4.6—HYDROLOGY AND WATER QUALITY

BENCHMARK RESOURCES

4.6—HYDROLOGY AND WATER QUALITY

This section of this subsequent environmental impact report (SEIR) addresses potential impacts of the project on hydrology and water quality, describes the environmental and regulatory setting, and discusses mitigation measures to reduce impacts where applicable. Issues addressed include impacts on potential flooding, surface water drainage, groundwater flow, groundwater supply, water quality, and water balance.

The hydrology and water quality conditions of the project were assessed through review of applicant-submitted documents, existing publicly available data and reports, aerial photos, and field observations. The information in this section is based on applicant-prepared studies and publicly available sources. The applicant-prepared studies used are:

- *Hydraulic Design Study* (Brown and Caldwell 2020) (Appendix F-1, "Hydraulic Design Study," of this SEIR),
- *Groundwater Hydrology and Water Quality Analysis Report for the Eliot Quarry SMP-23 Reclamation Plan Amendment Project, Alameda County, California* (EMKO Environmental Inc. [EMKO] 2020a) (Appendix F-2, "Groundwater Hydrology and Water Quality Report," of this SEIR),
- *Focused Water Quality Assessment Lake B Component Eliot Quarry Reclamation Plan Amendment Project Alameda, California.* (Kleinfelder 2020) (Appendix F-3, "Focused Water Quality Assessment for Lake B," of this SEIR),
- *3D Clay Bed Geologic Model and Lack of Evidence for the Presence of Aquitards* (Jeff Light Geological Consulting 2019) (Appendix F-4, "3D Clay Bed Geologic Model and Lack of Evidence for the Presence of Aquitards," of this SEIR),
- *2013 Becker Hammer and 2018 Sonic Drill Logs* (Brown and Caldwell 2019) (Appendix F-5, "2013 Becker Hammer and 2018 Sonic Drill Logs," of this SEIR),
- *Adaptive Management Program for Water Quality Regarding Iron* (EMKO 2020b) (Appendix F-6, "Adaptive Management Program for Water Quality Regarding Iron," of this SEIR), and
- *Water Supply Assessment* (EMKO 2019) (Appendix F-7, "Water Supply Assessment," of this SEIR).

These analyses were peer reviewed by the County-retained Stillwater Sciences in April of 2019, April of 2020, and July of 2020. The peer review letter reports are on file with the County. The applicant revised the referenced analyses and provided responses to the peer reviewer comments, which are also on file with the County. Appendices F-1 through F-7, referenced above and incorporated into this SEIR, were finalized after and adequately addressed the peer reviewer's comments and questions.

4.6.1 Hydrology and Water Quality Conditions at the Time of the LAVQAR EIR

The *Livermore-Amador Valley Quarry Area Reclamation Specific Plan Environmental Impact Report* (LAVQAR EIR) describes the setting of the project site in 1976 as an area encompassing about 2,100 acres of undisturbed, mostly agricultural area, 900 acres of working gravel pits and earth fill and settling ponds, and 750 acres of settling pond water area. Surface water and groundwater conditions at the time of the LAVQAR EIR's preparation are described below (Alameda County 1980: 9).

4.6.1.1 Surface Water

The LAVQAR EIR listed Arroyo Mocho and Arroyo del Valle (ADV) as the primary sources of surface water at the project site, with some contributions from Arroyo Las Positas as well. In 1976, the average annual natural runoff of Arroyo Mocho and ADV was 3,000 and 21,000 acre feet annually, respectively. (Alameda County 1980:9-11). The South Bay Aqueduct system was completed in 1968, featuring reservoir storage of 77,000 acre feet at the Del Valle Reservoir. At the time of the LAVQAR EIR, the reservoir allocated 10,000 acre feet for silt storage, 30,000 acre feet for water supply, 35,000 acre feet for primary flood control, and 3,000 acre feet for secondary flood control. However, the aqueduct was not operational at that time, as it required the collection of 30,000 acre feet of water conservation storage, which was not predicted to occur until sometime after 1985. Therefore, at that time, ADV stormwater was stored or released into the ADV or the South Bay Aqueduct at the request of Zone 7 Water Agency (Zone 7) or Alameda County Water District (Alameda County 1980:12).

Periodic sampling of ADV runoff from 1958 to 1968 (before Del Valle Reservoir) indicated total dissolved solids (TDS) ranged from 150 to over 1000 milligrams per liter (mg/l). Most samples were of low flows, and they indicated that with a flow of 5 to 20 cubic feet per second (cfs), TDS averaged about 325 mg/l. After 1968, however, part of the flow in Arroyo del Valle and below the Del Valle Reservoir consisted of imported water, not natural runoff. Therefore, flows after 1968 were not sampled on a regular basis. Water from the Sacramento-San Joaquin Delta is released into Arroyo del Valle in the summer; during the months of September, October, and November releases are made from Del Valle reservoir to evacuate about 15,000 acre feet of storage for conservation of local runoff. (Alameda County 1980:12, 20). The LAVQAR EIR also noted that both the Arroyo Mocho and ADV run through the Chain of Lakes area into Arroyo de la Laguna (Alameda County 1980: 9-22).

4.6.1.2 Groundwater

The LAVQAR EIR noted that the Pleasanton fault formed the Amador/Bernal subbasin boundary, and the Livermore fault formed the Amador/Mocho boundary. In addition, groundwater movement was described as restricted across the two faults and the south side of the project area that overlies the ADV forebay area. This area, located between the ADV and Stanley Boulevard, was identified as a primary recharge area for the groundwater basin. Furthermore, as of 1976, the project area utilized approximately 8,000 acre feet of groundwater annually (Alameda County 1980: 9-10). In 1976, Zone 7 imported 21,000 acre feet of water, about 7,000 of which was used to replenish the groundwater basin. Groundwater quality in the project area varied from about 300 mg/l TDS in the forebay area to over 700 mg/l on the north side of the project area. The groundwater was much harder than the imported water. Therefore, in 1976, imported water quality was generally considerably higher quality than groundwater at the project site. The imported water had an average annual TDS range of 1.50 to 2.50 mg/l at the time. However, from February through December of the 1977 drought, groundwater at the project site began to average about 230 mg/l TDS over time, whereas the imported water averaged nearly 600 mg/l TDS, constituting a considerable change (Alameda County 1980:10, 21)

4.6.2 Environmental Setting

The project site is located within the Livermore-Amador Valley, an east-west trending inland alluvial basin located in northeastern Alameda County (Figure 4.6-1, "Map of Groundwater Basins within Zone 7 Service Area"). The eastern portion of the site (east of Isabel Avenue) contains Lake A, a formerly mined area that contains water primarily from groundwater infiltration. South of Lake A is the eastern portion of the ADV at the project site, which is a perennial drainage channel that runs east-west along the southern portion of the site.

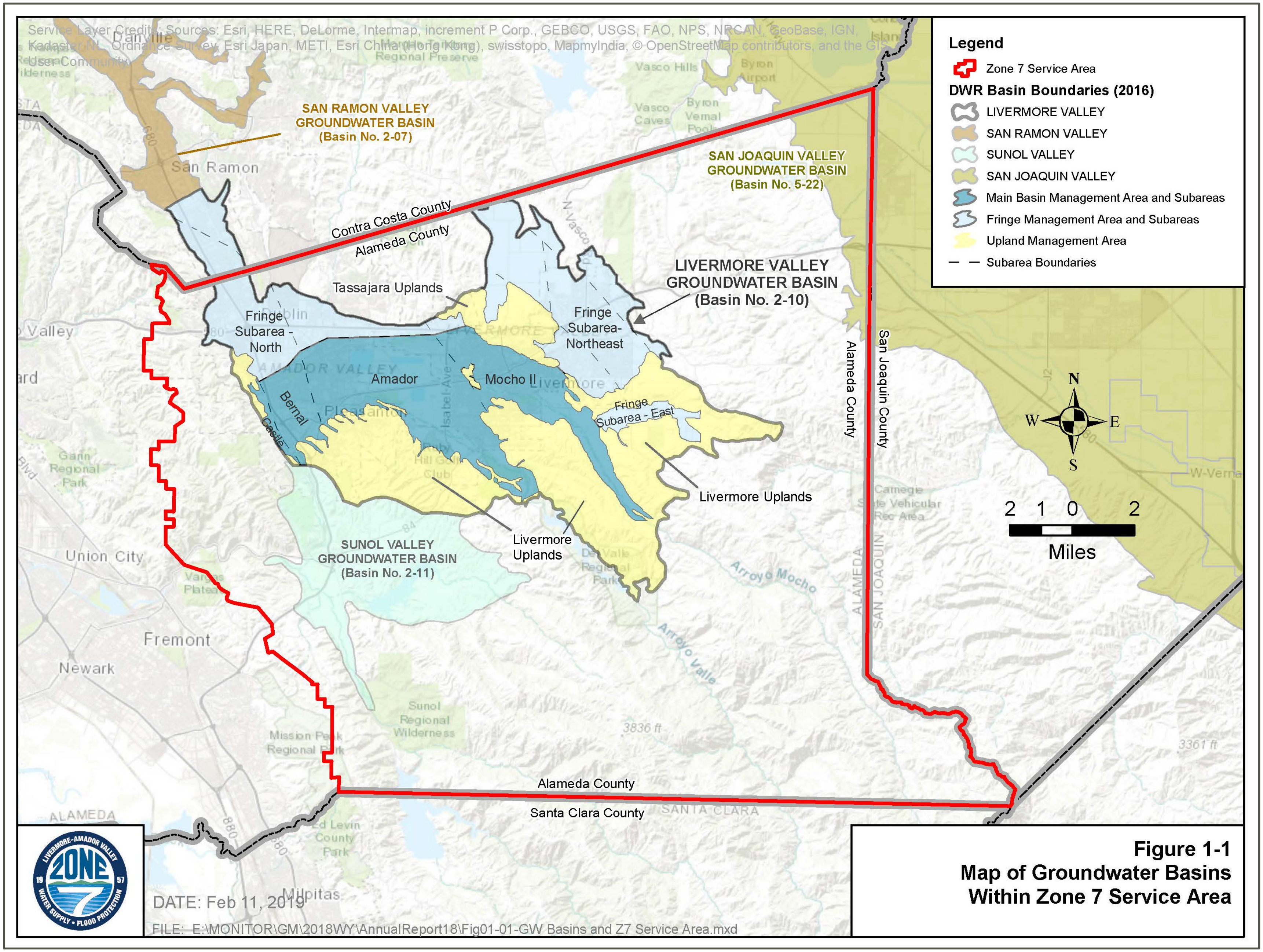

Figure 1-1
Map of Groundwater Basins Within Zone 7 Service Area

SOURCE: Zone 7 2018 Annual Report, Figure 1; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

Map of Groundwater Basins within Zone 7 Service Area

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Figure 4.6-1

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The portion of the site west of Isabel Avenue contains Lake B, which is a portion of the active mining area with a mine pit approximately 100 to 130 feet deep. Lake J, which is one of the active mining areas, is located north of Lake B. The ADV continues east-west along the southern portion of this area of the site before merging with Arroyo de la Laguna, which then merges with Alameda Creek near Interstate 680 in the Sunol area. (see Figure 2-6, "Existing Facilities," in Chapter 2, "Project Description").

4.6.2.1 Climate and Precipitation

The general climate of the project area is classified as Mediterranean, characterized by semi-arid temperatures with seasonal rainfall. Warm summers and mild winters typify local climatic conditions. Precipitation is confined mainly to the "wet" season, which lasts from late fall (late October) to early spring (early April) (DWR 1975).

Over the course of a year, the temperature typically varies from 39°F to 88°F and is rarely below 31°F or above 98°F. The average annual precipitation in the project vicinity is approximately 14.53 inches per year (WRCC 2020).

4.6.2.2 Surface Elevations

Lake A is located east of Isabel Avenue (State Route 84) and Lake B is located west of Isabel Avenue (see Figure 2-5, "Anticipated Zone 7 Land Designations" in Chapter 2, "Project Description"). Surface elevations around the perimeter of Lake A range from approximately 415 feet (ft) mean sea level (msl) on the southwest side of the pit to approximately 445 ft msl on the northeast side of the pit. The elevation of the bottom of Lake A ranges from approximately 390 ft msl to 350 ft msl. Mining has not occurred in Lake A for approximately 10 to 15 years.

Surface elevations around the perimeter of Lake B range from approximately 410 ft msl on the east side of the pit to approximately 373 ft msl on the west side of the pit. The current mining depths range from approximately 325 ft msl to 265 ft msl in Lake A and from approximately 325 ft msl to 262 ft msl in Lake B (see Appendix B-1, "Proposed Reclamation Plan Amendment," and CEMEX Annual Compliance Report) (CEMEX 2020). Mining is also currently occurring in the location of the previous aggregate processing plant area, referred to as Lake J, with a current bottom elevation of approximately 251 ft msl. (CEMEX 2020).

4.6.2.3 Hydrostratigraphy and Groundwater

The information presented in this section has been summarized primarily from the *Hydrostratigraphic Investigations of the Aquifer Recharge Potential for Lakes C and D of the Chain of Lakes, Livermore, California* (Zone 7 2011), the *Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin* (Jones and Stokes 2005, cited in EMKO 2020a), *Focused Water Quality Assessment Lake B Component Eliot Quarry Reclamation Plan Amendment Project Alameda, California* (Kleinfelder 2020), and Zone 7 groundwater and surface water data. Additional interpretation is also provided based on borehole data obtained by CEMEX in 2013 and 2018 (see Appendix F-5).

The discussion below is focused on the following hydrogeologic conditions:

- hydrostratigraphy;
- aquifer properties;
- water level trends; and
- dewatering.

Each of these hydrogeologic conditions is described in detail below.

Hydrostratigraphy

This section describes the hydrostratigraphy near the Eliot Quarry (project site). Hydrostratigraphy is a term that refers to the layering of the underlying geologic sediments (e.g., alternating layers of gravels and clays) and how that layering may affect the occurrence and movement of groundwater.

The project site is located within the Livermore-Amador Valley, an east-west trending inland alluvial basin located in northeastern Alameda County (Figure 4.6-1). An alluvial basin is a valley that has been filled with sediments deposited predominantly by streams and rivers. The basin is surrounded primarily by north-south trending faults and hills of the Diablo Range. The Livermore-Amador Valley encompasses approximately 42,000 acres, is about 14 miles long (east to west) and varies from 3 to 6 six miles wide (north to south). The Livermore Valley Groundwater Basin is located in the central part of the Livermore-Amador Valley. The Main Basin is a part of the Livermore Valley Groundwater Basin that contains the highest yielding aquifers and the best groundwater quality. Lakes A and B are located within the southeast corner of the Main Basin.

The Livermore-Amador Valley is partially filled with recent alluvial fan, stream, and lake deposits (of Pleistocene-Holocene age; less than about 1.6 million years old) that range in thickness from a few feet along the margins to nearly 800 feet in the west-central portion. The alluvium consists of unconsolidated gravel, sand, silt, and clay. The southeastern region of the Valley, the proximal (upstream) portion of the alluvial fan deposits, is the most important groundwater recharge area and consists mainly of sand and gravel that was deposited by the ancestral and present ADV and Arroyo Mocho. The coarse alluvial fan deposits are economically important aggregate deposits, which has resulted in widespread aggregate mining in the Main Basin area.

The Livermore Formation (Pleistocene age; 11,000 to 1.6 million years old), found below the majority of the alluvium in the groundwater basin, consists of beds of clayey gravel and sand, silt, and clay that are unconsolidated to semi-consolidated. This formation is estimated to be 4,000 feet thick in the southern and western portion of the basin. These sediments display lower groundwater yields in the upland areas.

The Tassajara and Green Valley Formations, located in the Tassajara Uplands north of the Valley, are roughly Pliocene in age (1.6 to 5.3 million years old). They consist of sandstone, tuffaceous sandstone/siltstone, conglomerate, shale, and limestone. Water movement from these formations to the alluvium of the fringe and Main Basins is diminished by faults and angular unconformities or by stratigraphic disconformities along the formation-alluvium contacts.

Within the Livermore Valley groundwater basin, faults are the major structural features known to have marked effect on the movement of groundwater. Faults in this region tend to act as barriers to the lateral movement of groundwater. The resulting groundwater levels stand higher on the up-gradient side. The Livermore, Pleasanton, and Parks faults act as such barriers, dividing the Quaternary Alluvium into five groundwater sub-basins (DWR 2006, as cited in Kleinfelder 2020).

The project site is located approximately within the southeast corner of the Main Basin. East of Isabel Avenue, in the Lake A area, groundwater occurs within a relatively thin layer of alluvium (approximately 80 to 100 feet thick) and within the underlying Livermore Formation. West of Isabel Avenue, groundwater occurs entirely within the alluvium, which extends to at least 600 feet below the surface in the area of Lake B (EMKO 2020a). The Pleistocene Livermore Formation was folded and faulted before deposition of the Recent Alluvium. This older geologic formation consists of a range of sediments that were deposited in a lake environment, referred to as lacustrine deposits. These deposits include oxidized, unoxidized, and sheared clay, freshwater limestone referred to as marl, and interbedded fine sand, silt, and clay that were deposited along the shoreline of and within the lacustrine environment (Cotton Shires 2006, as cited in Kleinfelder 2020). Due to the different structural history, different depositional environment, and preponderance of fine-grained deposits, the sediments of the Livermore Formation are not a part of the Upper or Lower Aquifers within the Recent Alluvium that is present in the Main Basin. This difference in the formation characteristics east and west of Isabel Avenue could result in some discrepancies in the chemical composition of groundwater in the east and west portions of the project site and suggests that they not be evaluated together (Kleinfelder 2020).

Numerous studies of the hydrogeology of the Livermore-Amador Valley Groundwater Basin have been conducted. In general, groundwater within the alluvium has been classified as being part of two main aquifer zones. In some parts of the groundwater basin, the two aquifer zones are separated by a silty clay aquitard up to 50 feet thick that prevents or limits the vertical migration of groundwater between the two zones. As demonstrated by JLGC, and later verified by EMKO (2020a) and Kleinfelder (2020), 5 sonic cores, 52 other drill hole logs, a three-dimensional geologic model, and sediments exposed in several high walls constitute substantial evidence to conclude that the 6 clay stratums identified by JLGC are discontinuous and do not provide aquitard forming conditions. JLGC also noted that the ADV's distribution of gravel and clay strata observed in the geologic model and depositional features observed in the sonic core are all consistent with a braided stream environment, which typically do not form large, interconnected clay strata that could provide for the formation of aquitards.

Figure 4.6-2, "Locations of Wells and Stratigraphic Cross Sections," shows the locations of several cross sections prepared by Zone 7 (2011) in the Chain of Lakes area of the Main Basin. The cross sections are shown on Figure 4.6-3, "Cross Sections ZA to ZC," and Figure 4.6-4, "Cross Section ZD." The cross sections show the relationships between the various aquifer zones and units. They also show the projected future depths of several of the mining pits that would become part of the Chain of Lakes, including Lake B, and Lakes C and D being mined by Vulcan Materials Company immediately north of Lake B. Lakes C and D are part of Alameda County Surface Mining Permit and Reclamation Plan No. 16 (SMP-16).

In addition to areas where it is absent, in areas where these variations occur, the aquitard is referred to as "leaky," because it allows groundwater to be transmitted between the two aquifers. The absence of a continuous silty clay aquitard is indicated by the 3D geologic model prepared by JLGC (2019)

As stated in *Hydrostratigraphic Investigations of the Aquifer Recharge Potential for Lakes C and D of the Chain of Lakes, Livermore, California* (Zone 7 2011), the two aquifer zones are designated as follows:

> **Upper Aquifer Zone:** The upper aquifer zone consists of alluvial materials, including primarily sandy gravel and sandy clayey gravels. These gravels are usually under the surficial clays, typically 5 to 70 feet below ground surface [bgs] in the west and exposed at the surface in the east. The base of the upper aquifer zone is at about 80 to 150 feet bgs. Groundwater in this zone is generally unconfined; however, when water levels are high, portions of the Upper Aquifer Zone in the western portion of the Main Basin can become confined.
>
> **Lower Aquifer Zone:** All sediments encountered below the clay aquitard in the center portion of the basin have been known collectively as the Lower Aquifer Zone. The aquifer materials consist of semi-confined to confined, coarse-grained, water-bearing units interbedded with relatively low permeability, fine-grained units. It is believed that the Lower Aquifer Zone derives most of its water

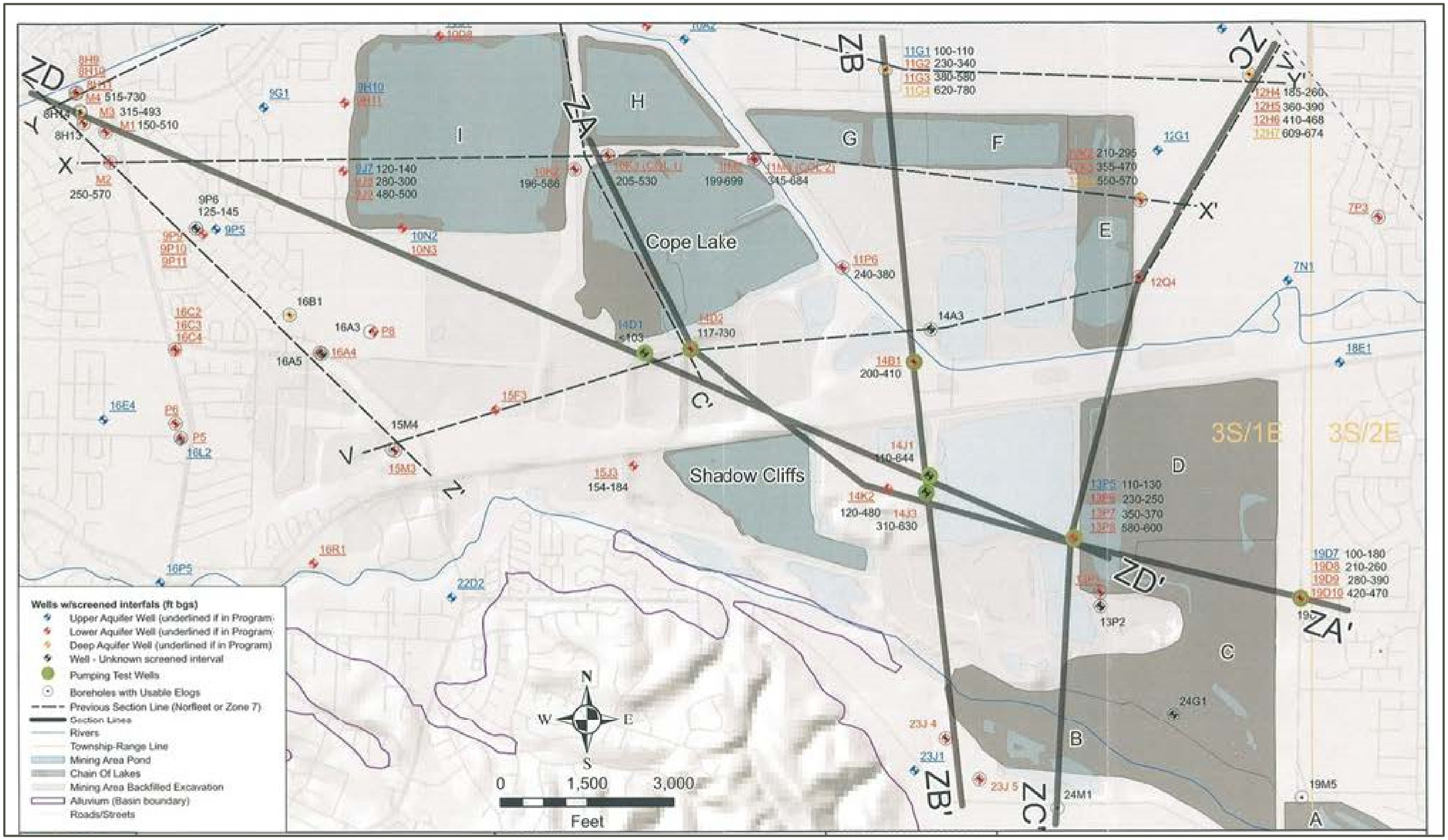
from the Upper Aquifer Zone through the leaky aquitard(s) when groundwater heads in the upper zone are greater than those in the lower zone.

The water-level trends evaluated by EMKO (2020a) show an appreciable difference in the water level behavior in wells and ponds along and south of ADV when compared to that in wells and ponds north of ADV. The water levels in the wells and ponds along and south of ADV have remained relatively stable for many decades and show minimal influence from drought periods. The Arroyo flows into or through several of these ponds (referred to as breached quarry ponds). These ponds are hydrologically connected to the arroyo. There is very little groundwater pumping south of ADV, so it is likely that recharge from the arroyo is sufficient to maintain the water levels in wells to the south and the ponds along the channel.

In contrast, the water levels in the wells and ponds north of ADV fluctuate cyclically in response to annual pumping and to drought and wet climatic cycles. Ponds that are not breached are generally not hydrologically connected at the surface with the Arroyo. Zone 7 (2012, 2013, 2014a, 2015, 2016, 2017, 2018, 2019) indicates that the reach of ADV adjacent to Lake B is a losing stream, meaning that the groundwater elevation is below the base of the stream bed and water from the stream percolates downward to the groundwater table. In addition, lack of recharge during drought periods combined with groundwater pumping and mine dewatering to the north of ADV appear to cause the cyclical water level trends at the monitoring locations north of the ADV.

The aquifer materials present in the southeastern part of the Amador sub-basin were deposited by ancestral streams that flowed in the same areas from which ADV and Arroyo Mocho currently originate within the Livermore highlands to the south (DWR 1966). While lakes formed intermittently in the central and western parts of the basin, the area south of Stanley Boulevard, in the current area of Lakes B, C, and D of the Chain of Lakes, was part of a large alluvial fan system emanating from the hills to the south (Alameda County 1980). Deposition of fine clays and silts in the lakes that formed away from the alluvial fan created the aquitard units between the main aquifers. The alternating deposition of coarse-grained aquifer materials and fine-grained aquitards materials outside of the alluvial fan resulted in the depositional sequences that were identified in the recent investigations conducted on behalf of Zone 7 (2011).

The ancestral stream channels for ADV and Arroyo Mocho were identified by DWR (1966). Figure 4.6-5, "Lines of Equal Thickness of Aquifers in the Depth Interval 100-200 Feet," and Figure 4.6-6, "Lines of Equal Thickness of Aquifers in the Depth Interval 0-100 Feet," are copies of a part of Plates 7 and 6, respectively, from the DWR (1966) study of the geology of the Livermore Valley. Figure 4.6-5 shows the gross thickness of aquifer materials in the depth interval between 100 ft bgs and 200 ft bgs in the Amador sub-basin. The ancestral axes of the major stream depositional channels, along with the present-day alignment of Stanley Boulevard are shown and labelled on Figure 4.6-5. In the area south of Stanley Boulevard and west of Isabel Avenue, the ancestral channel of ADV deposited as much as 90 feet of coarse-grained aquifer material within the 100-foot interval between 100 ft bgs to 200 ft bgs. The ancestral ADV channel depicted on Figure 4.6-5 is located along the northern and northeastern sides of Lake B. In contrast, north of Stanley Boulevard, the aquifer material comprises only 40 percent to 60 percent of the total sediment present in the interval between 100 ft bgs and 200 ft bgs. The information presented by DWR (1966), as shown on Figure 4.6-5, suggests that the aquitards are much thicker and more consistent in the area north of Stanley Boulevard than they are in the area of Lake B. Figure 4.6-5 also indicates that the Quaternary alluvium is not present in the depth interval from 100 ft bgs to 200 ft bgs east of Isabel Avenue and south of Alden Lane, in the area of Lake A.



SOURCE: Zone 7 2011, as cited in EMKO 2020a, EMKO 2020a Figure 2; modified by Benchmark Resources in 2020.

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BENCHMARK RESOURCES

Locations of Wells and Stratigraphic Cross Sections

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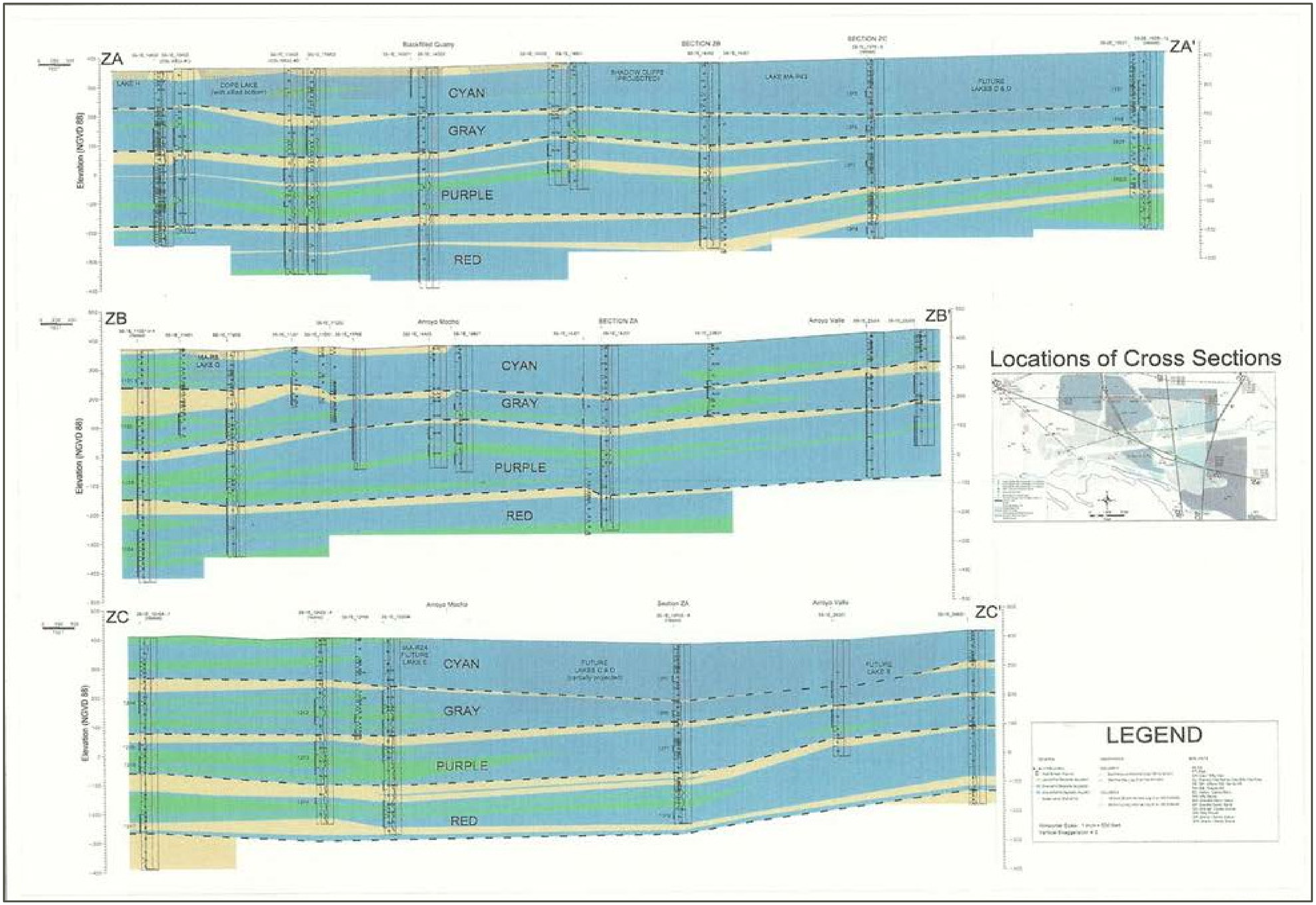

SOURCE: Zone 7 2011, as cited in EMKO 2020a, EMKO 2020a Figure 3; modified by Benchmark Resources in 2020.

