San Francisco Bay Conservation and Development Commission
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August 30, 2024

TO: Engineering Criteria Review Board (ECRB) Members

FROM: Lawrence J. Goldzband, Executive Director (415/352-3653; larry.goldzband@bcdc.ca.gov)
Jenn Hyman, Senior Engineer (415/352-3670; jennifer.hyman@bcdc.ca.gov)
Sam Fielding, Coastal Program Analyst (415/352-3665; sam.fielding@bcdc.ca.gov)

SUBJECT: **Cargill's Solar Sea Salt System Maintenance and Operations Project, Newark, Alameda County – Berm Stability – Third ECRB Meeting (BCDC Permit Application 2021.003.00)**
(For Board consideration on September 11, 2024)

Project Name

Cargill's Solar Sea Salt System Maintenance and Operations Project (BCDC Permit Application No. 2021.003.00)

Project Representatives

Connie Lee, Senior Land Management Engineer, Cargill, Inc.

Don Brown, Land Resources Manager, Cargill, Inc.

Matt Pitcher, Solar Plant Manager, Cargill, Inc.

Christine Boudreau, Boudreau Associates

Michael Whelan, P.E., Principal Geotechnical Engineer, Anchor QEA

Jeremy Mull, P.E., Coastal Engineering Manager, AECOM

Project Components under Review in this Meeting

Berms at Cargill – Newark Plant 2: Ponds P2-12 and P2-13 (the Mixed Sea Salt or MSS Ponds)

Project Description and ECRB Focus Area

On April 28, 2021, Cargill, Inc. submitted an application to the San Francisco Bay Conservation and Development Commission (BCDC) for the "Solar Sea Salt System Maintenance and Operations Project" (O&M Project), BCDC Permit Application No. 2021.003.00, to continue maintenance and operational activities at Cargill's solar salt facilities located in Newark, Fremont and Redwood City over a ten-year authorization period. BCDC is the lead agency for preparation of a draft Environmental Assessment (EA)[1], which can be downloaded for review here: https://bcdc.ca.gov/2024/07/02/environmental-assessment-cargill-incorporated-solar-salt-system-maintenance-and-operations-activities/. The public comment period is August 22 – September 21, 2024. It is planned for the permit and the Final EA to go before the Commission at the end of 2024.

BCDC Permit No. 1993.004.20 (with a time extension 1993.004.21 issued on November 3, 2023), currently authorizes Cargill to conduct ongoing operations and maintenance activities at its system of solar salt ponds in Alameda and San Mateo Counties through December 31, 2023 or until a new BCDC permit is issued, whichever is earlier. Since it was originally granted, the permit has gone through numerous time extensions, without changes to the authorizations and conditions. The BCDC permit for the ten-year O&M Project (BCDC Permit Application No. 2021.003.00), if authorized, would replace Permit No. 1993.004.21 with an updated set of authorizations and conditions to reflect consistency of Cargill's proposed continuance of its existing operations and maintenance activities with BCDC's current laws and policies as well as best management practices and mitigation measures detailed in the EA.

While the O&M Project would include a wide range of activities throughout the approximately 12,100-acre project site, the Board's review of the O&M Project will focus on the earthen berms surrounding Ponds P2-12 and P2-13 at Cargill's Plant 2, which currently store approximately 4 to 6 million tons of Mixed Sea Salts (MSS). Ponds P2-12 and P2-13 are called the MSS Ponds. MSS is a layered solid matrix, with some entrained liquid bittern, comprised of salts remaining following Cargill's commercial precipitation and harvesting of NaCl and liquid bittern (concentrated $MgCl_2$ brine). Due to its high salinity (350 to 600 parts per thousand (ppt); ocean water is about 35 ppt), and the fact that its ionic balance differs from Bay water, brine such as MSS "could contribute to potential environmental impacts if overtopping, scour, and erosion caused a release of brine to the Bay" (AECOM 2021). To address sea level rise risks, Cargill has agreed to add material to the MSS pond berms during the next 10-year permit period so they maintain a crest elevation of 11.5 feet NAVD88. The timing of this is still being discussed between BCDC and Cargill.

[1] The Environmental Assessment is being prepared pursuant to BCDC's certified regulatory program under the California Environmental Quality Act (CEQA). (14 CCR § 15251(h); reference also 14 CCR §§ 11520-25.)

Project Site and Existing Conditions

Cargill's current salt pond operations encompass an approximately 12,100-acre-area (Project Site) in the cities of Newark and Fremont (Alameda County), and Redwood City (San Mateo County). Cargill's solar salt system is separated from the Bay, streams, and flood control channels by a system of approximately 123 linear miles of earthen berms, of which approximately 62 miles are "outboard" berms abutting the Bay, sloughs, and tidal marsh habitats. According to Cargill, these earthen berms were first constructed at various times and by various salt production companies between the 1860s and the 1950s. They were constructed of mostly native materials excavated from within the salt ponds and completed prior to the development of modern civil engineering standards.

The berms that are the focus of the Board's review are those surrounding Ponds P2- 12 and P2-13 at Newark Plant 2, which store the MSS material. Pond P2-12 is approximately 250 acres in size, bound by a berm of approximately 19,000 linear feet. Pond P2-13 is approximately 400 acres in size, bound by a berm of approximately 23,000 linear feet. The outboard berms are adjacent to either tidal sloughs (Newark Slough, Plummer Creek) or tidal marsh within San Francisco Bay. Based on aerial imagery identified by BCDC staff, most of the P2-12 and P2-13 berms were originally built sometime between approximately 1946 and 1956.

The berms are maintained by Cargill by applying gravel to the top to improve drivability and repairing areas of erosion where it occurs. Where seepage is observed in adjacent tidal wetlands, berms are also improved using a technique called "berm core compaction", "keying", or "berm coring". At Ponds P2-12 and P2-13 where berm coring is applied, a 30-inch wide trench is dug down to a depth of up to about 9 feet. The excavated core section is backfilled with low-permeability clean imported material that is compacted in place. According to Cargill, this technique generally halts seepage of brine into the tidal marsh.

The MSS material in the ponds is primarily a solid matrix, 4-5 feet thick, with approximately 20% entrained brine. After rain events or when new liquid bittern is added to the ponds (before the salts precipitate out), liquid accumulates in the ponds on top of the solid salts. According to Cargill, Ponds P2-12 and P2-13 have over two feet of freeboard that could accommodate several decades of additional MSS inventory or an influx of Bay or flood waters. Photos taken on June 7, 2023 by Jenn Hyman, BCDC Senior Engineer, from a tour provided by Cargill to Ponds P2-12 and P2-13 are provided in Attachment A.

First and Second ECRB Meetings and Purpose of this Meeting

Given the historic nature of the construction of these berms, the extent of geotechnical information and site-specific analysis provided by Cargill, and the ecological risk associated with potential release of the MSS material contained within P2-12 and P2-13, BCDC staff requested the ECRB's input as to the seismic stability of the P2-12 and P2-13 berms, potential risk to the MSS berm stability from waves and sea level rise, and how

Cargill's proposed maintenance activities may affect the berms' integrity.

The first meeting of the ECRB to discuss the Cargill O&M Project was held on November 16, 2022. In this meeting, the Board learned about the Project, heard presentations from Cargill and requested specific studies be performed to better understand the berm stability and risks of a release. BCDC issued a letter to Cargill detailing data requests for a subsequent ECRB meeting. In the second ECRB meeting held on August 30, 2023, Cargill presented the results of Static and Seismic Stability Analysis and a Workplan for a field geotechnical investigation plus preliminary information from a sea level rise and wave runup analysis. The letter from BCDC to Cargill dated November 6, 2023, details information requested for a follow up ECRB meeting and is provided with Cargill's responses dated December 21, 2023 in Attachment B. In addition, just prior to the second ECRB meeting, BCDC received a comment letter from Save the Bay and Citizens Committee to Complete the Refuge (the Save the Bay letter), which was provided to Cargill and is included in Attachment C (note that the issues in the Save the Bay letter that are not engineering issues are being addressed by BCDC staff through the permitting process).

