U.S. Department of Homeland Security
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, California 94607

FEMA

HANDOUT 8.1-A
06/25/19

June 21, 2019

The Honorable Joe Simitian
President, Board of Supervisors
Santa Clara County
County of Santa Clara Government Center
70 West Hedding Street
East Wing, 10th Floor
San José, CA 95110

Dear President Simitian:

This letter is a response to correspondence dated June 6, 2016 and June 8, 2016, from Valley Water (formerly known as the Santa Clara Valley Water District (SCVWD)) appealing the proposed 1-percent-annual-chance Base Flood Elevations (BFEs) and Special Flood Hazard Area (SFHA) boundaries for the San Francisco Bay (the Bay), as presented on the Preliminary Flood Insurance Rate Map (FIRM) panels and in the Preliminary Flood Insurance Study (FIS) report for Santa Clara County, dated July 8, 2015. Please note that Valley Water's request is considered an appeal because it satisfies the data requirements defined in Title 44, Chapter 1, Part 67 of the Code of Federal Regulations (44 CFR Part 67), and it was submitted during the 90-day appeal period for the aforementioned Preliminary FIRM panels and FIS report.

The following scientific and/or technical data were submitted in support of this request:

- Letter dated June 6, 2016, prepared by SCVWD, referencing "Appeals to the California Coastal Analysis and Mapping Project (CCAMP): San Thomas Aquino Creek & Hwy 237 Embankments. Community Nos. 060349 & 060350; DFIRM Panels 06085C0061H, 06085C0063H, 06085C0062J, & 06085C0064H." Attached to this letter was a levee data package for the San Tomas Aquino Creek East Bank North Levee and the Highway 237 embankments between Calabazas Creek and San Tomas Aquino Creek.
- MT-2 Forms 1 and 3 for the site north of Lick Mill Park/Glanera Street and between San Tomas Aquino Creek to the west and the Guadalupe River to the east
- "Geotechnical Investigation Report, San Tomas Aquino Levee Evaluation Project," dated April 2016 and prepared by PARKH Consultants
- Technical Memorandum regarding Embankment Construction and Freeboard Evaluation, dated June 3, 2016 and prepared by SCVWD
- "San Tomas Aquino Creek – East Bank Levee Operation and Maintenance Plan," dated June 6, 2016 and prepared by SCVWD
- Technical Memorandum regarding SCVWD's Position on the Embankment as a Flood Barrier, dated June 6, 2016, for the site north of Tasman Drive, south of Highway 237, east of Calabazas Creek, and west of San Tomas Aquino Creek
- Highway 237 as-built drawings (Caltrans, 1996)

- Standard Specifications – Earthwork Section (Caltrans, 1992)
- Construction Plans of San Tomas Aquino Creek from Calabazas Basin to (Old) Mt. View-Alviso Road (Santa Clara County Flood Control and Water Conservation District, August 13, 1962)
- An agreement between SCVWD and the U.S. Fish and Wildlife Service to maintain outboard levees of Salt Ponds A5-A15, signed May 8, 2014
- Letter dated May 14, 2015 regarding Coastal Hydraulic Modeling Conducted by SCVWD
- Mapping report prepared by DHI, dated May 18, 2016
- Report titled "South San Francisco Bay Santa Clara Valley Water District Coastal Hazards Analysis," prepared by DHI, dated April 2016, with Appendices A-D
- Review of Existing South San Francisco Bay Shoreline Levee Breaches, dated May 4, 2015
- Revised work maps prepared by DHI, dated June 7, 2016
- Revised preliminary FIRM geodatabase and supporting spatial files prepared by DHI, dated May 27, 2016
- Report titled "Regional Coastal Hazard Modeling Study for South San Francisco Bay," prepared by DHI, dated January 2013, with Appendices A-E
- Summary Memorandum: Review of Existing San Francisco Bay Restoration Levee Breaches, dated August 2, 2013

All technical data necessary to resolve this appeal were received by June 8, 2016 and FEMA Regional Staff met with Valley Water on June 10, 2019 to discuss the issues described below.

For clarity, Valley Water's appeal may be divided into two parts. The first focuses on the preliminary mapping behind the San Tomas Aquino Creek East Bank North Levee and the Highway (Hwy) 237 embankments. The second focuses on the preliminary mapping along the Bay coastline.

