SITE INVESTIGATION WORK PLAN

Former Albany Landfill (Albany Bulb)
End of Buchanan Street
Albany, California 94706

Issued: April 1, 2024

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GSI ENVIRONMENTAL

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This Site Investigation Work Plan was prepared by the staff of GSI Environmental Inc., under the supervision of the Engineer(s) and/or Geologist(s) whose signatures appear hereon.

The findings, recommendations, specifications, or professional opinions were prepared in accordance with generally accepted professional engineering and/or geologic practice. No warranty is expressed or implied.

Issued: April 1, 2024

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1.0 INTRODUCTION

GSI Environmental Inc. (GSI) prepared this Site Investigation Work Plan (Work Plan) on behalf of the City of Albany (City) for the former Albany Landfill, currently referred to as the Albany Bulb, located at the western end of Buchanan Street on the east shore of the San Francisco Bay in Albany, California (the Site). The Site location is shown on Figure 1. This Work Plan was prepared in response to a San Francisco Bay Regional Water Quality Control Board (Water Board) letter *Albany Landfill, Albany, Alameda County – Requirements for Technical Reports Pursuant to Water Code Section 13267* dated January 18, 2024 (Water Board, 2024), requesting a work plan to conduct a one-time, representative sampling of soil and groundwater at the Site.

2.0 SITE DESCRIPTION AND BACKGROUND

The Site is approximately 40 acres and is a closed, unlined, Class III landfill. The Site is part of the former Albany Landfill, which included land to the east of the site, currently owned by East Bay Regional Parks District. According to the current Waste Discharge Requirements Order 99-068 (WDR), the landfill received approximately 2,000,000 tons of waste from 1963 until December 1983. The landfill waste has an average depth of 40 feet. Landfill operations involved constructing waste cells by forming dikes composed of concrete rubble, soil and steel-mill slag and infilling these cells with waste. The waste placed in these cells consisted primarly of construction and demolition wastes. Prior to 1975, some non-hazardous solid waste, such as wood and vegetable solid waste, was disposed of at the Site. The WDR focused on groundwater and surface water quality with respect to their potential impact to San Francisco Bay, should these media be impacted from landfill wastes. The WDR states that the landfill does not pose a water quality threat to San Francisco Bay. The landfill remains undeveloped and is used as public recreational area. The site layout and approximate locations of the waste cells are shown in Figure 2.

The January 18, 2024 Water Board letter states that it had recently discovered evidence that industrial waste from the Zeneca Richmond Plant may have been disposed of at the Albany Landfill from 1960 to 1971. The Water Board letter included a March 28, 1980 letter from Stauffer Chemicals, identifying the Albany Landfill Co. site, owned by the Santa Fe Land & Improvement Co., as one recipient of the Richmond Plant process waste. The Water Board letter states that the process waste may have included “alum mud”, a waste product generated from the processing of aluminum from bauxite ore. The primary constituents in alum mud include heavy and trace metals including iron, manganese, magnesium, zinc, cadmium, copper, trivalent chromium, and lead. Alum mud also typically contains certain radionuclides, referred to as “technologically enhanced naturally occurring radioactive material” (TENORM). Similar waste was disposed of at Blair Southern Pacific Landfill in Richmond, California. The Water Board letter indicated that radioisotopes associated with TENORM and pesticides that were produced at the Zeneca Richmond Plant have been detected at the Blair Southern Pacific landfill.

The Water Board indicated that the presence of waste from the Zeneca Richmond Plant was not known at the time of the previous WDR finding, and that it is possible that not all wastes within the landfill and their potential impacts have been thoroughly investigated. Therefore, the Water Board is requiring the City to submit a work plan to conduct a one-time representative soil and groundwater sampling investigation. The Water Board indicated that samples must be analyzed

for metals; radionuclides (including, but not limited to, thorium-232, uranium-238, and uranium-235); and pesticides (including, but not limited to, 4-4'-DDT and dieldrin).

It should be noted that the January 18, 2024 Water Board letter indicates the landfill is approximately 75 acres and operated intermittently beginning in the 1940s. This information is inconsistent with the description found in Order 99-068, which states the landfill occupies 40.8 acres and began filling operation in 1963. The letter may refer to the larger area that includes the former landfill currently owned by East Bay Regional Parks District. Given the separate ownership status of the sites, the activities covered in this Work Plan will be limited to the land owned by the City of Albany.