In December 2023, Cargill submitted an updated Geotechnical Investigation Work Plan by Anchor QEA which was approved by BCDC staff. Cargill has since carried out this field investigation and updated the static and seismic analysis to reflect the new results.

The Board will review the following reports submitted by Cargill in response to requests by the ECRB in their first and second meetings and detailed in the attached letter.

1. Sea Level Rise Assessment Update: Cargill Bayfront Berms Wave Runup and Overtopping Analysis by AECOM dated June 19, 2024
2. Geotechnical Investigation Work Plan by Anchor QEA dated December 2023
3. 2024 Field Investigation Results and Updated Assessment of Static and Seismic Stability of Perimeter Berms at Ponds P2-12 and P2-13 by Anchor QEA dated August 21, 2024.

BCDC staff requests that the Board review the content provided and advise on the following, considering the permit duration of at least 10 years[2]:

[2] While Cargill's current permit application only proposes a ten-year term, the existing permit (1993.004.20) was also only originally authorized for an initial ten-year period starting in 1995 but has been amended and extended for the past 28 years. Although Cargill represents that its separate MSS project is intended to transition storage from MSS from Ponds P2-12 and P2-13 to mix with effluent from the East Bay Dischargers Authority (EBDA) for eventual discharge into the Bay, realization of this project is not a certainty. Furthermore, Cargill has not publicly stated any intentions to otherwise cease use of Ponds P2-12 or P2-13 (independent of the MSS project) or any intentions to cease its saltmaking operations in general (and thus its need for future, ongoing operations and maintenance activities of its saltmaking facilities). Considering the above, while the current permit application only proposes a ten-year term, any approval of Cargill's permit application engenders BCDC policy concerns beyond a ten-year horizon, as reflected in the considerations that BCDC staff is requesting that the Board consider.

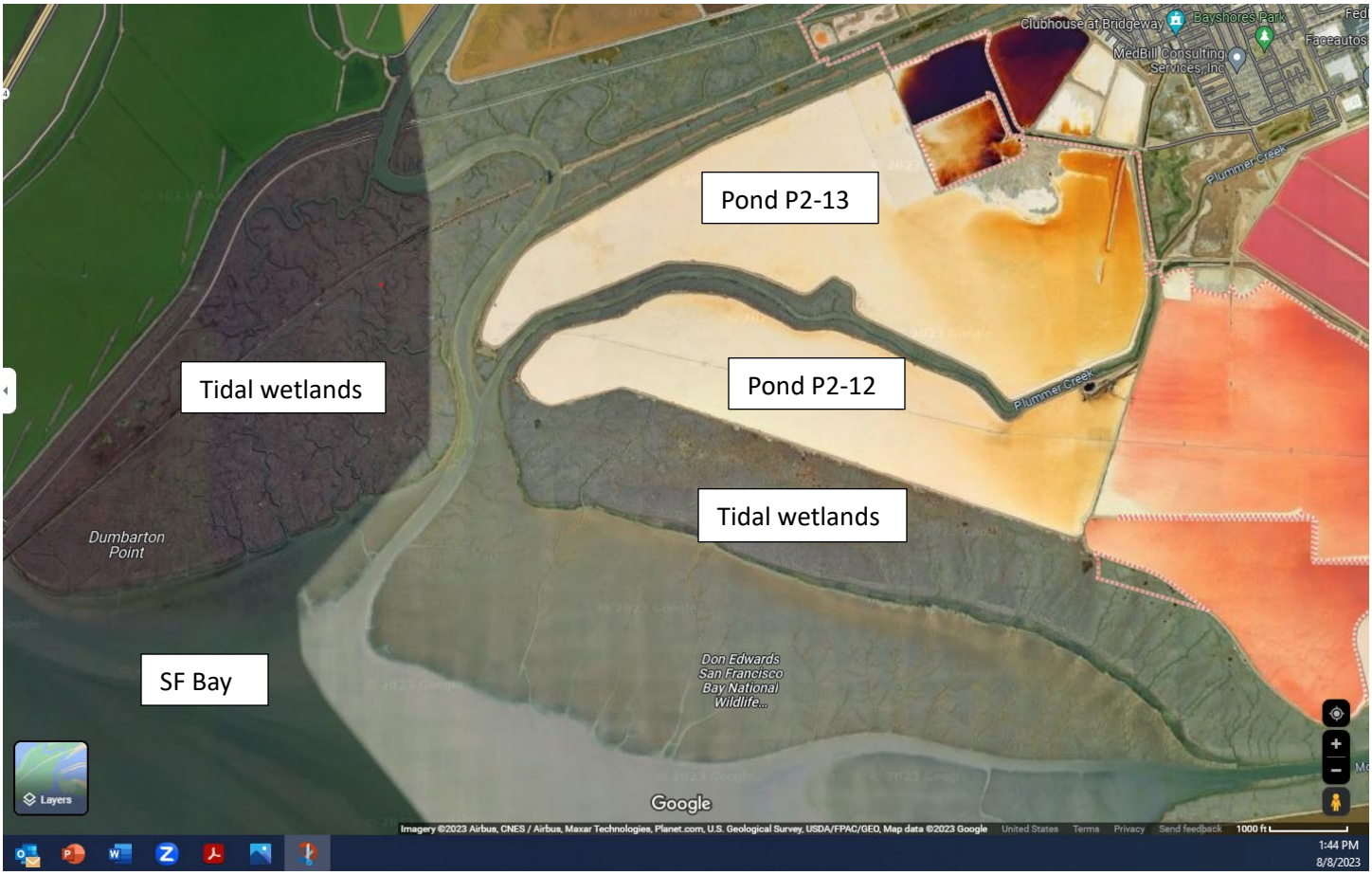
1. Is Cargill's plan to maintain the berms to a crest elevation of 11.5 feet NAVD88 plus inspections and maintenance adequate to address the risks posed by sea level rise and wave runup?
2. Did the field investigation adequately characterize the subsurface geology and geotechnical parameters?
3. Are the scenarios and criteria in the static and seismic berm stability analysis adequate for assessing the risk of berm failure at Ponds P2-12 and P2-13?
4. Do the updated static and seismic stability calculations for the berms adequately characterize and model the berm stability, including any berm raising, possible subsidence, and sea level rise predicted for 2030 and 2040?
5. For the stability analyses that indicate areas where the berms do not meet the 1.1 factor of safety, are the risks adequately addressed?
6. Does the presentation on MSS seepage and berm coring adequately address the concerns and comments from ECRB?
7. Do the results of the updated berm stability modeling utilize adequately conservative assumptions and meet adequate levels of safety so that an ecological and human health risk analysis is not needed (a statement made by Cargill in the second ECRB meeting)?
8. Does the Board have any other concerns regarding berm stability that have not been addressed?

Attachments

- A: Photos taken June 7, 2023 of Ponds P2-12 and P2-13 by Jenn Hyman, BCDC Senior Engineer
- B: Letter from Don Brown of Cargill Inc. to Jenn Hyman of BCDC - Summary of August 30, 2023 ECRB Meeting Comments, EA Studies Letter, and Permit Timeline
- C: Letter from Save the Bay and Citizens Committee to Complete the Refuge to the Chair of the ECRB dated November 12, 2022

ATTACHMENT A – PHOTOS TAKEN JUNE 7, 2023 BY JENN HYMAN, BCDC OF PONDS P2-12 AND P2-13

Photo 1. This aerial photo, downloaded from Google Maps on 8/8/23, shows the tidal wetlands surrounding Ponds P2-12 and P2-13, probably at low tide.