Appeal of the Preliminary Mapping Behind the San Tomas Aquino Creek East Bank North Levee and the Hwy 237 Embankments

FEMA reviewed the levee data package for the San Tomas Aquino Creek East Bank Levee north of Hwy 237 and the Hwy 237 embankments between Calabazas Creek and San Tomas Aquino Creek. This review assessed the compliance of the package with Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR Section 65.10).

The levee data package noted that FEMA's coastal hazard analysis assumed the San Tomas Aquino East Bank Levee would fail during the 1-percent-annual-chance event since it is not accredited by FEMA. Valley Water sought to certify a portion of the San Tomas Aquino Creek East Bank Levee and revise the preliminary FIRM panels to convert the proposed SFHA behind the levee to an area of reduced risk.

The levee data package also noted that FEMA's coastal hazard analysis assumed the Hwy 237 embankments would fail as they are not levees, allowing coastal flooding to extend south of Hwy

237. Valley Water sought to certify the Hwy 237 embankments and revise the preliminary FIRM to convert the proposed SFHA behind the non-levee embankment to an area of reduced risk.

The review of the submitted materials revealed that outstanding issues need to be resolved before the San Tomas Aquino Creek East Bank Levee north of Hwy 237 and the Hwy 237 embankments can be declared compliant with 44 CFR Section 65.10. These issues were documented in a memorandum dated January 17, 2019 and sent by FEMA's PTS contractor STARR II on behalf of FEMA to Emily Zedler with Valley Water.

Since these structures cannot be accredited by FEMA at this time, the proposed BFEs/base flood depths and SFHA zone designations are correct as shown on the Preliminary FIRM panels and in the Preliminary FIS report, and no changes are warranted.

Appeal of the Preliminary Mapping Along the San Francisco Bay Coastline

Valley Water contracted DHI to conduct an independent coastal flood hazard study of the Santa Clara County shoreline exposed to the Bay. Much of this shoreline includes former salt ponds constructed between upland developed areas and the Bay. These salt ponds are primarily owned and/or managed by the U.S. Fish and Wildlife Service (USFWS) who are in the process of restoring tidal wetlands to many of these areas. Currently, the salt pond complexes are in various states of conversion but are generally expansive open water areas separated by earthen berms. The condition of these earthen berms is variable, and no operation and maintenance plan or dedicated funding source has been established to repair and maintain these berms for flood protection.

Although these salt ponds were not constructed as flood protection measures, they may provide some ad hoc protection. Valley Water sought to characterize the flood protection benefits provided by the former salt pond berms in their modeling and analysis of the coastal flood hazards along the Santa Clara County Bay shoreline. Valley Water's study used a two-dimensional (2-D) modeling approach to develop spatially varying 1-percent-annual-chance stillwater elevations within the former salt pond complexes. Partial failure of the earthen pond berms was modeled using sustained 100-foot breaches (removal of 100-foot sections from the 2-D surge model grid) at selected locations to allow water to flow throughout the system. This approach restricted the flow into each pond, resulting in a lower 1-percent-annual-chance stillwater elevation within each pond than in FEMA's preliminary study.

A synthetic coastal storm event was developed for use in the 2-D model simulation to evaluate coastal flood hazards. Wave dissipation and regeneration within the ponds were modeled using similar methods as in the preliminary FEMA study; the earthen berms were retained and dissipate wave energy, interrupting wave regeneration as the waves propagate onshore.

FEMA has reviewed the materials submitted which form the basis of assertions that Valley Water's modeling provides a more refined definition of the existing conditions 1-percent-annual-chance flood hazard using this 2-D time-varying approach and earthen berm treatment. Following is a discussion of these assertions, the overall study, and the deficiencies identified in the review.

1. Valley Water did not provide any analysis, information, or evidence to satisfy the 44 CFR Part 67 requirement to prove that the analysis and results used in FEMA's study to inform the preliminary FIRM panels and FIS are scientifically or technically incorrect.