3.0 INVESTIGATION APPROACH

As stated above, the WDR for the Site focuses on impacts to San Francisco Bay from groundwater discharge and surface water runoff; therefore, these media will be the primary focus of proposed investigation. The proposed investigation approach will focus on near surface soil, which could potentially leach constituents of concern into surface water runoff, and groundwater. Additionally, because the landfill is currently open to recreational users, near-surface soil data will also be evaluated relative to these potential receptors and potential maintenance workers.

GSI proposes a stepwise investigation approach with initial activities (presented in this Work Plan) consisting of a comprehensive historical document review and walk-over gamma radiation survey of the Site to identify:

- Areas within the Site that may have received Zeneca Richmond Plant waste streams (thus potential Alum Mud);
- Existing soil and groundwater investigation data for the Site with respect to metals and pesticides; and
- Potential near-surface gamma radiation sources at the Site that may indicate the presence of TENORM.

Upon completion of the activities described in this Work Plan, the findings will be presented to the Water Board along with a proposed focused soil and groundwater sampling and analysis program informed by the results. Following discussion with the Water Board and with its concurrence on the proposed sampling program, GSI will prepare and submit a focused Soil and Groundwater Sampling and Analysis Plan (SAP). Following Water Board approval and subsequent implementation of the SAP, a Soil and Groundwater Investigation Completion Report (Completion Report) will be prepared and submitted to the Water Board.

4.0 PROPOSED SCOPE OF WORK

4.1 Historical Document Review

GSI will review historical documents to obtain information that will assist in development of the soil and groundwater sampling program and potentially focus the area to be sampled and/or the constituents of concern to be addressed. This task will include:

- submitting a public records request to the Water Board to review historical documents, if available;
- reviewing historical aerial photographs or other reports provided by the City;

- conducting a search for publicly or commercially available historical aerial photography; and
- reviewing documents for the Site available on the GeoTracker website.

4.2 Gamma Radiation Survey

GSI will contract with Cabrera Services to perform a gamma walkover survey (GWS) at the Albany Landfill prior to performing intrusive investigations. The purpose of the GWS is to identify sources of radiation on or near ground surface. The results of the GWS will assist in determining radiological risks to workers or members of the public from radioactive material potentially disposed of in the landfill and provide an estimate of the lateral extent of any surface radioactivity.

The initial radiation survey at the Albany Landfill will focus on gamma radiation. The radionuclides of concern identified by the Water Board emit gamma radiation, as well as alpha and beta radiation. Gamma radiation is penetrating and can travel significant distances through air and soil making it easier to detect in the environment compared with alpha or beta radiation. In addition, radiological exposures to workers and members of the public using the site for recreational purposes are expected to result from external exposure, primarily associated with gamma radiation.

4.2.1 Survey Instrumentation

The GWS will be performed using a Ludlum Model 44-10 sodium iodide (NaI) gamma ray detector connected to a Ludlum Model 2221 ratemeter/scaler, or equivalent. The detector is not collimated (i.e., shielded to limit the field of view). The radiation instrument is connected to a global positioning system to provide position correlated survey results with sub-meter accuracy. The gamma radiation count rate and measurement location are recorded once every second.

4.2.2 Survey Methodology

The GWS is performed with the NaI detector suspended approximately 10 centimeters (4 inches) above ground surface. The detector is swung left and right in a serpentine fashion while the survey technician slowly walks over the area being surveyed. To improve the measurement sensitivity of the GWS, the survey technicians will walk at a rate not to exceed 0.5 meters per second. Each 1-second measurement will represent an area of approximately 0.25 square meters.

The GWS of the Albany Landfill will be limited to the “bulb” area where the radioactive material was likely placed in the landfill. The GWS will cover 100% of the accessible ground surface to provide a comprehensive picture of the radiological conditions at the site. Accessible ground surface is defined as relatively level areas without debris, excessive vegetation, or standing water. Examples of inaccessible areas include:

- Steep slopes that can’t be safely navigated while carrying equipment,
- Standing water that shields radiation,
- Piles of debris that restricts detector placement and shield radiation,
- Dense vegetation that restricts detector placement and can’t be safely navigated while carrying equipment.

Multiple areas with piles of concrete rubble and dense vegetation were identified during the site visit. Areas considered inaccessible will be documented with photographs.