POND P2-13 PHOTOS

Photo 2. East end of canal on the north side of Pond P2-13, with pond berm on the right. The black pipeline is a Cargill process pipeline.

Photo 3. Looking east with the former barge canal on the left and Pond P2-13 on the right. This berm is drivable only during dry weather.

Photo 4. The brown bare spot in the wetland previously showed potential indications of a seep through the berm of Pond P2-13, which Cargill addressed through keying (berm coring).

Photo 5. This photo shows the side cast from keying (berm coring) placed on the pond side of the berm at Pond P2-13. The pond has rainwater in it from the previous very rainy winter. The crystallized, solid mixed sea salts are visible at the edge and a few inches under the surface of the pond.

Photo 6. Example of interior berm riprap in Pond P2-13.

Photo 7. The Pond P2-13 lock, circled in blue. It has not been used in a very long time and has been taken over by tidal marsh.

POND P2-12

Photo 8. The outboard berm of Pond P2-12. It is drivable only during dry weather.

Photo 9. The outboard berm at Pond P2-12 showing the extensive tidal wetlands.

Cargill Helping the world thrive

December 21, 2023 VIA ELECTRONIC MAIL ONLY

Ms. Jenn Hyman
Bay Conservation and Development Commission (BCDC)
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San Francisco, CA 94105
Email: Jennifer.Hymann@bcdc.ca.gov

RE: Cargill Solar Sea Salt System Maintenance and Operations Project - Summary of August 30, 2023 ECRB Meeting Comments, EA Studies Letter, and Permit Timeline; (BCDC Permit Application No. 2021.003.00)

Dear Ms. Hyman,

The purpose of this letter is to respond to BCDC's Summary of August 2023 ECRB Meeting Comments, EA Studies Letter, and Permit Timeline (November 6, 2023 letter attached). BCDC's questions and comments are listed below, and Cargill's and AECOM QEA's responses are provided in green font.

1. **Preliminary Sea Level Rise (SLR) and Wave Runup Analysis**

   a. The analysis only looks at extreme tides up to 2010 and doesn't consider how last winter's extreme storms may influence the analysis. If possible, add analysis of storm tides from 2011 to present.

December 21, 2023 Cargill Response:

Background Context: ECRB members suggested that because Cargill's wave runup and overtopping analysis is based on hindcast water level and wave conditions from 1956 to 2010, that it may not capture more recent storm events such as the strong atmospheric river and precipitation events that occurred during the 2022-2023 winter. The suggestion is that the analysis may not be representative of more recent climate conditions.

AECOM Response: The wave runup and overtopping analysis conducted for this assessment relied on readily available hydrodynamic and wave modeling data developed for the FEMA coastal flood studies in San Francisco Bay. The outputs of this study included a 54-year hindcast of water level and wave conditions at various points along the San Francisco Bay shoreline. This dataset represents the most comprehensive historical modeling study of San Francisco Bay hydrodynamic and wave conditions that is publicly available.

Extending the 54-year model simulation from 2011 to present is not necessary for the purposes of this analysis because the hindcast period already includes the most severe coastal storm events in the historical record – in particular, storms that occurred during the 1982-83 and 1997-98 El Niño winters. The maximum recorded water levels for the San Francisco, Alameda, and Redwood City tide gages all

occurred in 1983 and extreme tides are the primary driver of extreme Total Water Levels (TWL) along the Bay shoreline. Further, a statistical extreme value analysis was applied to the annual maximum TWL events in our analysis to extrapolate the historical data and estimate extreme storm water levels at the shoreline, such as the 10, 25, 50, and 100-year return period TWLs to characterize the potential for events larger than those captured in the historical record to occur. It should be noted that the extreme storm events that occurred during the 2022-2023 winter were primarily extreme precipitation events – a review of observed tide levels over the course of the winter indicates that the highest observed tides were on the order of a 2 to 5-yr event.

It is generally accepted that historical records of approximately 30 years or longer are sufficiently long to develop reliable estimates of extreme TWLs along Pacific coast shorelines, so we have strong confidence in the extreme TWL estimated derived from this analysis.

While it is generally accepted that climate change will increase the intensity of extreme *precipitation* events in the Bay Area and elsewhere, there is less research and evidence suggesting that the magnitude and frequency of Bay Area *coastal* storm events will change in response to climate change.

Regarding trends in storminess for coastal storm events in the Bay Area, analysis conducted by the Delta Stewardship Council as part of the Delta Adapts Climate Change Vulnerability Assessment evaluated downscaled climate model projections of storm surge at the San Francisco tide station and found no evidence for projected increased magnitude or frequency of storm surge events through 2100 as a result of climate change. This is an active area of research and our understanding of the effects of climate change on coastal storm hazards in San Francisco Bay will improve over time. It is our professional judgment, based on interpreting the results of that analysis and conducting numerous evaluations of future coastal flood hazards across a range of coastal settings, that the primary driver of increased future coastal flood risk in the Bay Area is sea level rise, not changes in storm climatology. Since our analysis captures the effect of sea level rise in increasing local wave heights at the shoreline and the potential for enhanced wave runup, we feel we are capturing the primary drivers of increased coastal flood vulnerability at Cargill's facility.

Therefore, it is our opinion that extending the historical record an additional 10 years is not necessary given that the model hindcast period already covers 50+ years of historical events, including the largest coastal storm events on record and there is currently little to no evidence of increased coastal storminess due to climate change in the Bay Area.

b. Settlement was not taken into account, and the "History of P2-12 and P2-13 Berms" memo states that these berms were constructed in the 1950s. Please address this topic.

December 21, 2023 Cargill Response:
Settlement was not considered in AECOM's wave overtopping analysis, but AECOM's opinion is that settlement would have a small effect on the results in the near term. Rates of settlement on the berms are variable and not well quantified. Cargill proposes to continue its maintenance activities to restore berm crest elevations and address settlement as needed. Please note that

maintenance activities also include frequent and stringent monitoring of the berms which Cargill utilizes to prioritize specific locations for maintenance.

c. LiDAR data from 2016 was used. How have elevations changed since then? Provide the metadata that describes the vertical and horizontal accuracy of the LiDAR data. It was also suggested to perform a land-based survey in at least a couple of locations to confirm the absolute elevations (or datum) of the LiDAR model.

December 21, 2023 Cargill Response: AECOM confirms that Quantum Spatial has performed ground checks and quantified the accuracy of the LiDAR data. Please see Attachment 1 for the Technical Data Report. In addition, Cargill's consultant, Anchor QEA, will perform additional ground checks of the berm elevations during the geotechnical investigation.

d. State of California (OPC 2018) Guidance on SLR projections presents projected SLR increase over the 1991-2009 mean sea level, or from a year 2000 benchmark. Please address this issue by mapping present day flood levels with SLR to date.

December 21, 2023 Cargill Response*:*
Background Context: This comment notes that California Ocean Protection Council's (OPC's) sea level rise projections are provided relative to a baseline year of 2000 and that a 0" sea level rise scenario would be representative of Year 2000 conditions and not Year 2023 "current" conditions.

AECOM Response: We concur that the baseline year for OPC's sea level rise projections is 2000 and that care needs to be taken when adding sea level rise to tidal datum and extreme tide estimates so that sea level rise is properly accounted for in existing and future water level conditions. However, given the relative low rate of historical sea level rise in the Bay Area, over relatively short periods of time, the effect of these differences in baseline are negligible, as discussed below.