2. Valley Water's approach generally follows the "Structural Based Inundation Procedure" described in FEMA's July 2013 report "Analysis and Mapping Procedures for Non-Accredited Levee Systems," also known as the Levee Analysis and Mapping Procedure (LAMP). The Structural Based Inundation Procedure identifies the limits of the 1-percent-annual-chance flood that may result from levee failure by relying on the modeling of levee breaches. While this procedure does not require as much documentation from levee owners as other procedures within LAMP, it does require that levee reach segments be sufficiently characterized to support the calculations, and it requires operation and maintenance plans, structural design standards, and inspection reports be provided in accordance with 44 CFR Section 65.10. The documentation submitted for the pond berms does not satisfy 44 CFR Section 65.10. At a minimum, the maintenance plan should specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance. See 44 CFR Section 65.10(c) and 44 CFR Section 65.10(d) for more information regarding operation and maintenance plans and criteria.

3. Valley Water's levee breaching approach includes the use of 100-foot breach widths in each pond berm segment. The size of the breaches and the number and location of the breaches are not consistent with the Structural Based Inundation Procedure described in FEMA's July 2013 report "Analysis and Mapping Procedures for Non-Accredited Levee Systems," also known as LAMP, which recommends a breach width for partial failure of 100 feet for clay and 500 feet for sand. A soil analysis performed by GEI Consultants (2013) concluded that the berms were composed of consolidated clay to silty clay material. During the USACE (2015) field assessment of the South Bay pond berms, it was found that the soil composition of the dike crests ranged from loose silt to a loose soil mixture with high organic fiber content; therefore, modeling a range of breach widths would be more appropriate to account for the variance in soil type from silt to clay.

   Sensitivity analyses, as described in FEMA's Guidance for Flood Risk Analysis and Mapping: Levees (February 2019), were not submitted to support the assumptions of breach width, location, or the number of breaches.

   For reference, the average width of the breaches observed in the Bay by GEI Consultants (page 10, 2013) was 195 feet, and the maximum width observed was 675 feet, both significantly greater than the 100-foot breaches applied in Valley Water's study. The differences of up to 2 feet in the stillwater elevations between the Bay and inside the outer breached ponds also support the need for sensitivity testing of a range of breach characteristics and locations.

4. Valley Water used a mixture of response- and event-based approaches, which a previous Scientific Resolution Panel for San Mateo County (SRP CASMC120916) found did not result in a flood scenario that can be characterized as a 1-percent-annual-chance flood event. When using a combined response- and event-based approach, it is necessary to demonstrate that the selected storm event(s) are representative of the 1-

percent-annual-chance event. These events must consider all contributing factors to the 1-percent-annual-chance coastal flood event over the full duration of the event. Valley Water did not provide an analysis demonstrating that the statistical probability of the flood elevations and durations for the two selected storm events sufficiently characterized a 1-percent-annual-chance storm event. As described in FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016), additional analysis which considers water levels (including El Niño effects), storm duration, windspeed and direction, and accompanying rainfall must be considered when selecting or developing the modeled storm event(s).

5. Justification to support the decision to use a 5-year maximum discharge for freshwater riverine inflows in the 2-D modeling was not submitted. This approach deviates from other FEMA studies, and as noted in Item 4, accurately accounting for companion precipitation is required when simulating an approximated 1-percent-annual-chance event.

   Although the response-based approach completed by FEMA did not consider rainfall and the associated riverine hazards, the consideration of discrete events should consider all relevant processes that occurred during the event that contribute to local flooding. FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016) note that where streams are tributary to a sheltered water body, the definition of the 1-percent-annual-chance flood event should consider the effects of both riverine and tidal flooding. Valley Water assessed the sensitivity of the large-scale regional hydrodynamic model to riverine inflows, showing varying regional influences of the different river systems. The sensitivity analyses, however, did not include any breaches into the former and current salt ponds.

6. A detailed review of the Wave Height Analysis for Flood Insurance Studies (WHAFIS) modeling submitted by Valley Water noted several errors and inconsistencies.

   - Wave inputs on the outboard side of the salt pond berm system were reduced at the start of the transects. Although the outermost berm will dissipate the wave energy, appropriate input conditions should be used to evaluate wave runup and potential wave overtopping along the berms.
   - WHAFIS carding errors were noted throughout the study area and should be reviewed and revised for subsequent submittals.

7. A detailed review of the floodplain mapping for the Valley Water study revealed inconsistencies with regards to FEMA's mapping guidelines for flood hazard zone designations and base flood elevations.

