other modifications to Valley Water infrastructure
- Purchase cost of imported water (Only applicable to Alternative 1)
- Operations and maintenance
- Conveyance energy costs (pumping)
- Potential costs of grouting joints and fissures in the Quarry
- Potential costs of slope stabilization in the Quarry
- Potential costs of treatment of water stored in the Quarry
- Permitting and/or mitigation
- Remediation costs
- Water loss due to evaporation and other conveyance losses

5 Project Feasibility Challenges

There are multiple criteria that need to be considered in evaluating the feasibility of using the Quarry for storage for this project. Some criteria may be of greater consequence to the overall project feasibility, and some are alternative-specific. A summary of these challenges is included in Table 2 below, and key changes are discussed in further detail in this section.

Table 2: Project Feasibility Challenges

Potential Impact	Quarry Use Feasibility Consideration	Alternative-Specific Feasibility Considerations	Feasibility Implications (Consequence)		
			High	Medium	Low
Change Mine Reclamation Plan	X		X		
Change in Lehigh Property Zoning	X		X		
Changes in Existing Water Rights		X		X	
Water Supply Availability		X	X		
Facilities and Operations		X		X	
End Use of Water		X		X	
Quarry Hydrogeologic Considerations	X				X
Source Water Quality		X			X
Stored Water Quality - RWQCB Water Quality Objectives	X	X	X		
Stored Water Quality – Public Health Standards	X		X		
California Red-Legged Frog		X		X	
In-Stream Flows and New Water Rights		X	X		
Other Environmental and Regulatory Factors	X	X		X	
Local Hydrologic Conditions	X				X
Project Costs	X	X	X		

Legend:

Potential issue that is regularly dealt with or can be easily evaluated or resolved
Potentially significant issue that does not affect project feasibility but could be challenging, costly, or affect the scope of the alternative
Critical issue that could result in the alternative being infeasible

5.1 Land Use Changes – All Alternatives

The reservoir project may not be compatible with the current HS-d1 zoning designation for the Lehigh property. If the project is not allowed within the HS-d1 designation, Valley Water can apply for a Conditional Use Permit with the Planning Commission. Since this is a discretionary permit, Santa Clara County would require CEQA documentation of potential project impacts and could decline to issue a permit. Therefore, obtaining this permit is a feasibility requirement of the project.

If the Quarry was used as a reservoir after ceasing mining operations, the Quarry basin could not be backfilled and reclaimed according to the approved 2012 Reclamation Plan Amendment. Therefore, the reservoir project requires Santa Clara County to amend the currently approved reclamation plans for the Quarry basin. It is not currently known if there are significant issues that preclude Santa Clara County from amending the reclamation plan without backfilling the basin, or if actions other than backfilling would need to be taken to reclaim the Quarry basin consistent with applicable mining laws. The project would be infeasible if the 2012 Reclamation Plan Amendment cannot be changed to remove backfilling of the Quarry basin, or this reclamation activity revised to otherwise make the Quarry basin suitable for a

reservoir at the capacity desired by Valley Water. Since the 2012 Reclamation Plan Amendment requires backfilling the Quarry basin by approximately 2030, there is also a timeline constraint as any changes to this plan would need to be approved prior to reclamation.

5.2 *Stored Water Quality – All Alternatives*

The SFBRWQCB Basin Plan includes water quality objectives that are intended to be protective of the identified beneficial uses for waterbodies; the beneficial use designation and the accompanying water quality objectives collectively define the water quality standards for a given waterbody or region. The Basin Plan contains water quality objectives including for specific chemical constituents, municipal and agricultural water supplies, and groundwater. All waters shall be maintained free of toxic substances in concentrations that are lethal to aquatic organisms or that produce other detrimental responses.

The project would not result in discharges of reservoir water to Permanente Creek. Under Alternative 1, the reservoir may not be waters of the U.S./State regulated by the RWQCB; however, this determination may depend on ultimate end uses of the water supplied by the reservoir. If water is ultimately used for groundwater recharge, applicable groundwater quality standards would need to be met. Under Alternative 2, the quality of water in the reservoir would need to meet water quality objectives related to beneficial uses, including those specified for Stevens Creek Reservoir, Stevens Creek, groundwater, and municipal water supplies.