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Cross Sections ZA to ZC

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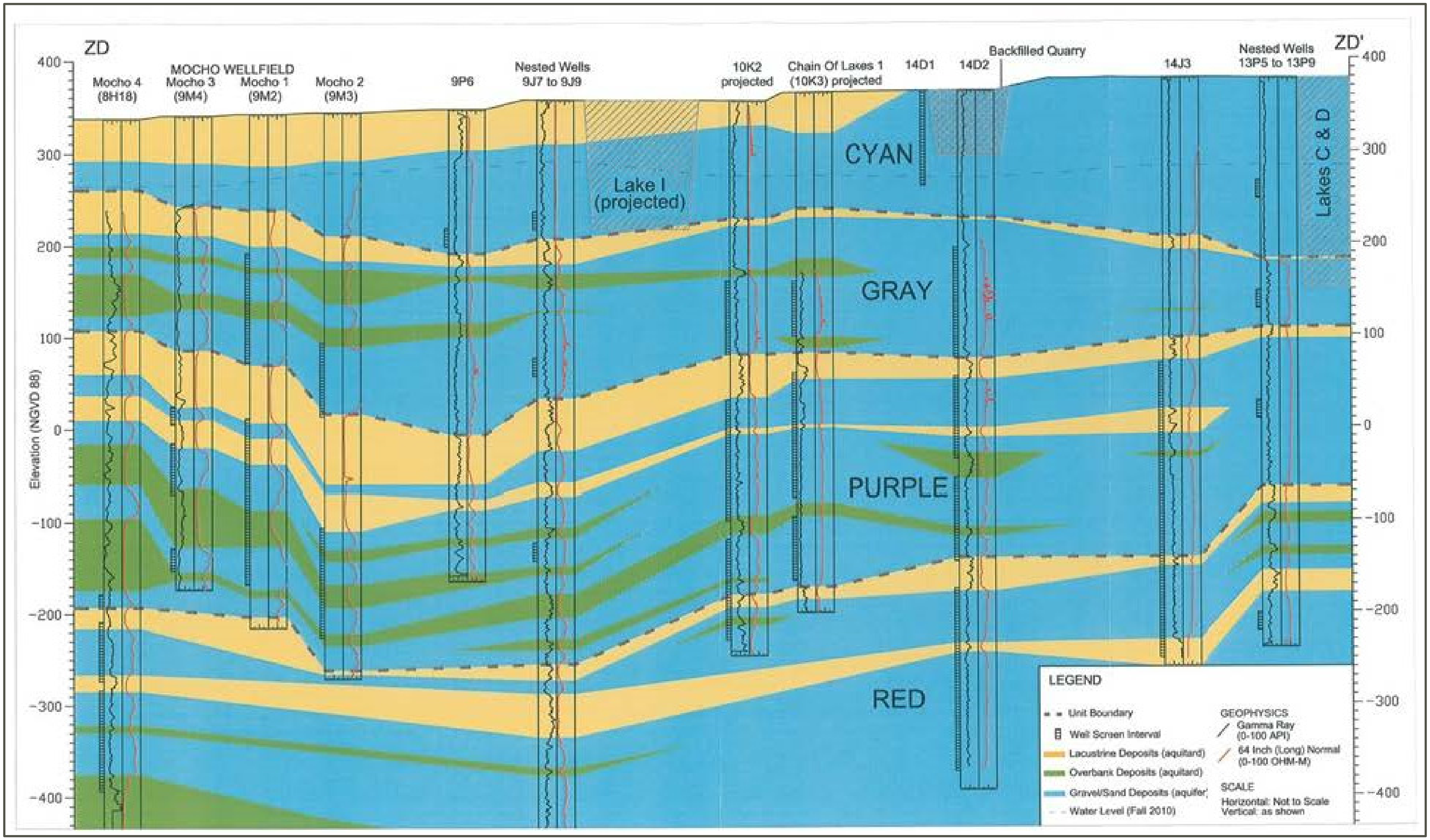

SOURCE: Zone 7 2011, as cited in EMKO 2020a, EMKO 2020a,, Figure 4; modified by Benchmark Resources in 2020.

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BENCHMARK RESOURCES

Cross Section ZD

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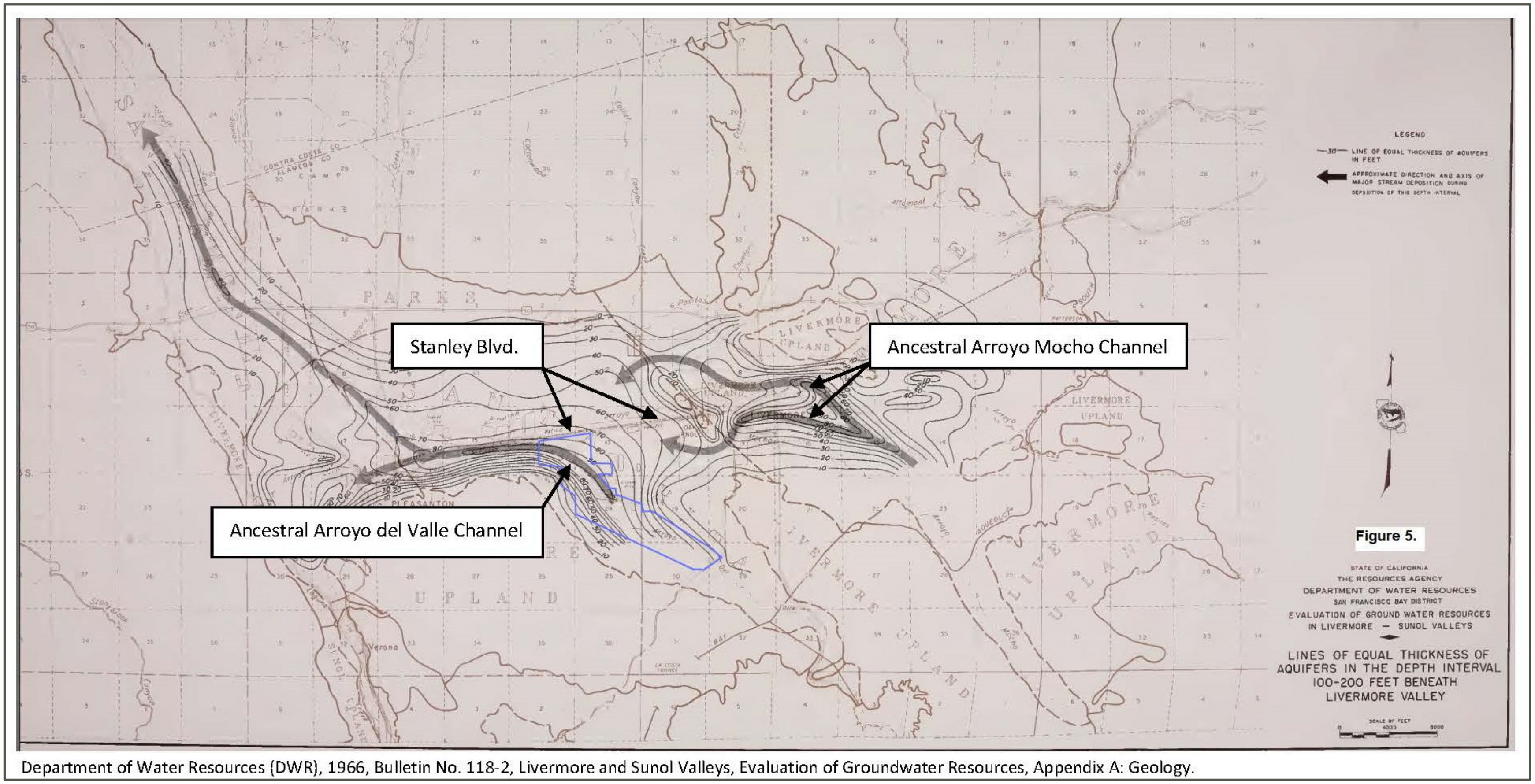

Department of Water Resources (DWR), 1966, Bulletin No. 118-2, Livermore and Sunol Valleys, Evaluation of Groundwater Resources, Appendix A: Geology.

SOURCE: DWR 1966, as cited in EMKO 2020a, EMKO 2020a Figure 5; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

Lines of Equal Thickness of Aquifers in the Depth Interval 100-200 Feet

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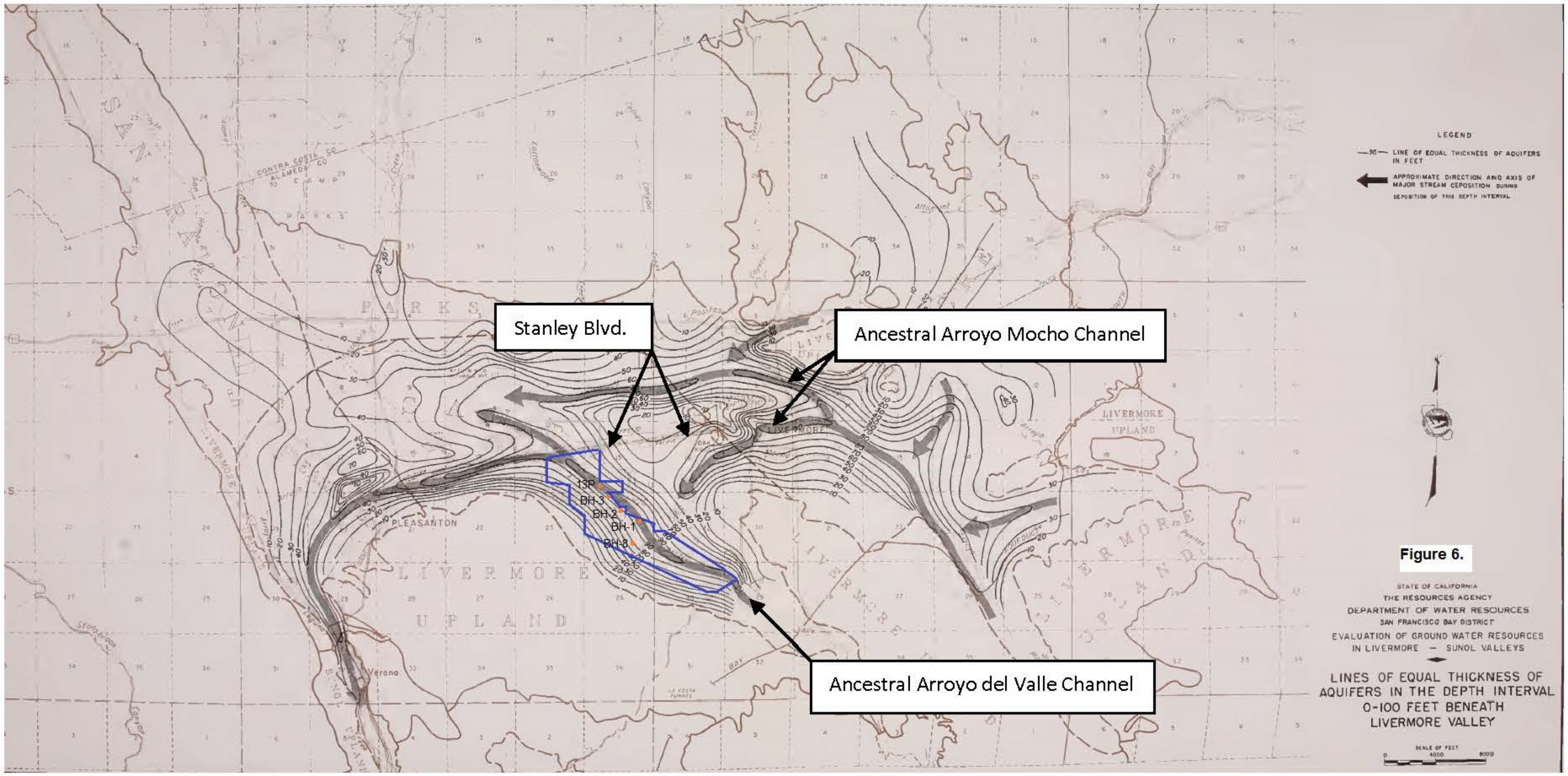

Department of Water Resources (DWR), 1966, Bulletin No. 118-2, Livermore and Sunol Valleys, Evaluation of Groundwater Resources, Appendix A: Geology.

SOURCE: DWR 1966, as cited in EMKO 2020a, EMKO 2020a Figure 6; modified by Benchmark Resources in 2020.

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Figure 4.6-6 shows the gross thickness of aquifer materials in the depth interval between the ground surface and 100 ft bgs in the Amador sub-basin. The ancestral axes of the major stream depositional channels, along with the present-day alignment of Stanley Boulevard, are shown and labelled on Figure 4.6-6. The approximate outline of the project site and the location of several boreholes are also indicated on Figure 4.6-6. Deposition associated with the ancestral ADV channel within the depth interval down to 100 ft bgs extends east of Vallecitos Road. In the western part of Lake A, the eastern part of Lake B, and along the north side of Lake B, the coarse-grained aquifer deposits comprise over 90 percent of the material deposited by the ancestral ADV. It is also important to note that, while the ancestral stream channel follows the current stream channel in the Lake A area, it turns to the north in the Lake B area and then parallels the current location of Stanley Boulevard.

Boreholes

In April 2013, CEMEX drilled and logged 22 boreholes at SMP-23. The borehole locations are shown on Figure 4.6-7, "Borehole Locations." Five boreholes were drilled along the west and south sides Lake A, 14 boreholes were drilled around the perimeter of and within Lake B, and three boreholes were drilled in the existing plant area. At Lake A the boreholes were drilled to 110–200 feet bgs (approximately 320–220 ft msl). At Lake B the boreholes were drilled to 200–220 feet bgs within the pit and 280–300 feet bgs around the perimeter (approximately 136–96 ft msl), except for the two shallow holes within the pit, which were drilled to 50 feet bgs (approximately 250 ft msl). In the plant area the boreholes were drilled to 280–290 feet bgs (approximately 100–90 ft msl).

In May through July 2018, CEMEX and Zone 7 jointly drilled four boreholes around the perimeter of Lake B and one borehole to the west of Lake A to further define the aquitard issue. The borehole locations are shown on Figure 4.6-8, "Geologic Cross Section A-A," Figure 4.6-9, "Geologic Cross Section B-B," Figure 4.6-10, "Geologic Cross Section C-C," Figure 4.6-11, "Sand and Gravel Gross Section A-A," and Figure 4.6-12, "Location Map Clay #5," and are designated 2017-A through 2017-E, with the year 2017 representing the year in which CEMEX applied for drilling permits. At each location, a sonic drilling rig was initially used to obtain geologic cores to provide a visual understanding of the vertical distribution of coarse and fine-grained deposits. The sonic core holes were drilled to depths ranging from 250 ft bgs to 283 ft bgs, corresponding to elevations of approximately 166 ft msl to 121 ft msl. After the sonic core holes were drilled and plugged, a second set of borings were drilled at the same locations using a mud-rotary rig so that electric (geophysical) logs could be obtained from each borehole. The mud-rotary holes were drilled to depths ranging from 220 ft bgs to 360 ft bgs, corresponding to elevations of approximately 197 ft msl to 21 ft msl. Natural gamma ray and self-potential logs were obtained from each of the mud rotary boreholes, in addition to long-normal, short-normal, and single-point resistivity logs. A detailed evaluation of the drilling, geologic core, and electric logs is provided in *3D Clay Bed Geologic Model and Lack of Evidence for the Presence of Aquitards, Eliot Quarry-CEMEX Aggregates, Alameda County, California* (Jeff Light Geologic Consulting [JLGC] 2019) (see Appendix F-4).

The EMKO (2020a) report evaluated the data from the 2018 drilling program, including the logs from the sonic cores, the cuttings logs from the mud rotary holes, and the electric logs from the mud rotary holes. The EMKO (2020a) report made the following observations based on this data:

1. The sonic cores provide the highest detail and greatest resolution of the variations in the stratigraphy, with the ability to easily discern clay layers that are much less than one-foot thick.
2. The cuttings logs from the mud rotary holes have the lowest resolution and occasionally miss important stratigraphic changes; and

3. The electric logs provide a reasonable representation of subsurface conditions, but they can be difficult to interpret in the absence of core data. For example, in several instances, the electric logs were unable to detect clay layers up to two feet thick that were readily apparent in the sonic cores.

Based on these observations, JLGC (and later EMKO, citing JLGC) compared the percent of clay identified in the logs from four different series of boreholes, including the 2013 Becker Hammer logs, the electric logs from 86-series and 2012-series of boreholes obtained by Zone 7, and the sonic core logs from 2018. The comparison is presented on Figure 4.6-13 "Percentage of Clay Logged in Borehole Drilled at Different Times," which show the range in the percent of clay identified in each borehole from each series of boreholes. The data presented on Figures 4.6-12 and 4.6-13 demonstrate that there is no perceptible bias in the percent of clay identified in any of the different series of boreholes. More specifically, the range of clay percentage identified in the 2013 Becker Hammer logs falls within the same range as the clay percentage identified for all other series of boreholes. The data presented on Figure 4.6-12 and Figure 4.6-13 clearly demonstrate that there is no defensible scientific basis to selectively disregard any of the available borehole data. As a result, the cross sections shown in Figures 4.6-8, 4.6-9, 4.6-10, and 4.6-11 are based on all of the available data.

Detailed borehole logs are provided in Appendix F-5 of this SEIR.

Aquifer Transmissivity and Storativity

The aquifer properties addressed in the discussion below are the transmissivity and the storativity of the aquifer units. The transmissivity is a measurement of the ability of the aquifer to transmit water and is correlated to the permeability of the geologic material and the thickness of the aquifer. The storativity is a measurement of how much water the aquifer will provide when pumped, expressed as a fraction of the total volume of the geologic material and void space that comprises the aquifer.

As part of the Zone 7 (2011) report, Zone 7 installed new monitoring wells and conducted an aquifer pumping test with grant funds from the California Department of Water Resources. The maximum, minimum, and average aquifer parameters identified by the interpretation of the pumping test results are summarized in Table 4.6-1, "Aquifer Properties."

TABLE 4.6-1
AQUIFER PROPERTIES

Parameter	Units	Zone 7			EMKO
		Maximum	*Minimum*	*Average*	*Best Fit*
Transmissivity	Feet squared per day	6,900	2,400	4,600	4,350
Storativity	Unit-less[1]	0.001	0.00012	0.0007	0.0007

Source: EMKO 2020a
Notes:
1. Storativity units are volume of water pumped divided by the volume of the aquifer that released that water. The volumes could be expressed as cubic feet of water per cubic foot of aquifer. However, the cubic feet cancel out, making it unitless.

The aquifer test results indicate that the aquitard units are thin or discontinuous in the area of Lake B, as reflected by drawdown in the shallower aquifer units (Cyan and Gray) during pumping in deeper units (Purple and Red).

SOURCE: Compass Land Group 2020; modified by Benchmark Resources in 2020.

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BENCHMARK RESOURCES

Borehole Locations

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Figure 4.6-7

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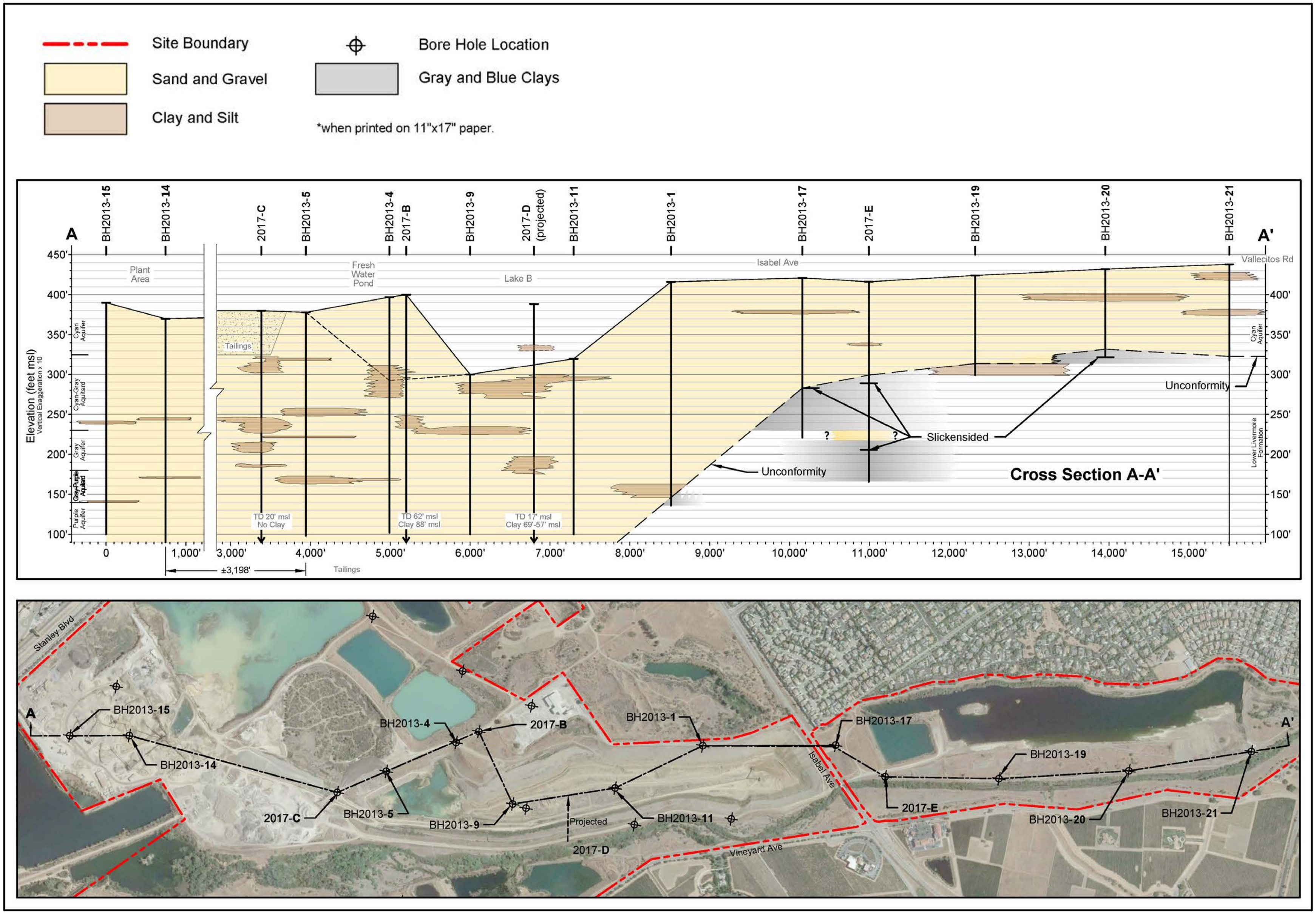

SOURCE: EMKO 2020a, Figure 8; modified by Benchmark Resources in 2020.

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Geologic Cross Section A-A

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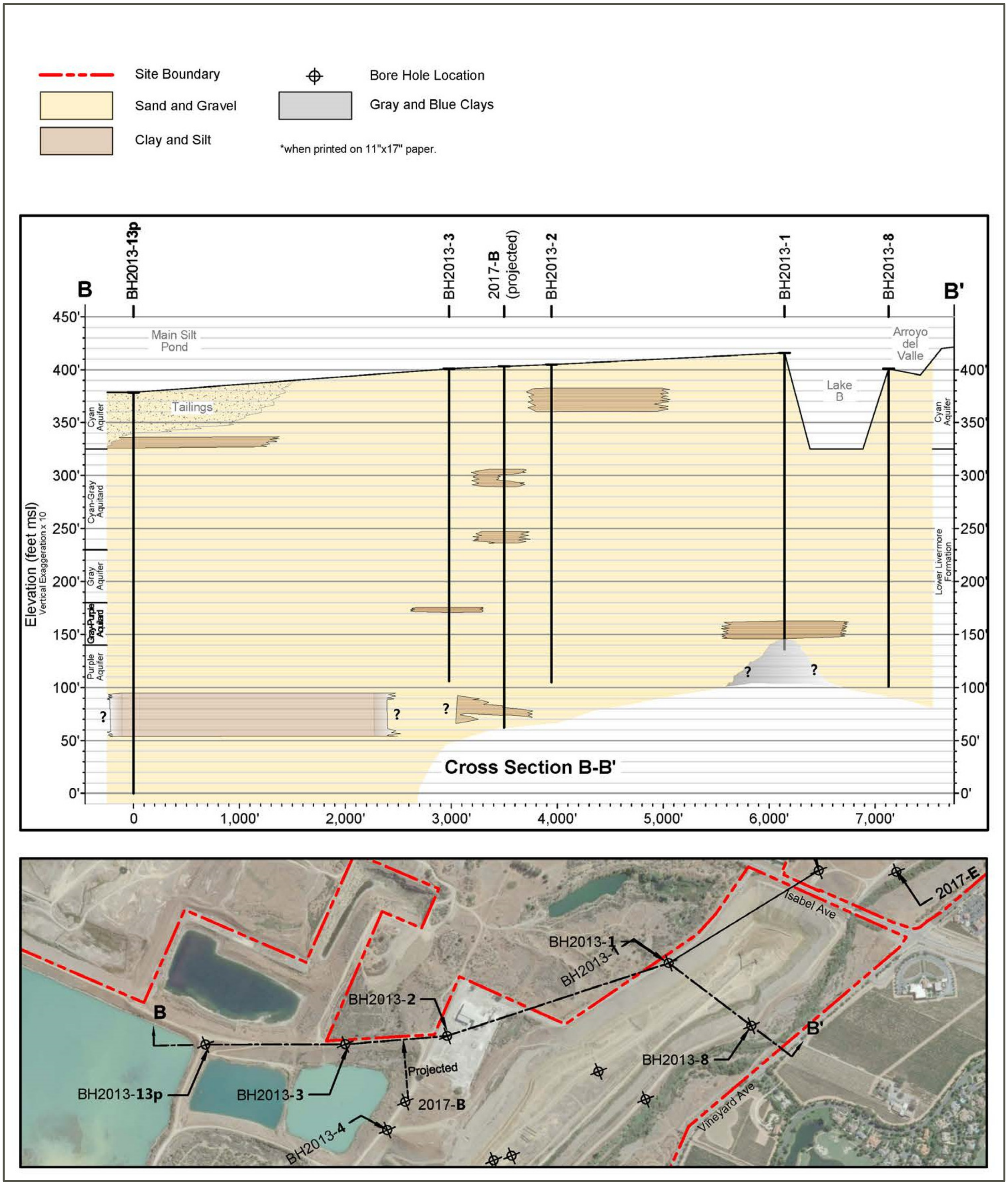

SOURCE: EMKO 2020a, Figure 9; modified by Benchmark Resources in 2020.

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Geologic Cross Section B-B

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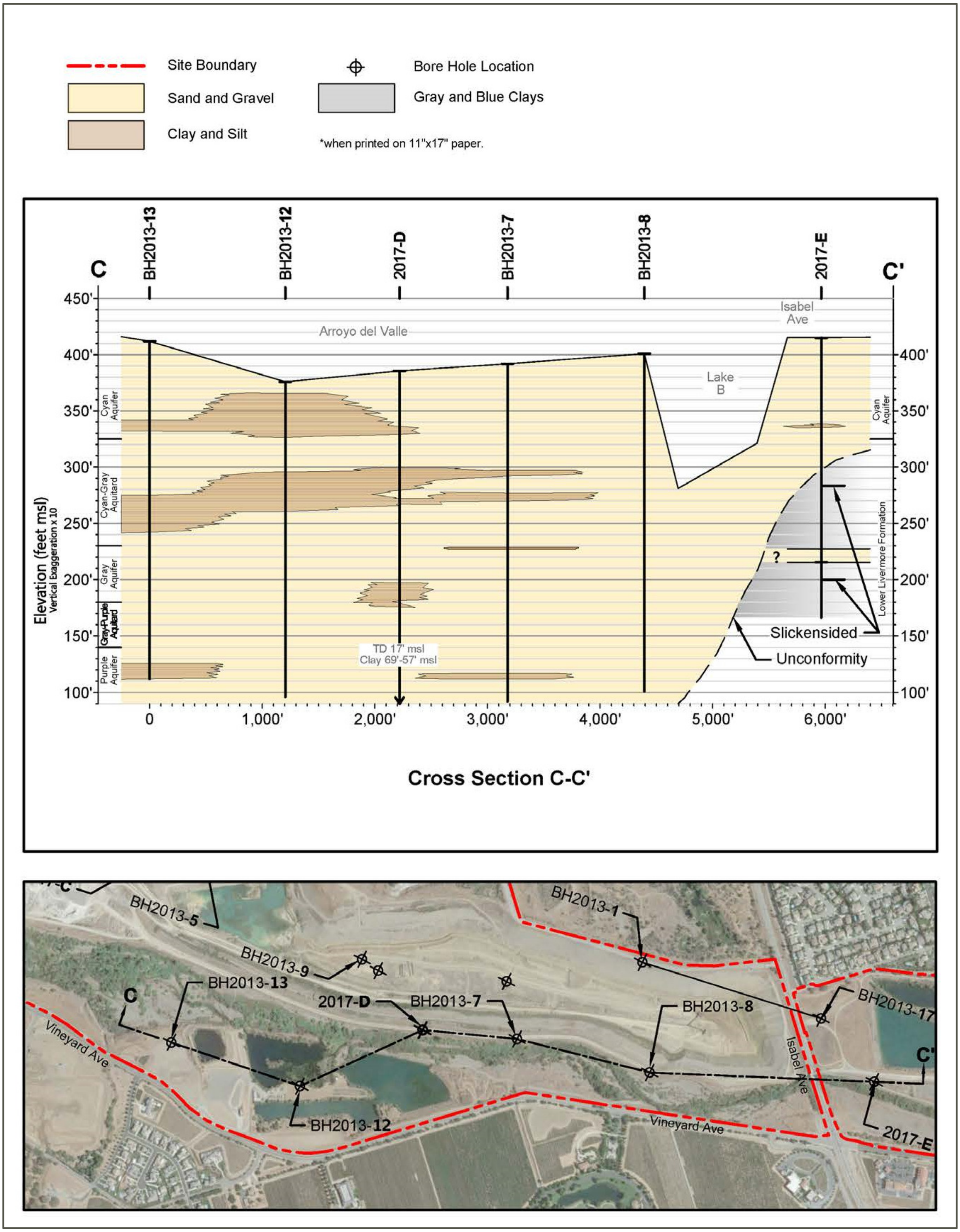

SOURCE: EMKO 2020a, Figure 10; modified by Benchmark Resources in 2020.

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Geologic Cross Section C-C

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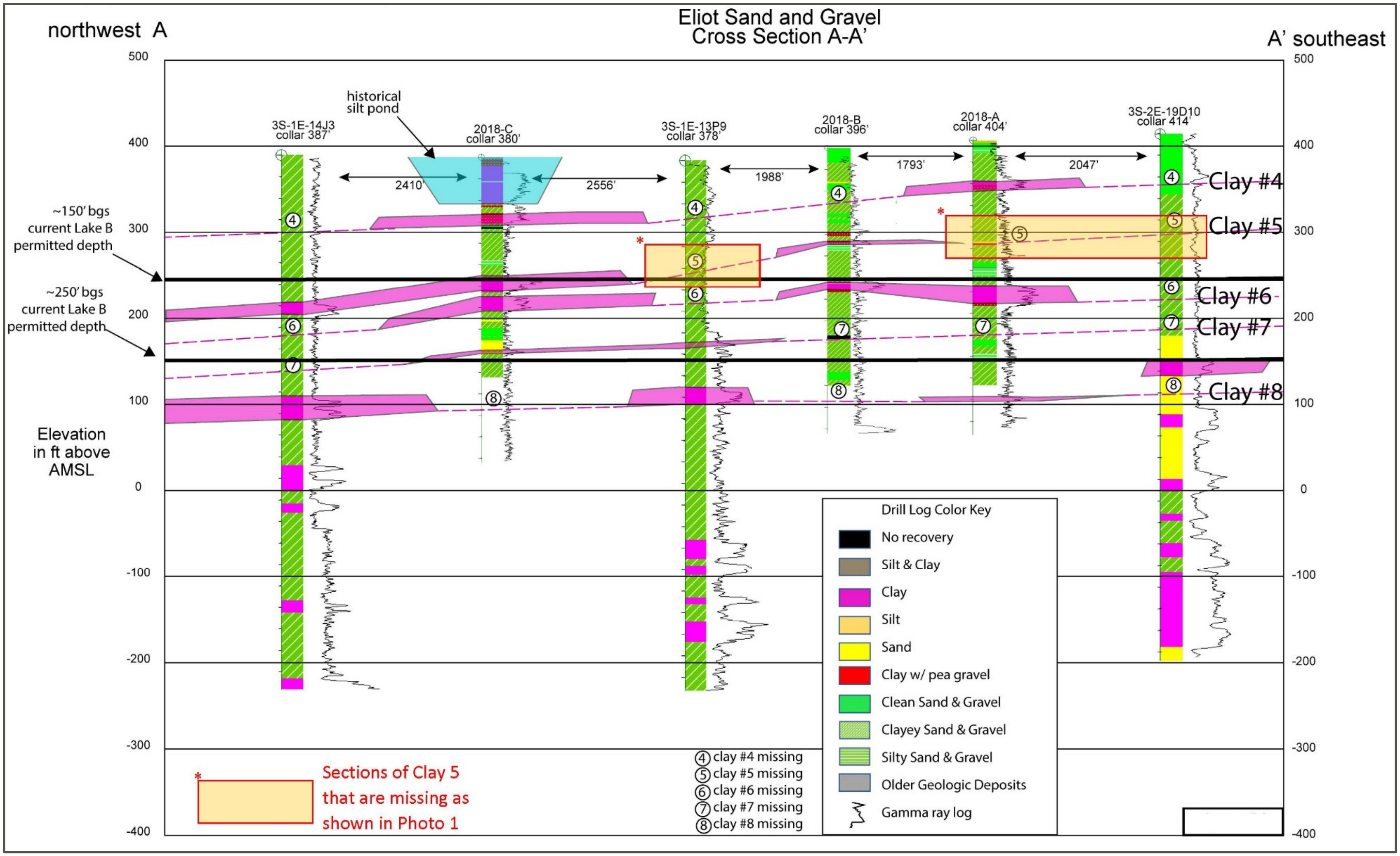

SOURCE: JGLC 2019; modified by Benchmark Resources in 2020.