The NOAA 2022 sea level rise report includes analysis of historical sea level trends from 1970-2019 at the San Francisco and Alameda tide stations. In general, these trends show relatively low rates of recent sea level rise on the order of 1.5 mm (0.059 inches)/yr. (at Alameda) to 2 mm (0.079 inches)/yr. (at San Francisco), which are comparable to long-term rates observed over the 20th century.

Extrapolation of the NOAA tide gage historical trends projects the following amount of sea level rise at 2023 (relative to a Year 2000 baseline):

- San Francisco tide station: +1.8 inches from 2000 baseline
- Alameda tide station: +1.4 inches from 2000 baseline

It is noted that the DHI/FEMA model output is referenced to a baseline year of approximately 2010, for which observed sea level rise since 2000 would be estimated to be approximately +0.6 to 0.8 inches (assuming a recent historical rate of +1.5 to 2 mm (0.059 to 0.079 inches)/yr.). As such, the baseline

water levels from the model data have already been adjusted to 2010 sea level conditions, so any potential "missing" sea level rise would be that which occurred from 2010 to 2023.

Based on the above observed recent rates of sea level rise, the difference between a 2010 and 2023 baseline sea level condition is estimated to be approximately 0.8 to 1.0 inch. We therefore feel that our current baseline sea level condition (relative to the Year 2010) is a reasonable baseline for "current" or "recent historical" conditions. To address this comment, we have relabeled our figures to change "0 inches" to "Baseline", with the intent that "Baseline" refers to a 2010 (recent historical) condition from which comparisons can be made to future conditions.

e. Please provide an analysis of the likelihood and impact of berm overtopping and the risk of erosion, by presenting an analysis or discussion of the duration of overtopping events.

December 21, 2023 Cargill Response: There are no standard methods to evaluate landside scour of berm slopes due to overtopping. Alternatively, Cargill proposes to continue monitoring areas with the highest potential risk based on the SLR Assessment that identified various locations where over time had the potential for SLR and wave run up following large storm events. As explained previously, Cargill already implements a frequent and stringent monitoring program, in particular after storm events, to identify any areas that need to be prioritized for maintenance.

f. Less Critical Comments:

i. AECOM figures show results with one bin (or color) covering 10-100 year events. Please break this down into at least two bins, for example 10-50 and 50-100 year events.

December 21, 2023 Cargill Response: AECOM has completed this task. Please see Attachment 2.

ii. Storms are getting more intense due to climate change. There is no guidance on how to account for this; however, please take it under consideration and provide a general narrative on potential adaptive measures.

December 21, 2023 Cargill Response: Cargill has taken this into consideration and proposes to prioritize monitoring in the highest areas of risk identified from the SLR and wave run up analysis following large storm events, and to implement the Emergency Contingency Response Plan as necessary.

2. **Geotechnical Analysis**

a. Marine Oil Terminal Engineering & Maintenance Standards (MOTEMS) design guidance was used to select design earthquakes. This guidance has different risk levels (high/med/low) depending on risk of the facility. Ponds P2-12 and P2-13 risk to human health, the environment, and economic impact to existing development is still to be determined. Provide an assessment of the ecological, human health, and economic risk (consequences) of a release of mixed sea salts (MSS) to confirm which risk category and earthquake return

period is appropriate for your site. Your initial approach, to assume the highest risk level in the absence of a risk assessment, is acceptable.

December 21, 2023 Cargill Response:
Background Context: BCDC's November 6, 2023 follow-up letter indicates that BCDC concurred that the "initial approach, to assume the highest risk level in the absence of a risk assessment, is acceptable." Cargill provides further input from its geotechnical consulting experts at Anchor QEA in this response.

Anchor QEA Response: The Berm Stability Memo cited seismic design guidance from the Marine Oil Terminal Engineering and Maintenance Standards and application of a "high-risk" category criteria to the berms containing Ponds P2-12 and P2-13. The resulting earthquake event used in the seismic analysis presented was one with an average return period of 475 years.

This is a conservative approach because Cargill's berms would not pose a risk to human lives if they were breached and given the limited time span of the permit that Cargill is seeking, it could be argued that a smaller (lesser) return period would be more appropriate to the stability analysis. There was in fact some discussion during the August 30 meeting with ECRB that a 250-year return period might be appropriate.

Still, we recommend keeping the "high-risk" category and 475-year return period unchanged in the analysis. Using a shorter return period and smaller earthquake would not have a significant effect on the findings.

b. The berm geometry in the model outputs (Figure A.2 for example) shows an assumed top of berm 28 feet wide, berm height of about 4 feet from toe to top, outboard slope of about 7:1 and inboard slope of about 5:1. In correspondence between GAIA and Cargill, the MSS berms were described as 16 to 24 feet wide at the top. Using LiDAR data, examine actual berm widths and side slopes to justify the berm geometry analyzed. It is recommended to collect field data with topographic survey of the berms and conduct additional surveying at the critical sections for berm stability. Which berm sections have the critical geometry? Are there borrow ditches along the berm toes? Identify the areas of the berms that are critical regarding geometry and focus on these for the stability analysis.

December 21, 2023 Cargill Response:
Cargill Response: The outboard slope of the berms around P2-12 and P2-13 range from approximately 3:1 to 7:1, and the inboard slope varies from approximately 2:1 to 5:1. Borrow ditches once existed along the inboard side of the berm when the berms were created, but have since been filled in with salts. Such salt fills tend to agglomerate and stiffen over time. There are no borrow ditches on the outboard side of a berm.

Anchor QEA Response: Five critical sections were selected for stability analyses, with the most impactful (lowest safety factor) results presented in the Berm Stability Memo. The locations of the five selected

critical sections are shown in Attachment 3, relative to the topography of the perimeter berms, which is presented as color gradients relative to different surface elevations. Critical sections for the stability analyses were selected in a systematic manner, using key available information, as described in the following paragraphs.

First, available subsurface data were gathered from previously completed field investigations, comprising the dataset mentioned in the Berm Stability Memo. The most pertinent data were from cone penetration test (CPT) investigations performed by Berlogar Stevens and Associates (BSA; BSA 2017 and 2018), which generally reached a depth of 20 feet below the ground surface (berm crest). This information indicated a relatively consistent strength and thickness of young bay mud (YBM) and was used to generate the strength parameters summarized in Table 1, provided below in the response to item 2f. Since the CPT data did not reveal any significant geographic trends regarding the strength and thickness of YBM, it did not influence the selection of critical sections for analysis.

Second, topographic information from the site (LiDAR survey data; USGS 2020) was mapped to determine variations in the amount of vertical relief between the berm crest and the adjoining land areas. The site topography suggested that certain locations were most critical, as follows:

- Critical sections A, B, and C were selected based on proximity of the berm to adjoining tidal channels and on the vertical relief (elevation change) between berm crest and channel bottom.
- Critical sections D and E were based on proximity to San Francisco Bay waters.

Further in-field manual measurements of berm geometry will be obtained during the planned geotechnical field program documented in the *Geotechnical Investigation Work Plan* (Anchor QEA 2023) (the "Work Plan"), submitted to BCDC on December 8, 2023.

c. The berm seismic stability results show critical failure circles to be deep circles that include the full berm height; however, in some cases toe-slope failures may be more likely than deep failures. Analyze this toe circle scenario. Consider using the Spencer Method with non-circular failure surfaces, and consider the possibility of layered soils where failures follow weaker depositional layers. It is likely that soils underlying the toes of the berms are less consolidated than soils underlying the centers of the berms. Consider accounting for this in the analysis.