Based on the SFRWQCB Cease-and-Desists Order, and various water quality studies conducted at the Quarry, constituents of concern include selenium, nickel, total dissolved solids (primarily sulfate), iron, and manganese. Elevated selenium concentrations have occurred in the past from overburden removed from the Quarry and stored onsite and from native soils (similar to the removed overburden) in the swale that discharges to Permanente Creek.

Samples collected from the limestone sediments within the Quarry have less than 5 µg/L of selenium (which is also the current four-day average limitation for selenium in the National Toxics Rule cited by the Basin Plan). Other metals like hexavalent chromium and mercury were detected in negligible concentrations at the ITS influent. Nickel was detected in moderate concentrations, but the average was approximately one-half the basin threshold. These trace metals may also be leaching from overburden but were not tested at various sites like selenium.

Samples collected from water pooled in the Quarry indicate total dissolved solids, iron, and manganese may leach into the stored water. With the relatively small volume of water tested, these constituents are slightly higher than their respective Secondary Maximum Contaminant Level (MCLs). Further evaluation is needed to fully understand potential degradation. Reclamation of the Quarry and other potential constituents of concern, such as algal toxins, should also be considered in further analysis.

If reservoir water quality is anticipated to exceed and violate applicable public health and/or RWQCB water quality objectives and cannot be mitigated onsite below these levels, the project/alternative would be considered infeasible.

5.3 *New Water Rights and In-Stream Flow Requirements – Alternatives 2 and 3*

Stevens Creek contains Central California Coastal steelhead and reductions in streamflow could impact habitat and migration. Existing diversions from Stevens Creek are subject to the requirements of Valley Water's Fish and Aquatic Habitat Collaborative Effort. New water rights under Alternative 2 would be subject to maintaining the same levels of instream flows to protect steelhead. Water stored in the Quarry reservoir would ultimately be conveyed back to Stevens Creek Reservoir and released downstream,

resulting in additional changes to the existing hydrograph of Stevens Creek. While this could result in periods of increased instream flows compared to existing conditions, further study is required to identify potential impacts to steelhead and other special-status species and desired flow levels during periods of the year when releases may occur.

Since the present-day hydrology of the Permanente Creek watershed does not support anadromous fish, it is not anticipated that diversion of Permanente Creek flows would need to consider instream flows for anadromous fish. However, the California red-legged frog and potentially other special-status amphibians are present in Permanente Creek, and aquatic habitat for these species could be permanently impacted due to reduced streamflow from new diversions under Alternative 3.

Potential effects to special-status species from stream diversions would be reduced by limiting diversions to flows during larger storm events. However, if insufficient flow is available after in-stream flow requirements, Alternative 2 and/or 3 could be infeasible.

5.4 Project Alternative Costs – All Alternatives

Ultimately, the cost of project infrastructure, property, and operations and maintenance can make a project economically infeasible. This study focused on approximating the major infrastructure requirements and determining the capital costs of these improvements. Additional expenses include acquisition of the Quarry site, operations and maintenance, and any mitigation measures. These will need to be considered to determine the overall cost of water that could be stored in the Quarry to augment Valley Water supplies.

6 Conclusions and Recommendations

6.1 Conclusions

Below is a summary of the conclusions presented in the four Reconnaissance-Level Study of Permanente (Lehigh) Quarry Site Technical Memoranda.

6.1.1 Conclusions from TM1: Hydrogeologic Setting and Water Quality

TM1 described the existing hydrogeologic setting and water quality conditions to inform Valley Water of issues that could make the project infeasible, require further analysis to understand, or be costly.

TM1 described the Quarry as located within the Franciscan Assemblage consisting of metamorphose sediments. Groundwater stored within the joints and fractures of the Franciscan Assemblage is considered by DWR to be non-water bearing with respect to production of usable quantities of water. The Quarry is located in a seismically active area that is subject to earthquakes. Because the reservoir would be located within the Quarry pit it is the seismic activity is not expected to determine the overall project feasibility, but the Quarry has a history of landslides that may affect project design and operations. Additional studies could be undertaken to better understand the roll of the joint and fracture system in groundwater flow and identify the need for grouting. Additionally, more information may be needed to evaluate the need for slope stabilization activities to reduce the threat from landslides into the reservoir.