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BENCHMARK RESOURCES

Sand and Gravel Cross Section A-A

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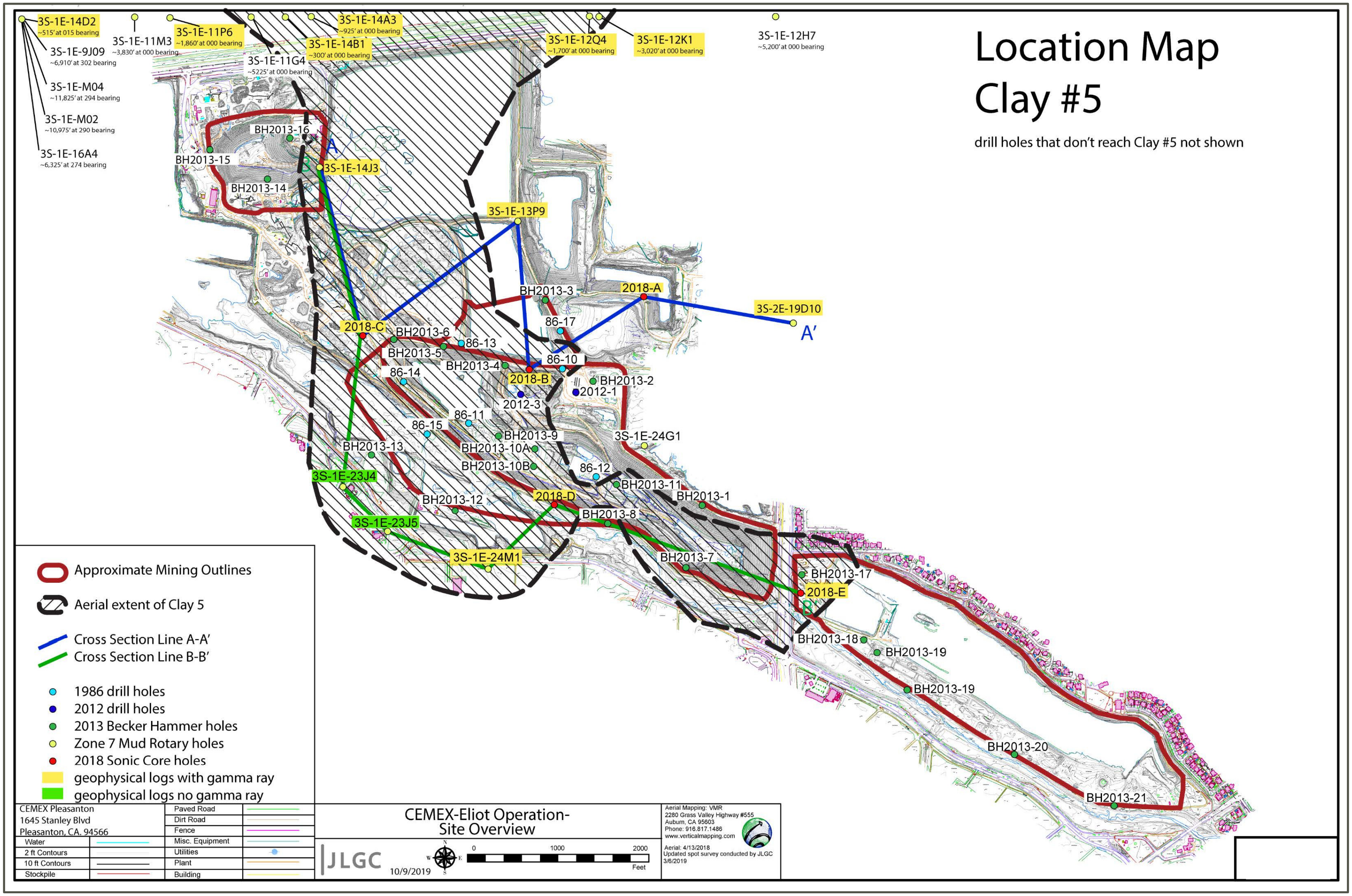

SOURCE: JGLC 2019; modified by Benchmark Resources in 2020.

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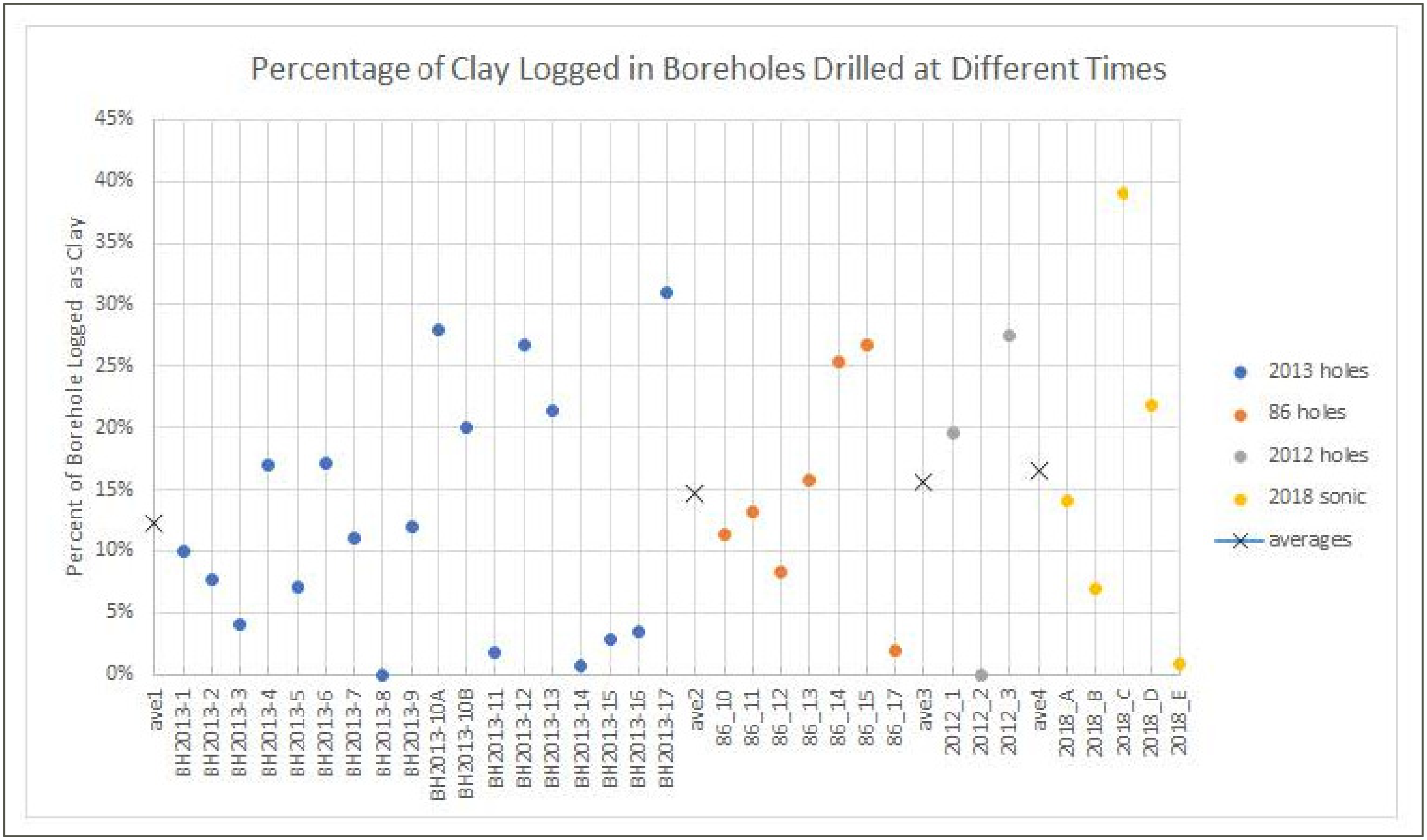

SOURCE: JLGC 2019, Figure 11; modified by Benchmark Resources in 2020.
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Percentage of Clay Logged in Borehole Drilled at Different Times
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Figure 4.6-13

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EMKO conducted analytical simulations and a sensitivity analysis to verify the results of Zone 7's pumping tests. Table 4.6-1 presents EMKO's results under the "best fit" values. The EMKO results are within the range of values found by Zone 7.

Water Level Trends

Water level data were requested and received from Zone 7 in May 2013 for 17 wells near Lake A and Lake B. The well locations are shown on Figure 4.6-14, "Location of Wells Used for Water Level Trends" (EMKO 2020a). Figure 4.6-15, "Hydrograph 1948–2018," is a hydrograph of the water levels measured in these 17 wells. More recent water level data have been obtained from Zone 7 annual monitoring reports (2014a, 2015, 2016). The well designations are listed in the legend of Figure 4.6-15.

Water level records for two wells (13P1 and 20M1) are available since 1948, and from an additional well (23J1) since 1958. The water level data show that in most wells, the water levels have tended to fluctuate based on rainfall patterns. For example, significant dry periods in the late 1980s to early 1990s and in the early 2000s are reflected in lower water levels at many locations. There are, however, exceptions to this pattern. Water levels in wells 29F4 and 30D2 show very little fluctuation over time. These two wells are both completed in the upper aquifer and located east of Isabel Avenue adjacent to the ADV.

To provide a closer focus on more recent water level trends, Figure 4.6-16, "Hydrograph Since 1999," shows the water level data for the same 17 wells since 1999. These same hydrographs have been plotted on a site map in Figure 4.6-17, "Hydrographs of Wells for Water Level Trends," so that the variation of water level conditions in different areas or locations can be visualized. These figures provide a clearer depiction of the wells with relatively stable water levels and those with more cyclical water levels. Essentially all of the wells with water levels above 350 ft msl exhibit stable water levels over time. These wells include 23J1, 25C3, 20M1, 29F4, 30D2, and 30G1, which are all located south of the ADV or east of Lake A. The data indicate that these six wells are in locations that are not affected by dewatering and pumping activities within the main groundwater basin. These characteristics may be attributed to wells located in recharge areas or some distance upgradient of groundwater extraction areas.

The water levels for the other 11 wells shown on Figures 4.6-14 and 4.6-16 typically have a dual cyclical pattern. As discussed above, long-term cycles are related to climatic changes such as wet periods and drought periods. Annual cycles are caused by recharge during the wet season and extraction during the dry season. Peak water levels generally occur between March and May each year, and minimum water levels generally occur in August or September. The long-term climatic cycles can result in water-level changes of up to 100 feet. The annual cycles typically range in magnitude from approximately 15 to 40 feet.

There are two well clusters included in the data evaluated for this study. Well cluster 13P5 through 13P8 is located just north of Lake B, between the SMP-23 main silt pond and future Lake D. Well cluster 19D7 through 19D10 is located along Isabel Avenue east of future Lake C. These two well cluster locations are identified on Figure 4.6-15. In each cluster, the screened interval is deeper with the higher number designation (i.e., 13P5 is the shallowest well and 13P8 is the deepest). At both clusters, the screened intervals correlate to the Cyan, Grey, Purple, and Red aquifer zones, respectively, as indicated on Figure 4.6-3. At both well cluster locations, the water levels show a downward vertical gradient, except between the Gray and the Purple units. Thus, the groundwater elevation in the Cyan unit is typically at a higher elevation than that in the Gray unit, and the water level in the Gray unit is typically higher than that in the Red unit, while the water level in the Purple unit is typically between that measured in the Cyan and Gray units. These relationships are further illustrated in Figures 15B, 16B, 15C, 16C, and 17 of the

Groundwater Hydrology and Water Quality Analysis Report for the Eliot Quarry SMP-23 Reclamation Plan Amendment Project, Alameda County, California (EMKO 2020a) (see Appendix F-2).

The water-level trends evaluated by EMKO (2020a) show an appreciable difference in the water level behavior in wells and ponds along and south of ADV when compared to that in wells and ponds north of ADV. The water levels in the wells and ponds along and south of ADV have remained relatively stable for many decades and show minimal influence from drought periods. The Arroyo flows into or through several of these ponds (referred to as breached quarry ponds). These ponds are hydrologically connected to the arroyo. There is very little groundwater pumping south of ADV, so it is likely that recharge from the arroyo is sufficient to maintain the water levels in wells to the south and the ponds along the channel.

In contrast, the water levels in the wells and ponds north of ADV fluctuate cyclically in response to annual pumping and to drought and wet climatic cycles. Ponds that are not breached are generally not hydrologically connected at the surface with the Arroyo. Zone 7 (2012, 2013, 2014a, 2015, 2016, 2017, 2018, 2019) indicates that the reach of ADV adjacent to Lake B is a losing stream, meaning that the groundwater elevation is below the base of the stream bed and water from the stream percolates downward to the groundwater table. In addition, lack of recharge during drought periods combined with groundwater pumping and mine dewatering to the north of ADV appear to cause the cyclical water level trends at the monitoring locations north of the Arroyo (Kleinfelder 2020).

Summary

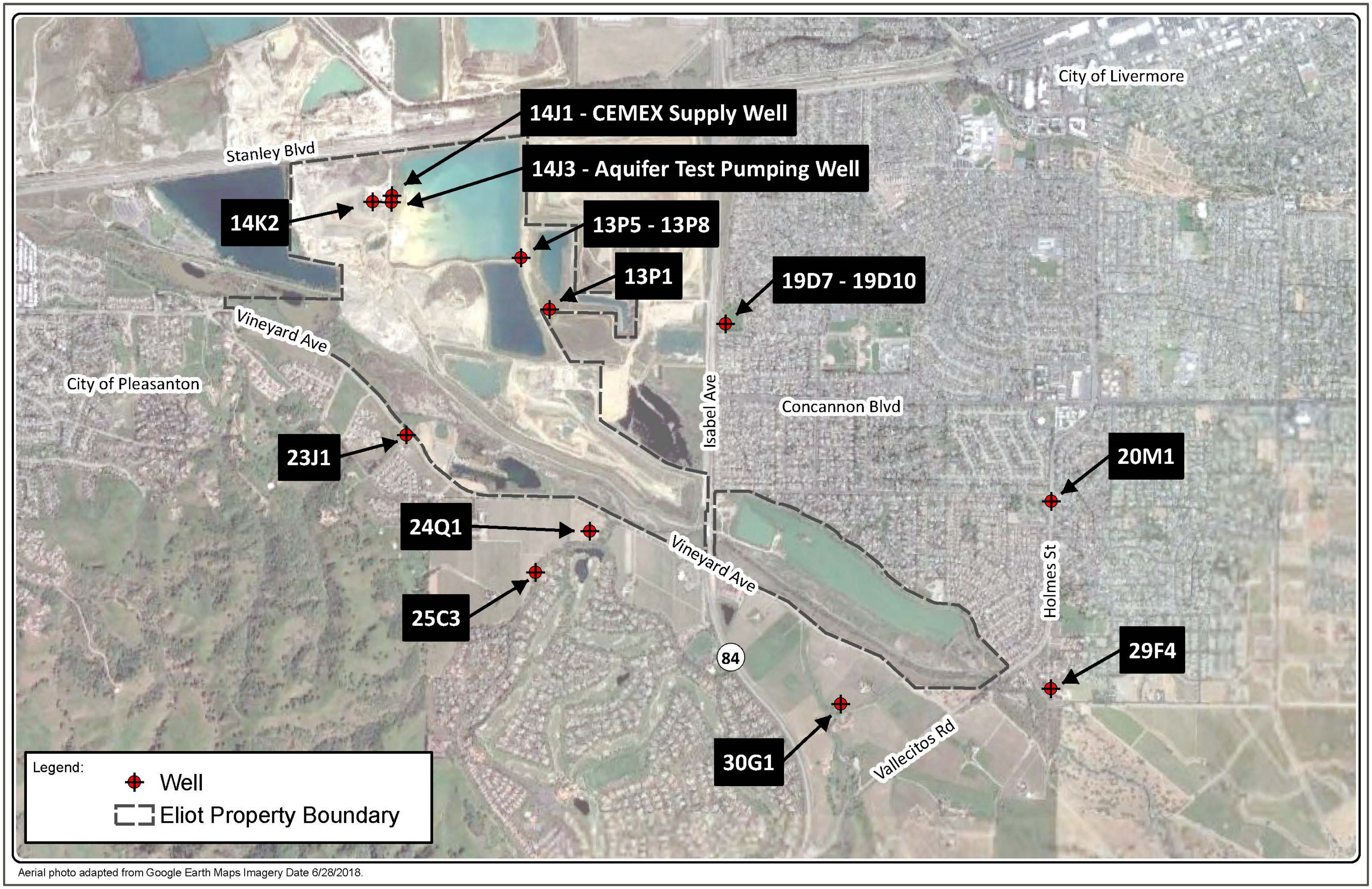
In summary of the results described in detail in the Jeff Light Geologic Consulting (2019), EMKO (2020a), Kleinfelder (2020), Appendix A of *Livermore and Sunol Valleys, Evaluation of Ground Water Resources* (DWR 1966), *Pleasanton Quarry Hydrogeologic Data Evaluation for Calmat Co. dba Vulcan Materials Company, Western Division* (Brown and Caldwell 2004), and *Hydrostratigraphic Investigation of the Aquifer Recharge Potential for Lakes C and D of the Chain of Lakes, Livermore, California* (Zone 7 2011) reports, the clay layers at the project area are discontinuous and do not act as aquitards separating the Upper and Lower Aquifer Zones.

4.6.2.4 Surface Water Hydrology

The ADV is located in the upper Alameda Creek watershed. The ADV drains an area of approximately 172 square miles before it discharges to Arroyo de la Laguna, west of Pleasanton. Arroyo de la Laguna flows south and discharges into Alameda Creek near the town of Sunol. Alameda Creek then flows west through the East Bay Hills before discharging into San Francisco Bay (Brown and Caldwell 2020).

Approximately 85 percent (146 square miles) of the ADV basin is located upstream of Del Valle Reservoir, constructed in 1968 to serve as off-channel storage for water delivered through the South Bay Aqueduct (part of the California State Water project) and for flood control. Three water agencies are served by the South Bay Aqueduct (Zone 7, Alameda County Water District, and Santa Clara Valley Water District). Zone 7 also uses a small portion of Del Valle Reservoir capacity to store runoff from the local watershed. Although Del Valle Reservoir primarily serves as water supply storage, a portion of its 77,100-acre-foot capacity is normally reserved for flood control.

Del Valle Reservoir has altered the hydrologic flow regime in the lower reaches of ADV (Kamman 2009, cited in Brown and Caldwell 2020). Peak flows have decreased, and large-magnitude flood flows have been virtually eliminated. Managed releases during the dry season have resulted in perennial flow conditions along the valley floor rather than the historical intermittent flow conditions when the arroyo would become dry in the summertime (Kamman 2009, cited in Brown and Caldwell 2020; LSA 2013, cited in Brown and Caldwell 2020).



SOURCE: Compass Land Group 2020; modified by Benchmark Resources in 2020.

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Location of Wells Used for Water Level Trends

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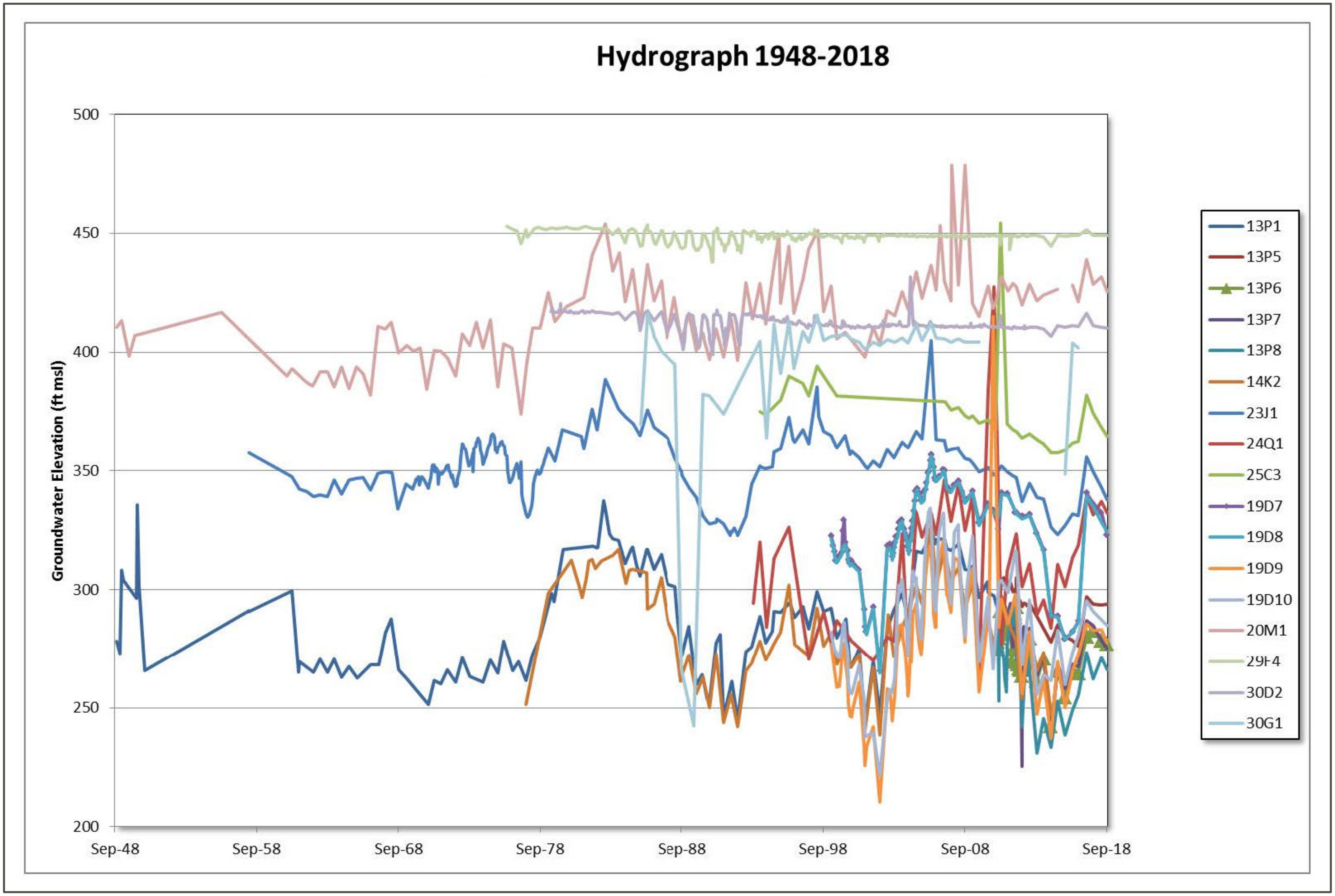

SOURCE: EMKO 2020a, Figure 15A; modified by Benchmark Resources in 2020.

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Hydrograph 1948-2018

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Figure 4.6-15

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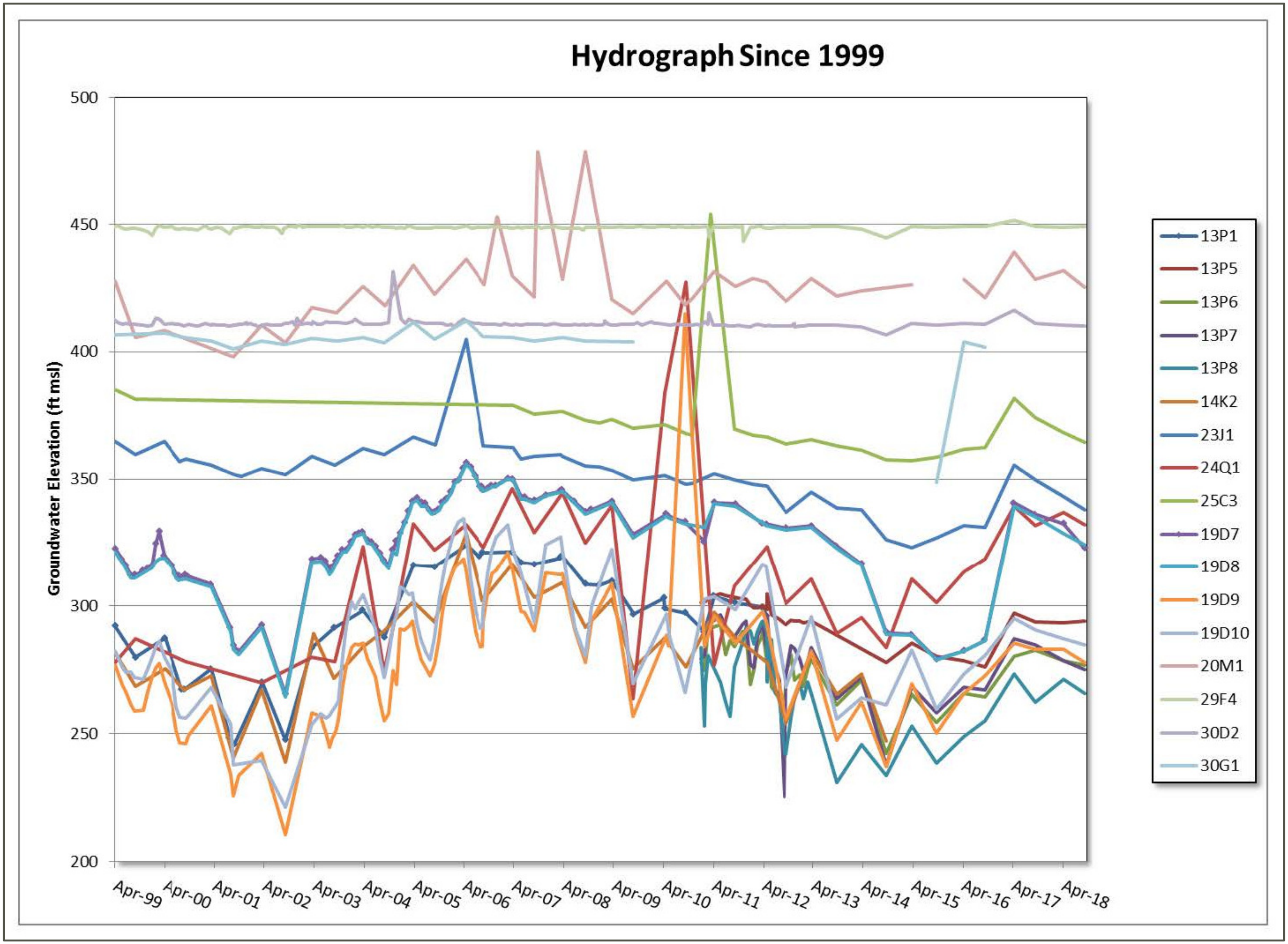

SOURCE: EMKO 2020a, Figure 16A; modified by Benchmark Resources in 2020.
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Hydrograph Since 1999
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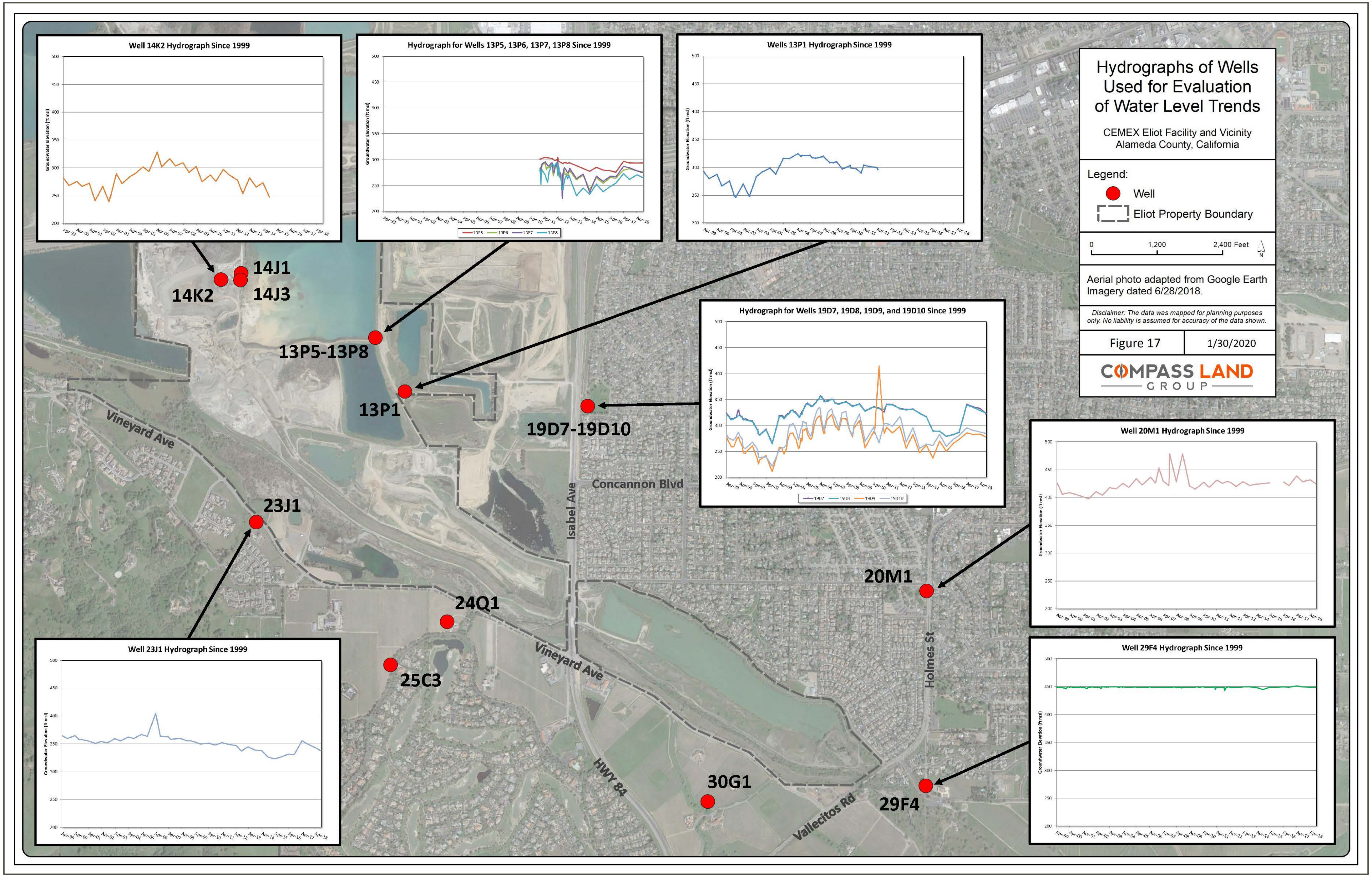

SOURCE: Compass Land Group 2020; modified by Benchmark Resources in 2020.