December 21, 2023 Cargill Response: The consolidation levels in the soils along the toe relative to the soils underlying the berms are unknown at present and will be assessed during the proposed Work Plan.

Anchor QEA Response: The stability analyses conducted by Anchor QEA evaluated the full suite of possible failure planes (angles and depths); methods (Morgenstern-Price and Spencer); shapes (circular, non-circular, auto-refined, block, and combinations thereof); and geometries (through entire berm, through center of berm, and intercepting toe of berm), appropriate for the subsurface conditions evident from available data. Rather than publishing the full set of stability analyses run—

well over a hundred different analyses—we selected stability analysis results that had the lowest factors of safety. These were included in the package submittal to the ECRB on July 31, 2023, and primarily depicted the results of circular failure analyses, because these modes of potential failure tended to be the most critical (lowest FOS).

Further example analysis results are included as Attachment 4 to this transmittal, to represent additional variations in failure planes, methods, and geometries that were not represented in the original July 31 document. Note that the full spectrum of analytical variations are not always evident from these output results, because regardless of how the analysis is initiated, the program converges its final result to the "worst-case" (lowest FOS) outcome of all potential outcomes for a specific analytical model. While the analyses specifically allowed for consideration of significant deviations from circular failure modes when initiated, the program typically converged on circular, or near-circular, failure modes as the ultimate "worst-case" (lowest FOS) outcome. From that perspective, the analyses results represent the most conservative scenarios.

When evaluating the geotechnical character of a site, the Anchor QEA team acknowledges the possibility for layered soils that may allow preferential failure planes to potential develop through weaker depositional layers. However, our analyses were developed to specifically represent the subsurface conditions inferred from available geotechnical subsurface information, and the available site information did not reveal indications of significantly weak continuous layers being present. The potential for weak layers to be present in Young Bay Mud will be further evaluated by the planned field investigations described in the proposed Work Plan.

The results of the additional higher safety factors analyses do not change the results of the initial analysis presented to the ECRB.

d. Could coring (keying) of the berm with native or imported materials create potential preferential failure planes? Perform berm stability analyses on these scenarios to address this.

December 21, 2023 Cargill Response:
Anchor QEA Response: The effect of keying on berm global stability and seepage potential is dependent on the materials used to backfill the keying trench, their level of compaction and shear strength compared to the in-situ material removed from the trench.

Prior to keying, the berms predominantly consisted of YBM materials that were originally placed when the berms were built decades ago, and typically consists of silty clay with variable sand content. Because the berm material was sourced from immediately adjacent areas of the Bay and the ponds, it is very similar in its material properties to the YBM layer directly underneath the berms, although in a more compacted state than the native YBM material due to the combined effects of reconstitution of soil particles, compaction under self-weight, drying and active vehicular traffic loads.

The most useful existing data for densified berm material is available from explorations presented from BSA (2017 and 2018), confirming that the berm material is a fine-grained material with characteristics consistent with underlying softer YBM deposits. (The BSA explorations pre-date Cargill's recent keying activities, as is discussed later in this memorandum).

Cargill's regular berm inspections identify candidate areas for keying. Trench excavation for keying is conducted to remove soil that may have higher organic content (e.g., vegetation or peat). By backfilling the trench with compacted material from on-site stockpiles, the intention is to replace the excavated material with a controlled and purposely compacted backfill material within the berm.

Cargill follows stringent import material specifications as per the permit conditions when accepting and receiving off-site soils. Cargill requires documented testing data demonstrating that imported material meets its standards for clean material. Cargill's Clean Import Material Request Form requires that:

> *"The import material must be free of debris, trash and other foreign materials* [including excessive organics] *… In the event delivered import material does not meet Cargill specifications, the Requestor* [the outside party delivering the material] *shall remove and/or clean import soil at Requestors expense."*

The selection approach to accepting material for on-site use is supported and confirmed through a direct evaluation of the soils used as backfill. In 2022, Anchor QEA conducted a reconnaissance and sampling program for Cargill's on-site stockpiles (Anchor QEA, 2022). The observed stockpile was approximately 350 feet long, 8-10 feet high, and between 20 and 150 feet wide, and appeared to be relatively uniform in composition, containing predominantly brown, silty sand with clay and some gravel. No significant debris, cobbles, or large organic material, such as branches or wood, were noted in the stockpile, consistent with Cargill's screening and acceptance procedures.

Stockpile samples were tested for moisture content, density, specific gravity, plasticity, grain size, and compaction. These physical analyses provide information useful for assessing suitability in construction applications, including fill placement, backfilling, compaction, and grading. These tests resulted in the soil classifications summarized in Table 1.

Table 1: Summary of On-Site Stockpile Sampling (Anchor QEA, 2022)

Sample	Material Description	Max. Dry Density (pounds per cubic foot)	Optimum Moisture Content (%)
B1	Brown sandy lean clay	115.2	13.3
B2	Yellow-brown sandy clay with gravel	117.9	12.0
B3	Brown clayey sand	119.1	11.7

The material types observed in the on-site stockpiles, as summarized in Table 1, are expected to be significantly more competent, once compacted, than the fine-grained YBM materials that comprise and underlie the berms. The reduced organics and plasticity associated with the backfill materials relative to the trenched soils combined with the compaction effort during their placement is likely to increase the emplaced density, stiffness and strength of the berm core. These attributes are likely to reduce the potential for localized degradation or softening within the key induced by transient loading. Therefore, the placement of a key is likely to provide additional resistance to any potential failure surfaces that may extend across the berm, thereby engendering greater overall stability in a keyed berm. Therefore, the keying process is unlikely to create any preferential failure planes.

A more comprehensive analysis of the keyed backfill material will be completed after further planned field investigations on site and is described in the Work Plan submitted to BCDC on December 8, 2023.

e. Berm stability is strongly dependent on the modeled thickness of the YBM as well as the berm height. The YBM thickness chosen appears to be too thin (typically shown as 7-8 ft) compared to the CPT data, which shows typically 16-20 ft thickness or more. (The CPT data presented terminates at a depth of 20 feet, so presumably the YBM extends deeper than this in at least some cases.) The ECRB recommends giving priority to CPT data where available, especially for identifying the top and bottom of YBM as well as for defining its strength profile, rather than developing profiles based on limited boring log data and a few strengths from lab data. They suggest creating a plan-view figure showing each CPT along the berm and the YBM thickness at each (see the Geomatrix [2006, Fig. 2] isopach map provided with the project data). Some CPT logs are cut off before the bottom of the YBM is reached; any future CPTs (as well as borings) should extend at least a few feet below the bottom of YBM. Use the CPT data to identify the most critical areas of the berms in terms of YBM thickness.

December 21, 2023 Cargill Response: The proposed Work Plan will assess the true depth of underlying soft sediments within the Young Bay mud layer and further delineate any regions where this layer is at its thickest. The proposed CPTs in the Work Plan will extend 30 feet below ground surface or at least 1-2 feet below the bottom of the YBM layer. (Please refer to the response provided in 2b above for additional information.)

Anchor QEA Response: Available CPT data from BSA (2017 and 2018) were considered a priority source of data and were evaluated relative to the properties of YBM. Since the CPT data did not reveal any significant geographic trends in the strength and thickness of YBM, it was not a factor in selecting critical sections for analysis (as shown in Attachment 3).

f. The Table of Summary of Undrained Soil Properties Used for Analyses shows the Cohesion at the base of the Young Bay Mud (YBM) to be 1,000 psf; however, this will be dependent

on thickness of the YBM and so correct this number to reflect the thickness used in the model.