TM1 synthesized the available water quality information to serve as a feasibility level assessment of the Quarry in the context of Valley Water's proposal to use the Quarry to store raw water. While there is a considerable amount of data available, reports that were referenced for this study were prepared for the purpose of demonstrating compliance with waste discharge permitting requirements. Use of these studies

relied on data interpretations and conclusions relevant to the purpose of the study and applied to Valley Water's proposed use of the quarry.

6.1.2 Conclusions from TM2: Existing Conditions, Potential Environmental Issues, and Regulatory Requirements

TM2 describes how the feasibility of developing a reservoir project at the Quarry depends on amending the *2012 Reclamation Plan Amendment* to change plans for backfilling the Quarry and potentially discretionary approval from the County for a Use Permit or zoning amendment to develop a reservoir at the Quarry. In addition, instream flow requirements need to be considered in state water rights for new diversions of water on Permanente Creek for CRLF and on Stevens Creek for steelhead. The reservoir project, including development and operation of the reservoir and associated infrastructure, would result in a range of environmental impacts, including to water quality, biological resources and especially CRLF, cultural resources and especially the Kaiser Permanente Quarry Mining District, noise generation, energy use, and greenhouse gas emissions, among others. With further site-specific study, there may be opportunities to avoid or reduce impacts to some of these resources during project planning and design. The project would also require several permits from federal, state, and local regulatory agencies and compliance with the California Environmental Quality Act and possibly the National Environmental Policy Act, if federal approvals are required or funding is provided (refer to TM 2 for more details on regulatory approvals).

6.1.3 Conclusions from TM3: Hydrologic Setting and Flood Conditions

TM 3 presents the hydrologic setting for the Permanente and Stevens Creek watersheds and describes the existing and potential flood risk associated with the project. The use of the Quarry for storage of raw water is anticipated to have limited effect on the downstream flood risk. The Quarry is off-stream and would thus have limited uncontrolled runoff into the Quarry and is anticipated to have sufficient freeboard to accommodate the limited water entering the Quarry during a precipitation event.

6.1.4 Conclusions from TM4: Existing Valley Water Infrastructure and Water Supply Availability

TM4 presented an assessment of the existing infrastructure and sources of water that could potentially be leveraged in utilizing the Quarry as a raw water storage reservoir. Based on this assessment, three sources were identified including (a) Imported Water, (b) Local Watershed Diversions, and (c) Local Reservoirs. From these sources, three different alternatives were defined which could be constructed to convey water to the Quarry. These alternatives include:

- Alternative 1 – Stevens Creek Pipeline to Quarry
- Alternative 2 – Stevens Creek Reservoir to Quarry
- Alternative 3 – Permanente Creek Diversion to Quarry

The potential water supplies for each of these alternatives was estimated using readily available data and information. It should be noted that none of these alternatives are estimated to be able to regularly fill the Quarry, and it would take multiple normal years to fill. Additionally, there are minor losses and environmental flow considerations which need to be refined to provide more accurate estimates of the water available for storage.

A high-level assessment of the infrastructure requirements was developed for each of the alternatives. Based on these infrastructure requirements, reconnaissance level cost estimates were developed, but

additional work is needed to define project costs which are not directly related to the infrastructure elements.