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Altered flows have also contributed to changes in ADV channel; the once actively braided channel network along the valley floor now has shifted to a more defined central channel system (Kamman 2009, cited in Brown and Caldwell 2020).

Directly downstream of the dam, the ADV flows through a narrow, sinuous canyon until it reaches the valley floor about 1 mile downstream, near the Veterans Administration hospital. At this point, the channel and floodplain become wider and, in the past, more active and braided. Sycamore Grove Park is an important community park that preserves mature Western Sycamore trees along this reach of the historical ADV floodplain. This park stretches approximately 2 miles from the hospital to Vallecitos Road.

The project site is located just downstream of Sycamore Grove Park. The ADV flows along the southern portion of the project site and adjacent to Lakes A and B. The arroyo flows through two small lakes along the south side of the Shadow Cliffs Regional Recreation Area and then continues west through the city of Pleasanton. Several small streams drain into ADV between the dam and its confluence with Arroyo de la Laguna.

Existing Flow Regime

As noted above, the hydrologic flow regime of the ADV was substantially altered by the construction of Del Valle Reservoir in 1968. The construction of Del Valle Reservoir resulted in a reduction in high flows and an increase in low flows, with a shift from intermittent to perennial flow conditions. Through the project reach, the ADV discharges a minimum flow of 0.01 cfs, greater than 1 cfs more than 50 percent of the time, greater than 10 cfs more than 20 percent of the time, and greater than 100 cfs only about 3 percent of the time (Brown and Caldwell 2020). In addition, based on U.S. Geologic Survey stream gauge station data for the Arroyo del Valle at Livermore (AVL), the post-dam average daily discharge for the period 2002 through 2017 exhibits a reasonably consistent pattern of seasonal flow releases. Based on the AVL stream gauge data, median daily flow rates are observed in the range of 0.5 to 3.0 cfs in the wet season (i.e., November through April) and 5 to 10 cfs in the dry season (i.e., May through October). This pattern suggests that dry season flows are predominantly due to controlled releases from upstream facilities (Brown and Caldwell 2020).

The peak annual discharge data for AVL was used to perform statistical estimates of peak discharges for a range of annual probabilities (Brown and Caldwell 2020). Table 4.6-2, "Peak Discharge Summary," below lists the estimated peak discharges for a range of annual probabilities, and Figure 4.6-18, "Peak Flow Frequency Curves for ADV from Regression Analysis," presents the peak discharge frequency results.

TABLE 4.6-2
PEAK DISCHARGE SUMMARY

Recurrence Interval (years)	Annual Chance of Exceedance (percent)	Peak Discharges from Analysis of USGS Streamflow Records (cfs) [a]		Peak Discharges from FEMA Flood Insurance Study[b]	Peak Discharges with Regulation at Del Valle Reservoir[c]
		Pre-dam	*Post-dam*		
1.5	66.7	547	87	--[d]	--[d]
2.0	50.0	1,413	198	--[d]	--[d]
5.0	20.0	6,434	898	--[d]	--[d]
10.0	10.0	12,087	1,891	1,860	2,200
25.0	4.0	21,198	4,042	--[d]	3,500
50.0	2.0	28,818	6,483 [e]	4,150	4,500

Recurrence Interval (years)	Annual Chance of Exceedance (percent)	Peak Discharges from Analysis of USGS Streamflow Records (cfs) [a]		Peak Discharges from FEMA Flood Insurance Study[b]	Peak Discharges with Regulation at Del Valle Reservoir[c]
		Pre-dam	*Post-dam*		
100.0	1.0	36,695 [e]	9,797 [e]	7,000	4,500
200.	0.5	44,565 [e]	14,153 [e]	--[d]	7,000
500.0	0.2	54,617 [e]	21,831[e]	9,080	20,000

Source: Brown and Caldwell 2020

Notes:

a. Peak discharges calculated using Bulletin 17B methodology (see Appendix A of Appendix F-1 of this SEIR); analysis performed using peak annual discharge records from USGS 11176500 (pre-dam, 1912–67) and (post-dam, 1969–2017).

b. Peak discharges obtained from effective Flood Insurance Study (FIS) for Alameda County (FEMA 2009); the 100-year (i.e., base flood) peak discharge corresponds with managed releases plus spill at Del Valle Reservoir during the standard project flood (see next footnote).

c. Discharges estimated from Plate 3 of "Report on Reservoir Regulation" by the U.S. Army Corp of Engineers (USACE 1978). Flood control operations described by USACE (1978) as follows: "When the reservoir water surface is between 701.7 and 742.0 feet (39,000 and 74,000 acre-feet of storage, respectively), releases will be restricted to a maximum of 4,500 cfs, the estimated discharge when bank erosion begins on Arroyo Valle. When the reservoir water surface is between 742.0 and 749.0 (81,400 acre-feet of storage including 4,400 acre-feet of surcharge storage) releases will be made to restrict releases plus spill to a maximum of 7,000 cfs during floods up to the standard project flood magnitude. Inundation on Arroyo Valle is estimated to begin when discharge exceeds 7,000 cfs. When reservoir water surface is above elevation 749.0 no releases will be made."

d. Data not available at specified recurrence interval.

e. Recurrence intervals of 100, 200, and 500 years are greater than the available period of record and are therefore considered extrapolations; post-dam estimates do not account for flood control operations at Del Valle Reservoir and should not be relied upon for floodplain management.

f. Base Flood for floodplain management.

g. Standard Project Flood for Del Valle Reservoir (USACE 1978).

h. The peak discharge for the 500-year is large relative to the other discharges in the table; this is likely due to the rapid increase in discharge expected at the spillway.

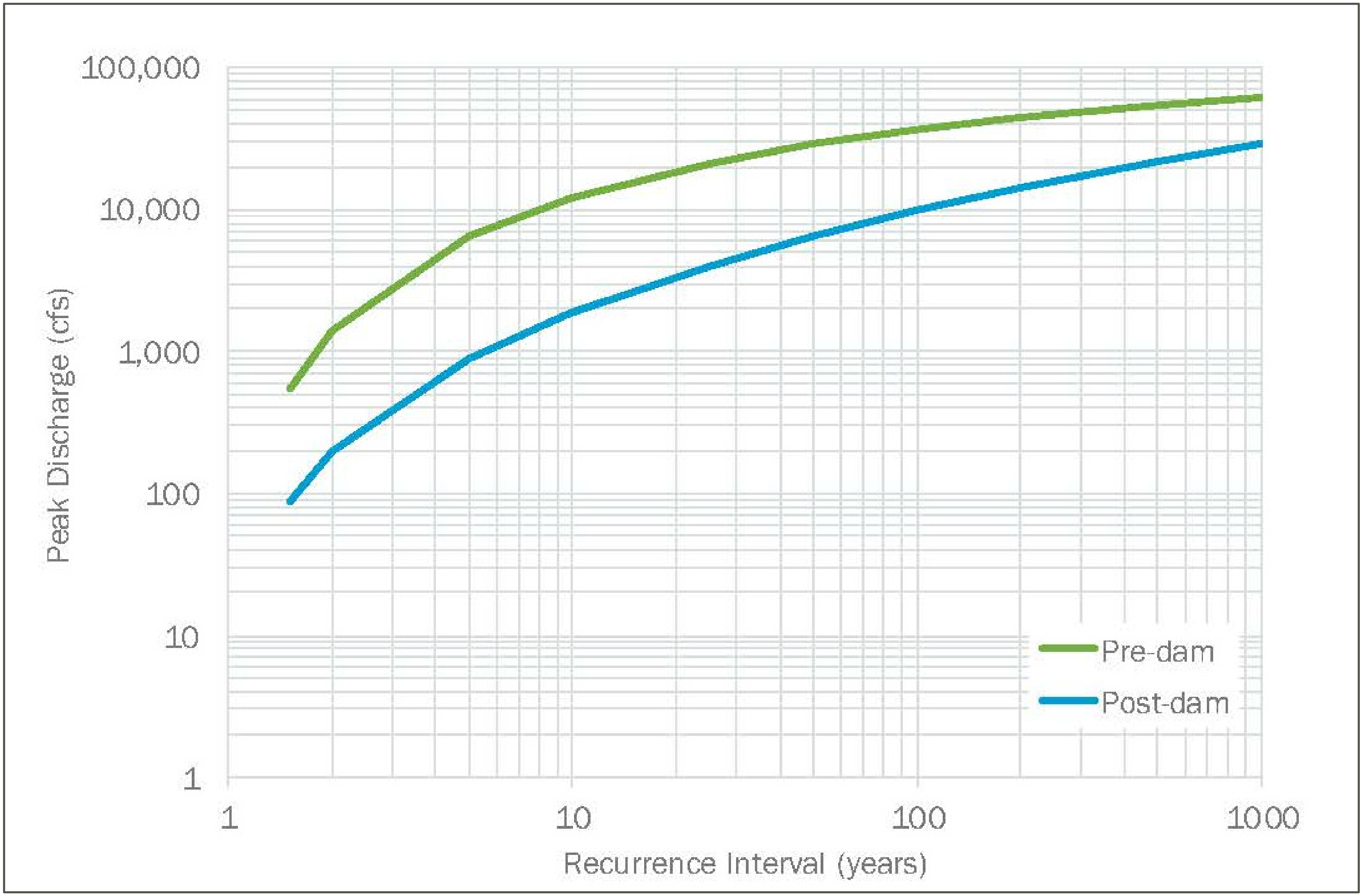
Existing Floodplain

FEMA has completed flood hazard mapping for ADV, including a detailed study of the reach upstream of Isabel Avenue (FEMA 2009). The entire reach of ADV from Arroyo de la Laguna to Del Valle Dam is mapped as a Special Flood Hazard Area (SFHA) (see Figure 4.6-19, "FEMA Flood Hazard Mapping").

The area shown to be within the SFHA is equivalent to the area that can be inundated by the base flood. The SFHA along ADV is divided into the following two flood hazard designations:

- Zone AE is a riverine flooding hazard with established base flood elevations; the delineated areas and flood profiles are based on detailed hydraulic modeling.
- Zone A is a riverine flooding hazard with no base flood elevations; these areas are delineated by approximate methods that may not have included any detailed modeling.

Two reaches of the ADV are shown as Zone AE in Figure 4.6-19. The first reach begins at the confluence with Arroyo de la Laguna and ends approximately 1,300 feet upstream of Bernal Avenue. The second reach begins at Isabel Avenue and ends at Del Valle Dam. The connecting Zone A reach covers approximately 3 miles, including areas adjacent to Shadow Cliffs Regional Recreation Area and Lake B of the project site (FEMA 2009).



SOURCE: B&C 2020, Figure 3-6; modified by Benchmark Resources in 2020.
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Peak Flow Frequency Curves for ADV from Regression Analysis
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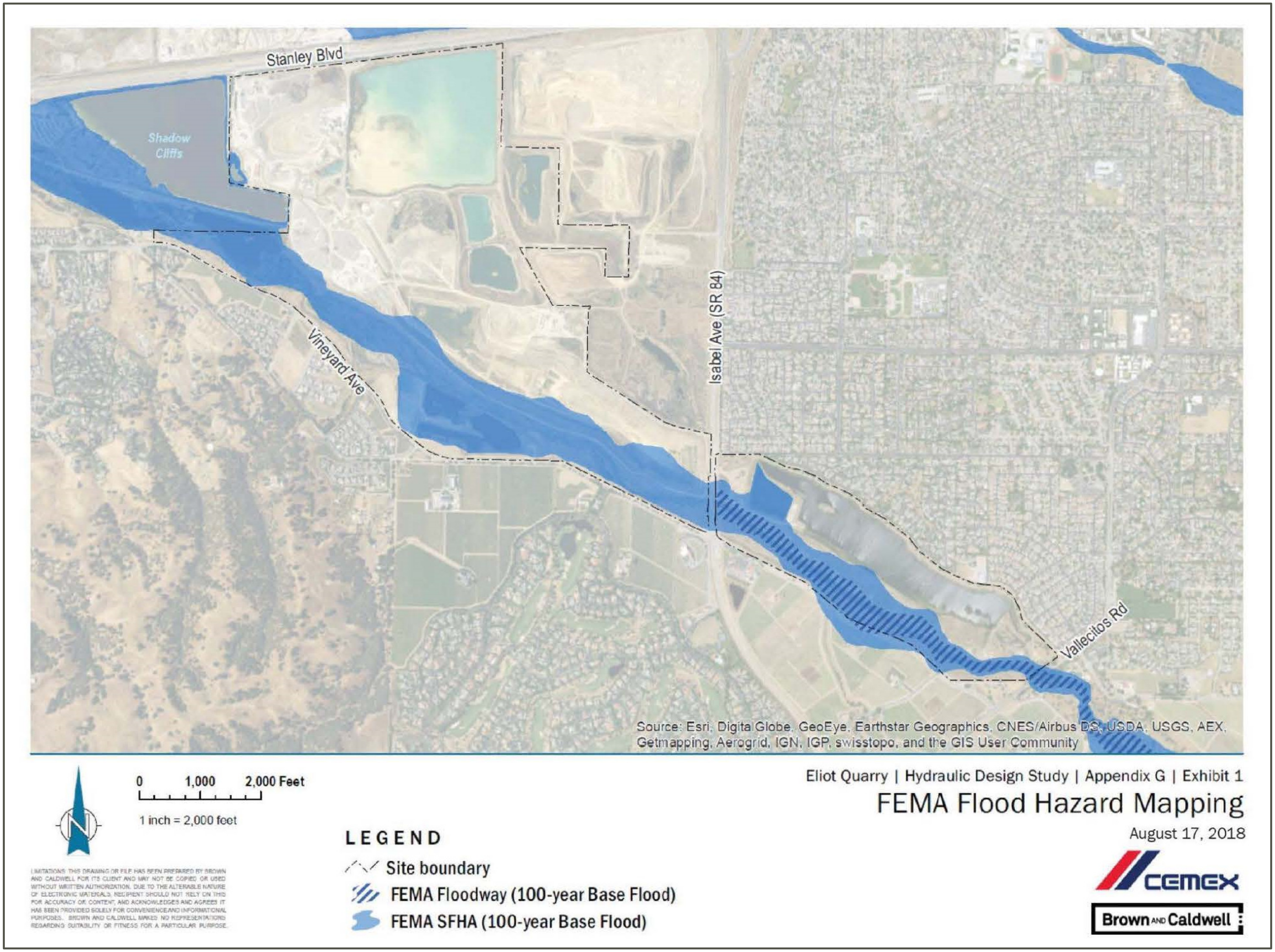

SOURCE: B&C 2020, Appendix G, Exhibit 1; modified by Benchmark Resources in 2020.

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FEMA Flood Hazard Mapping

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Conditions have changed since the original FEMA study was completed and supporting technical data, such as the current effective hydraulic model, were not available. Therefore, new and updated analyses were needed to obtain an accurate depiction of flooding potential under existing conditions. To perform new steady-state hydraulic simulations for the 10-, 50-, 100-, and 500-year floods, Brown and Caldwell developed a hydraulic model of ADV from approximately 1,000 feet downstream of Bernal Avenue to approximately 4,500 feet upstream of Vallecitos Road using Hydrologic Engineering Centers River Analysis System (HEC-RAS)[1] software (Version 5.0, 2016). (Brown and Caldwell 2020) (Appendix F-1). The peak discharges from the current FEMA FIS were used to develop the data inputs for the HEC-RAS model. According to FEMA's current FIS for the County, the peak 100-year discharge is 7,000 cfs, which corresponds to a managed flood release from the dam (FEMA 2009, USACE 1978). Furthermore, Brown and Caldwell reviewed existing hydraulic modeling data as well as new topographic data from 2018 to develop an up-to-date existing-conditions (i.e., baseline conditions) model of ADV. Brown and Caldwell then modified that model to reflect the conditions of the proposed project.

The estimated 100-year flood inundation in the project reach based on the existing conditions hydraulic model is shown on Figure 4.6-20, "100-Year Flood Inundation Based on Existing Conditions Hydraulic Modeling." The estimated water surface elevations in ADV are high enough to indicate that water could potentially flow into Lake A and/or Lake B at two low spots, as shown on Figure 4.6-20.

4.6.2.5 Groundwater and Surface Water Quality

The EMKO report (Appendix F-2) assesses water quality conditions at the entire project site. Water quality data were obtained from Zone 7 for wells and surface water locations near Lake A and Lake B. Figure 4.6-21, "Pond Water Elevations and Surface Water Sampling Locations," and Figure 4.6-22, "Well Sampling Locations," show the locations of wells and surface water samples, respectively. The water quality data are provided in Table 4.6-3, "Groundwater Quality Data," and Table 4.6-4, "Surface Water Quality Data." Note that not all locations shown on these figures were evaluated as some are located outside the project boundary and others would not be affected by the proposed project. The water quality data were evaluated using a combination of Stiff plots, Piper diagrams, Durov diagrams, and Schoeller diagrams. See Appendix B of the EMKO (2020a) report (provided in Appendix F-2 of this SEIR) for the data plots for the 2012 groundwater data. These graphical presentation and analysis tools are standard approaches for evaluating general mineral water quality data (USGS 1989).

The Kleinfelder focused water quality assessment (Appendix F-3), however, was prepared to determine potential differences in water quality between the Upper and Lower Aquifers in the vicinity of Lake B only and to evaluate if the proposed increase in depth of Lake B has the potential to substantially degrade water quality in the Lower Aquifer. The assessment is based on an evaluation of data collected for groundwater and surface water by Zone 7, with a focus on four of the five constituents listed in Zone 7's Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin (i.e., TDS, nitrate, boron, and hexavalent chromium). The fifth constituent, toxic sites, does not apply to the project site.

[1] HEC-RAS is a 1-dimensional step backwater flow model developed by USACE HEC. Standard hydraulic simulations require two types of input data: (1) geometric data comprising cross-sections, stream reach lengths, and bridge/culvert dimensions; and (2) flow data comprising flow rates and boundary conditions. Both types of input data were imported into HEC-RAS for the Hydraulic Analysis (see Section 6.1 of Appendix F-1 of this SEIR).

TABLE 4.6-3
GROUNDWATER QUALITY DATA

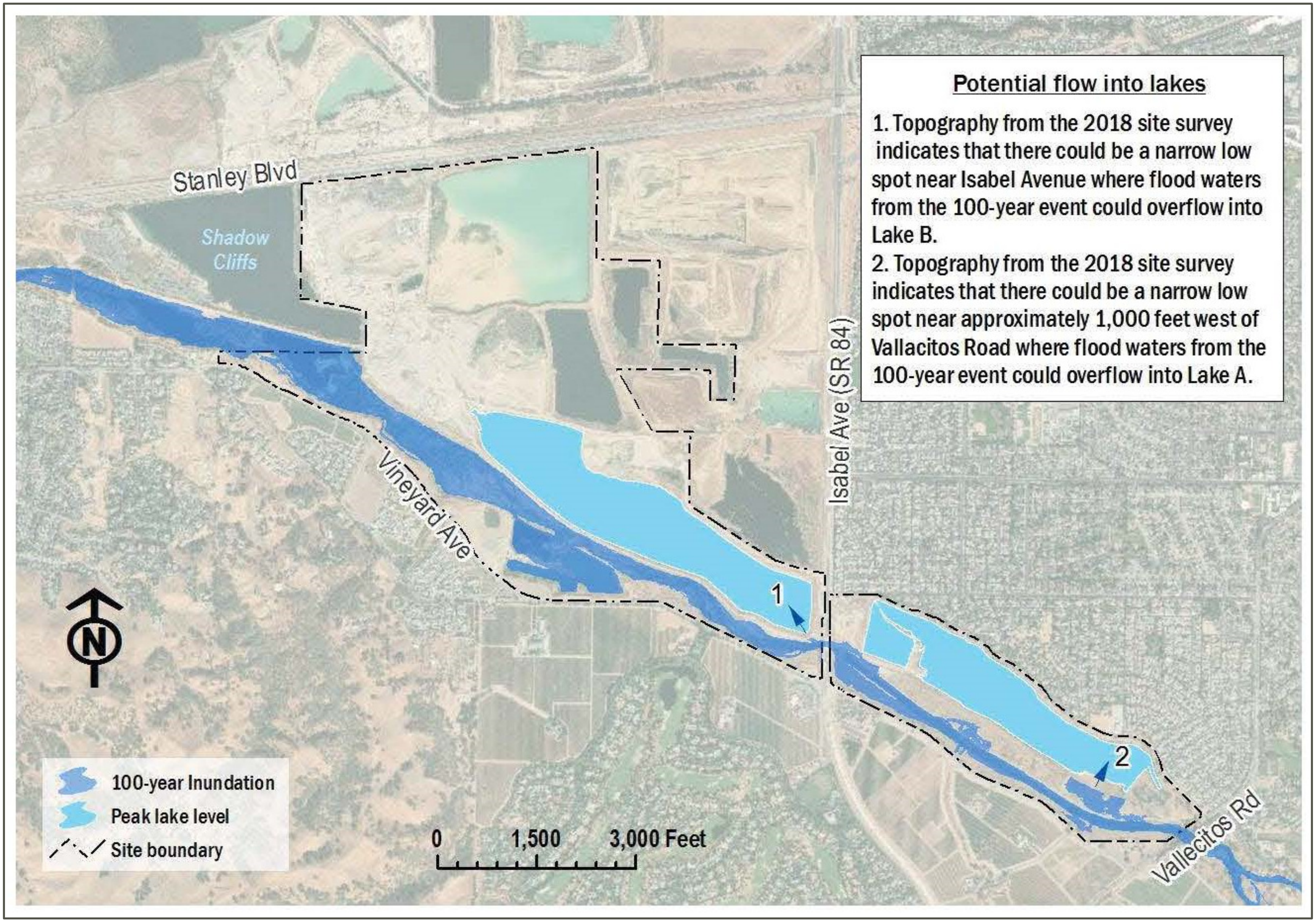
Parameter	Well:	13P1	13P05	13P06	13P07	13P08	23J01	25C03	19D07	19D08	19D09	19D10	20M01	29F04	30D02
	Units	*4/17/12*	*4/17/12*	*4/17/12*	*4/17/12*	*4/17/12*	*2/8/12*	*2/8/12*	*4/16/12*	*4/16/12*	*4/16/12*	*4/16/12*	*2/8/12*	*4/16/12*	*5/30/12*
Calcium	mg/L	56	50	86	49	61	53	56	75	88	44	61	73	64	44
Magnesium	mg/L	18	22	22	12	17	30	23	51	56	15	30	33	26	22
Sodium	mg/L	48	49	34	50	52	58	69	30	32	27	44	68	38	37
Potassium	mg/L	1.8	1.7	2.0	2.0	2.1	1.0	1.3	2.1	2.3	1.4	1.8	1.7	1.9	1.9
Bicarbonate (as $CaCO_3$)	mg/L	188	182	267	246	229	166	254	281	304	133	208	326	285	202
Sulfate	mg/L	45	45	42	40	43	13	31	22	25	10	32	53	56	43
Chloride	mg/L	80	83	69	16	56	144	96	135	152	48	97	89	42	54
TDS	mg/L	357	359	415	316	376	447	446	501	553	294	449	511	391	326
Specific Conductivity	umho/ cm	623	621	704	506	628	813	763	902	988	467	735	881	657	566
pH	std units	7.4	7.4	7.3	7.7	7.3	8.0	6.8	7.2	7.3	7.4	7.3	7.6	7.6	7.7

Source: EMKO 2020a: Table 5
Notes: mg/L = milligrams per liter; std units = standard units; TDS = total dissolved solids; umho/cm = micromhos.

TABLE 4.6-4
SURFACE WATER QUALITY DATA

Sample Location:		K18	P10	P12	P42	P28	P41
Parameter	*Units*	*5/29/2012*	*5/29/2012*	*5/29/2012*	*5/29/2012*	*5/29/2012*	*5/29/2012*
Calcium	mg/L	36	25	40	47	35	52
Magnesium	mg/L	17	26	18	23	42	36
Sodium	mg/L	49	53	41	41	83	62
Potassium	mg/L	2.1	2.4	2.0	1.4	2.4	2.5
Bicarbonate (as CaCO3)	mg/L	138	473	164	202	216	236
Sulfate	mg/L	45	21	45	41	52	39
Chloride	mg/L	70	72	71	66	153	130
TDS	mg/L	308	310	313	339	487	457
Specific Conductivity	umho/cm	539	558	568	617	883	851
pH	std units	8.9	8.7	8.4	8.4	8.6	8.6

Source: EMKO 2020a: Table 6
Notes: mg/L = milligrams per liter; std units = standard units; TDS = total dissolved solids; umho/cm = micromhos.



SOURCE: B&C 2020, Figure 6-8; modified by Benchmark Resources in 2020.
NOTE: Figure is not printed to scale.

100-Year Flood Inundation Based on Existing Conditions Hydraulic Modeling

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Figure 4.6-20

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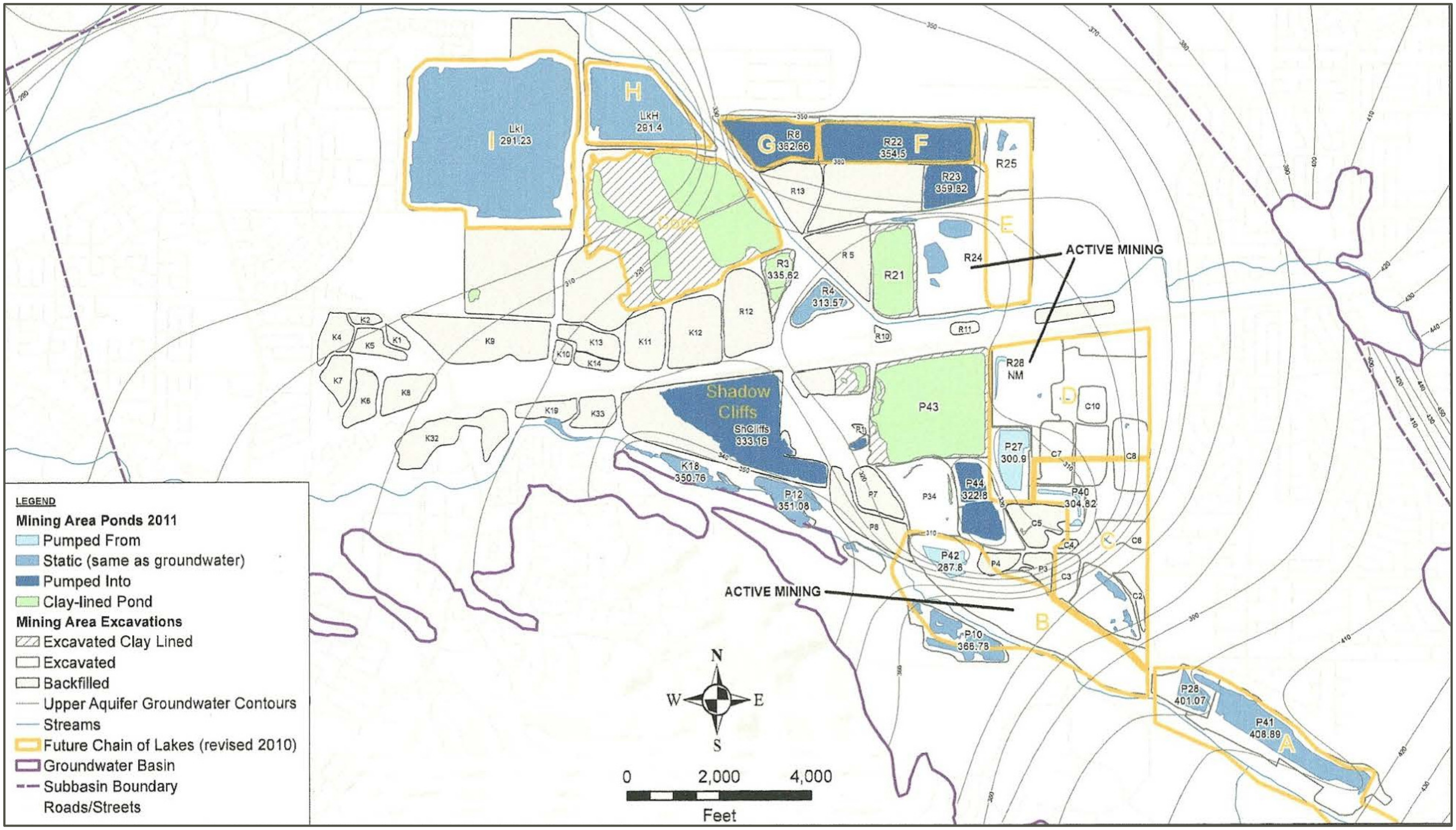

SOURCE: EMKO 2020a; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

Pond Water Elevations and Surface Water Sampling Locations

ELIOT QUARRY SMP-23 SEIR

Figure 4.6-21

BENCHMARK RESOURCES

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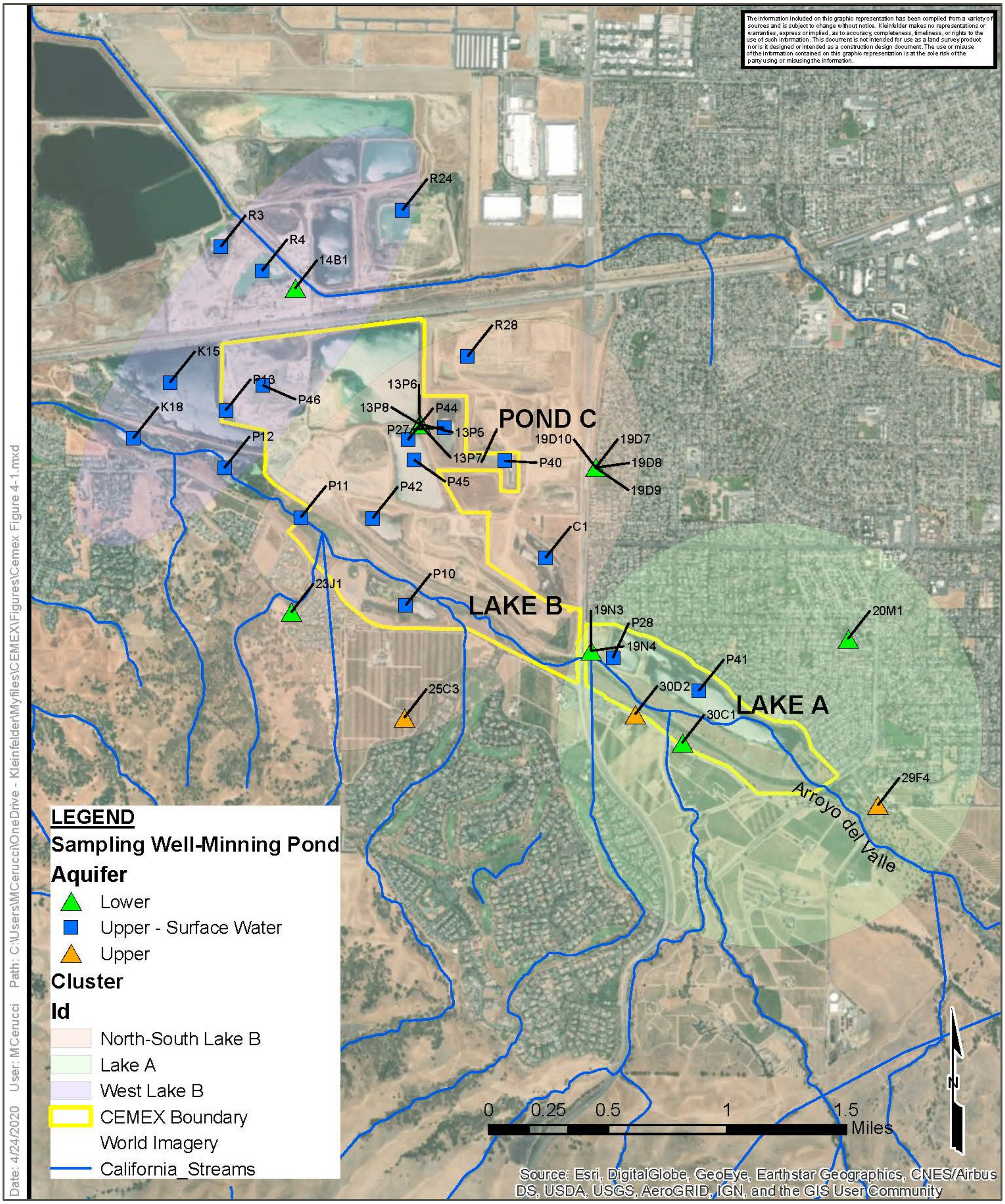

SOURCE: Kleinfelder 2020, Figure 4.1; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

BENCHMARK RESOURCES

Well Sampling Locations

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Figure 4.6-22

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The chemical parameters evaluated in the Kleinfelder assessment were arsenic, boron, calcium, chloride, bicarbonate plus carbonate, chromium, iron, potassium, magnesium, sodium, nitrate, sulfate, silica, TDS, and pH. The graphing tools Piper, Schoeller, and Durov diagrams were used to evaluate hydrochemical facies (water types), mixing of waters, and potential sources. Box-whisker plots were prepared to identify outliers. Parametric statistics (mean, maximum, and minimum) were calculated for most parameters, and non-parametric statistics were derived for nitrate, boron, chromium, and TDS using the 40-year data record provided by Zone 7.