4.2.3 Data Evaluation

The objective of the GWS is to identify sources of radiation that could result in unacceptable risks to workers during subsequent investigations, or present unacceptable risks to members of the

public currently accessing the site. The results of the GWS will present levels of gamma radiation at ground surface. The average and standard deviation of the GWS results will be calculated, and the data presented in units of standard deviations above the mean, or z-score. Higher z-scores identify areas with the highest levels of gamma radiation. A posting plot of the GWS results as z-scores will be prepared to visually present the results of the GWS.

Radioactivity can be naturally occurring and is present in the environment. All soils and many building materials (e.g., concrete) contain naturally occurring radioactive material (NORM) at varying concentrations. The Albany Landfill received large quantities of building material debris. The concentrations of radionuclides in the building debris could be similar to the concentrations in soil. The concentrations could also be significantly higher or lower than the concentrations in soil.

4.2.4 Measurement Sensitivity

There are several factors that affect measurement sensitivity for the GWS. These include the energy and abundance (i.e., frequency of gamma rays of a specific energy that are emitted following the decay of an atom) of the gamma rays as well as time, distance, and shielding.

The radionuclides of concern determine the energy and abundance of gamma rays being measured. Naturally occurring radioactivity in background also contributes to the mix of radiation being measured. Low-energy gamma rays will be absorbed or attenuated before they reach the detector. High-energy gamma rays are more likely to pass through the detector without being detected. In addition, the more gamma rays present, the more likely some gamma rays will be detected.

The time the detector is close to the source of radiation also affects sensitivity. The longer the detector is present, the more likely the radiation will be detected. The GWS uses extremely short count times of one second. By slowing down the scan speed to less than 0.5 meters per second, the detection sensitivity is improved. Faster scan speeds cover the survey area in less time, but the measurement sensitivity is reduced. The area of the radiation source is included under time since it takes longer to move the detector over a larger source.

Distance is also a factor in determining sensitivity. The smaller the distance between the radiation source and the detector, the better the sensitivity of the measurement. The GWS is designed to keep the detector within 10 centimeters of the ground surface. However, uneven surfaces change the detector height above ground surface constant. Rough terrain and debris also make it difficult to maintain the detector height above ground surface.

Shielding is an additional factor in determining measurement sensitivity. If the radioactive material is on the surface, there is only air between the source and the detector. Air provides minimal shielding. However, if the source of radiation is not on the surface the additional overlying material will act as a shield, limiting the amount of radiation reaching the detector. Soil, concrete, and water are materials at the Albany Landfill that are expected to impact the amount of shielding associated with each measurement.

Cabrera can make assumptions about the radiation sources and provide estimates on how much radiation is expected to be detected by the GWS. Guidance on determining sensitivity and minimum detectable concentrations (MDCs) for GWS measurements is provided in *Minimum Detectable Concentrations with Typical Radiation Survey for Instruments for Various Contaminants and Field Conditions*, (NUREG 1507 Revision 1, August 2020, US Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards).

If the area of radioactive material is assumed to be very small such that the time over the source is approximately 1 second, the MDC for thorium-232 would be 3.8 picocuries per gram (pCi/g),

and the MDC for radium-226 would be 5.3 pCi/g above the natural background in the soil. If a large source of radiation is assumed where the count time is increased to 2 seconds, the MDC could be as low as 1.5 pCi/g for thorium-232 and 2.1 pCi/g for radium-226. Radiation sources covered by more than 15 centimeters (6 inches) of soil are usually not detectable at the surface unless they contain extremely high concentrations of the radionuclides of concern.

4.3 Soil and Groundwater Sampling and Analysis Plan (SAP)

4.3.1 SAP Components

GSI will prepare a SAP for the soil and groundwater sampling activities requested by the Water Board. The SAP will include the following components:

- A summary of site historical data and background information obtained from the historical information review described in Section 4.1, including data tables and figures presenting historical metals and organochlorine pesticide (OCP) data, if identified;
- A summary of the gamma radiation survey results described in Section 4.2;
- The data quality objective of the proposed sampling program;
- The proposed sampling approach and rationale;
- A detailed description of proposed soil and groundwater sampling and analytical methodology;
- A discussion of the risk-based data evaluation process, including screening levels that will be used to evaluate the data; and
- A description of and schedule for submittal of the Soil and Groundwater Investigation Completion Report.