December 21, 2023 Cargill Response:
This comment references the estimated strength properties of YBM, as shown in Table 1 of the Berm Stability Memo. Specifically, there was some uncertainty in the interpretation of cohesion applied to deeper portions of the soil units. The table has been updated by Anchor QEA as follows:

Table 2
Summary of Undrained[1] Soil Properties Used for Analyses

Soil Units	Unit Weight (lb/cf)	Cohesion, Top of Unit (psf)	Cohesion Increase with Depth (psf per foot of depth)	Limiting (not to exceed) Maximum Strength Value (psf)
Densified Berm Fill	115	700	12, not to exceed limiting maximum value	1,250
YBM	105	300	8, not to exceed limiting maximum value	1,000
Old Bay Mud	115	1,500	12, not to exceed limiting maximum value	4,000

Notes:
1. Undrained properties are most appropriate for the soil types encountered at this Site, as discussed in text.
lb/cf: pounds per cubic foot
psf: pound of force per square foot
YBM: young bay mud

The strength properties for YBM are the most influential of all the soil units on the stability analysis. The CPT results obtained by BSA (2017 and 2018) suggest that the strength of YBM ranges from 300 to 500 psf, so the selection of values shown in Table 1 is considered accurate and conservative overall.

Collection of additional site data will allow for confirmation and refinement of our existing understanding of site subsurface conditions. A plan for further geotechnical investigations at Ponds P2-12 and P2-13 is presented in a separate *Geotechnical Investigation Work Plan* (Anchor QEA 2023). This set of investigations is intended to confirm, clarify, or allow modification to these estimates of soil strength.

g. If the required seismic Factor of Safety is not met, then displacement analysis shall be performed to assess the magnitude of displacement and the risk of a MSS release after the design event.

December 21, 2023 Cargill Response: Noted.

h. Less Critical Comments:

December 21, 2023 Cargill Response: To allow for resources to focus on critical comments, these less critical items were not addressed unless noted.

i. Provide a tabulation of available relevant moisture content data.

ii. Perform a sensitivity analysis of the results on critical parameters such as thickness of YBM and berm geometry.

iii. Could horizontal layering of the berm or the underlying Young Bay Mud (YBM) contain potential preferential non-circular failure planes? Perform berm stability analyses on this scenario to address this.

3. **Geotechnical Workplan for Supplemental Investigation**

a. Instead of the proposed 4 borings and 1 CPT, all extending to 100 feet, as proposed in the applicant's presentation, it is recommended to perform just 1 or possibly 2 soil borings and numerous CPTs (likely as many as 2 dozen or more 30-foot CPTs could be performed for a similar cost to a couple of 100-foot borings) that extend at least a few feet below the bottom of the YBM (possibly 20 to 30 feet?), possibly with 1 or 2 CPTs down to 100 ft, since CPT data will be more reliable for this study than soil borings. At least one deep CPT could have shear wave velocities measured for use in evaluating the seismic site class.

December 21, 2023 Cargill Response: The Work Plan has been revised to propose 24 cone penetrometer tests (CPTs) and 1 additional deep boring that will be advanced to a depth of 100 feet. The Work Plan was submitted to BCDC on December 8, 2023. The deep exploration will be conducted as a seismic CPT to allow for indirect determination of shear wave velocity, to confirm or modify values used in our analyses.

b. CPTs should be located in particular along the anticipated critical cross sections of the berms.

December 21, 2023 Cargill Response: The CPT locations have been selected based on the geographic arrangement of different locations subject to varying wind, deposition, and wave action such that a variety of different locations are represented. Critical sections, or areas where there is the most abrupt elevation difference between the berm crest and adjoining water, were also an important consideration in locating the planned explorations.

c. Anchor said they will collect hand auger samples at the toes of the berms. This is a good idea since they are likely to be less consolidated. Also investigate the geometry and elevations of the borrow ditches along the interior berm toe while there.

December 21, 2023 Cargill Response: The Work Plan has been revised to accommodate 7 hand auger explorations. Borrow ditches once existed along the inboard side of the berm and have since been filled with salt. Cargill's consultant will perform ground checks as able during the geotechnical investigation.

d. Please provide an updated geotechnical workplan to BCDC for review.

December 21, 2023 Cargill Response: The revised Work Plan was submitted to BCDC on December 8, 2023. Cargill received comments from BCDC on December 18, 2023, and Cargill will be preparing a response.

e. Less Critical Comments:

December 21, 2023 Cargill Response*:* To allow for resources to focus on critical comments, these less critical items were not addressed unless noted.

i. It may be useful to obtain high-quality undisturbed soil samples (e.g., with a Dames & Moore or other piston sampler) and perform laboratory consolidation tests to estimate berm settlement.

ii. It was suggested to collect soil samples for moisture testing as a less-expensive way to estimate degree of consolidation.

Moisture content is included in the Work Plan, submitted to BCDC on December 8, 2023.

iii. With at least some of the CPTs, conducting pore pressure dissipation testing may be useful to assess consolidation behavior.

Pore pressure dissipation testing is included in the Work Plan, submitted to BCDC on December 8, 2023.

4. **Seepage/Berm Coring**

a. Please provide information on seepage through berms: is it known or suspected to occur; if so, how often and where does it happen; and how much seepage is detected?

December 21, 2023 Cargill Response: The berms are comprised of compacted soils. The soils likely have low permeability, which is reflected in the absence of persistent, predictable, or quantifiable brine seepage through the berms. This is monitored through Cargill's routine berm maintenance, including visual inspections of the salt ponds and associated berms. The visual inspections proactively focus on indirect indications of potential seepage risks, including distressed vegetation, discolored outboard berm soil, cracks in soil, and/or saturated surface soils. The identification of indicators of potential seepage facilitates prioritization of berm maintenance, including berm keying. As an example, Cargill observed indications of potential seepage along the NW side of P2-12 in 2020 and prioritized that stretch of berm for keying in 2020-2021.

5. **Additional Comments by BCDC**

a. AECOM, in their preliminary results in their updated SLR analysis, shows results for different levels of SLR, but these heights are not associated with specific years. In order for us to understand which scenarios will happen during the life of the permit, please provide estimates or ranges of predicted SLR associated with different years, including 2034, the anticipated final year of authorization for the permit. Note that OPC is expected to publish updated SLR guidance for California by the end of the year.

December 21, 2023 Cargill Response:
Background Context: BCDC requested additional information be provided on the potential timing for the various sea level rise scenarios evaluated in the wave hazard assessment, including providing a projection of potential sea level rise over the permit lifespan.

AECOM Response: Sea level rise projections are provided below assuming a permit lifespan through 2034. There are currently two primary sources of sea level rise projections for the State of California: the OPC (2018) sea level rise guidance and the NOAA (2022) federal guidance. The State is currently in the process of updating its sea level rise guidance and it is anticipated that the new guidance will closely align with the projections in the NOAA (2022) guidance. In both sources, sea level rise projections are provided in decadal increments, so projections for 2034 have been linearly interpolated from the 2030 and 2040 projections.

Based on consideration of all the available projections (various risk tolerance levels, multiple tide stations, extrapolation of recent observed sea level rise), **AECOM recommends adoption of 0.5 ft of sea level rise for planning purposes over the permit lifespan through 2034**, coupled with continued monitoring and adaptive management over that time. The various scenarios that correspond to a 0.5 ft projection are highlighted below. A projection of 0.5 ft at 2034 corresponds to the *Median* OPC (2018) projection for San Francisco, the *Intermediate* and *Intermediate-High* NOAA (2022) projection for San Francisco, and the *High* NOAA (2022) projection for Alameda.