Groundwater Quality

Zone 7 (2011) reports that no distinct water quality characteristics uniquely distinguish an individual well or aquifer unit. The groundwater is primarily a calcium-bicarbonate water type. Levels of total dissolved solids (TDS) range from approximately 300 mg/L to 550 mg/L.

For several wells, water-quality data since the 1970s is available. To evaluate any trends or major changes in water quality over time, the data from well 13P1, located on the east side of SMP-23, were used. The data plots for the historical data evaluation of well 13P1 are provided in Appendix B of the EMKO (2020a) report (Appendix F-2 of this SEIR).

For groundwater, TDS levels range fairly uniformly from approximately 300 to 550 mg/L. The pH ranges from 6.8 to 8.0, with all but two values being between 7.2 and 7.7. The predominant anion (negatively charged ion) is bicarbonate in all wells except 23J1, where chloride is the predominant anion. Calcium is the predominant cation (positively charged ion), however magnesium is slightly more predominant in wells 19D7 and 19D8, while sodium is more predominant in 25C3 (see Appendix A of EMKO 2020a [Appendix F-2 of this SEIR] for all diagrams and plots).

The Kleinfelder report compared existing groundwater water quality data, described above, with the thresholds in the Zone 7 Alternative Plan. As a result, Kleinfelder collected data for TDS, nitrate, chromium, and boron (the priority constituents listed in the Alternative Groundwater Sustainability Plan) concentrations in groundwater (see Table 4.6-5, "Maximum Concentration of Constituents 1980 -2019: Groundwater") and noted the following observations:

- **TDS**: Average TDS concentration varies from 373 mg/L in the Upper Aquifer of North-South Lake B area to 432.57 mg/L in the Upper Aquifer west of Lake B area. An individual elevated TDS result for mining pond P40 (6,199 mg/L) is recognized as an outlier and was not used in the parametric statistical analyses. Subsequent sampling performed in 2017 indicated significantly lower levels of TDS in P40 (380 mg/L).
- **Nitrate:** Nitrate levels are lower for the Upper Aquifer wells and mining ponds. Lower Aquifer well 19D10 has an average nitrate concentration above the 10 mg/L Alternative Plan threshold. This is an indication that water from the Upper Aquifer in the vicinity of nested well 19D10 would not degrade water quality in the Lower Aquifer with respect to nitrate. Silica also has higher concentrations in the Lower Aquifer.
- **Chromium:** The averages of chromium for the different spatial clusters are within the same order of magnitude and well below the 10 μg/L Alternative Plan threshold, and even further below the current state MCL of 50 μg/L. The analysis of samples according to their position in the aquifer does not indicate significant differences in chromium concentrations for the Upper and Lower Aquifers. Thus, based on concentrations it is unlikely that the mixing of Upper and Lower aquifer waters would significantly change chromium concentrations in the Lower Aquifer.

- **Boron:** The average boron concentration is higher in the Upper Aquifer, mainly in surface water. However, the average concentrations are significantly lower than the 1,400 µg/L Alternative Plan threshold. It is possible that concentrations of boron in the Lower Aquifer would increase over time due to mixing if surface water infiltrates from the Upper Aquifer. However, because higher boron concentrations are normally found in surface water, the existing grading was designed to divert stormwater from reclaimed areas to retention ponds to prevent it entering Lake A and Lake B.

TABLE 4.6-5
MAXIMUM CONCENTRATION OF CONSTITUENTS 1980 -2019: GROUNDWATER

Well ID	Nitrate mg/L	Boron µg/L	Chromium µg/L	TDS mg/L	Arsenic mg/L	Silica µg/L	Iron µg/L
13P5	0.4	410.0	3.6	366.0	< 1.0	17.1	<100.0
13P6	0.9	390.0	4.6	424.0	< 1.0	23.5	680.0
13P7	0.2	210.0	6.5	322.0	< 1.0	23.8	490.0
13P8	1.1	330.0	< 2.0	385.0	< 1.0	27.8	170.0
14B1	2.7	390.0	6.0	457.0	< 1.0	21.4	<50.0
19D10	13.5	220.0	2.7	469.0	< 1.0	36.2	<50.0
19D7	8.3	100.0	12.0	802.0	< 1.0	28.9	140.0
19D8	6.7	100.0	8.3	587.0	< 1.0	27.2	<50.0
19D9	13.1	100.0	6.7	297.0	< 1.0	28.2	200.0
19N3	0.6	240.0	< 1.0	361.0	9.1	27.8	<100.0
23J1	7.9	340.0	5.0	486.0	< 1.0	38.7	<50.0
25C3	5.0	410.0	2.0	465.0	< 1.0	29.3	120.0
29F4	1.3	1400.0	11.0	655.0	8.0	25.3	540.0
30D2	1.8	800.0	4.4	494.0	< 1.0	25.2	<100.0

Source: Kleinfelder 2020

As stated above, the data from well 13P1 from 1971 through 2012 were also evaluated to assess variations or trends over time. The data from well 13P1 indicate that the general water quality parameters in this well have been consistent over time and no significant trends in these parameters have occurred over the last several decades.

Surface Water Quality

Surface water data plots are provided in Appendix D of the EMKO (2020a) report (Appendix F-2 of this SEIR). The surface water data suggest that the general water chemistry is slightly different at Lake A compared to downstream locations. At Lake A, the water chemistry is more similar to that for groundwater in nearby wells than it is to the other surface water locations downstream, with TDS levels in the range of 450 mg/L to 490 mg/L, and with magnesium, sodium, and chloride present at higher proportions than at other locations. While the overall water type from Lake A is similar to the groundwater wells, there are also some differences related to individual parameters between Lake A and the available data from two nearby wells, 30D2 and 29F4. For example, the TDS in Lake A (457 to 487 mg/L) is higher than 30D2 (326 mg/L) and 29F4 (391 mg/L). The chloride in Lake A (130 to 153 mg/L) is higher than 30D2 (54 mg/L) and 29F4 (42 mg/L). The pH in Lake A (8.6) is higher than 30D2 (7.7) and 29F4 (7.6). The specific conductivity in Lake A (851 to 883 micromhos per centimeter [umhos/cm]) is higher than 30D2 (566 umhos/com) and 29F4 (657 umhos/cm). However, other parameters, such as calcium, bicarbonate, and sulfate in Lake A generally have comparable concentrations to those in the nearby wells. The water in Lake A is primarily groundwater that has been exposed to the atmosphere.

Therefore, evaporation and exposure to oxygen in the atmosphere may result in some modification of the water chemistry in Lake A compared to that in the nearby wells, where the groundwater is not directly exposed to the atmosphere (see Table 4.6-3).

The surface water in the ADV generally has slightly lower TDS levels and a slightly higher pH than groundwater in the vicinity of Lake A and Lake B. The general mineral chemistry of the surface water is comparable to that observed in the groundwater in the area.

As noted above, the Kleinfelder report compared existing surface water quality data with the thresholds in the Zone 7 Alternative Plan. Only one of those four constituents, boron, applied to surface water. As a result, the Kleinfelder report noted the average boron concentration is higher in the Upper Aquifer, mainly in surface water. However, the average concentrations were significantly lower than the 1,400 μg/L Alternative Plan threshold (see Table 4.6-6, "Maximum Concentration of Constituents 1980 -2019: Surface Water"). Because higher boron concentrations are normally found in surface water, the existing grading was designed to divert stormwater from reclaimed areas to retention ponds to prevent it entering Lake A and Lake B.

TABLE 4.6-6
MAXIMUM CONCENTRATION OF CONSTITUENTS 1980 -2019: SURFACE WATER

Well ID	Nitrate mg/L	Boron μg/L	Chromium μg/L	TDS mg/L	Arsenic mg/L	Silica μg/L	Iron μg/L
C1	0.3	2480.0	2.0	1057.0	13.0	22.0	222.0
K18	0.3	420.0	<5.0	553.0	2.1	11.4	<100.0
P10	0.3	1000.0	2.3	662.0	5.9	22.3	210.0
P11	0.6	700.0	3.0	524.0	2.0	20.2	350.0
P12	0.3	440.0	3.1	516.0	3.9	21.4	510.0
P13	NA	NA	NA	588.0	NA	NA	NA
P27	0.3	560.0	2.7	447.0	5.0	20.3	290.0
P28	0.1	680.0	< 5.0	544.0	4.9	13.9	520.0
P40	0.1	650.0	4.3	484.0	3.5	17.1	2100.0
P41	0.1	590.0	4.1	555.0	4.0	13.8	300.0
P42	0.7	400.0	9.6	423.0	2.4	20.1	1160.0
P44	0.1	530.0	6.3	428.0	2.0	12.4	660.0
P45	0.3	500.0	3.8	377.0	3.9	11.2	890.0
P46	1.3	420.0	1.0	476.0	< 1.0	19.0	<100.0
R24	0.3	810.0	17.0	567.0	4.0	19.4	940.0
R28	0.6	470.0	8.1	407.0	< 1.0	18.2	1200.0
R3	0.5	930.0	11.0	690.0	2.1	23.1	3500.0
R4	0.6	930.0	6.7	631.0	3.2	24.4	960.0
K15	0.3	410.0	2.1	747.0	4.8	14.0	130.0

Source: Kleinfelder 2020
Notes: NA = Not Available

4.6.3 Regulatory Setting

A discussion of the key laws, regulations, and programs pertaining to hydrology and water quality is provided in the following sections.

4.6.3.1 Federal

Federal Water Pollution Control Act (33 USC 1251 et seq.)

The Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), established the basic structure for regulating discharges of pollutants into the waters of the United States. This gave U.S. Environmental Protection Agency (EPA) the authority to implement pollution control programs such as setting water quality standards and criteria for contaminants in surface waters. The CWA does not deal directly with groundwater or with water quantity issues. Section 208 requires the use of best management practices (BMPs) to control releases of pollutants in stormwater at construction sites. Section 303(d) requires the states identify waters for which effluent limits are not stringent enough to implement the applicable water quality standards, and to prepare plans for improving the quality of these water bodies. Section 401 requires the federal government to obtain certification from the state that a project is consistent with state water quality standards. Section 402(p)(3)(B)(iii) authorizes the National Pollutant Discharge Elimination System (NPDES) permit program to control water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or human-made ditches. Section 404 authorizes the U.S. Army Corps of Engineers to regulate projects that will discharge dredge or fill materials into waters of the United States.

Construction projects and many industrial facilities must obtain NPDES permits to control the release of industrial chemicals in stormwater runoff. Stormwater discharges are generated by runoff from land and impervious areas such as paved streets, parking lots, and building rooftops during rainfall events that often contain pollutants in quantities that could adversely affect water quality. The primary method to control stormwater discharges is through the use of BMPs.

Anti-degradation Standards of the CWA dictate that once the existing uses of a water body have been established—by evaluating the water's quality relative to uses already attained—a State/Tribe must maintain the level of water quality that has been identified as being necessary to support those existing uses. The "use" of a water body is the most fundamental articulation of its role in the aquatic and human environments. The "designated" uses of a water body are an expression of goals for the water, such as supporting aquatic life and human activities, including recreation and use as a public water supply. That is, these uses may not currently be attained for the water body. The general parameters of a State or Tribe's antidegradation program must address the following three categories:

- **Tier 1:** Protection of water quality for existing uses by maintaining the water quality necessary to support those uses. Tier 1 is applicable to all surface waters;
- **Tier 2:** Protection of high quality waters, or water bodies where existing water quality conditions are better than necessary to protect CWA 101(a) designated uses. High quality waters must be addressed by the State or Tribe's antidegradation program because of the importance of such waters as a resource with economic, public health, and ecological value; and
- **Tier 3:** Outstanding National Resource Waters (ONRWs), or waters that have unique characteristics to be preserved (e.g., waters of exceptional recreational, environmental, or ecological significance). While States/Tribes are required to have provisions in their antidegradation policy that address ONRWs, it is left to the State/Tribe's discretion to identify waters as ONRWs.

At a minimum, States/Tribes must apply their antidegradation program to activities that are regulated under State, Tribal, or federal law, including:

- Any activity that requires a permit or water quality certification.
- Any activity subject to State/Tribal non-point source control requirements or regulations.
- Any activity that is otherwise subject to State/Tribal regulations specifying that water quality standards are applicable (EPA 2020).

4.6.3.2 State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code) [Section 13000 et seq.]) was enacted to establish a regulatory program to protect water quality and beneficial uses of all waters of the State of California. It created the State Water Resources Control Board (SWRCB) and nine regional water quality control boards (RWQCBs) to plan, implement, manage, and enforce water quality protection and management. The RWQCBs are empowered by the Porter-Cologne Water Quality Control Act to require compliance with State and local water quality standards. The project site is located within the San Francisco Bay and is regulated by the San Francisco Bay RWQCB. The NPDES permitting program is administered by the SWRCB. To obtain a NPDES permit under the General Permit for stormwater, applicants must prepare and submit a notice of intent with the SWRCB and development of a stormwater pollution prevention plan (SWPPP) and monitoring program that incorporates applicable BMPs. The applicable NPDES permit for the proposed project is NPDES No. CAG982001, which was adopted on October 14, 2020, will become effective on January 1, 2021, and will expire on December 31, 2025.

Regional Water Quality Control Boards

The regulations set by the nine RWQCBs pertain to water quality aspects of discharges of solid waste to land for treatment, storage, or disposal. The provisions of California Code of Regulations, Title 27, Division 2, Article 1, Subchapter 1, Chapter 7, Subdivision 1 (Section 22470), regulate the discharge of mining waste. The standards set by the RWQCBs do not override or relieve an owner of compliance with other orders, laws, regulations, or other requirements of other approval, regulatory, or enforcement agencies, such as the California Department of Toxic Substances Control, local health entities, water and air quality control boards, local land use authorities, fire authorities, and other agencies.

Senate Bill 610: Water Supply Assessment

Water Code Sections 10910 through 10915 were amended by Senate Bill 610 (SB 610) in 2002. SB 610 requires that under specific circumstances, as detailed below, an assessment of available water supplies must be conducted. The purpose of the assessment is to determine if available water supplies are sufficient to serve the demand generated by the project, as well as the reasonably foreseeable demand in the region over the next 20 years under average normal year, single dry year, and multiple dry year conditions. Water Code Section 10910 was further amended by SB 1262 on September 24, 2016 to require a Water Supply Assessment to include additional information regarding the groundwater basin designation and adjacent water systems. Appendix F-7, "Water Supply Assessment," provides the information required for a Water Supply Assessment (WSA), as described in the October 2003 *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001 to Assist Water Suppliers, Cities, and Counties in Integrating Water and Land Use Planning*, published by the California Department of Water Resources (DWR Guidebook) along with the additional information required by SB 1262. The SB 610 water supply assessment has been completed for the project (EMKO 2019) (see Appendix F-7).

California Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act of 1975 (SMARA) (Public Resources Code [PRC], Sections 2710–2796) and its implementing regulations (California Code of Regulations [CCR], Title 14, §3500 et seq.) provide a comprehensive surface mining and reclamation policy with the regulation of surface mining operations to assure that adverse environmental impacts are minimized, and mined lands are reclaimed to a usable condition. SMARA also encourages the production, conservation, and protection of the state's mineral resources. PRC Section 2207 provides annual reporting requirements for all mines in the state, under which the State Mining and Geology Board is also granted authority and obligations.

SMARA CCR Section 3706 applies to the discussion of the project's potential for hydrology and water quality impacts:

a) Surface mining and reclamation activities shall be conducted to protect on-site and downstream beneficial uses of water in accordance with the Porter-Cologne Water Quality Control Act, Water Code section 13000, et seq., and the Federal Clean Water Act, 33 U.S.C. Section 1251, et seq.
b) The quality of water, recharge potential, and storage capacity of ground water aquifers which are the source of water for domestic, agricultural, or other uses dependent on the water, shall not be diminished, except as allowed in the approved reclamation plan.
c) Erosion and sedimentation shall be controlled during all phases of construction, operation, reclamation, and closure of a surface mining operation to minimize siltation of lakes and watercourses, as required by the Regional Water Quality Control Board or the State Water Resources Control Board.
d) Surface runoff and drainage from surface mining activities shall be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other erosion control measures, to ensure that surrounding land and water resources are protected from erosion, gullying, sedimentation and contamination. Erosion control methods shall be designed to handle runoff from not less than the 20 year/l-hour intensity storm event.
e) Where natural drainages are covered, restricted, rerouted, or otherwise impacted by surface mining activities, mitigating alternatives shall be proposed and specifically approved in the reclamation plan to assure that runoff shall not cause increased erosion or sedimentation.
f) When stream diversions are required, they shall be constructed in accordance with: (1) the stream and lake alteration agreement between the operator and the Department of Fish and Game; and (2) the requirements of the Federal Clean Water Act, Sections 301 (33 U.S.C. 1311) and Section 404 (33 U.S.C. 1344) and/or Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
g) When no longer needed to achieve the purpose for which they were authorized, all temporary stream channel diversions shall be removed and the affected land reclaimed.

Sustainable Groundwater Management Act

Under California's Sustainable Groundwater Management Act (SGMA) passed in 2014, Zone 7 is designated as the exclusive Groundwater Sustainability Agency (GSA) for the Livermore Valley Groundwater Basin. The project site is located within the Livermore Valley Groundwater Basin or Basin Number 2-10 as defined by the California Department of Water Resources (DWR) California's Groundwater, Bulletin 118—Update 2003. In compliance with the SGMA regulations, the GSA must prepare either a Groundwater Sustainability Plan (GSP) or an Alternative Plan. An Alternative Plan must be functionally equivalent to a GSP and demonstrate that the entire basin has been operating within its sustainable yield for at least 10 years. In December 2016, Zone 7 submitted an Alternative Plan for the

Livermore Valley Groundwater Basin. On July 17, 2019, DWR approved the Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin.

In accordance with SGMA, sustainability plans must address sustainability indicators that effect groundwater conditions occurring throughout the basin that, when significant and unreasonable, become undesirable results. SGMA lists six undesirable results, one of which is significant and unreasonable degraded water quality including the migration of contaminant plumes that impair water supplies. For groundwater quality within the area of the project site, Zone 7's Alternative Plan states undesirable results are defined as the loss of beneficial uses as measured in basin municipal wells that provide drinking water supply for the basin. This result would be caused by degradation of the Lower Aquifer such that constituent levels in municipal wellfields cannot be managed to provide drinking water supply. The Alternative Plan lists five specific constituents identified in the basin that could result in undesirable results including total dissolved solids (TDS), nitrate, boron, hexavalent chromium, and toxic sites. Toxic sites are those sites that generally have been impacted by fuels and industrial chemicals (Zone 7 2016). Based on review of the Alternative Plan and the 2018 Annual Water Monitoring Report for the basin, no toxic sites have been identified in the vicinity of the project site.

Pursuant to SGMA, minimum thresholds must be established to assess if undesirable results are occurring. For the five constituents listed above, the minimum thresholds as defined by Zone 7 in the Alternative Plan are as follows:

- TDS—500 mg/L
- Nitrate as nitrogen (N)—10 mg/L
- Boron—1.4 mg/L
- Hexavalent Chromium—10 micrograms per liter (μg/L) (assumes all total chromium is hexavalent chromium)
- Toxic Sites—Primary Maximum Contaminant Levels (MCLs) established by Federal and State Agencies. As stated above, there are currently no toxic sites identified in the area of the Eliot Mine.

Consistent with the Alternative Groundwater Sustainability Plan developed by Zone 7, these constituents and established minimum thresholds are used to assess if the proposed change to the final elevation (increase in depth) of Lake B could adversely affect groundwater quality in Section 4.6.5 below.

4.6.3.3 Local

East County Area Plan

The goals and policies in the *East County Area Plan* (ECAP) are intended to inform decision makers, the general public, public agencies, and those doing business in the County of the County's position on land use–related issues and to provide guidance for day-to-day decision making (Alameda County 2000). The following goals and policies in the ECAP are related to hydrology and water quality. The project's consistency with the goals and policies is evaluated in Section 4.8, "Land Use and Planning," of this EIR.

Watershed

Policy 101: The County shall encourage public water management agencies to explore recreational opportunities on watershed lands, particularly reclaimed quarries, where recreational use would not conflict with watershed protection objectives.

Water Quality

Goal: To protect and enhance surface and groundwater quality.

Policy 306: The County shall protect surface and groundwater resources by:

- preserving areas with prime percolation capabilities and minimizing placement of potential sources of pollution in such areas;
- minimizing sedimentation and erosion through control of grading, quarrying, cutting of trees, removal of vegetation, placement of roads and bridges, use of off-road vehicles, and animal related disturbance of the soil;

Flood Hazards

Goal: To minimize the risks to lives and property due to flood hazards.

Policy 316: The County shall require new residential, public, commercial, and industrial development to have protection from a 100-year flood.

Zone 7 of the Alameda County Flood Control and Water Conservation District

On June 18, 1957, Livermore-Amador Valley voters approved creation of the Zone 7 of the Alameda County Flood Control and Water Conservation District. The purpose of Zone 7 was to place under local control, through a locally elected board of directors, the matters of flood protection and water resource management in eastern Alameda County (Zone 7 2020b). Zone 7's responsibilities include managing the Livermore-Amador Valley groundwater basin and the Chain of Lakes.

As described in Zone 7's *2020 Preliminary Lake Use Evaluation Report*, Lake A's primary uses are surface water conveyance, water storage, and stormwater management. Lake B's primary use is surface water conveyance and water storage. Lake A's secondary uses are recreation and habitat restoration/conservation. Lake B's secondary use is habitat restoration/conservation (Zone 7 2020a).

Alameda County Specific Plan for the Livermore-Amador Valley Quarry Area Reclamation (1981)

As part of the *Alameda County Specific Plan for the Livermore-Amador Valley Quarry Area Reclamation* (Specific Plan) (Alameda County 1981), quarry operators in the Livermore-Amador Valley are required to excavate basins for future use by Zone 7 for groundwater storage, conveyance, and recharge facilities collectively and commonly known as the "Chain of Lakes" (see Figure 4.6-1). The Specific Plan requires the mining operators to dedicate to Zone 7 all excavated basins that are identified as part of the Chain of Lakes within the Specific Plan area. On the Eliot site, Lakes A and B are identified as part of the Chain of Lakes, while Lake J is not included in the Chain of Lakes.

The following aspects of the Specific Plan relate to hydrology and water quality:

III. General Objectives

5. To provide a coordinated plan for arrangement of mining-produced land and water masses into a coherent, flexible form, reflecting interrelatedness of geology, hydrology, land use, and other factors throughout the Quarry Area.

IV. Specific Objectives

1. To mitigate alteration/impedance of groundwater movement and storage due to mining operations.
2. To mitigate exposure of groundwater to evaporative losses due to mining operations.

3. To mitigate exposure of groundwater to increased risk of quality degradation due to surface exposure as a result of mining operations.
4. To provide uninterrupted and undiminished satisfactory water quantity and quality in the upper aquifer of the mined area for beneficial uses.
6. To provide a surface water storage and transmission system to replace a portion of the existing subsurface system to mitigate mining impacts and enhance the ability to utilize, develop, and manage the water resources of the Livermore-Amador Valley for public benefit.

2. Specific Plan: Water Areas

- Water from Arroyos del Valle and Mocho (and possibly Las Positas and other waters) will be diverted into the chain of lakes.
- The diversion structure from Arroyo del Valle within Lake A into Lake C will be capable of diverting at least the first 500 cubic feet per second of flow from the Arroyo.

IV. Policies

6. Levees and dikes constructed as part of the water management system shall be guaranteed by the constructing operator (s) for 5 years after construction and maintained in a sound and acceptable condition until dedicated to Zone 7: Water Conveyance structures (conduits, appurtenances, diversion structures etc.) will be guaranteed for 2 years after construction, and maintained in a sound and acceptable condition until dedication to Zone 7 and further guaranteed for one year after acceptance of dedication by Zone 7 if more than one-half the 2-year guarantee period has expired. All other reclamation features shall be guaranteed by the operators for 2 years after completion of the component.
8. The operators shall pay for their fair share of the following studies or reviews necessary to demonstrate viability of their proposal in an amount to be fixed by the Planning Commission. The "fair share" shall be in proportion to the extent to which the study or review is necessary to address impacts of mining or reclamation in each operator's mining area. Studies or reviews to which this policy shall apply are as follows:
   - A routing study showing how water would be routed through the chain of lakes including interfaces with the groundwater basin and how the system would be operated under a number of hypothetical conditions (wet year, dry year, flood, drought, etc.).
   - A study of hydrology near Stanley Boulevard to demonstrate whether the area is critical for recharge of lower aquifers and to justify placement of inert material in an area shown for water on the approved Q-76 reclamation plan.
   - A study to demonstrate imperviousness and stability of pits and dikes under uplift pressures. Monitoring of water levels and quality necessary to determine the potential effects on mining and water resources.
18. The reclamation plans to be submitted by each operator shall indicate how drainage is to be provided for all land areas which will not pollute the lakes.

Alameda County Surface Mining Ordinance

The Alameda County Surface Mining Ordinance (Chapter 6.80) includes the following provisions related to hydrology and water quality:

6.80.210—Mining

G. Drainage—Water Quality and Conservation

1. Provision shall be made to protect mining operations from overflow from adjacent streams or from slope failures caused by infiltration and seepage from surface water bodies by the construction of levees or other devices to prevent flooding. No obstruction shall be placed in stream channels without obtaining a permit allowing such obstruction from the county flood control and water conservation district.
3. Excavations that may penetrate near or into usable water bearing strata shall not reduce the transmissivity or area through which water may flow unless approved equivalent transmissivity or area has been provided elsewhere, nor subject such groundwater basin or subbasin to pollution or contamination.
4. Nothing in this chapter shall be construed to prevent the use of mined lands for the conservation or storage of water, or for the control of flood or storm waters, by a public agency duly authorized to engage in such work, provided that any such use will not conflict with nor prevent reclamation required under an approved reclamation plan, and provided such use is approved by the county flood control and water conservation district and/or public works agency.
5. Any waters discharged from the site to adjacent lands, streams, or bodies of water or to any groundwater body shall meet all applicable water quality standards of the regional water quality control board and any other agency with authority over such discharges. Records of any water quality monitoring conducted in conjunction with the requirements of such agency or agencies shall be made available to the director of community development and the director of public works on request. Discharges of water to designated on-site settling ponds or desilting basins shall not be deemed to be in violation of this chapter solely on the basis of sediment content.

6.80.240—Reclamation and Reclamation Plans

D. Drainage, Erosion and Sediment Control.

5. Upon reclamation, no condition shall remain that will or could lead to the degradation of water quality below applicable standards of the regional water quality control board or any other agency with authority over water quality.

4.6.4 Significance Criteria and Analysis Methodology

4.6.4.1 Significance Criteria

Hydrology and water quality impacts were determined based on an evaluation of existing project-area surface and groundwater hydrology and water quality conditions and consideration of project water consumption and potential changes to surface and groundwater hydrology and quality caused by project ground disturbance and land uses.

Based on Appendix G of the CEQA Guidelines, the proposed project would have a significant impact to hydrology and water quality if it would:

a) violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater water quality;
b) substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin;

c) substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:
   - result in substantial erosion or siltation on- or off-site,
   - substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite,
   - create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff, or
   - impede or redirect flood flows;

d) in flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation; or

e) conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

4.6.4.2 Analysis Methodology

Evaluation of the hydrology and water quality impacts in this section is based on information from published maps, reports, and other documents that describe the hydrological and hydrogeological conditions of the project area, and on professional judgment. The analysis assumes that the project proponents would conform to the requirements of the County General Plan (*East County Area Plan)*, the LAVQAR Specific Plan, the County Surface Mining Ordinance, the county grading ordinance, and National Pollutant Discharge Elimination System requirements. In addition to review and incorporation of data contained in publicly available reports, the County conducted peer review of the reclamation plan amendment, project description, erosion control plan, and technical evaluations that incorporated design measures to determine potential impacts that could substantially alter the existing drainage pattern of the project site or area, either by the alteration of the course of the ADV or through the addition of impervious surfaces that could result in substantial erosion or siltation by on and off the project site.

The evaluation also peer reviewed and incorporated both applicable FEMA maps and Brown and Caldwell's HEC-RAS model. The HEC-RAS model provided a detailed description of the existing flow regime and flood flow in and around the project site to determine if the project would substantially increase the rate or amount of surface runoff in a manner that would: 1) result in flooding on- or offsite, 2) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems, 3) provide substantial additional sources of polluted runoff, or 4) impede or redirect flood flows.

One of the technical reports prepared regarding water quality impacts (EMKO 2020a) analyzed two baseline conditions: current operating conditions and conditions that would occur if mining and dewatering ceased (non-operational conditions). The baseline for the CEQA analysis considers current operating conditions with dewatered active mining excavations.

The datasets for this analysis include existing water quality, well construction details, and spatial data in the vicinity of the mine. Information was obtained from Zone 7 and from CEMEX. Spatial data acquired for the project is referenced to the California State Plane Zone III coordinate system. The water-quality data provided by Zone 7 are available in electronic format in (Kleinfelder 2020) (see Appendix F-3). The information provided by Zone 7 includes water quality parameters measured in samples from wells located in the Upper Aquifer, Lower Aquifer, and the Livermore Formation and parameters measured in several mining ponds in the vicinity of the project site (surface water). Data from 36 sampling locations within 1-mile of the project site were used. Figure 4.6-22 presents the locations of wells and mining ponds with water-quality data. Table 4.6-7, "Well and Mining Pond Characteristics," presents the well and mining ponds characteristics.

Table 4.6-7
Well and Mining Pond Characteristics

Well ID	Type	Use	Aquifer	Depth (feet)
GROUNDWATER				
13P5	well-static	nested	upper	135
13P6	well-static	nested	lower	255
13P7	well-static	nested	lower	375
13P8	well-static	nested	lower	605
14B1	well-supply	industrial	lower	435
19D10	well-static	nested	lower	470
19D7	well-static	nested	upper	180
19D8	well-static	nested	lower	260
19D9	well-static	nested	lower	390
19N3	well-static	nested	upper	120
19N4*	well-static	nested	lower	203
20M1*	well-supply	supply	lower	184
23J1	well-supply	supply	lower	120
25C3	well-static	monitor	upper	146
29F4	well-static	monitor	upper	36
30C1*	well-supply	supply	lower	150
30D2	well-static	monitor	upper	44
SURFACE WATER				
C1	mining pond	mining	upper	NA
K18	mining pond	mining	upper	NA
P10	mining pond	mining	upper	NA
P11	mining pond	mining	upper	NA
P12	mining pond	mining	upper	NA
P13	mining pond	mining	upper	NA
P27	mining pond	mining	upper	NA
P28	mining pond	mining	upper	NA
P40	mining pond	mining	upper	NA
P41	mining pond	mining	upper	NA
P42	mining pond	mining	upper	NA
P44	mining pond	mining	upper	NA
P45	mining pond	mining	upper	NA
P46	mining pond	mining	upper	NA
R24	mining pond	mining	upper	NA
R28	mining pond	mining	upper	NA
R3	mining pond	mining	upper	NA
R4	mining pond	mining	upper	NA
K15	mining pond	mining	upper	NA

Source: Kleinfelder 2020
Notes: * = Livermore Formation

The wells and surface water observations are not evenly distributed in space and time. The southeast portion of the site has more groundwater samples whereas the central and northwest portions of the site have a greater number of surface water samples. Also, the sampling timeframe is not consistent for all sampling locations. Some monitoring locations are sampled multiple times every year while others have a period of several years between samples. The frequency of sampling also varies according to the water-quality parameter. The spatial and temporal variabilities are inherent to the dataset and a potential source of bias for the statistical analysis. Thus, the data were grouped, presented, and evaluated in different ways to reduce the effect of potential bias in the conclusions.