6.2 Recommendations on Further Considerations for this Project

- Additional studies could be undertaken to better understand the roll of the joint and fracture system in groundwater flow and identify the need for grouting. Additionally, more information may be needed to evaluate the need for slope stabilization activities to reduce the threat from landslides into the reservoir.
- GEI recommends conducting a comprehensive analysis of the sample methods and results to evaluate the water quality data strictly for the perspective of the proposed future use to accurately characterize impacts of using the Quarry as a storage reservoir.
- GEI recommends an independent review of sample results and water quality characterization based on analysis of sample methods (i.e., stormwater sampling, wall scouring then sampling, sampling stagnant pond water, etc.), then applying the data interpretations to Valley Water's proposed use of the Quarry.
- There are monitoring wells onsite to detect potential contaminant migration. The Operations, Maintenance and Contingency Plan are used to address contaminant leaching so GEI suggests making a public records request to the SFRWQCB, for items such as lab reports. A subsequent phase of this feasibility study could be conducted to evaluate if stored water would seep into the groundwater and potentially mobilize contaminants from buried wastes.
- Further evaluation of water quality, including, but not limited to, source water quality for Alternatives 1 through 3, stormwater quality, Quarry basin geology and soils, presence of historic contamination in the Quarry basin, approaches to Quarry basin reclamation (in lieu of filling the basin), and effects of dilution from water storage, among others. Modeling project water quality would help clarify if applicable public health and RWQCB water quality objectives may be exceeded by the project.
- If local water supplies from either Permanente Creek or Stevens Creek are used as the supply for the Quarry, additional hydrologic modeling would be needed to determine the timing and refine the volume of supplies that might be available for storage in the Quarry.
- If imported water is used as the supply for the Quarry, Valley Water would then have to decide how to balance their available supplies in the Quarry compared to storage in San Luis Reservoir. This may require hydraulic modeling of the Valley Water conveyance system to identify the timing and available capacity to deliver water to the Quarry. This study may identify additional infrastructure not yet identified.
- In conjunction with the water supply modeling, a pipeline hydraulic model should be developed to refine and optimize the pipeline and pumpstation sizing to maximize water supplies.
- The end use of the water stored in the reservoir would need to be determined. Currently this study has identified several opportunities for the end use of the water but, to better refine the infrastructure requirements, an end use will need to be determined.

- Coordination with Santa Clara County is needed to determine requirements and options for modifying the 2012 Reclamation Plan Amendment to eliminate backfilling of the Quarry basin and to determine if a zoning change and Conditional Use Permit are required for the project.
- Define the potential costs which are not currently quantified in this TM to better understand the total potential costs associated with the Quarry.

6.3 *Response to Task Order Requests*

Additional planning studies are necessary to further evaluate the technical and economic feasibility of using the Quarry as raw water storage. The additional information would be needed to refine the project purpose (use of the stored water) to evaluate the feasibility based on water supply availability, infrastructure and operational requirements, and impacts on water quality. There are additional environmental considerations and regulatory requirements that would also need to be addressed. The specific questions identified in the Task Order are summarized below.

- **Description of potential to utilize quarry site to store and distribute raw water.** This is the primary purpose of this summary report and four supporting TMs. This topic is covered from a wide variety of feasibility topics.
- **Rough determination of infrastructure needed including costs based on analysis of piping, pumps, and other required infrastructure.** Description of required infrastructure is included in Section 4, and further detailed in Technical Memorandum No. 4 – Existing Valley Water Infrastructure and Water Supply Availability.
- **Discussion of operational feasibility (including where to source water - would it come from local or imported water).** Description of water supply sources are covered in Section 3.3 and Section 4 and are further detailed in Technical Memorandum 4 – Existing Valley Water Infrastructure and Water Supply Availability.
- **Discussion of potential changes to current site hydrology benefits for flood protection (drainage pattern) and other potential flood benefits.** Descriptions of hydrology and flood protection are covered in Section 2.4 and further detailed in TM 3 – Hydrologic Setting and Flood Conditions.
- **Water quality risks, both for water supply use as well as environmental risk of continued water storage onsite.** Water quality risks are covered in Sections 2.3 and 5.2. This topic is also discussed in all the TMs covering water quality related to storage in the Quarry, the environment, and surface water quality.
- **Other potential benefits or risks (i.e., community issues/risks, geophysical risks).** This is discussed throughout this TM and the other four TMs.
- **Recommendations on further considerations for this project.** Recommendations are explicitly answered in Section 6.1.
- **Citations to all references and data used (all referenced reports and data to be compiled and delivered to Valley Water).** The references used to support this reconnaissance-level feasibility study are listed in Section 7 – References. They include numerous references provided by Valley Water and additional references and data identified by the project team. The references and data were reviewed by GEI staff and Valley Water staff through a series of four interviews focused on each of the draft TMs.

7 References

Santa Clara Valley Water District (Valley Water). 2019. Water Supply Master Plan 2040.

