Geo-Logic ASSOCIATES

Technical Memorandum

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Subject: Streamflow Infiltration to Groundwater
Proposed Cottonwood Sand Mine

Geo-Logic Associates (GLA) prepared this technical memorandum for the Cottonwood Sand Mine Project (Project) Environmental Impact Report (EIR) as part of the requirements for obtaining a Major Use Permit (MUP) for the extraction of aggregate on the existing Cottonwood Golf Club property. The Cottonwood Sand Mine Project is proposed on the current Cottonwood Golf Club property, replacing the two 18-hole golf courses (referred to as the Lakes and Ivanhoe courses). Specifically, the Project is located in Jamacha Valley at 3121 Willow Glen Drive in southern San Diego County, California. The approximately 280-acre site is situated within the Sweetwater River valley and in the floodplain of the Sweetwater River, which flows southwesterly through the site.

The project proposes to convert two golf courses to a sand mining operation that would be conducted in three phases over 10 years. The project's mining operations would extract, process, and transport sand using conventional earth moving and processing equipment. Approximately 4.3 million cubic yards (CY; 6.40 million tons) of material are proposed to be extracted. Mining and extraction activities are expected to produce approximately 3.8 million CY (5.7 million tons) of sand and gravel for market use. Extraction operations would be limited to a maximum production of 380,000 CY (570,000 tons) of construction grade aggregate (sand) per calendar year, with a 10 percent waste factor from the total amount extracted that includes wash fines and materials undesirable for processing.

Since the release of the Draft EIR, the project description has been updated to include backfilling of the site in order to achieve final elevations. Backfilling would be accomplished using a combination of wash fines and overburden produced from the mining operations and imported fill. Approximately 2.5 million cubic yards would be needed to be imported to the site to fulfill the backfill requirements. The imported material would consist of inert debris transported to the project site at an estimated rate of 250,000 cubic yards per year for the 10-year duration of mining activities. Backfill material import operations would occur from 9:00 a.m. to 3:30 p.m. Monday through Friday to avoid peak traffic periods. In addition to the 88 trucks necessary for daily export of the saleable material, 58 trucks are assumed to commute to the construction site on a daily basis for the import of backfill material. A comparison of the project description information presented in the Public Review Draft EIR and the current Project Description is presented below:

Project Component	Public Review Draft EIR Project Description	Current Project Description
Excavated Sand	4,266,900	4,266,900
Saleable Sand	3,840,210	3,840,210
Waste Sand (10 percent of Excavated Sand)	426,690	426,690
Total Backfill Required	2,928,700	2,928,700
Total Imported Backfill (Backfill – Waste Sand)	0	2,502,010
Export Trucks (Average/Day)	88.6	88.6
Import Trucks (Average/Day)	0	57.7

*All volumes are reported in cubic yards

The purpose of this memorandum is to evaluate downward infiltration of surface water (streamflow) to groundwater and potential impacts to surface water or groundwater as a result of proposed sand mining operations and the proposed future restoration at the at the property.

Downward streamflow infiltration to groundwater in a wetted stream channel is estimated by Darcy's Law Q = KiA, where

Q = flow (cubic feet per day) (ft^3/d)
K = hydraulic conductivity (feet per day) (ft/d)
i = hydraulic gradient (feet per foot) (ft/ft)
A = area of the wetted stream channel (square feet) (ft^2).

K can be estimated from surface soil classifications noted in boring logs completed in the property area[1]. Thirty five of forty completed soil borings were noted to have encountered silty sand (SM) or poorly graded sand with silt (SP-SM) at grade and in the shallow subsurface (up to approximately 4 feet below grade). This soil type is estimated from literature sources[2] to have a K value of approximately $3x10^{-4}$ centimeters per second (cm/s) or 8.50×10^{-1} ft/d; however, actual measured K value may be different and may vary within the streambed area.

The existing wetted channel is approximately 9,504 feet long (1.8 miles) by 53 wide on average, which corresponds to an area A of 500,544 ft^2 (11.49 acres). The hydraulic gradient (i) is directed downward at 1.0 ft/ft. These values equate to:

$$Q\ (ft^3/d) = 0.850\ (ft/d) \times 1\ (ft/ft) \times 500{,}544\ ft^2 = 425{,}626\ ft^3/d\ (9.77\ \text{acre-feet [AF]/d}).$$

Vertical flow (Q) is directly proportional to both channel area (A) and hydraulic conductivity (K), so if either the channel area or the channel surface soil type is modified the vertical flow (i.e., transfer loss to groundwater within the Site footprint) will also be modified proportionately. For example, if the channel area is increased with the same surface soil type having the same K, then Q would also increase.

The existing stream channel will remain unaltered during mining operations and in the future restored condition. The mining activities will lower the channel banks, but the banks will remain at 3.5 feet high, which has been shown to adequately convey maximum water transfers.[3] Since soil hydraulic connectivity (K) and channel area (A) will remain the same, downward infiltration (Q) will remain unchanged. In addition, soil hydraulic connectivity (K) in project areas outside of the channel, which may periodically flood at times, is planned to remain unchanged. Therefore, vertical flow (Q) in the future condition in these areas will remain unchanged as well. This result is independent of the texture of imported fill as long as the K remains unchanged in the upper soil column (approximately the top 3 feet).

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[1] *Geocon, 2017. Evaluation of Soils for Use as Construction Aggregate Sand, Cottonwood Golf Course, El Cajon, California, July 19, 2017.*

[2] *Freeze, R. A. and J.A. Cherry, 1979. Range of Values of Hydraulic Conductivity and Permeability, Table 2-1 (p.2-64). Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.*

[3] *Chang, Wayne, 2022. CEQA-level Drainage Study for the Cottonwood Sand Mining Project. October 4.*