Additional detailed discussion regarding methodology for analyzing hydrology and water quality impacts are provided in Appendices F-1 through F-7.

4.6.5 Project Impacts and Mitigation Measures

4.6.5.1 LAVQAR EIR Impact Analysis

Under the LAVQAR EIR, several hydrology and water quality impacts were determined to be significant and unavoidable, though several mitigation measures were proposed to lessen the impacts. (Alameda County 1980: 22-38).

The approved project includes the following mitigation relevant to water quality impacts:

- **Side Slopes.** Experience in California in Los Angeles County, in Orange County, in Santa Clara County, and in the Niles Canyon area has been that worked out gravel pits used for groundwater recharge must occasionally be cleaned and reshaped. Steep side slopes are difficult to maintain, are not conducive to water-oriented recreation, and present a safety hazard to those who may enter the water for any reason. Earthquakes may create problems, and equipment should be able to enter the pits. As a mitigation measure enabling maintenance and management of the gravel pits after excavation is finished, a minimum side slope standard of 2:1 should be set. Exception to this standard should be allowed under certain conditions when compatible with the water and land use planning for a specific area. (Alameda County 1980: 32)
- **Maintenance Access and Buffer Strips.** Without access worked out gravel pits can become a nuisance; it is difficult to monitor them, to prevent or clean up pollution, and to maintain, and/or to rehabilitate them.

  For routine maintenance, a minimum access of at least 20 feet should be provided around the gravel pits. These access areas should be shown in the Plan. Additional area should be designated where special maintenance problems might occur; for example, around water conduits and areas where silt cleaning equipment would have to operate. In Los Angeles County, maintenance benches are designed for the pits so carry-alls can collect silt as it is scraped from the pit sides. These benches could also be used for recreation purposes and for safety.

  In addition, buffer strips should be provided along each major traffic corridor and adjacent to urban areas to minimize the potential for pollution of groundwater. The major traffic corridors identified in the Plan are Vineyard Avenue, Isabel Avenue (State Route 84), Stanley Boulevard, Las Positas Boulevard, and El Charro Road. Extra space also should be provided where pollution could be a problem from heavy concentrations of people, traffic, or urban uses. Reasonable standards would be 50 feet along major corridors and 50 to 200 feet or more adjacent to urban areas where direct pollution could be a problem. Lands adjacent to the basins could be zoned for uses that would be compatible and non-polluting; for example, service stations should not be allowed next to the open gravel pit lakes.

In the past, setbacks for maintenance roads and buffer strips have been set for individual quarry permits. With standards adopted as part of the Reclamation Plan, or as part of the County General Plan, the general setback allowances could be modified over time as necessary in the site specific reclamation plans developed by the quarry operators. A general agreement should be reached on the setback standards by the County, local agencies, Zone 7, and the gravel companies. However, the establishment of maintenance access and/or buffer strip standards cannot be done without considering alternative plans for the area as described in the Alternative Section. Maintenance and buffer strips should be shown as part of the Reclamation Plan as illustrated in Figure 14 [of the LAVQAR EIR]. (Alameda County 1980: 33)

- **Relocation of Arroyo Mocho and Arroyo del Valle Channels.** For both channel relocations, the existing streamflow capacity and the percolation rates under both low flow and storm conditions would have to be maintained. To prevent possible adverse impacts on the groundwater due to any reduction in channel percolation, spreading basins might be needed. All costs for design and construction and in-kind maintenance for the proposed relocation of these two channels would accrue solely to increase gravel production.

  Extensive studies would be required to determine existing channel capacities and percolation rates. Some special monitoring of streamflow rates would be necessary. Both Zone 7 and ACWD share rights to storm water in Del Valle. Existing agreements between the two agencies might have to be modified if percolation rates in ADV are changed. A water rights study will be needed if the channel is relocated and percolation rates changed, and the point of diversion moved. (Alameda County 1980: 33)

- **Desilting Facilities.** Desilting and flocculation facilities would be necessary for storm runoff diverted to spreading basins if spreading basins were found necessary. Desilting basins will be necessary if water is diverted into the gravel pits for any operational Local Storm Water Control Facilities. (Alameda County 1980: 34)

- **Local Storm Water Control Facilities.** Because of potential pollution from storm water originating on the development areas envisioned in the Plan, storm water runoff should be prevented from directly entering the gravel pit lakes. A storm drainage system should be designed for Reclamation Plan Class 1, 2, and 3 development areas as part of the reclamation plans for individual quarry areas. Likewise, storm runoff from adjacent or nearby industrial, commercial, residential, and agricultural areas should be prevented from directly entering the lakes through diking or other means.

- **Groundwater Movement and Storage Facilities.** To determine natural flow rates, additional groundwater monitoring and planning studies would be required. Water quality must be considered. Modeling might be necessary. The size and design of the facilities needed to maintain water movement and water quality would have to be determined. More conduits might be needed to release water into Arroyo Mocho and del Valle and also in the forebay area south of Stanley Boulevard since the northwesterly movement of water might be more rapid under the Reclamation Plan than under natural conditions. Gates might be needed on the conduits to maintain water quality and flow. With full exposure of the gravel pit lakes along both sides of Stanley Boulevard, the proposed conduit under Stanley Boulevard probably would not be required for water movement.

During mining operations, each gravel pit is composed of several individual cells separated by earthfill dikes. After the pit has been worked out, it is proposed to breech the earthfill dikes between these cells so as to allow water to move freely within each gravel pit lake. The dikes should be lowered to a point below normal low groundwater levels, as shown by studies, and the breeching should be done in a manner which will ensure adequate water movement throughout the pit after the dike has been under water many years. (Alameda County 1980: 34)

Engineering studies should be made in each major pit area to show that the underwater earthfill material will not create sediment and/or turbidity that would block water flow through exposed gravel faces. This is particularly necessary in the forebay area south of Stanley Boulevard and in the area west of El Charro Road. In the forebay area, water percolates sideways and downward into the upper and lower aquifers. It is very important to maintain this area free of silt. The gravel pits north of Stanley Boulevard could theoretically be dewatered for maintenance, but it would be difficult to dewater the forebay area once it is filled with water. As shown in the Plan, earthfill dikes would be constructed adjacent to ADV and in between the gravel pit lakes. Gravel dikes, perhaps topped with earthfill above the high groundwater level, should be used instead of earthfill dikes in the forebay area unless it can be conclusively shown that earthfill dikes would not interfere with water movement or create other problems. Since the storage capacity created would exceed the present groundwater storage, mitigation measures with respect to storage capacity would not be necessary except for the volume of water necessary to fill the additional space. The Alameda County Surface Mining Ordinance prohibits, upon reclamation, any condition "which will or could lead to the degradation of water quality below applicable standards of the Regional Water Quality Control Board or any other agency with authority over water quality." (Alameda County 1980: 34)

- **Monitoring.** Geohydrologic and water resource data for the project area and areas adjacent thereto are insufficient for the needed analyses. Zone 7 has a groundwater monitoring program for the entire Valley. This needs to be expanded so the gravel extraction area and adjacent areas, where maximum disruption to the basin is occurring, can be modeled in detail. Specifically, the monitoring program should be expanded to include more data on groundwater levels, water quality, and water use in the Plan area. Geologic data on storage and transmissibility should be compiled. Water quality data is needed on flows in Arroyos Los Positas, Mocho, and del Valle. Water levels and pumpage into specific pits during specific period of time should be monitored as needed. One of the best ways to design the monitoring system would be to develop a detailed model nodal pattern for the area and then monitor to obtain the hydrologic and geohydrologic input needed. The detailed or fine grid model would be part of the larger model of the Valley already partially developed by the California Department of Water Resources. The monitoring program should be carried out by Zone 7 and the gravel companies. (Alameda County 1980: 35)
- **Water Resource Optimization/Multiple Use Scenario.** The arrangement of land and water areas proposed in the Reclamation Plan presents great opportunities for a variety of public benefits. An ideal Reclamation Plan could present basic elements needed for management of the Livermore-Amador Valley's water resources for multiple purpose and not just minimal mitigation facilities needed for water transmissivity as proposed. This would enable the general public and agencies using the Plan report to be aware of the larger potential water resource management concepts for the area, and the validity of subsequent reclamation plans for individual areas could be judged against this larger concept. Included would be use of the Plan area to help achieve management goals for flood control, water conservation, recreation, and water quality management. All these

goals are mentioned in the Reclamation Plan but are not fully explored, especially as they translate to possible physical facilities necessary for effectuation.

Properly envisioning this alternative requires postulation of a possible optimum water resource management concept, under which landforms would be shaped over time to accommodate all needed water management facilities, not just mitigation facilities. Costs of both mitigation and non-mitigation facilities would be estimated. Allocation of costs toward different functions, such as between quarry mitigation, flood control, and water supply, could be identified. Complete range of benefits (many of which could outweigh impacts which cannot be directly mitigated) could be specified, rather than just adverse impacts.

An example of such a concept is presented in Figure 14 [of the LAVQAR EIR]. Illustration of a water resource optimization scenario. The basic land and water areas as proposed in the Reclamation Plan would be retained because of their assumed flexibility. Building upon the Plan, general management concepts could be explored for their feasibility, benefits, cost, and compatibility. Such a scenario, for example, could be based on the following management concepts:

- Water management in the gravel pits would be done in conjunction with the adjacent groundwater basin.
- The west gravel pit basins would be used for current operation purposes.
- The south (forebay) basins would be used for recharge purposes and as a source of emergency water supply.
- Flood control storage would be provided in the north and east basins area.
- An annual average of over 10,000-acre feet of runoff would be conserved.
- Well fields to evacuate water stored in the gravel pits lakes would be located within the project area and in the groundwater basin to the west.
- The pit basins could be used for temporary storage of imported South Aqueduct water and storage of storm flows for other agencies.
- Urbanization and urban activities would be minimized in the forebay area; the forebay would be used primarily for passive recreation and open space to prevent pollution.
- In the west and east basins area there would be strict separation of the basins from urban uses.
- Buffer zones would be maintained.
- To minimize the inflow of poor quality groundwater it might be practical to seal off the northern side of the north and east basins.
- Recreation use, facilities, and linkage trails would be considered in the design of the water management facilities.

The facilities needed to manage the water under these concepts would include:

- Surface water diversion structures
- Surface conveyance channels connecting the streams to the basins and turnouts as required.
- Desilting areas for each stream.
- Maintenance areas for each stream.
- Maintenance roads throughout the area.

- Buffer strips needed for prevention of pollution.
- Well fields.
- Recreation facility linkage including bridges.
- Gated multiple level conduits designed for water quality control purposes between the basins.

Project Revisions

The LAVQAR EIR assessed the realigned ADV to flow through Lake B. The 1981 project also included a Lake A with a final surface area of 208 acres and Lake B with a surface area of 243 acres. Under the proposed project, approximately 5,800 linear feet of the ADV would be realigned to flow around, rather than through, Lake B under the proposed project. Figure 4.6-23, "Surface Flows Related to ADV and proposed Lakes A, B, and C," depicts the proposed directional flows of water under the proposed project. Reclamation of Lake A would involve limited earthmoving, with a reduction in final surface area from 208 acres to 81 acres and construction of a diversion structure from the ADV that is capable of diverting up to the first 500 cfs of flow from the ADV into the lake. Reclamation of Lake B would also involve a reduction in final surface disturbance compared to the currently approved design from 243 acres to 208 acres, in addition to installation of a pipeline turn-out from Lake A, a water pipeline conduit to future Lake C, and two overflow outlets to allow water to flow back into ADV when Lake A and Lake B water levels are high. Furthermore, the proposed project would adjust reclamation boundaries and contours, develop a new segment of public use trail along the southern boundary of Lake B, as well as enhance drainage and water conveyance facilities. Finally, the proposed project would reclaim the Lake J excavation (not part of the Chain of Lakes), processing plant sites, process water ponds, and Ponds C and D, referenced as the "North Reclamation Area." These design changes are substantial and may create a new or increased significant impact to hydrology or water quality.

Changed Circumstances

Since 1981, new residential subdivisions have been developed to the north of Lake A (e.g., Pulte Oaks and Kristopher Ranch) and to the south of Lake B (e.g. Ruby Hills) These sensitive land uses are changed circumstances that could create a new or increased significant impact. In 1989–1992, CEMEX's predecessor purchased the Jamieson Parcels (see Figure 2-1, "Vested Mining Permits" in Chapter 2, "Project Description"). Jamieson Parcels 1 and 2 were within the scope of Q-76, while Jamieson Parcels 3 and 4 were within the scope of Q-4 initially granted to California Rock and Gravel Company in 1957. The Jamieson Parcels also have vested mining rights. The Jamieson Parcels were acquired by CEMEX's predecessors after the County had approved SMP-23 in 1987; therefore, those parcels were not included within the currently approved SMP-23 reclamation plan boundary.

New Information

Extensive new information of substantial importance is available that was not known and could not have been known with the exercise of reasonable diligence at the time the LAVQAR EIR was adopted. In addition to existing publicly available data and reports, aerial photos, and field observations discussed above, there are several applicant-prepared studies that have been peer reviewed and incorporated into this SEIR as the following appendices:

- *Hydraulic Design Study* (Brown and Caldwell 2020) (Appendix F-1 of this SEIR),
- *Groundwater Hydrology and Water Quality Analysis Report for the Eliot Quarry SMP-23 Reclamation Plan Amendment Project, Alameda County, California* (EMKO 2020a) (Appendix F-2 of this SEIR),

- *Focused Water Quality Assessment Lake B Component Eliot Quarry Reclamation Plan Amendment Project Alameda, California.* (Kleinfelder 2020) (Appendix F-3 of this SEIR),
- *3D Clay Bed Geologic Model and Lack of Evidence for the Presence of Aquitards* (Jeff Light Geological Consulting 2019) (Appendix F-4 of this EIR),
- *2013 Becker Hammer and 2018 Sonic Drill Logs* (Brown and Caldwell 2019) (Appendix F-5 of this SEIR),
- *Adaptive Management Program for Water Quality Regarding Iron* (EMKO 2020b) (Appendix F-6 of this SEIR), and
- *Water Supply Assessment* (EMKO 2019) (Appendix F-7 of this SEIR).

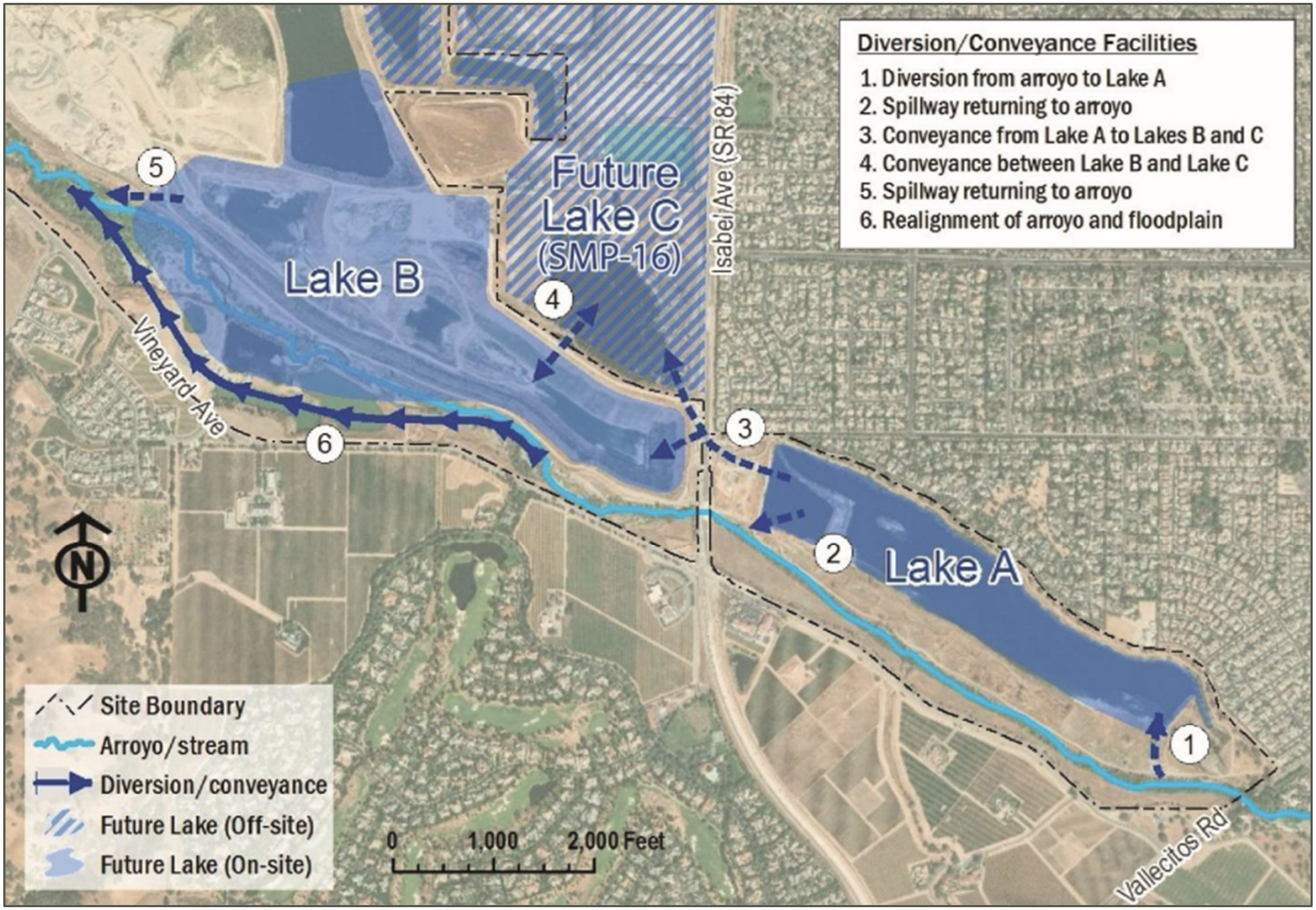
4.6.5.2 Subsequent Environmental Analysis

The impact analysis for the proposed project is complex because there are several components of the project that have potential significant impacts to hydrology and water quality resources. Therefore, for each significance threshold specified in Appendix G of the CEQA Guidelines, a separate sub-impact statement is provided in this analysis. The following components are separately evaluated for each significance threshold criterion:

- Diversion Structure from ADV to Lake A, including:
  1) infiltration gallery,
  2) conversion of a berm in Lake A to a small island,
  3) diversion from ADV to Lake A,
  4) conduit from Lake A to Lake C, and
  5) the overflow from Lake A back into ADV;
- ADV Realignment;
- North Reclamation Area, including the grading, revegetation, and return to open space and/or agriculture of Lake J, Ponds C and D, and creation of new retention ponds; and
- Reclamation of Lake B, including the depth of the reclaimed Lake B, the backfill of the eastern end of Lake B, the spillway of Lake B back into ADV, turnout to Lake B, and the creation of Lake B trail.

Impact 4.6-1a: Violation of Water Quality Standards or Waste Discharge Requirements or Substantial Degradation of Surface Water or Groundwater Quality Regarding Lake A Reclamation and Diversion Structure Construction

Lake A Reclamation and Diversion Structure Construction would consist of the installation of a surface water diversion from the ADV to Lake A; conversion of a berm that is currently located in Lake A that blocks water to a small island to allow water to flow across the lake; installation of a water conveyance pipeline from Lake A to future Lake C (located off-site to the northwest); and an overflow outlet to allow water to flow back into ADV when Lake A water levels are high to prevent flooding in the localized area.



SOURCE: B&C 2020, Figure ES-2; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

Surface Flows Related to ADV and Proposed Lakes A, B, and C

ELIOT QUARRY SMP-23 SEIR

Figure 4.6-23

BENCHMARK RESOURCES

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Infiltration Gallery and Diversion from ADV to Lake A

The diversion from ADV to Lake A would consist of an intake and fish screen, a lowhead diversion dam to control water levels in the channel, a bypass structure for fish passage, a flow control structure, and a conduit into Lake A. The diversion would feature an infiltration bed concept that includes a 100-foot-wide (extending in the horizontal direction perpendicular to the stream bank) by 200-foot-long gravel infiltration bed to be constructed along the north bank of ADV. To meet the objectives of the LAVQAR Specific Plan and the Zone 7 Agreement, the diversion structure would convey up to 500 cfs through an 84-inch-diameter pipe into Lake A.

Based on the detailed engineering analysis, Brown & Caldwell identified an infiltration bed as the best alternative to divert up to 500 cfs and meet the Zone 7 and CDFW design criteria. The diversion structure would consist of a 100- by 200- by 4-foot-deep gravel infiltration bed adjacent to the stream channel. A rock-covered, concrete grade-control structure with fish bypass would provide the necessary head to inundate the gravel infiltration bed. The grade-control structure would be placed to a top elevation that is 3.2 feet above the creek bed and would not increase the area inundated by a 100-year flood event. Forty 100-foot-long, perforated, horizontal drainpipes would be buried near the base of the gravel bed. The horizontal drainpipes would join along a manifold pipe connected to a flow control gate. When the flow-control gate is opened, water from the ADV would infiltrate through the gravel, be collected in the drainpipes through the manifold, and pass through the flow-control gate. The connection to Lake A would be completed with an 84-inch pipe with a riprap outfall extending into Lake A (see Figure 2-10, "Proposed Lake A Diversion Plan" in Chapter 2, "Project Description").

Potential impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality would be reduced to a level of insignificance by adherence to requirements of a construction SWPPP and implementation of erosion control measures in Mitigation Measure 4.6-1, "Development of SWPPP and 4.4-1, "Erosion Control Plan," respectively.

Mitigation Measure 4.6-1 includes specified erosion control measures and discharge limitations. Furthermore, adherence to these requirements would be monitored to ensure compliance.

In addition, the infiltration gallery has been designed to create a low flow channel to ensure that at least 8 cfs of water stays in the ADV to ensure a minimum flow is retained within the ADV. The infiltration gallery would also contain a gravel bed to screen out potential sedimentation that could otherwise be discharged from the ADV to Lake A. Thus, the gravel bed and Mitigation Measure 4.6-1 would eliminate or reduce any impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality to a less than significant level.

Conduit from Lake A to Lake C

The Permittee, or its contractors would conduct necessary grading and excavation to install the water pipeline under Isabel Avenue to connect Lake A to future Lake C. Pursuant to a request from the end user of the facilities, Zone 7, a turnout to Lake B would also be included in the conveyance structure; this feature is discussed in Impact 4.6-1(d), below. These grading and excavation activities would adhere to Mitigation Measure 4.6-1 to eliminate or reduce any impacts to water quality standards or waste discharge requirements. As a result, substantial degradation to surface water or groundwater quality would be reduced to a less than significant level.

Convert Lake A Berm to Small Island

The existing berm blocks the efficient flow of water. The proposed project would convert this berm to small island in the middle of Lake A, allowing water to more efficiently flow across the lake. The Permittee, or its contractors, would excavate two small drainage slots at the western end of Lake A. Based on input from EMKO, the excavations would be conducted to a bottom elevation of 405 feet msl (about 12 feet below existing ground surface) with a bottom excavation width of approximately 80 feet. These excavation activities would adhere to Mitigation Measure 4.6-1 to eliminate or reduce any impacts to water quality standards or waste discharge requirements. As a result, substantial degradation to surface water or groundwater quality would be reduced to a less than significant level.

Overflow from Lake A back into ADV

The Permittee, or its contractors would install an earth- and rock-lined structure to collect overflow water from Lake A to allow water to flow back into ADV when Lake A water levels are high to prevent flooding in the localized area. The rock lined outflow would consist of a 270-ft wide shallow spillway lined with pit run gravel that slopes south toward ADV at 3 horizontal to 1 vertical, designed to eliminate or reduce erosion potential that could be caused by water flowing from Lake A back into ADV (Brown and Caldwell 2020). In addition, the construction activities associated with establishing the overflow structure would adhere to Mitigation Measure 4.6-1, which would eliminate or reduce any impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality would be reduced to a less than significant level.

Level of Significance: Potentially significant.

Mitigation Measures:

Mitigation Measure 4.6-1: *Development of SWPPP*

The Permittee, and its contractors, shall conduct activities consistent with the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, which would require development of a stormwater pollution prevention plan (SWPPP) for the reclamation construction activities. The SWPPP and Notice of Intent to comply with the General Permit shall be prepared and filed with the RWQCB before commencement of construction activities. This mitigation may be fulfilled through one or more separate Notices of Intent.

Mitigation Measure 4.4-1: *Erosion Control Plan (see Section 4.4, "Geology and Soils")*

The Applicant, and its contractors shall adhere to the Erosion Control Plan for the ADV realignment and Lake A diversion structure prepared by Brown and Caldwell, which shall be incorporated by reference into the conditions of approval for the project.

Level of Significance after Mitigation: Less than significant.

Impact 4.6-1b: Violation of Water Quality Standards or Waste Discharge Requirements or Substantial Degradation of Surface Water or Groundwater Quality Regarding the ADV Realignment

To facilitate the southerly progression of mining of Lake B, the proposed project includes realignment and restoration of an approximately 5,800-linear-foot reach of the ADV (see Figure 2-4, "Realigned Arroyo del Valle Concept" in Chapter 2, "Project Description"). CEMEX plans to move the ADV closer to Vineyard Avenue in a realigned stream channel and floodplain, creating an enhanced riparian and aquatic habitat. The planned ADV realignment would result in a riparian corridor that flows around, rather than through (as originally anticipated in SMP-23), Lake B.

Design Considerations to Reduce or Eliminate Erosion and Potential Water Quality Impacts

The Permittee, or its contractors, would grade transitions at the upstream and downstream ends of the realignment to provide smooth and gradual connections between the designed channel and the existing geometry. For example, the banks of the new backfill channel would be extended upstream and tied into the outer slopes of the existing floodplain to intercept flow from a wider area and minimize the potential for ADV to shift channels upstream and flank the transition point. This concept is illustrated in Figure 4.6-24, "Schematic of Bank Tie-in at Upstream Transition."

Several tributary drainages flow into ADV between the proposed upstream and downstream tie-in points. The tributaries are typically dry with intermittent flow from stormwater runoff; drainage areas range between about 0.5 to 2.0 square miles. Each tributary originates from the south and crosses Vineyard Avenue via an existing culvert. These existing culverts would be extended and connected to maintenance holes and new pipes where stormwater runoff would be dropped to a lower elevation and conveyed to the realigned floodplain. The drop structures would reduce the discharge velocities at the outfalls; however, riprap aprons would also be constructed at the outfall to ADV to reduce the potential for erosion.

Given the considerable uncertainty associated with transient and highly variable sediment loads and transport rates the ADV realignment was designed with additional stability features to mitigate the potential for channel migration and floodplain widening that could impact Lake B or adjacent properties and infrastructure. Rock barbs would be installed along the outer bends of the floodplain. These barbs would function like vanes, designed to reduce velocities along the outside edges of the floodplain and direct flow away from the outer slopes of the floodplain corridor.

Pursuant to the project design, rocks used to construct the stone barbs would have a median stone diameter of at least 24 inches to remain stable under 100-year flood conditions. Rock material would also meet Caltrans standard specifications for "1/2-ton" riprap with "Method B" placement (Racin et. al. 2000, cited in Brown and Caldwell 2020). Riprap should be composed of well-graded angular rocks to allow for interlocking and include a mixture of smaller rocks to fill interstices.

The Permittee would also have to obtain permits or biological opinions from the CDFW, RWQCB, Army Corps of Engineers (ACOE), United States Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) to protect water quality and biological resources. Adherence to State and Federal water quality requirements would be a condition of approval for the project.

In addition to these design considerations and permitting requirements, the construction activities associated with constructing the ADV realignment shall adhere to Mitigation Measure 4.6-1 and 4.4-1, which would eliminate or reduce any impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality to a less than significant level.

Level of Significance Before Mitigation: Potentially significant.

Mitigation Measures: Implement Mitigation Measures 4.6-1 (see Impact 4.6-1a, above), 4.4-1 (see Section 4.4, "Geology and Soils").

Level of Significance after Mitigation: Less than significant.

Impact 4.6-1c: Violation of Water Quality Standards or Waste Discharge Requirements or Substantial Degradation of Surface Water or Groundwater Quality at the Northern Reclamation Area

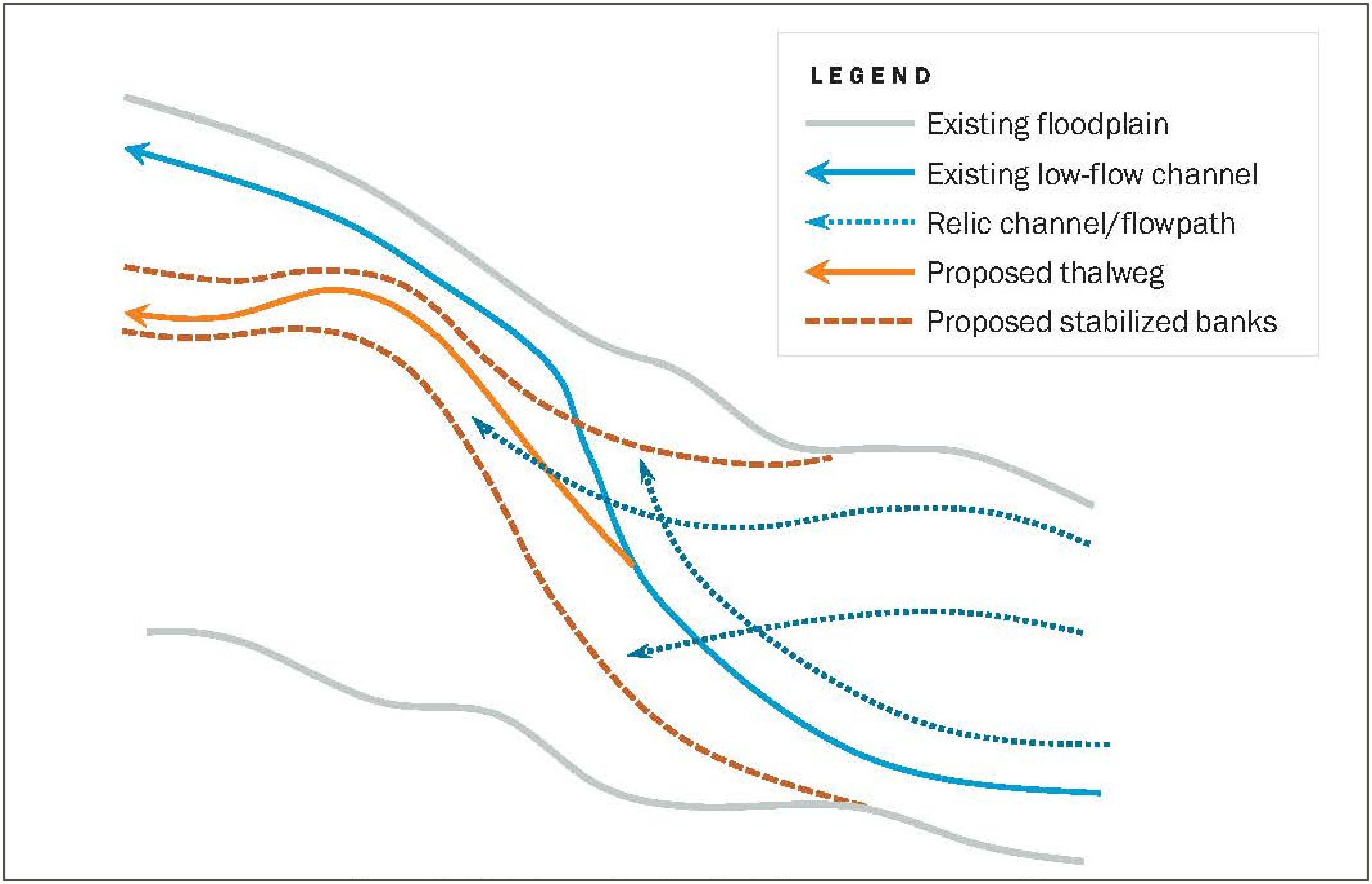
Reclamation of the Northern Reclamation Area includes reclaiming the Lake J excavation (not part of the Chain of Lakes), processing plant sites, process water ponds, and Ponds C and D, which includes grading, revegetation, and a return to open space and/or agriculture. Two potential impacts to water quality in the Northern Reclamation Area could occur as a result of the proposed project: water quality impacts associated with boron and with agricultural runoff. These potential impacts are discussed below.