4.3.2 SAP Concept

The SAP will propose collection of soil samples to assess potential leaching into surface water runoff and impacts to the potential receptors that are the focus of the investigation. The proposed soil sample locations will be determined based on the results of the historical document review and walk-over gamma radiation survey.

For example:

- Soil samples may be collected in targeted areas within the upper 1 foot of the landfill to evaluate potential impacts to surface water runoff, these samples could be easily retrieved with hand tools (e.g., trowel, shovel, hand auger).
- Soil samples may be collected within the upper 10 feet to consider possible exposure to existing or future site users. These samples may be collected from trenches that would allow for observation of soil lithology and visual identification of alum mud waste. A gamma radiation survey on the trench sidewalls may be used to identify sample collection locations.

It is not anticipated that deeper soil samples will be collected. The primary concern related to soil at depth would be leaching to groundwater and subsequent discharge to San Francisco Bay. If present, potential waste from the Zeneca Richmond facility will have been in place in the landifll for over 50 years. Therefore, groundwater samples should identify potential impacts from deeper soil.

The SAP will also propose collection of groundwater samples for radioisotope analysis and potentially metals and organochloride pesticides analysis. Previous water level elevations and

lithology observations will be used to determine the drilling method and the need for installing monitoring wells versus collecting grab groundwater samples. Results of the historical data review will also be used to determine the location and number of groundwater samples. Due to the presence of mixed waste and construction debris, it may be difficult or infeasible to drill within the landfill cells. An alternate approach for evaluating groundwater impacts would be to evaluate water quality at the point of compliance for potential discharge to San Francisco Bay around the landfill perimeter.

4.3 Soil and Groundwater Investigation Completion Report

Following implementation of the SAP, GSI will prepare a Completion Report and submit it to the Water Board within 90 days. The components of the Completion Report will be described in detail in the SAP, but at a minimum, will include:

- A summary of the Site historical data and background information obtained from the historical information review and the gamma radiation survey results as described in Section 4.1 and 4.2, respectively.
- A description of soil and groundwater sampling activities, sampling methodologies and laboratory analytical methods;
- An evaluation of the soil and groundwater analytical data;
- Tables summarizing laboratory analytical results;
- Site maps showing sample locations and depths;
- Boring and/or trench logs;
- Temporary and/or permanent well construction details; and
- A data validation summary.

5.0 PROJECT SCHEDULE

GSI proposes the following project completion schedule:

Exhibit 1. Project Schedule

Task Number	Task Description	Estimated Timeframe
1	Historical Document Review	3 weeks following approval of this Work Plan
2	Gamma Radiation Survey	Estimated to commence 3 to 6 weeks following approval of this Work Plan[1] and will require 3 to 4 weeks to complete
3	Meeting with Water Board to discuss investigation and document review findings and proposed soil and groundwater sampling program	2 weeks following completion of Tasks 1 and 2
4	Soil and Groundwater Sampling and Analysis Plan (SAP)	3 weeks following completion of Task 3
5	Soil and Groundwater Sampling	6 weeks following approval of the SAP
6	Soil and Groundwater Investigation Completion Report	4 weeks following receipt of analytical data collected during Task 4

Note:

1. The schedule for this task is dependent on the City's process for contracting with the consultant and subcontractors that will perform this work, which will require approval by City Council. The City is commencing this process now with the goal of seeking contract approvals at the May 6, 2024, City Council meeting.

6.0 REFERENCES

California Bay Regional Water Quality Control Board, San Francisco Bay Region (Water Board). 1999. Order 99-068, Updated Waste Discharge Requirements and Recission of Order No. 84-089 for, City of Albany, Albany Landfill Albany, Alameda County, California. September 15.