OPC (2018) Projections for San Francisco Tide Station (ft)

Year	Median	Low Risk Aversion	Medium-High Risk Aversion
2030	0.4	0.5	0.8
2040	0.6	0.8	1.3
2034	**0.5**	**0.6**	**1.0**

NOAA (2022) Projections for San Francisco Tide Station (ft)

Year	Intermediate	Intermediate-High	High	Extrapolation of Recent Observations
2030	0.4	0.4	0.4	0.2
2040	0.6	0.7	0.8	0.3
2034	**0.5**	**0.5**	**0.6**	**0.2**

NOAA (2022) Projections for Alameda Tide Station (ft)

Year	Intermediate	Intermediate-High	High	Extrapolation of Recent Observations
2030	0.3	0.3	0.4	0.2
2040	0.4	0.5	0.6	0.2
2034	**0.3**	**0.4**	**0.5**	**0.2**

AECOM also estimated the timing of occurrence for the sea level rise scenarios evaluated in the wave hazard assessment: 6 inches, 12 inches, and 36 inches based on the OPC (2018) guidance as shown below.

Projected Timing of Sea Level Rise Based on OPC (2018)

Sea Level Rise (inches)	"As early as" (Medium-High Risk Aversion)	"Likely by" (Median)
6	<2030	2035
12	2035	2055
36	2065	2120

b. For both the berm stability analyses and the wave runup study, please consider the different elevations of the MSS Pond berms during the life of the permit, including the elevations to be identified in the Sea Level Rise Adaptation Plan described in #2 of Attachment A.

December 21, 2023 Cargill Response:

AECOM Response: Based on review of the AECOM (2016) San Francisco Bay Tidal Datums and Extreme Tides Study, it is AECOM's recommendation that a 100-year stillwater elevation of 11 ft NAVD88 be adopted for baseline conditions at the MSS ponds. As discussed above in Item 28, AECOM recommends adoption of 0.5 ft of sea level rise through the 2034 permit lifespan. Based on this guidance, **Cargill will target maintaining external berm elevations around the MSS ponds to meet or exceed 11.5 ft NAVD88 by 2034**.

c. Berm cores (excavations for keying) are shown in the Updated Cross-section Memo by Anchor QEA as being 10 feet across at the top and about 4-5 feet deep. The History of Berm Coring attachment states the berm core depth is 10 feet. In meetings, Cargill staff have described the berm coring as 2-3 feet wide. Please confirm the dimensions (width and depth) of the berm cores and in the next ECRB meeting, make a presentation on the issue of seepage and the practice of berm coring at the MSS ponds. Please provide a statement from Cargill's geotechnical engineer that the berm coring methodology currently being used is expected to increase the strength of the berms and reduce seepage.

December 21, 2023 Cargill Response:

As previously described to BCDC and the ECRB,[1] the purpose of berm keying is to remove soils that may have higher organic content (e.g., vegetation or peat), while increasing the density of the keyed soil matrix through reconstitution and additional compaction. Please see the response to 2d above, for a statement from Anchor on the berm coring methodology.

Anchor QEA Response:
The keying process begins by using a track-mounted excavator to open a trench along the approximately the centerline of a berm, and generally in sections that measure up to approximately 30 feet in length. The trench is excavated to a width of approximately 30 inches (the width of the excavator bucket). See Photograph 1.

[1] *See* June 20, 2023, Cargill submission to BCDC of responses to Items 1-3 in the BCDC/ECRB Dec. 20, 2022 Request Letter, at Appendix 3 ("History of BP-12 and BP-13) ("Cargill theorized that the inherent organic material (e.g., peat or plant detritus) in Bay muds could increase potential permeability of the mud. With the goal of strengthening the effectiveness of the berm, starting in 2019 Cargill improved keying methods by using more homogenous clean imported material to backfill the excavated core sections, instead of re-using the Bay Muds in the berms."); *see also* September 21, 2022, Cargill report to BCDC, at pg. 19 ("The internal cores of the berms are selectively compacted to maintain integrity and decrease the permeability of the berms and thereby reduce the risk of brines or water seeping through the berms.").

Photograph 1
Typical Excavation of Keying Trench

Source: Cargill

Once a depth of roughly ten feet below ground surface (BGS) has been reached, the keying trench has penetrated fully through the berm and into the underlying deposits of softer Young Bay Mud (YBM). The trench is then backfilled with soil fill available from on-site stockpiles and compacted with a sheepsfoot roller in individual lifts ranging from 2 to 4 feet thick. See Photograph 2.

Photograph 2
Typical Compaction in Keying Trench

Source: Cargill

The trench is backfilled with the in-situ material devoid of organic material and compacted using a roller or through passage of truck traffic, following which the backfill is levelled with the berm crest. All weather berm sections receive a surface layer of gravelly material.

Attachment 5 presents a generalized cross-section through a section of perimeter berm in which keying has been performed. The keying trench is shown roughly to scale, extending through the berm and into underlying Young Bay Mud (YBM) layer.

Please do not hesitate to contact me if you require further information or clarification.

Very truly yours,

Don Brown
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Cargill, Incorporated
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Attachments

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November 12, 2022

Rod K. Iwashita, P.E., F.ASCE, Chair
Engineering Criteria Review Board
San Francisco Bay Conservation and Development Commission
375 Beale St., Suite 510
San Francisco, CA 94105

RE: November 16, 2022 Engineering Criteria Review Board Meeting, Agenda Item #4

Dear Mr. Chairman and Board Members:

We appreciate the diligence of BCDC staff in seeking additional information from Cargill about its facilities and the ability to operate them safely, without risk to San Francisco Bay. After significant questions were raised last year regarding the draft Environmental Assessment for Cargill's Solar Sea Salt System Maintenance and Operation Activities, staff has diligently sought answers to pressing questions in order to establish appropriate permit guidelines and conditions. We appreciate the Board's attention to examine information collected to date and provide the staff with your additional input on the sufficiency of that information for crafting a permit. Our review of the staff report and supporting materials reveals significant additional questions we recommend the Board ask Cargill representatives and BCDC staff.

We remain deeply concerned that the extended storage of high volumes of bittern, which Cargill calls mixed sea salts (MSS) in ponds 12 and 13 immediately adjacent to the Bay, increases the stakes for effective maintenance of those pond berms, especially in a time of rising sea levels and increasing storm intensity and frequency. While Cargill has proposed a pipeline project with the East Bay Dischargers Authority to remove, dilute and discharge stored MSS over time, that project has not yet been approved, and the timing of its permitting, construction and operation are uncertain. Meanwhile, Cargill's annual salt production continues to add more bittern to the 6 million ton stockpile already in those ponds.

To provide additional relevant information for BCDC staff, other regulatory agencies and the public to assess past, current and future adequacy and integrity of the berms, the Engineering Criteria Review Board should ask for answers to questions on several topics. We appreciate you pursuing this information:

A) Seepage and Releases

The staff report represents seepage through berms as "highly limited," [staff report p.8] also that there is no evidence of "prolonged seepage" of brine or MSS [staff report p.9]. Cargill also states there is no "significant evidence" of seepage [ECRB Presentation Package p. 39]. These statements indicate that Cargill has been monitoring for seepage, and that there has in fact been some seepage that the staff memo does not quantify or date. The report does not define the terms "highly limited," "prolonged seepage," or "significant evidence".

- Has any brine of MSS exited from these ponds in the last 20 years via seepage, overtopping, leaks or in other ways, when and how much?
- Did Cargill report those releases to BCDC, the San Francisco Bay Regional Water Quality Control Board (RWQCB) or the U.S. Fish and Wildlife Service (USFWS)?
- How has Cargill monitored for seepage or other releases to reach the above conclusions? How did Cargill document that monitoring?
- Has BCDC obtained that documentation of seepage or other releases from Cargill and if not, why not?