Santa Clara Valley Water District (Valley Water). 2021a. 2020 Urban Water Management Plan.

Santa Clara Valley Water District (Valley Water). 2021b. 2021 Groundwater Management Plan for the Santa Clara and Llagas Subbasins.

Golder Associates Inc. 2011a. Hydrologic Investigation (revision 1.0) Permanente Quarry Reclamation Plan Update. Santa Clara County, California.

USGS. Stream Stats Report. Accessed March 07, 2022. Retrieved from: <https://streamstats.usgs.gov/ss/>

Santa Clara Valley Water website. Retrieved from: <https://valleywater.org>

Strategic Engineering & Science, Inc (SES).2011b *Reclamation Water Quality*. Permanente Quarry, Santa Clara County, California.

Santa Clara County. 2019. *Permanente Quarry Application Package, Binder 2 of 2: Project Description and Supplemental Environmental Information*. Available: https://stgenpln.blob.core.windows.net/document/2250_2019RPA_ProjectDescription_EnvironmentalInfo.pdf Accessed: March 1, 2022.

Santa Clara County. 2011. *Lehigh Permanente Quarry Reclamation Plan Amendment, Environmental Impact Report*. Available: https://stgenpln.blob.core.windows.net/document/Lehigh_DEIR_201112.pdf Accessed: March 1, 2022.

Edward L. Pack Associates, Inc. . 2010. *Noise Monitoring Lehigh Quarry*. Available: https://stgenpln.blob.core.windows.net/document/2250_Lehigh_NoiseMonitoring.pdf Accessed: March 1, 2022.

Santa Clara Valley Water District (Valley Water). 2015. Urban Water Management Plan. Available: <https://www.valleywater.org/sites/default/files/SCVWD%202015%20UWMP-Report%20Only.pdf> Accessed: March 1, 2022.

_____. 2021. Fish and Aquatic Habitat Collaborative Effort Draft Program Environmental Impact Report.

_____. 2011. Permanente Creek Flood Protection Project Volume I Final Subsequent Environmental Impact Report. Available: https://www.valleywater.org/sites/default/files/Permanente%20FSEIR_Volume%201_Nov%202012_lrz.pdf Accessed: March 15, 2022.

_____. 2022. Protection and Augmentation of Water Supplies. Available: <https://www.valleywater.org/sites/default/files/2021-03/2021-22%20Protection%20and%20Augmentation%20of%20Water%20Supplies%20Report.pdf> Accessed: March 21, 2022.

Paul Rogers. 2015. *Cupertino cement quarry to pay \$7.5 million to settle water pollution violations*. Bay Area News.

Sharon Simonson. 2020. *Permanente Quarry: Life on the Rocks*. Silicon Valley One World.

Golder Associates, Inc (Golder). 2011a. Geotechnical Evaluations and Design Recommendations (Revised). Santa Clara County, California

Golder Associates, Inc (Golder Hydrologic Conditions). 2011b. Summary of Hydrologic Conditions of Reclamation Planning, Santa Clara, California

Golder Associates. 2016 *EMSA Selenium Concentrations 2016*.

State Water Resource Control Board (SWRCB). 2019. ORDER No. R2-2019-0024 NPDES No. CA0030210. Available:
https://www.waterboards.ca.gov/rwqcb2/board_info/agendas/2019/July/7_final_to.pdf Accessed: March 15, 2022.

San Francisco Regional Water Quality Control Board (RWQCB). Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin 2017. May. Available:
https://www.waterboards.ca.gov/sanfranciscobay/basin_planning.html#basinplan. Accessed: March 29, 2022

San Francisco Regional Water Quality Control Board (RWQCB). Tentative Order No. R2-2018-XXXX, Waste Discharge Requirements Lehigh Southwest Cement Company and Hanson Permanente Cement, Inc. Permanente Quarry and Cement Plant, 2018.

(Appendix H), Golder Associates, April 2019, Summary of Hydrologic Conditions of Reclamation Planning, Permanente Quarry Reclamation Plan Amendment, Santa Clara County, California

Strategic Engineering and Science, Inc., December 2011, Reclamation Water Quality, Permanente Quarry, Santa Clara County, California