California Bay Regional Water Quality Control Board, San Francisco Bay Region (Water Board). 2024. *Albany Landfill, Albany, Alameda County – Requirements for Technical Reports Pursuant to Water Code Section 13267. January 18.*

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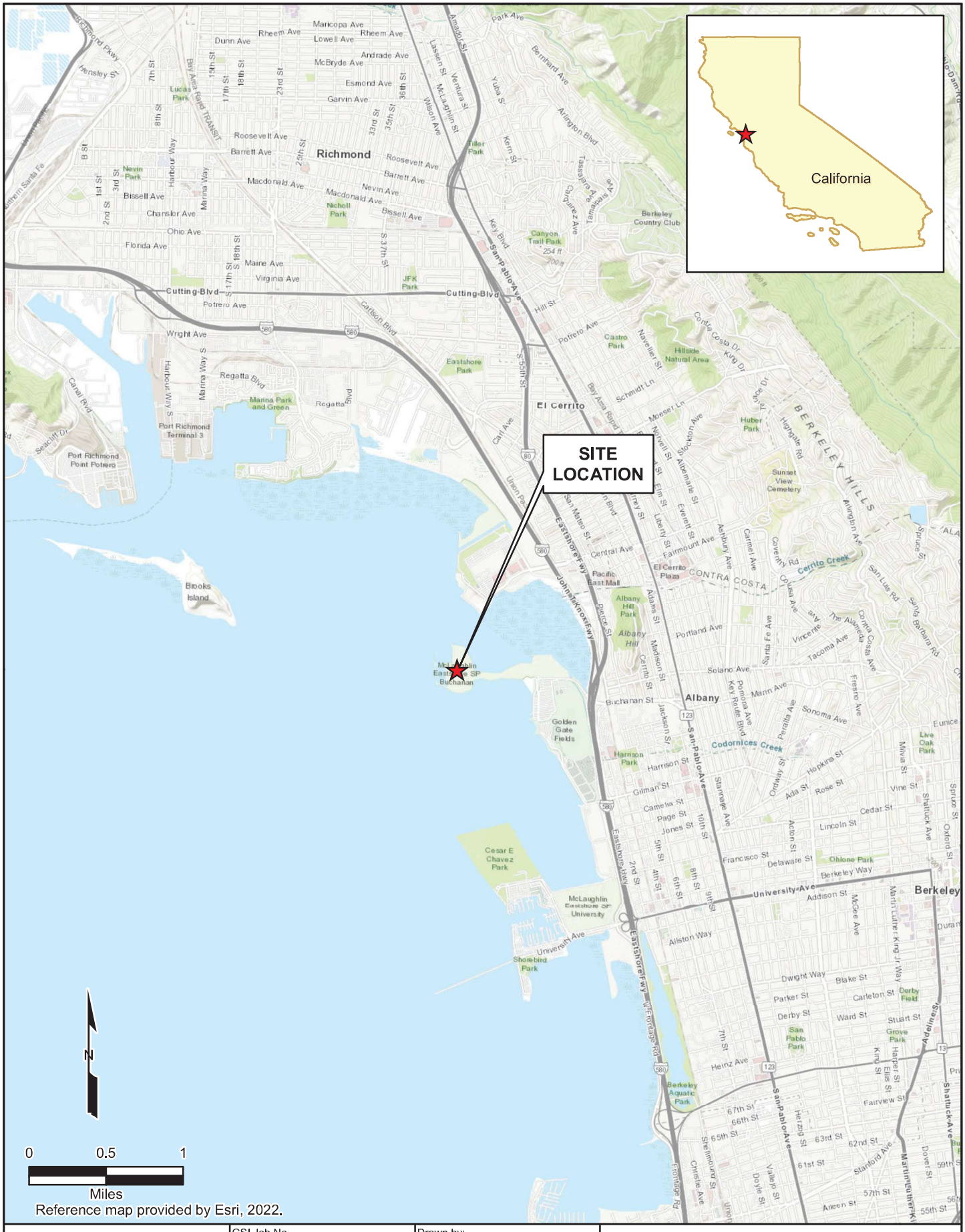
Albany, California

FIGURES



Reference map provided by Esri, 2022.

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GSI Job No.	10008	Drawn by:	AJC
Issued:	29-Mar-2024	Chk'd by:	KCA
Revised:		Aprv'd by:	JPD
Map ID:	Bulb_SiteLoc	**FIGURE 1**	

SITE LOCATION MAP

Former Albany Landfill
Albany, California

Reference map provided by Esri, 2022.

GSI ENVIRONMENTAL

GSI Job No.	10008	Drawn by:	AJC
Issued:	31-Mar-2024	Chk'd by:	KCA
Revised:		Aprv'd by:	JPD
Map ID:	Bulb_SitePlan	**FIGURE 2**	

SITE PLAN

Former Albany Landfill
Albany, California