B) Direct Inspections

- Has any staff from BCDC, RWQCB or USFWS inspected berms in these ponds in person, instead of relying solely on statements submitted by Cargill? If not, why not?

C) Ponds 12 & 13 Berm Core Compaction

The staff report contains the revelation that

> "Cargill completed approximately four miles of berm core compaction, primarily prioritized around P-12 and P2-13 (see Figure 3-2a through Figure 3-2d of the Package). This berm core compaction involved extracting the existing berm soils and refilling and compacting the trench with imported materials." [staff report p. 10]

Yet Cargill states that "no wide-scale repairs or berm reconstruction work has proven necessary due to seismic or erosive events." [Cargill ECRB Presentation Package, p. 39]

- What led Cargill to determine this significant berm core compaction work was needed? Did Cargill observe seepage or other berm integrity issues that prompted the company to conduct core samplings or other investigations? Has Cargill provided that information to BCDC and if not, why not?
- Why did Cargill determine that extracting the existing berm soils and replacing them with new material was necessary, after asserting that its bay mud berms are impermeable to seepage from ponds? [Cargill ECRB Presentation Package p. 36]
- What imported materials were used to refill and compact berm this trench? Were these imported materials tested for permeability before placement, and for compaction after placement? Has Cargill provided that materials testing data to BCDC and if not, why not?
- Were imported materials tested for chemical composition in advance of placement to ensure protection of the Bay from toxic contamination, and was this material certified by the RWQCB in advance of placement? If not, why not?
- Were imported materials screened according to Cargill's own specifications for acceptable riprap and clean material to ensure they are "free of debris, trash and other foreign material" [Draft Environmental Assessment, April 2021, Appendix 3]
- Was any of this extraction and refilling activity approved and permitted by BCDC or the RWQCB, and if not why not? Was this activity reported to these agencies in full through annual maintenance reports or other means before the current permit revision process was initiated?

D) Mixed Sea Salt Storage Volumes

Accurate assessment of berm safety and containment capability should be based on future MSS volumes stored in pond 12 and 13, and increasing potential for significant rainfall into the ponds from extreme storms added to MSS, not just current levels of MSS during extended drought conditions.

- What is the rate at which additional MSS is being added annually to the existing stockpile in ponds 12 and 13?
- How could these additions affect the integrity of the berms and the risk of seepage, spilling, or overtopping in combination with other factors, until the proposed pipeline to remove stockpiled MSS is approved, constructed and begins operating – which would be at least two years from now or longer depending on approval, permitting and construction delays [Cargill ECRB presentation package, p. 27]?
- If the pipeline does begin operation and removes MSS at the maximum rate proposed, and new material is being added to the stockpile at the same annual rate, what will be the net change in material volume each year?
- Has Cargill or BCDC modeled the impact of significant precipitation adding to combined MSS and water levels in ponds 12 and 13? What would be the impact of this added hydraulic pressure on seepage, risk of overtopping and berm integrity during all normal and extreme tide conditions?

E) Water Level Variation – Differential and Overtopping

Cargill's earthen berm maintenance and sea level rise assessment includes a figure presenting a "typical berm cross-section" [ECRB Presentation Package, figure 3-1] but does not detail how much variability in berm height and width, and internal and external berm water levels are present in ponds 12 and 13, and the potential for more significant differential water head to increase berm seepage.

Cargill also states "Although Bay water levels fluctuate tidally, on average there is typically less than a foot of difference between average water levels inside the ponds compared to average water elevations in the tidally influenced Bay." [Cargill ECRB Presentation Package, p. 39]. Reliance on "average" water levels does not address the risks to berm integrity, overtopping or other releases from ponds to the Bay by the much more significant differences between water levels inside the ponds and in the Bay from daily tidal fluctuations, seasonal variation, extreme storm precipitation and wind conditions, and the combination of these factors.

In addition, Cargill's sea level rise assessment notes, "overtopping only considers astronomical tide and storm tide and does not account for wave overtopping, which may occur along bayfront segments of the berms prior to still water overtopping." [AECOM Final Sea Level Rise Assessment, p. 13] The Assessment notes additional caveats regarding its inundation maps [AECOM p. 18]:

- maps "represent stillwater elevations and do not account for storm waves, rainfall or other potential variations in conditions that could affect the depth of overtopping at any given location…. Increases in storminess were not considered in this analysis. Various physical processes are typically grouped together under the term "storminess" including frequency and intensity of storms, shift in storm tracks, magnitude of storm surges, and wave heights."
- Maps "do not account for localized flooding associated with rainfall events or any changes to rainfall patterns, frequency, or intensity. During heavy rain events, berms along stormwater channels have experience occasional overtopping and scour in he past."
- "The maps do not account for potential berm failures or breaching that may occur due to scouring of berm walls during flood events or chronic inundation due to sea level rise."

- How much does the difference between internal and external berm water levels vary daily and seasonally in ponds 12 and 13? What combination of conditions creates the greatest difference in these levels, and what is the risk to berm integrity and exchange of water between ponds and the Bay under those conditions?
- Do Cargill operations dictate specified differential water head, and do they dictate a specific amount of combined mixed sea salts, brine and rainwater that can be safely stored in ponds 12 and 13?
- Has BCDC considered mandating restrictions on differential water head in Cargill's permit to ensure margin of safety against seepage or other release to the Bay?

F) Other Ponds

Several other ponds in addition to ponds 12 and 13 contain hypersaline materials.

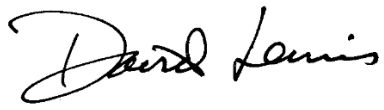
- How will BCDC evaluate and verify the integrity of these other berms and risk of seepage or failure there?

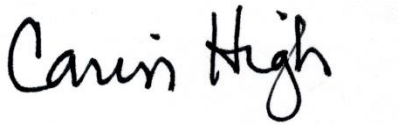
G. Vinyl Sheet Pile

The draft Environmental Assessment for this permit revision references a pilot study proposed by Cargill to install vinyl sheet pile in its earthen berms to improve their structural integrity.

- Has BCDC evaluated the feasibility, benefits and impacts of such installation?
- Has the RWQCB determined that placement of vinyl sheet pile in these berms is consistent with water quality protection guidelines?

Thank you again for your attention to these important issues. Sincerely,





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About Save The Bay

Save The Bay is the largest organization working to protect and restore San Francisco Bay for people and wildlife, with 60 years of accomplishments and tens of thousands of supporters. We led the movement to halt unlimited filling of the Bay in the 1960s, and sponsored the legislation to establish BCDC with the mandate to minimize fill and maximize public access to the Bay. We advocate to reduce pollution, expand wetlands and accelerate region-wide adaptation to sea level rise and other climate impacts. We annually engage more than 5,000 volunteers to restore the Bay shoreline, and educate thousands of students about the Bay.

About the Citizens Committee to Complete the Refuge

The Citizens Committee to Complete the Refuge (CCCR), has an ongoing history of interest in wetlands protection, wetlands restoration and wetlands acquisition. Our senior members were part of a group of citizens who joined together, and with the support of Congressman Don Edwards, requested that Congress establish the Nation's first national wildlife refuge in an urban setting. In 1972 legislation was passed to form the San Francisco Bay National Wildlife Refuge ("Refuge"). We turned to Mr. Edwards again, and in 1988, his legislation to double the size of the Refuge was signed into law. CCCR has taken an active interest in the protection of tidal wetlands and the habitats and species supported by complete tidal wetlands habitats, and in the McAteer-Petris Act and BCDC's Bay Plan. As such we regularly comment on permit applications, policies and potential permit non-compliance.