   - WHAFIS modeling results did not support the mapped flood zones in several areas. One example occurs in the vicinity of Valley Water Transects 39-41 where a Zone VE (EL 11) is mapped in an area for which the WHAFIS results indicate no wave heights greater than 3 feet. The Valley Water SWEL is 9.4 feet

NAVD88 within this area, and the WHAFIS results support mapping a Zone AE (EL 10).

- There are several areas in the Valley Water mapping in which zones with BFEs greater than 3 feet above the FEMA statistical SWEL are labeled as AE Zones instead of VE Zones. This highlights a potential issue with using a time-varying SWEL instead of the statistical SWEL as a reference for the base flood, since SFHAs can theoretically have a lower BFE than a neighboring zone yet have a more restrictive zone designation. One example of this situation occurs at Valley Water Transect 48 which is near FEMA Transect 13, where the same SFHA that is classified as a VE Zone (EL 12) in the Valley Water study is classified in the FEMA study as a Zone AE (EL 13).

This appeal has been resolved in accordance with the requirements of 44 CFR Part 67, and we have determined that the proposed flood risk information is correct as shown on the Preliminary FIRM panels and in the Preliminary FIS report. No changes are warranted at this time. Please submit any comments regarding this appeal resolution within 30 days of the date of this letter to the following address:

Federal Emergency Management Agency (FEMA)
Mitigation Division
Attention: Alison Kearns, Risk Analysis Branch Chief
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

If you feel that the technical issues originally raised have not been adequately addressed by this resolution letter, and that an acceptable resolution will not be feasible through the submittal of additional comments as outlined above, please note that FEMA makes Scientific Resolution Panels (SRPs) available to support the appeal resolution process. SRPs are independent panels of experts in hydrology, hydraulics, and other pertinent sciences established to review conflicting scientific and technical data and provide recommendations for resolution. An SRP is an option after FEMA and a local community have been engaged in a collaborative consultation process without a mutually acceptable resolution.

To request that an SRP review your scientific or technical data, your community must complete the enclosed SRP Request Form and submit it to the address above within 30 days of the date of this letter. More information on this process is included in the SRP Fact Sheet.

If we do not receive any comments or the completed SRP Request Form from your community during the 30-day review period associated with this resolution, we will finalize the revised FIRM panels and FIS report by issuing Letters of Final Determination (LFD). The LFDs will explain the adoption/compliance process and will state the date when the revised FIRM panels and FIS report will become effective.

We appreciate your community's comments and commitment to having the most accurate flood hazard information available reflected on the FIRM panels and in the FIS report. As discussed during the June 10, 2019 meeting between Valley Water and FEMA Regional Staff, we look forward to continuing to work together to ensure compliance with Federal guidance and standards. If you have any questions regarding this matter, please contact me by telephone at 510-627-7125 or by e-mail at alison.kearns@fema.dhs.gov.

Sincerely,

Alison Kearns
Risk Analysis Branch Chief
FEMA Region IX

Enclosures:
SRP Fact Sheet and SRP Request Form
Metzger, N. Memo to Alison Kearns, Risk Analysis Branch Chief, FEMA Region IX, June 21, 2019
Ahrens, S. Memo to Emily Zedler, Associate Engineer, Valley Water, January 17, 2019

cc: Michael Harrison, Building Official, Santa Clara County
Melanie Richardson, Chief Operating Officer of Watersheds, Valley Water
Rich Tran, Mayor, City of Milpitas
Sharon Goei, Chief Building Official, City of Milpitas
Lisa Matichak, Mayor, City of Mountain View
Jacqueline Solomon, Assistant Public Works Director, City of Mountain View
Eric Filseth, Mayor, City of Palo Alto
Brad Eggleston, Public Works Director, City of Palo Alto
Sam Liccardo, Mayor, City of San José
Arlene Lew, Principal Engineer Technician, City of San José
Lisa M. Gillmor, Mayor, City of Santa Clara
Andrew Crabtree, Director of Community Development, City of Santa Clara
Larry Klein, Mayor, City of Sunnyvale
Trudi Ryan, Community Development Director, City of Sunnyvale
Raul Barba, State NFIP Coordinator, California Department of Water Resources
Craig Conner, Flood Risk Manager, San Francisco District, USACE
Charlton Bonham, Director, California Department of Fish and Wildlife
Kaylee Allen, Field Supervisor, San Francisco Bay Delta Office, U.S. Fish and Wildlife Services