Potential Boron Impacts

The Zone 7 *2016 Alternative Groundwater Sustainability Plan* (GSP) for the Livermore Valley Groundwater Basin identifies boron as a constituent that could cause undesirable results and establishes a minimum threshold of 1,400 micrograms per liter (ug/L). Based on Kleinfelder's 2020 evaluation of water quality data provided by Zone 7 for surface water and groundwater at and near the project site, average boron concentrations do not exceed the minimum threshold at any location for which data were available. Individual boron concentrations also do not exceed the minimum threshold in any of the groundwater wells evaluated, except for Well ID 29F4. In surface water ponds, the only locations at which the boron concentrations occasionally exceeded the minimum threshold were at Lake C (sample location C1) on the Vulcan site and at Shadow Cliffs Lake (sample location K15). Neither of these surface waters are located on the project site. Except for outliers, boron concentrations do not exceed the minimum threshold at any of the surface water sample locations on the project site or along the ADV south of Lakes A and B.

Figure 4.6-25, "Boron Concentration at Lake C and Shadow Cliffs Lake," shows the available boron data for Lake C and Shadow Cliffs Lake. At Lake C, boron exceeded the minimum threshold four times from 1991 to 1994 and one time in 2003. The peak concentration was 2,480 ug/L in October 2003. Since 2004, the boron concentrations at Lake C have generally been decreasing. At Shadow Cliffs Lake, boron exceeded the minimum threshold once in 1991 and once in 2003. The peak concentration was 1,770 ug/L in September 2003. Neither of these surface waters are located on the project site.

As shown on Figure 4.6-25, the boron concentrations in Lake C and Shadow Cliffs Lake follow similar trends over time, with the concentration at Shadow Cliffs generally being lower than that at Lake C. Given the distance between Lake C and Shadow Cliffs Lake, the lack of any elevated boron concentrations in the surface water ponds at and south of the project site (i.e., between Lake C and Shadow Cliffs), and the absence of any direct connection between these two locations, it is unclear why the boron concentration trends are so similar.



SOURCE: B&C 2020, Figure 5-19; modified by Benchmark Resources in 2020.
NOTE: Figure is not printed to scale.

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Schematic of Bank Tie-in at Upstream Transition
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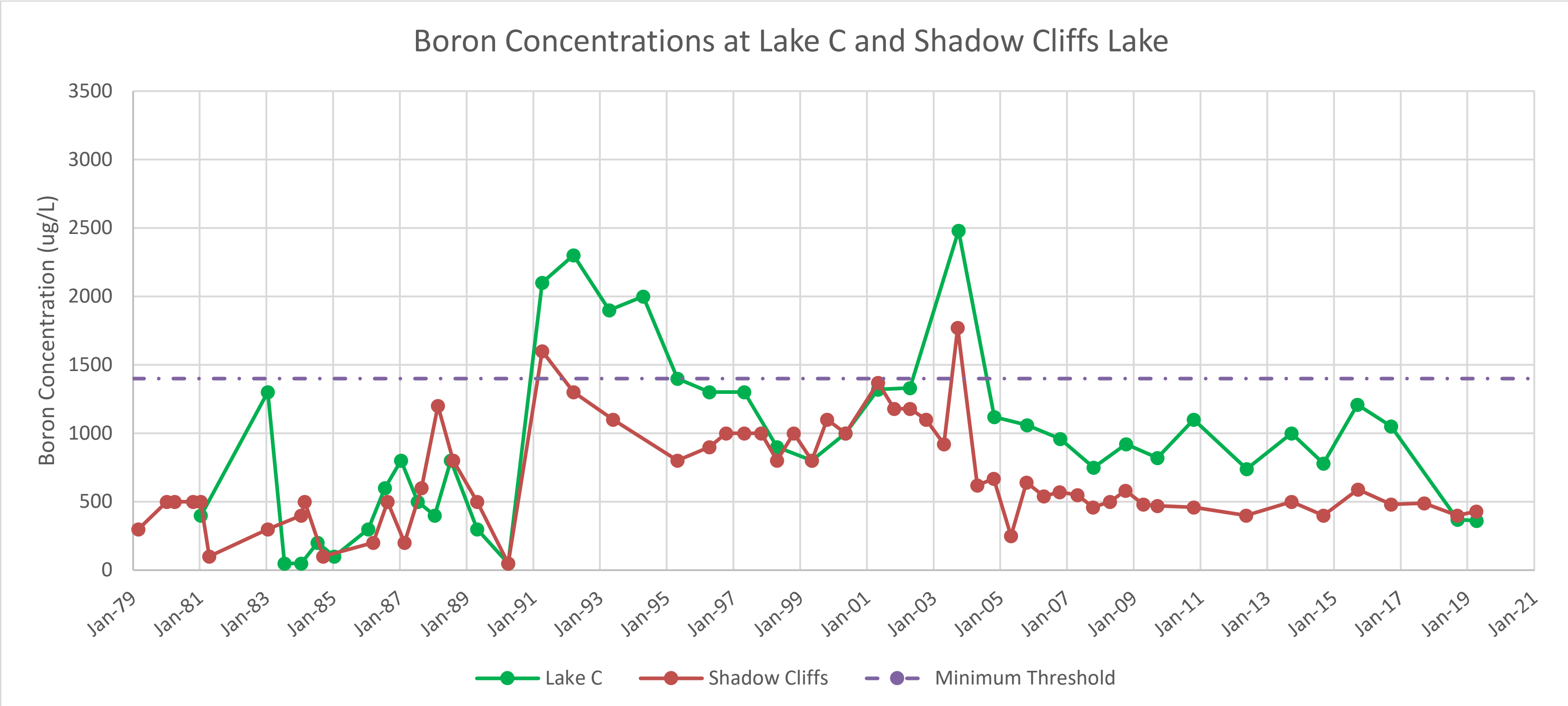

SOURCE: Kleinfelder 2020, Figure 1; modified by Benchmark Resources in 2020.

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Boron Concentration at Lake C and Shadow Cliffs Lake

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Figure 4.6-25

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The primary similarity between Lake C and Shadow Cliffs Lake compared to the surface water ponds at Eliot are that both Lake C and Shadow Cliffs Lake are adjacent to major roadways (Isabel Avenue and Stanley Boulevard, respectively).

To assess the potential that surface runoff from major roadways may be the primary source of boron at Lake C and Shadow Cliffs Lake, the boron concentrations over time were compared with annual rainfall totals for Livermore. Figure 4.6-26, "Comparison of Lake C Boron Concentrations with Annual Rainfall," compares the boron concentrations from Lake C with the annual rainfall amounts. As indicated on Figure 4.6-26, there is somewhat of an inverse correlation between rainfall and boron concentrations, with periods of low boron concentrations following wet years and elevated boron concentrations following drought periods. Thus, there is not an immediate response of increased boron concentrations at times when runoff from the major roadways would be expected. Conversely, the lack of a consistent elevated boron concentration in the surface water and groundwater samples throughout the Chain of Lakes area precludes the possibility that increased runoff from the roadways during wet years would be diluting otherwise elevated boron concentrations in the surface water ponds or shallow aquifer.

Lake C is an active Vulcan mining area, and Shadow Cliffs is a reclaimed area now used as a public recreation area, neither of which are located on the project site. The elevated boron levels at Lake C and Shadow Cliffs Lake are most likely related to specific activities occurring at those separate and disparate locations. In contrast, the reclaimed mining excavations at the project site would be primarily used for water diversion and storage as part of the Chain of Lakes. Mining activities, such as those occurring at Lake C, or contact water recreation, such as that occurring at Shadow Cliffs, would not occur as part of the reclamation of the project site. Furthermore, the primary water source feeding Lakes A and B would be local groundwater and surface water diverted from the ADV that was released from Del Valle Reservoir. The 40 years of monitoring data from Zone 7 do not provide any indication that groundwater in the area or surface water from Lake Del Valle and the ADV have ever had elevated boron concentrations. In any case, the data do not provide any indication that the few, infrequent, and dated detections of elevated boron are related to existing practices occurring at the project site or that reclamation of the site would in any way contribute to future boron detections above the minimum threshold. For these reasons, the potential impact associated with elevated boron concentrations in reclaimed lakes at the project site and water quality in the Upper and Lower Aquifers is considered less than significant.

Potential Agricultural Runoff Impacts

Ponds C and D would potentially be used as silt ponds during mining operations, with a silt deposit allowance of up to 330 feet msl. Prior to converting Pond D to a silt pond, mining could continue to 200 feet msl. These ponds would be reclaimed as either independent open water bodies or merge with larger future Lakes C and D.

The existing main silt pond and future silt pond locations (i.e., Pond C, Pond D, and Lake J) are shown on Figure 2-6, "Existing Facilities," in Chapter 2, "Project Description," of this SEIR. The Permittee would continue to use the main pond as its primary silt settling pond until it reaches its capacity, at which time a 3-foot soil cap would be graded atop the pond. The Lake J excavation area is then intended to serve as the facility's primary silt pond but depending on timing of aggregate excavation in the Lake J area, Ponds C and D may be used first. In addition, dry silts and overburden may also be placed in the pit floor of the eastern end of Lake B below the future water surface elevation of the lake (as shown on Sheet R-2 of Appendix B-1). The use of these settling ponds and silt storage areas prevents the potential sedimentation of the ADV with process wash fines, particularly since these basins do not have an outlet to lower ground.

As part of reclamation, small retention ponds are planned in the northeast corner of the main silt pond and north and south ends of the Lake J area (identified as Ponds 1, 2, and 3 on Sheet R-1 of Appendix B-1) to prevent future agricultural runoff from entering Lake B. Thus, the potential impact associated with agricultural runoff due to project activities in the Northern Reclamation Area is considered less than significant.

Level of Significance: Less than significant.

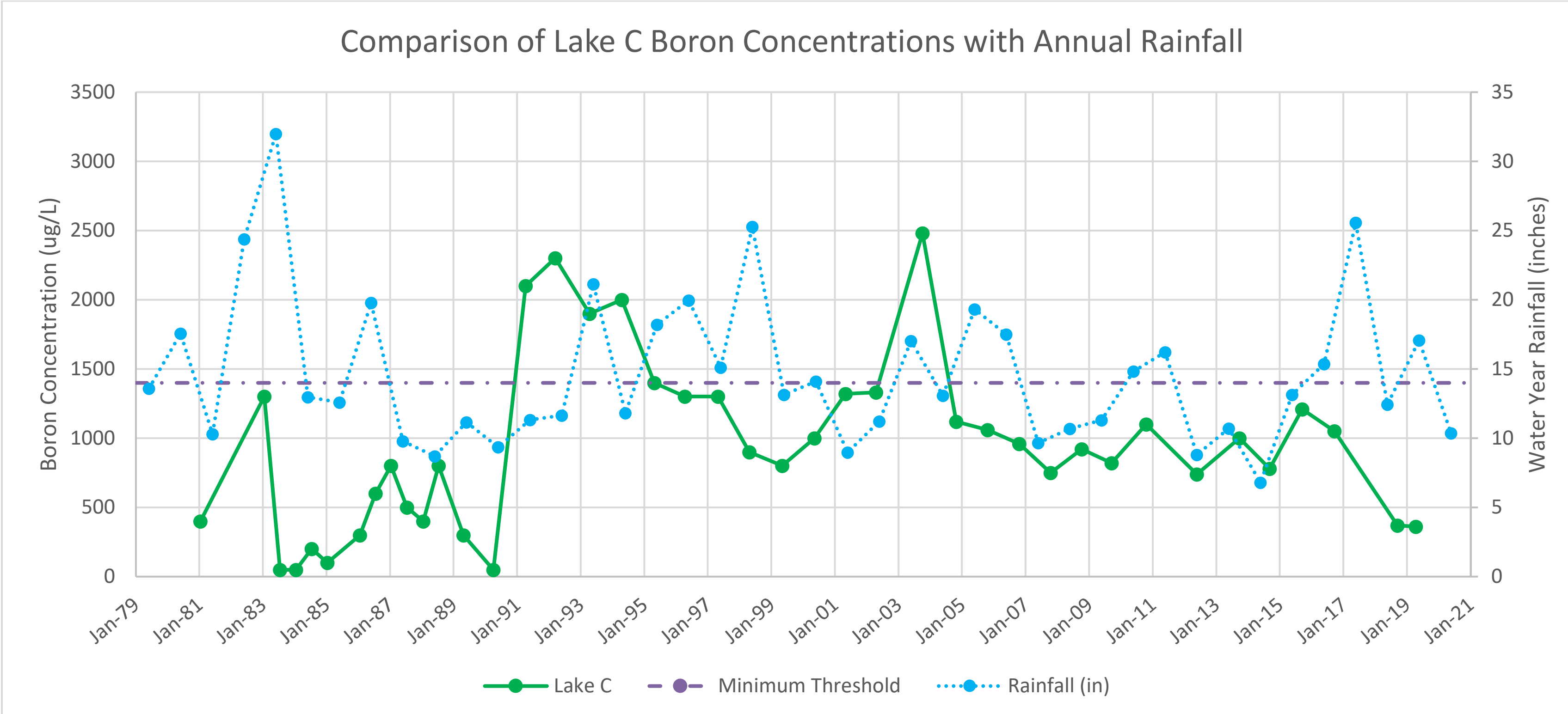
Mitigation Measure: None required.

Impact 4.6-1d: Violation of Water Quality Standards or Waste Discharge Requirements or Substantial Degradation of Surface Water or Groundwater Quality Regarding Reclamation of Lake B

Lake B reclamation would include installation of a pipeline turn-out from Lake A, a water pipeline conduit to future Lake C, and an overflow outlet to allow water to flow back into ADV when Lake B water levels are high. The final bottom elevation of Lake B is proposed at 150 feet msl, in order to maximize the available aggregate resource. The final surface area of Lake B would be 208 acres as compared to 243 acres in the approved reclamation plan. Reclamation would be conducted in accordance with the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, which would require development of a SWPPP for the reclamation construction activities. A SWPPP would identify the potential sources of sediment and other pollutants that could affect the quality of stormwater discharges from the site. The SWPPP would also identify site-specific measures (BMPs) that would eliminate or reduce to acceptable levels sediment and other pollutants in stormwater discharges from the site. Therefore, Mitigation Measure 4.6-1 shall be implemented to protect groundwater quality from potential stormwater pollution. The mitigation measure requires the General Permit and SWPPP, which further require CEMEX to file a Notice of Intent to comply with the stormwater regulations with both the State Water Resources Control Board and the Regional Water Quality Control Board. In addition, as discussed in further detail below, Mitigation Measure 4.6-2 must be implemented to protect groundwater quality from potential impacts due to elevated levels of iron. Thus, impacts to groundwater quality would be less than significant with mitigation incorporated.

Potential Agricultural Runoff Impacts

The area around Lake B and any other remaining ponds would need to be graded to prevent runoff from agricultural areas, roads, and developed areas from entering the water bodies. Runoff from these areas could contain contaminants that may result in a significant impact to groundwater quality. Therefore, preventing runoff from entering reclaimed pits and ponds would protect groundwater quality and any impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality would be less than significant.



SOURCE: Kleinfelder 2020, Figure 2; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

Comparison of Lake C Boron Concentration with Annual Rainfall

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Figure 4.6-26

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Potential Boron, TDS, Nitrate, and Chromium Impacts

The statistical analysis presented in the Kleinfelder report (see Section 4.6.2.5, above, and Appendix F-3) provides an indication of areas of potential sources for the parameters of interest listed in the Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin. The average concentrations calculated for most wells and mining ponds in the vicinity of the project are below the maximum thresholds of TDS, chromium, nitrate, and boron.

The Livermore Formation wells of Lake A group (20M1, 19N4 and 30C1) were not included in the overall statistics presented in the above-referenced tables, because these wells are screened in a different formation. The overall averages and non-parametric statistics calculated with and without Livermore Formation wells in Lake A group are very similar. Although the Livermore Formation wells are not included in the overall statistics presented below, they are referenced in the discussion if the calculated average for the well is above the Alternative Plan threshold for a water quality parameter.

For TDS, 97 percent of wells and ponds have average concentrations below the threshold (without considering Livermore Formation wells 20M1, 19N4, and 30C1). An individual elevated TDS result for mining pond P40 (6,199 mg/L) was recognized as an outlier and was not used in the overall statistics. Subsequent sampling performed in 2017 indicated significantly lower levels of TDS in P40 (380 mg/L). When these wells are added to the overall statistics, 94 percent of wells and ponds have average concentrations below the threshold. For nitrate, 97 percent of sampling locations have average concentrations below the threshold (with and without Livermore Formation wells 20M1, 19N4 and 30C1). There are no sampling locations with average concentrations of chromium and boron above the threshold. There are also no sampling locations on the project site where a maximum concentration of chromium has been recorded above the threshold (see Figure 4.6-19 and Tables 4.6-5 and 4.6-6).

Potential Iron Impacts

The existing grading, designed to divert stormwater to retention ponds, would also reduce the likelihood of higher iron concentrations in surface water reaching the Lower Aquifer. Although iron is not identified in the Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin as a constituent that could cause undesirable results, the average iron concentration in surface water is approximately double of the average calculated for the Lower Aquifer. The averages of some mining ponds (P40, P45, R24 and R28) are above the 300 μg/L drinking water standard for iron. Elevated iron is common in silt ponds and reclaimed mine pits with substantial vegetative growth that creates reducing conditions when the vegetation dies and decays, so concentrations would likely decrease rapidly upon contact with elevated iron in the aquifer. The average iron concentration in Upper Aquifer wells is 95.5 μg/L, which is very close to the Lower Aquifer well average of 82.3 μg/L. Both are significantly below the 300 μg/L drinking water standard for iron. Based on concentrations, it is unlikely that the mixing of Upper and Lower Aquifer waters would significantly change iron concentrations in the Lower Aquifer. However, an adaptive management plan (AMP) that addresses the potential for elevated iron in the mining ponds was prepared by EMKO Environmental, Inc., on July 6, 2020 (see Appendix F-6). Mitigation Measure 4.6-2 requires the Permittee to implement this AMP to ensure water quality is protected.

The analysis of cations and anions with Piper, Durov, and Schoeller diagrams indicates the hydrochemical facies of the Upper Aquifer, Lower Aquifer, Livermore Formation, and surface water are similar. The predominant anion is bicarbonate for most locations, with chloride predominant during drought conditions at some locations. Surface water has more spatial variability than groundwater. Most sampling locations do not have a dominant cation and are classified as mixed geochemical water types. Magnesium is slightly more predominant in surface water and calcium slightly more predominant in groundwater. The hydrochemical facies derived for the 10-year period are typical for shallow fresh groundwaters and were identified in both Upper and Lower Aquifers suggesting shallow and deep waters are similar.

The findings of the Kleinfelder report indicate that there are no distinct water quality characteristics in the vicinity of the project site that would uniquely distinguish an individual well or aquifer unit within the basin. Therefore, the proposed 100-foot depth increase in the final elevation of Lake B is not anticipated to result in undesirable effects or degrade groundwater quality. Other than the recommendation for an Adaptive Management Plan, no additional measures are deemed necessary to protect groundwater quality during the course of mining or reclamation at Lake B.

Once mining at Lake B is completed, several actions would be appropriate to protect water quality. As noted above, the area around Lake B and any other remaining ponds would need to be graded to prevent runoff from agricultural areas, roads, and developed areas from entering the water bodies. Runoff from these areas could contain contaminants that might affect groundwater quality. Therefore, preventing runoff from entering reclaimed pits and ponds would protect groundwater quality.

The Waste Discharge Requirements (WDRs) would apply to future operations at the mine site. While these mining operations are outside the scope of this reclamation plan amendment project, the WDRs would require monitoring of discharges for compliance with specific water quality standards, as presented in Table 4.6-8, "Water Quality Standards and Effluent Limitations."

TABLE 4.6-8
WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

Parameter	Units	Daily Maximum	30-Day Arithmetic Mean	7-Day Arithmetic Mean	90-Day Arithmetic Mean
Total dissolved solids	mg/L	500	–	–	360
Chlorides	mg/L	250	–	–	60
Total suspended solids	mg/L	–	30	45	–
Turbidity	NTU	40	–	–	–
Total settleable solids	mL/hr	0.2	0.1	–	–
Chlorine residual	mg/L	0.0		–	–
pH	std units	6.5–8.5			
Acute toxicity (96-hour)	–	70% survival			

Source: EMKO 2020a.
Notes: NTU = nephelometric turbidity units; mg/L = milligrams per liter; mL/hr = milliliters per hour; std units = standard units.
1. Total dissolved solids and chlorides limits are applicable only to discharges to Alameda Creek watershed above Niles. Exceedance of the dissolved solids or chloride limits would not constitute a violation of this order if the discharger demonstrates that the source water is also high in dissolved solids or chloride concentration and the exceedance is not caused by its facility operation.
2. Chlorine residual limit is applicable only to sand washing facilities that use municipal water supply as wash water.
3. Exceedance of pH limit would not constitute a violation of the waste discharge requirements if the discharger demonstrates that the source water is also high in pH and the high pH in its discharge effluent is not caused by the facility's operation.

Once mining is completed, there would be no significant impact related to mixing of groundwater from the lower and upper aquifers with the implementation of design features discussed above and the adoption of Mitigation Measure 4.6-2, which would eliminate or reduce any impacts to water quality standards or waste discharge requirements or substantial degradation to surface water or groundwater quality due to iron. In addition, two or three groundwater well monitoring locations would be added on the perimeter of Lake B to monitor groundwater quality. For these reasons, the potential impact associated with elevated iron concentrations in reclaimed lakes at the project site and water quality in the Upper and Lower Aquifers is considered less than significant with mitigation incorporated.

Level of Significance: Potentially significant.

Mitigation Measures:

Mitigation Measures: *Implement Mitigation Measure 4.6-1 (see Impact 4.6-1a, above).*

Mitigation Measure 4.6-2: *Implementation of Adaptive Management Program for Iron*

The Permittee shall implement the Adaptive Management Program for Iron (see Appendix F-6 to the SEIR), which will be incorporated into conditions of approval.

Mitigation Measure 4.6-3: *Install Lake B Groundwater Monitoring Wells*

The Permittee shall install two or three groundwater monitoring wells on Lake B perimeter after consultation on locations with Zone 7 to inform MM 4.6-3 actions.

Significance After Mitigation: Less than significant.

Impact 4.6-2a: Substantial Depletion of Groundwater Supplies or Interference with Groundwater Recharge Regarding Lake A Reclamation and Diversion Structure Construction

A description of the Lake A Reclamation and Diversion Structure Construction is provided in Impact 4.6-1a. In addition, as discussed more fully below in Impact 4.6-3a, a small overflow spillway would be installed at the top of the berm along the south side of Lake A, near the western end of the berm. If a flooding event on the ADV or a mechanical failure affected the ability of the upstream diversion structure into Lake A to shut off, and Lake A began to overfill, the overflow channel would allow the excess water to return to the ADV. The overflow channel would be rock lined to prevent erosion and siltation. If Lake A were to overfill, most if not all of the water in Lake A would consist of water diverted from the ADV, or water from the arroyo that seeped into the lake through the porous and permeable gravel material present between Lake A and the ADV. The overflow channel would only involve excess Lake A water and the Lake A Reclamation and Diversion Structure Construction would not result in the substantial depletion of groundwater supplies or interference with groundwater recharge. There would be no substantial depletion of groundwater supplies or interference with groundwater recharge associated with Lake A reclamation and diversion structure construction activities. Therefore, such impacts would be less than significant.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-2b: Substantial Depletion of Groundwater Supplies or Interference with Groundwater Recharge Regarding the ADV Realignment

A description of the ADV Realignment activities is provided in Impact 4.6-1b. Balance Hydrologics, Inc. and EMKO performed infiltration testing at the proposed ADV realignment site to compare properties of the native soils with onsite spoil materials and evaluate their suitability as a construction material for the realigned channel and floodplain (Appendix F). The realigned corridor will require cut, fill, and compaction of the spoil soil material present at the site. Thus, existing spoil soil material around the proposed realignment is considered representative of the soil that will compose the substrate under the realigned channel. Results from field testing indicate that infiltration rates for the spoil material are less (i.e., slower) than those observed in native soil materials, indicating that stream channel seepage rates along the restored channel are likely to be less than current rates (Brown and Caldwell 2020).

Furthermore, there would no substantial depletion of groundwater supplies or interference with groundwater recharge associated ADV Realignment, as the realigned ADV would provide improved natural functions over existing and currently approved conditions. Therefore, such impacts would be less than significant.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-2c: Substantial Depletion of Groundwater Supplies or Interference with Groundwater Recharge at the Northern Reclamation Area

Reclamation treatment for the North Reclamation Area, which includes the Lake J excavation area (not part of the Chain of Lakes), processing plant sites, and process water ponds, would generally involve final grading, following backfilling under the mining operation, for a return to open space and/or agriculture. The final bottom mining elevation of Lake J would be 130 feet msl (i.e., approximately 260 feet bgs). However, upon the completion of mining, Lake J would be repurposed as a silt pond and would be backfilled during the course of mining with overburden and silt to approximately 360 to 380 feet msl. Ponds C and D in the North Reclamation Area may also be repurposed as silt ponds. For these ponds, silts may be deposited up to elevation 330 feet msl. These ponds would either be reclaimed as independent open water bodies with a projected water surface elevation of 370 feet msl or merged with the larger future Lakes C and D to be developed by Vulcan. Lake J would be backfilled with overburden and process wash fines during the course of mining elsewhere at the site. Then, as part of the proposed project, the Lake J area would be returned to open space and/or agriculture.

Silt and other fine-grained material that is washed from the aggregate would be deposited in several areas of the site. The current location is the Main Silt Pond in the northeast corner of the project site, adjacent to Stanley Boulevard. However, prior to the completion of the project, the Main Silt Pond would become filled and additional capacity would be required in other locations. These locations include Lake J and Ponds C & D along the east side of the project site, located adjacent to Lakes C & D, respectively. Lake J is anticipated to be converted for use as the next primary silt pond once the Main Silt Pond reaches its capacity.

Lake J

During the course of mining (not part of the proposed project), approximately 6.4 million cubic yards of backfill materials (silts and overburden) would be placed in Lake J, to an elevation of 360 ft msl to 380 ft msl. As part of the proposed project, the backfilled area would be contoured to achieve the final reclaimed ground surface, as shown on Sheets R-1 and R-3. In the reclaimed condition, the ground in the Lake J area would be mostly comprised of a combination of silts and overburden. The lowest elevation of silt would be at approximately 130 ft msl while the anticipated post-mining groundwater elevation at Lake J is anticipated to be 330 ft msl, coincident with the water level in the Shadow Cliffs Lake to the west. Thus, the silt backfill would extend 30 feet to 50 feet above the groundwater surface after reclamation. The width of the top of the silt backfill at the groundwater surface elevation would be approximately 1,450 feet, in the direction perpendicular to groundwater flow. The width of the silt at the bottom of Lake J, at 130 ft msl, would be about 200 feet. The cross-sectional area of the silt placement relative to the total cross-sectional area of the aquifer is identified in Table 4.6-9, "Cross-Sectional Areas Perpendicular to the Direction of Groundwater Flow: Northern Reclamation Area." These cross-sectional areas are oriented perpendicular to the direction of groundwater flow.

TABLE 4.6-9
CROSS-SECTIONAL AREAS PERPENDICULAR TO THE DIRECTION OF GROUNDWATER FLOW: NORTHERN RECLAMATION AREA

Location	Silt Backfill				Across Project Site			Percent of Area Backfilled	Open Water Area Relative to Backfill
	Top Width	*Bottom Width*	*Thickness*	*Area*	*Width*	*Thickness*	*Area*		
Lake J Fill	1,450	200	200	165,000	2,250	200	450,000	37%	--
Ponds C & D Fill	1,400	900	170	195,500	5,150	220	1,133,000	17%	--
C & D Above Fill	1,560	1,400	200	59,200	--	--	--	--	30%

Source: EMKO 2020a

As shown in Table 4.6-9, the cross-sectional area of the fill in Lake J below the water table would be 165,000 square feet, while the cross-sectional area of the aquifer across this part of the project is 450,000 square feet. The cross-sectional area of the aquifer is calculated based on the width of the project site across the Lake J area (2,250 feet) and the vertical distance between the bottom elevation of proposed mining (130 ft msl) and the groundwater surface elevation for Lake J (330 ft msl), or 200 feet, as shown in Table 4.6-9. Based on the cross-sectional area of the fill and the cross-sectional area of the aquifer, the fill would replace about 37 percent of the aquifer cross section with silt. While the backfilling at Lake J will reduce part of the area available for groundwater flow, the water in the aquifer would have large areas to move around the subject silt fill areas. As a result, reclamation of Lake J would have a less than significant impact due to depletion of groundwater supplies or interference with groundwater recharge.

Ponds C & D

Additional mining is planned to occur in Pond D to an elevation of 200 ft msl. Approximately 140,000 cubic yards of silt backfill could then be placed in Pond C and approximately 1.6 million cubic yards of silt backfill could be placed in Pond D during the course of mining, up to an elevation of 330 ft msl. The anticipated groundwater surface elevation in the vicinity of Ponds C & D after mining and dewatering is completed at both SMP-23 and SMP-16 is approximately 370 ft msl. The width of the top of the silt would be approximately 1,400 feet and the width of the bottom of the silt would be approximately 900 feet, in the direction perpendicular to groundwater flow. As shown in Table 4.6-9, the cross-sectional area of the fill would be 195,500 square feet, while the cross-sectional area of the aquifer across this part of the project site is 1,133,000 square feet. The cross-sectional area of the aquifer is calculated based on the width of the Eliot Quarry across the Pond D area (5,150 feet) and the vertical distance between the bottom elevation of proposed mining under the Reclamation Plan Amendment (150 ft msl) and the groundwater surface elevation for Ponds C and D (370 ft msl), or 220 feet, as shown in Table 4.6-9. Based on the cross-sectional area of the fill and the cross-sectional area of the aquifer, the fill would replace about 17 percent of the aquifer cross section with silt. However, the silt would not extend to the top of the water surface in Ponds C and D. The cross-sectional area of water above the silt would be 59,200 square feet, which is roughly 30 percent of the fill cross-sectional area.

While the silt placement in Ponds C and D during mining would reduce part of the area available for groundwater flow, the open-water area above the fill provides the ability for unrestricted water flow across Ponds C and D. In addition, Ponds C and D will be dedicated to Zone 7 for water storage, conveyance, and recharge management upon reclamation. As a result, the reclamation of the backfilled Ponds C and D would not reduce the transmissivity or area through which water may flow. Thus, the reclamation of Ponds C & D would have a less than significant impact due to depletion of groundwater supplies or interference with groundwater recharge.

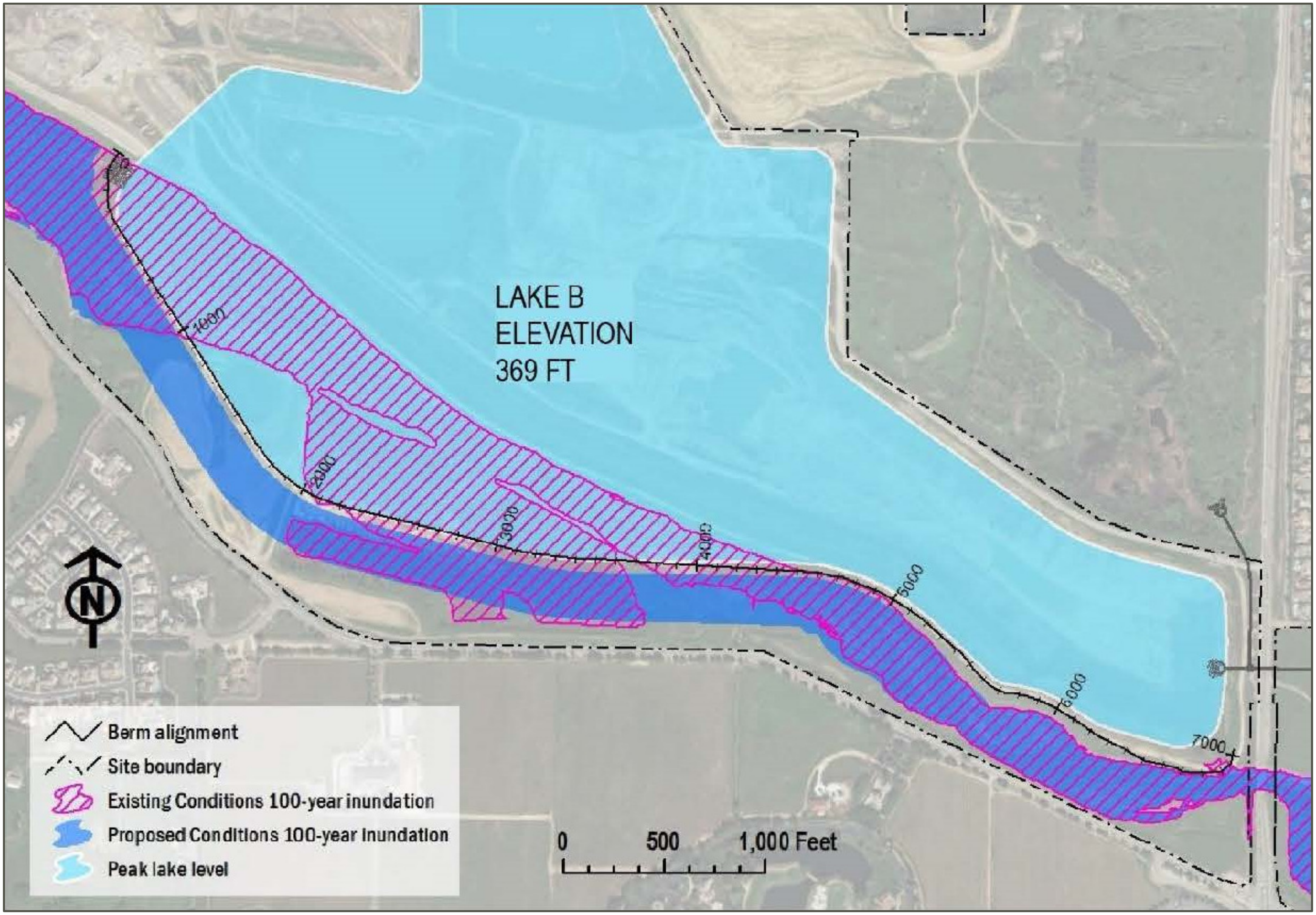
Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-2d: Substantial Depletion of Groundwater Supplies or Interference with Groundwater Recharge Regarding Reclamation of Lake B

Lake B Spillway

Various spillway or berm elevations for Lake B have been proposed over the past 37 years. The LAVQAR Specific Plan and approved SMP-23 Reclamation Plan ("approved plan") both show a spillway elevation of 360 ft msl. The proposed approved Reclamation Plan sheets show the spillway elevation at 369 ft msl. The 100-year flood elevation in the area of the spillway is just below 369 ft msl, as shown in Figure 4.6-27, "100-Year Water Surface Profiles for Existing and Proposed Conditions at Lake B" (Brown and Caldwell 2019). A spillway elevation of 369 ft msl is assumed to be the minimum design elevation to exclude the 100-year flood along the ADV from entering Lake B at the spillway location. To achieve the recommended four feet of freeboard, the minimum berm height adjacent to the spillway is 373 ft msl. The berm and spillway design for Lake B are further limited by the area needed to realign the ADV, such that the berms along the southwest side of Lake B do not encroach into the necessary floodway for the arroyo. Taller berms would require a wider footprint given the angle of the side-slopes, which would limit the width of the realigned arroyo and constrain the floodplain.



SOURCE: Brown and Caldwell 2020, Hydraulic Design Study Figures ES-5; modified by Benchmark Resources in 2020.
NOTE: Figure is not printed to scale.

100-Year Water Surface Profiles for Existing and Proposed Conditions at Lake B
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Figure 4.6-27

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Lake B Reclamation

Approximately 2.1 million cubic yards of dry silt and overburden may be placed in the east end of Lake B, as shown on Sheets R-2 and R-3 of Appendix B-1. The lowest elevation of silt would be at approximately 230 ft msl, whereas the top elevation would be 340 ft msl, which is 29 feet below the anticipated water surface elevation in Lake B of 369 ft msl. The width of the top silt elevation would be approximately 630 feet. The cross-sectional area of the silt placement relative to the total cross-sectional area of the aquifer is identified in Table 4.6-10, "Cross-sectional Areas Perpendicular to the Direction of Groundwater Flow: Lake B." These cross-sectional areas are oriented perpendicular to the direction of groundwater flow.

TABLE 4.6-10
CROSS-SECTIONAL AREAS PERPENDICULAR TO THE DIRECTION OF GROUNDWATER FLOW: LAKE B

Location	Silt Backfill				Across Project Site			Percent of Area Backfilled	Open Water Area Relative to Backfill
	Top Width	*Bottom Width*	*Thickness*	*Area*	*Width*	*Thickness*	*Area*		
Lake B Fill	630	0	110	34,650	1,350	223	301,050	12%	--
Lake B Above Fill	770	630	29	20,300	--	--	--	--	59%

Source: EMKO 2020a

As shown in Table 4.6-10, the cross-sectional area of the fill would be 34,650 square feet, while the cross-sectional area of the aquifer across this part of the Eliot Quarry is 301,050 square feet. The cross-sectional area of the aquifer is calculated based on the width of the Eliot Quarry in the east side of Lake B (1,350 feet) and the vertical distance between the bottom elevation of proposed mining (150 ft msl) and the average groundwater surface elevation for Lake B (373 ft msl), or 223 feet, as shown in Table 4.6-10.

Based on the cross-sectional area of the fill and the cross-sectional area of the aquifer, the fill would replace about 12 percent of the aquifer cross section in this limited area with silt and overburden. However, the silt would not extend to the top of the water surface in Lake B. The cross-sectional area of the unimpeded water above the silt would be 20,300 square feet, which is roughly 60 percent of the fill cross-sectional area.

In accordance with the Alameda County Surface Mining Ordinance (ACSMO—Title 6, Chapter 6.80.240.C.2), while the silt and overburden placement in the east end of Lake B would reduce part of the area available for groundwater flow, the open-water area above the fill provides for unrestricted water flow across the east end of Lake B. Assuming that the natural aquifer material has a porosity of 30 percent, the cross-sectional area of the pore space available for groundwater movement across the area that would be backfilled with silt would have been about 10,400 square feet (34,650 X 0.3) prior to mining in the east part of Lake B. The cross-sectional area of the pore space in the area that would become open water from 340 ft msl to 369 ft msl would have been about 6,100 square feet (20,300 X 0.3) prior to mining. The cross-sectional area of open water of 20,300 square feet, with unrestricted transmissivity, exceeds the cross-sectional area of the pore space present prior to mining of 16,500 square feet. Thus, the silt placement in the east end of Lake B would not reduce the transmissivity or area through which water may flow. As a result, reclamation of Lake B would have a less than significant impact due to depletion of groundwater supplies or interference with groundwater recharge.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-3a: Substantially Alter Drainage Patterns Causing Erosion or Siltation, Increase Surface Runoff that would result in Flooding, Provide Substantial Additional Sources of Polluted Runoff, or Impede or Redirect Flood Flows Regarding Lake A Reclamation and Diversion Structure Construction, Construction of the Infiltration Gallery, and Construction of Conduit from Lake A to Lake C with a Turnout to Lake B

A description of the Lake A Reclamation and Diversion Structure Construction is provided in Impact 4.6-1a. Please see the impact discussion for Impact 4.6-1a for a discussion regarding infiltration gallery, construction of the diversion structure and construction of the conduit from Lake A to Lake C with a turnout to Lake B as the primary impacts were water quality issues associated with drainage pattern alternations that could cause erosion or siltation.

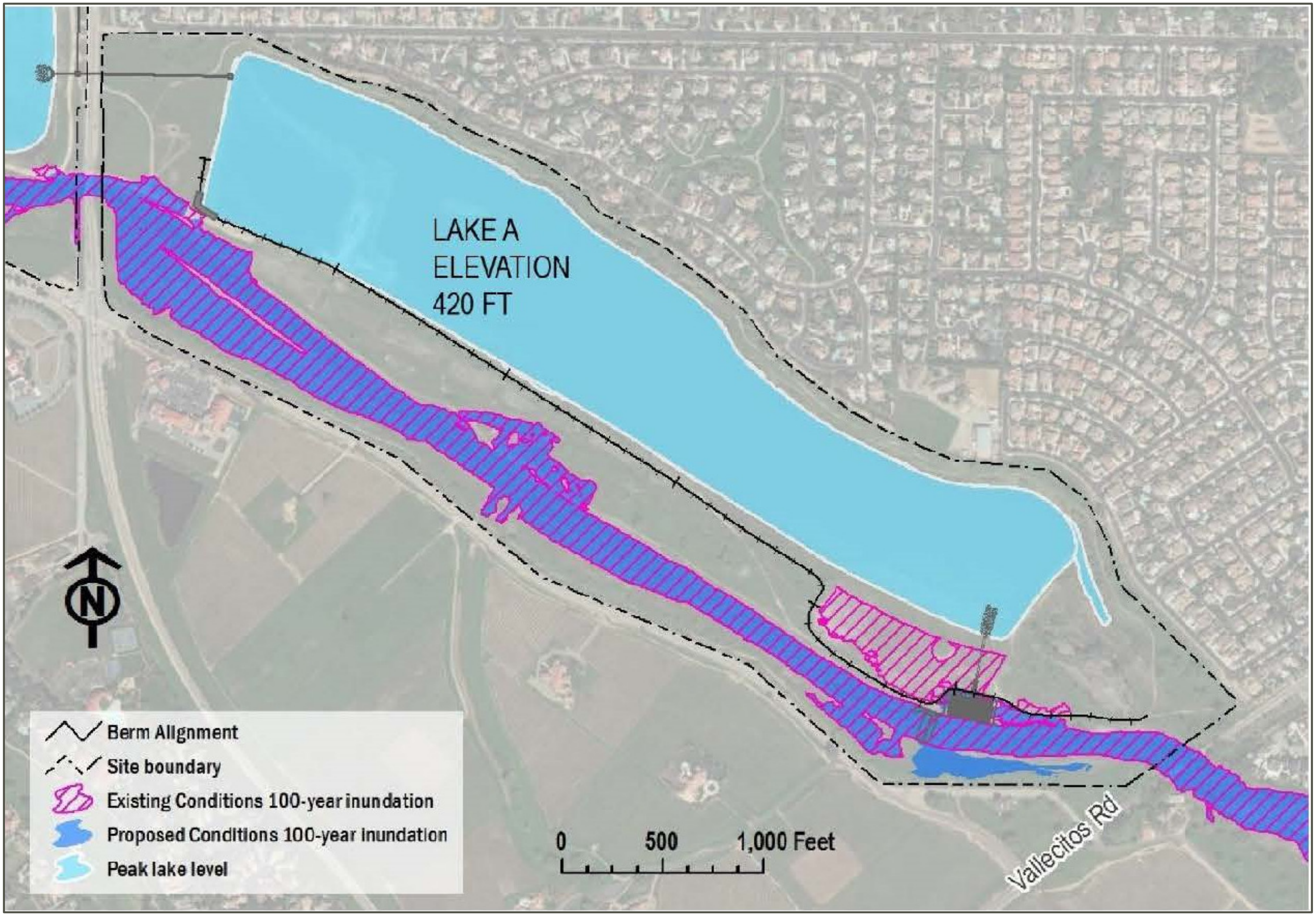
Overflow Structure from Lake A back into ADV

Historic high groundwater elevations present a challenge for design and construction of berms and spillways that would be capable of retaining groundwater that enters Lake A and Lake B, while maintaining appropriate freeboard. In addition, it is uncertain what groundwater levels would be once Zone 7 begins diverting water from the ADV and actively recharging the Shallow Aquifer through the Chain of Lakes. At a minimum, the berms and spillways for Lake A and Lake B should prevent the 100-year flood on Arroyo del Valle from flowing into the reclaimed lakes. The 100-year water surface profiles for the existing and proposed conditions at Lake A are provided in Figure 4.6-28, "100-Year Water Surface Profiles for Existing and Proposed Conditions at Lake A."

As part of the project, a small overflow spillway would be installed at the top of the berm along the south side of Lake A, near the western end of the berm. If a flooding event on the ADV or a mechanical failure affected the ability of the upstream diversion structure into Lake A to shut off, and Lake A began to overfill, the overflow channel would allow the excess water to return to the ADV before flooding adjacent properties or eroding the berm. The overflow channel would be rock lined to prevent erosion and siltation. If Lake A were to overfill, most if not all of the water in Lake A would consist of water diverted from the ADV, or water from the arroyo that seeped into the lake through the porous and permeable gravel material present between Lake A and the ADV. Therefore, the overflow channel would not result in erosion or siltation in the ADV. As a result, the overflow structure would have a less than significant impact due to erosion, siltation, or increases in surface runoff.

Level of Significance: Less than significant.

Mitigation Measure: None required.



SOURCE: Brown and Caldwell 2020, Hydraulic Design Study Figures ES-6; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

100-Year Water Surface Profiles for Existing and Proposed Conditions at Lake A

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Figure 4.6-28

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Impact 4.6-3b: Substantially Alter Drainage Patterns Causing Erosion or Siltation, Increase Surface Runoff that would result in Flooding, Provide Substantial Additional Sources of Polluted Runoff, or Impede or Redirect Flood Flows Regarding ADV Realignment

A description of the ADV Realignment is provided in Impact 4.6-1b. Regarding erosion and sedimentation impacts and mitigation regarding the ADV realignment, please see the analysis for Impact 4.6.1b, which adequately describes these issues. In addition, compliance with Mitigation Measure 4.6-1 and obtaining and complying with regulatory permits would ensure that impacts such as surface runoff that would result in flooding, additional sources of runoff, or impeding or directing flood flows would be reduced to a less than significant level.

Level of Significance: Potentially Significant

Mitigation Measure: Implement Mitigation Measure 4.6-1 (see Impact 4.6-1a, above).

Significance after Mitigation: Less than significant

Impact 4.6-3c: Substantially Alter Drainage Patterns Causing Erosion or Siltation, Increase Surface Runoff that would result in Flooding, Provide Substantial Additional Sources of Polluted Runoff, or Impede or Redirect Flood Flows Regarding the Northern Reclamation Area

A description of the reclamation activities in the Northern Reclamation Area and potential impacts that could cause erosion and sedimentation are provided Impact 4.6-1c, above. In summary, reclamation would be conducted in accordance with the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, which would require development of a SWPPP for the reclamation construction activities. A SWPPP would identify the potential erosion issues and sources of sediment and other pollutants that could affect the quality of stormwater discharges from the site. The SWPPP would also identify BMPs that would eliminate or reduce to acceptable levels erosion and sedimentation and other pollutants in stormwater discharges from the site. As noted above, the General Permit and SWPPP are required by Mitigation Measure 4.6.1, which would eliminate or reduce any impacts associated with erosion control and sedimentation to a level of insignificance. In addition, compliance with Mitigation Measure 4.6-1 would ensure that impacts such as surface runoff that would result in flooding, additional sources of runoff, or impeding or directing flood flows would be reduced to a less than significant level.

Level of Significance: Potentially Significant

Mitigation Measure: Implement Mitigation Measure 4.6-1, "Development of SWPPP" (see Impact 4.6-1a, above).

Significance after Mitigation: Less than significant.

Impact 4.6-3d: Substantially Alter Drainage Patterns Causing Erosion or Siltation, Increase Surface Runoff that would result in Flooding, Provide Substantial Additional Sources of Polluted Runoff, or Impede or Redirect Flood Flows Regarding Reclamation of Lake B

A description of the Reclamation of Lake B is provided in Impact 4.6-1d. Regarding erosion and siltation impacts and mitigation regarding the ADV realignment, please see the analysis for Impact 4.6-1d, which describes issues associated with erosion control and siltation.

Conveyance of Water from Lake A to Lake C with a turnout to Lake B

The conveyance of water from Lake A to Lake C with a turnout to Lake B could also result in flooding, erosion, or siltation impacts. The following water conveyance structures would be installed in or near the east end of Lake B:

- 84" pipe from Lake A to Lake C capable of conveying up to 500 cfs;
- 30" pipe between Lake B and Lake C at an invert elevation of 349 ft msl capable of conveying up to 100 cfs in either direction, depending on water-level differences in the two lakes; and
- 84" pipe from Lake A to Lake B capable of conveying up to 400 cfs.

As indicated on Sheet R-2 of Appendix B-1, the pipe between Lake B and Lake C would be located in the northeastern portion of Lake B and be separated from the backfills that would occur in the east panhandle of Lake B.

The 84" pipe from Lake A to Lake B would discharge water down the east slope of Lake B. Energy dissipation and erosion protection along the east face of Lake B would be included to prevent the discharge from eroding the east face of Lake B if the discharge occurred at times when Lake B was not full. If discharge to Lake B occurred at times when the water level in Lake B was below or within roughly 10 feet above the elevation of the top of the silt (e.g., when Lake B is first being filled after mining is completed), the flow could temporarily disturb the silt and cause it to be redistributed throughout Lake B where it would likely settle.

To prevent any disruption to the silt caused by conveyance of water from Lake A to Lake B, with associated erosion and sedimentation, implementation of Mitigation Measure 4.6-3 is required. Mitigation Measure 4.6-3 requires implementation of one of two options to convey water around the Lake B silt storage area, including a high-density polyethylene (HDPE) pipe connected to the Lake B pipeline turnout or a lined channel across the top of the compacted backfill surface of the silt storage facility at the east end of Lake B. With the implementation of Mitigation Measure 4.6-3, erosion and siltation impacts due to conveyance of water from Lake A to Lake C and Lake A to Lake B would be less than significant.

EMKO estimated the volume of water that may spill from Lake B based on the rate of groundwater flow into Lake B. An overflow outlet would be created in the crest of the berm installed at the west end of Lake B at an elevation of 369 feet msl to allow water to flow back into ADV through a controlled and stable pathway. The outlet would consist of an armored trapezoidal weir and chute, with an armored outlet apron. The outlet crest would be 60 feet wide perpendicular to the flow with 4H:1V side slopes. The outlet crest is 120 feet wide in the direction of the flow.

The Lake B area is mostly dry because it is actively dewatered to facilitate mining. The current controlling (baseline) water level elevation for Lake B is 373 ft msl, assuming a non-operating (no mine dewatering) condition. At this elevation, the total groundwater flow through Lake B would be approximately 7,900 AF per year. The median Lake B water level elevation is 373 ft msl, which by coincidence is the same as the controlling baseline elevation.

Since the actual water level is constantly fluctuating, the median value infers that half the time the water level would be above that elevation and half the time the water level would be below that elevation. With a maximum potential Lake B water level of about 395 ft msl, the average elevation of the water surface during the times when the water surface is above the median water level would be 384 ft msl. Based on these parameters, under non- operating baseline conditions, the average rate of overflow from Lake B would be approximately 465 AF/yr for periods when the water level is above the median. However, since the water level is above the median only half the time, the long-term average non-operating baseline overflow would be one-half that value, or approximately 235 AF/yr.

Under operating baseline conditions, there would be no overflow from Lake B since the mining excavation is dewatered. The fluctuations in water levels follow major climatic cycles of 10 to 20 years. Thus, under actual conditions, there may be no overflow for a decade or more, followed by a period of several years where there may be constant overflow above the non-operating baseline controlling elevation. The annual averages described above and, in the paragraph, below are not meant to infer that overflow might occur every year. The annual averages are provided solely as a means for comparison of baseline and proposed project conditions.

As part of the project, the proposed spillway elevation for Lake B is 369 ft msl. At this elevation, the total groundwater flow through Lake B would be approximately 7,700 AF/yr under reclaimed proposed conditions. Thus, the amount of water that overflows from Lake B via the spillway under project conditions would be 200 AF/yr greater, on average, than under non-operating baseline conditions (i.e., 7,900 AF/yr minus 7,700 AF/yr). This represents only about a 2.6 percent increase in water that would overflow from Lake B under the non-operating baseline condition. Based on the Lake B water levels presented in the EMKO report (Appendix F-2), water would flow over the spillway at 369 ft msl over 80 percent of the time, on a long-term basis.

Although not germane to the evaluation of the project's impacts pursuant to CEQA (since existing conditions are used to define baseline), the 200 AF/yr (or 2.6 percent) increase of water overflow under project conditions as compared to non-operating baseline and the total average annual overflow of 435 AF/yr under project conditions constitute much less water loss than would occur under implementation of SMP-23 with a spillway at 360 ft msl (i.e. nine feet lower than proposed project conditions).

In addition, the overflow outlet flow path and apron would be lined with riprap to mitigate the potential for erosion to occur. This stable pathway would ensure that construction of the Lake B spillway would have a less than significant impact on erosion, siltation, surface runoff that would result in flooding, polluted runoff, or impeded or redirected flood flows. However, as noted above, the conveyance of water from Lake A to Lake B could result in a significant impact in this regard. As a result, Mitigation Measure 4.6-3, below, is required to reduce this impact to a less than significant level.

Level of Significance: Potentially significant.

Mitigation Measure 4.6-4: Conveyance to Avoid Lake B Silt Storage Area

The Permittee, or its contractor, shall implement one of the following two water conveyance options for the pipeline turnout from Lake A to Lake B:

1) *Install a high-density polyethylene (HDPE) pipe, connected to the Lake A to Lake B pipeline turnout, that will be capable of conveying the flow from the end of the Lake A to Lake B pipeline across or around the overburden/silt backfill area in the eastern end of Lake B.*
2) *Compact the backfill surface in the eastern end of Lake B and construct a lined channel across the top of the backfill that will be capable of conveying the flow from the end of Lake A to Lake B pipeline turnout across the backfill area. This channel shall be lined with gravel or cobbles to minimize the potential for erosion or sediment transport.*

Significance after Mitigation: Less than Significant.

Impact 4.6-4a: Release of Pollutants In Flood Hazard, Tsunami, or Seiche Zones Due to Project Inundation Regarding Lake A Reclamation and Diversion Structure Construction, Construction of the Infiltration Gallery, and Construction of Conduit from Lake A to Lake C with a Turnout to Lake B

A description of the Lake A Reclamation and Diversion Structure Construction is provided in Impact 4.6-1a. Please see the impact discussions for Impact 4.6-1a and Impact 4.6-3a for a discussion regarding infiltration gallery, construction of the diversion structure and construction of the conduit from Lake A to Lake C with a Turnout to Lake B as the primary impacts were water quality issues associated with flood hazard are discussed.

Seiche

A seiche could be cause by wind or by an earthquake. A seiche could incrementally increase the amount of water leaving Lake A during periods when the groundwater level is above the minimum freeboard level, or 3.5 ft (see Table 4.6-11, "Wave Amplitude and Run-Up Values"). The recommended design water level is 420 ft msl in Lake A, and the recommended freeboard is four feet. Thus, the Lake A minimum berm elevation should be 424 ft msl, which is above the historic peak water level elevation. Consideration was given to including a spillway at 420 ft msl near the southwest corner of Lake A to address the potential for overfilling of the lake due to excess diversion of water to or insufficient release of water from Lake A.

The 100-year flood elevation at the west end of Lake A is approximately 410 ft msl (Brown & Caldwell 2019). A spillway at an elevation of 420 ft msl would exclude flood waters from entering Lake A through the spillway and, therefore, meets the applicable design criteria.

Since the predominant wind direction is generally from west to east, wind-generated waves would move away from the west side of Lake A, where the berms would be at or near the minimum design elevation. The wind-generated waves would reach their maximum height at the east side of Lake A, where the minimum natural topographic elevation around the edge of the lake is greater than 430 ft msl. Thus, wind-generated waves would only affect the east end of Lake A, where the natural ground surface is well above the design elevations. In addition, the localized influence of wave run-up would occur substantially below any neighboring developments to the north of Lake A, which vary in elevation from approximately 425 ft msl on the north side of Alden Lane to over 450 ft msl at Lakeside Circle (EMKO 2020a). The maximum elevation of a seiche would depend on the elevation of the water in Lake A at the time the seiche occurred, but the critical point is when the lake is full (elevation 420 ft msl). Thus, if the max seiche wave height is 3.5 ft, the max elevation is the sum of 420 and 3.5, or 423.5 ft msl.

TABLE 4.6-11
WAVE AMPLITUDE AND RUN-UP VALUES

Wave Type	Lake A			Lake B		
	Amplitude	*Run-up*	*Total Height*	*Amplitude*	*Run-up*	*Total Height*
Seiche	1.5	2.0	3.5	1.5	2.0	3.5
30 mph Wind-generated	1.2	1.6	2.8	1.1	1.4	2.5
40 mph Wind-generated	1.7	2.2	3.9	1.5	2.0	3.5

Source: EMKO 2020a
Note: All values in feet

The spillway elevation of 420 ft msl may not provide sufficient freeboard to fully retain a seiche if one were to occur during a time when the peak water level existed in Lake A. The historic peak groundwater elevation occurred for a period of only two to three weeks in February 1980. The second-highest historic groundwater elevation in the Lake A area occurred for a period of two to three weeks in March 1991, at an elevation of 417.8 ft msl.

EMKO estimated the volume of water that would potentially overtop and flow over the Lake A spillway as the result of a seiche, assuming the initial water level in Lake A was at the spillway elevation. The first order seiche period for Lake A is 33 seconds, as described above. This means that the water level during a seiche at any specific location in the lake would exceed the normal water level for 16.5 seconds per wave cycle and would be less than the normal water level for 16.5 seconds per wave cycle. The average water height of a seiche above the spillway elevation during the 16.5-second timeframe above the normal water level would be 0.75 ft. The rate of flow over the spillway under these conditions would be approximately 3,855 cfs. For each 16.5-second overtopping event, the total volume of water that would spill into the arroyo from Lake A would be approximately 63,600 cubic feet, or about 1.46 acre-feet. Due to friction loss from wave run-up on the sides of Lake A and the loss of water over the berm, it is anticipated that the seiche would attenuate relatively rapidly. If the seiche oscillated for five periods before the amplitude became too small to result in any additional water loss, then less than 8.85 acre-feet of water would be released to ADV. These results are based on the predominant earthquake, ground shaking with a period comparable to that for a seiche in Lake A, and Lake A being full to the spillway level all occurring at the same time. Such a coincidental event is extremely unlikely.

Based on the above analysis, the recommended design elevation and freeboard would retain all naturally occurring groundwater, prevent overtopping from wind-generated waves, and would only allow a minimal release of water into the ADV in the unlikely occurrence of a seiche during the relatively brief periods that water levels would reach the elevation of the spillway. Thus, the potential impacts due to release of pollutants caused by seiches would be less than significant.

Tsunami

The site is located about 36 miles from the Pacific Ocean and about 18 miles from the nearest part of the San Francisco Bay (Google 2020), therefore, there is no reasonable likelihood of induction caused by a tsunami at the project site.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-4b: Release of Pollutants in Flood Hazard, Tsunami, or Seiche Zones Due to Project Inundation Regarding the ADV Realignment

A description of the ADV realignment is provided in Impact 4.6-1b. Please see Impact 4.6-1b and Impact 4.6-3b for discussions regarding impacts from the potential release of pollutants associated with flood hazards. Due to the limited size of the ADV realignment, no reasonably foreseeable project inundation would occur from a seiche. In addition, the site is located about 36 miles from the Pacific Ocean and about 18 miles from the nearest part of the San Francisco Bay; therefore, no reasonably foreseeable project inundation would occur from a tsunami.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-4c: Release of Pollutants in Flood Hazard, Tsunami, or Seiche Zones Due to Project Inundation at the Northern Reclamation Area

A description of the Northern Reclamation Area is provided in Impact 4.6-1c. Please see Impact 4.6-1b and Impact 4.6-3b for discussions regarding impacts from the potential release of pollutants associated with flood hazards. The Lake J excavation area would be reclaimed to open space and/or non-prime agriculture. Ponds C and D in the North reclamation area may be repurposed as silt ponds. For these ponds, silts may be deposited up to elevation 330 feet msl with groundwater above that. Ultimately, these ponds would either be reclaimed as independent open water bodies with a projected water surface elevation of 370 feet msl or merged with the larger future Lakes C and D, to be developed by Vulcan on its adjoining property. Due to the limited sizes of Ponds C and D, no reasonably foreseeable project inundation would occur from a seiche. In addition, the site is located about 36 miles from the Pacific Ocean and about 18 miles from the nearest part of the San Francisco Bay; therefore, no reasonably foreseeable project inundation would occur from a tsunami.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-4d: Release of Pollutants in Flood Hazard, Tsunami, or Seiche Zones Due to Project Inundation Regarding Reclamation of Lake B

A description of the Reclamation of Lake B is provided in Impact 4.6-1d. Please see Impact 4.6-1b and Impact 4.6-3b for discussions regarding impacts from the potential release of pollutants associated with flood hazards.

A seiche could incrementally increase the amount of water leaving Lake B during periods when the groundwater level is above the minimum freeboard level, or 3.5 ft (see Table 4.6-11, above). Similar to Lake A, a 40-mph wind event occurs less than 0.2 percent of the time in Livermore (EMKO 2020a). Thus, the maximum potential combined wave height due to seiche and wind-generated waves would be contained with 3.5 feet of freeboard 99.8 percent of the time at Lake A and Lake B. Based on the EMKO report (Appendix F-2), under non-operating baseline conditions, the average rate of overflow from Lake B would be approximately 465 AF/yr for periods when the water level is above the median. However, since the water level is above the median only half the time, the long-term average non-operating baseline overflow would be one-half that value, or approximately 235 AF/yr. Under operating baseline conditions, there would be no overflow from Lake B since the mining excavation is dewatered.

The quality of the water in Lake B and the design of the spillway, which has been designed to prevent erosion and the discharge of sediment to the ADV during releases, would neither result in any incremental overflow due to a seiche nor the potential release of any pollutants.

In addition, the site is located about 36 miles from the Pacific Ocean and about 18 miles from the nearest part of the San Francisco Bay; therefore, no reasonably foreseeable project inundation would occur from a tsunami.

Level of Significance: Less than significant.

Mitigation Measure: None required.

Impact 4.6-5: Conflict with or Obstruct Implementation of a Water Quality Control Plan or Sustainable Groundwater Management Plan

Unlike the previous thresholds of significance that require impact statements for each major component of the proposed project, this impact statement applies to the entire site and each component. Zone 7's Alternative Plan requires implementation of the Chain of Lakes to comply with the Sustainable Groundwater Management Plan. The proposed reclamation plan is a component of the implementation of the Chain of Lakes. The Applicant would continue to adhere to all applicable plans, permits, and regulations governing water quality. During construction related to reclamation, the Applicant would comply with its NPDES permit (NPDES No. CAG982001), effective January 1, 2021, and Mitigation Measure 4.6-1, discussed above, which includes obtaining a Stormwater General Permit with an associated SWPPP that would require BMPs for construction. Therefore, the proposed project would not conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan, and impacts would be less than significant.

Level of Significance: Potentially Significant

Mitigation Measure: Implement Mitigation Measures 4.6-1 (see Impact 4.6-1a, above), 4.4-1 (see Section 4.4), 4.6-2, and 4.6-3 (see Impact 4.6-1d, above).

Significance after Mitigation: Less than significant

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