OVERVIEW

SCIENTIFIC RESOLUTION PANELS

The Federal Emergency Management Agency (FEMA), through its flood hazard mapping program, Risk MAP (Risk Mapping, Assessment, and Planning), identifies flood hazards, assesses flood risks, and partners with states, tribes and local communities to provide accurate flood hazard and risk data to guide them in taking effective mitigation actions. The resulting National Flood Insurance Program (NFIP) maps provide the basis for community floodplain management regulations and flood insurance requirements.

What is a Scientific Resolution Panel?

FEMA's Scientific Resolution Panel (SRP) process reinforces FEMA's commitment to work with communities to ensure the flood hazard data depicted on Flood Insurance Rate Maps (FIRMs) are developed collaboratively, using the best science available.

Flood hazards are constantly changing, and FEMA updates FIRMs through several methods to reflect those changes. When proposed changes to a FIRM are met with conflicting technical and/or scientific data during a regulatory appeal period, an independent third-party review of the information may be appropriate. An SRP serves as an independent third party.

The SRP process benefits both FEMA and the community:

- It offers a neutral review process by independent third parties.
- It confirms FEMA's commitment to using the best science for the purpose of accurately depicting flood hazards on flood maps.
- It provides an additional opportunity for resolving community appeals involving conflicting technical and/or scientific data.

While FEMA had previously established an SRP process, the Biggert-Waters Flood Insurance Reform Act of 2012 formally established a statutory SRP process. The *Appeal and Comment Processing Guidance for Flood Risk Analysis and Mapping*, which incorporates the legislative requirements for the SRP, is available at www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping

For Additional Information

For more information on appeals, see the FEMA document *Appeals, Revisions, and Amendments to National Flood Insurance Program Maps: A Guide for Community Officials* at www.fema.gov/media-library/assets/documents/17930

Part 67 of the NFIP regulations, which pertains to appeals, is available at http://www.fema.gov/guidance-documents-other-published-resources

FEMA's Guidelines and Standards for Flood Risk Analysis and Mapping webpage includes the *Appeal and Comment Processing Guidance for Flood Risk Analysis and Mapping*: www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping

Templates and Other Resources: www.fema.gov/media-library/assets/documents/32786?id=7577

Other Important Links:

- NIBS Scientific Review Panel website: www.floodsrp.org/
- Risk MAP: www.fema.gov/risk-mapping-assessment-and-planning-risk-map
- Information on Recent and Upcoming Map Changes: www.fema.gov/status-map-change-requests
- Flood Insurance: www.floodsmart.gov

RISK MAPPING, ASSESSMENT, AND PLANNING PROGRAM (RISK MAP)

The Federal Emergency Management Agency's Risk MAP Program delivers quality data that increases public awareness and leads to action to reduce risk to life and property. Risk MAP is a nationwide program that works in collaboration with states, tribes, and local communities using best available science, rigorously vetted standards, and expert analysis to identify risk and promote mitigation action, resulting in safer, more resilient communities.

RiskMAP
Increasing Resilience Together

FEMA

Who Can Request an SRP?

A community, tribe, or other political entity with the authority to adopt and enforce floodplain ordinances for the area under its jurisdiction can request that FEMA use an SRP when conflicting technical and/or scientific data have been presented. For additional information, review the *Appeal and Comment Processing Guidance for Flood Risk Analysis and Mapping* at www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

When Can Communities Request an SRP?

A community can request an SRP if the following requirements have been met:

- It has not yet received a Letter of Final Determination (LFD) from FEMA.
- Conflicting technical and/or scientific data, submitted during the 90-day appeal period, resulted in different flood hazards than those proposed by FEMA.
- At least 60 days of community consultation with FEMA (but no more than 120 days) have taken place.

Additionally, a community that receives a FEMA-issued resolution letter and has not previously exercised the SRP process will have 30 days from the issuance of the letter to request an SRP.

Independent Panel Sponsor

The SRP process is managed by the National Institute for Building Sciences (NIBS), a non-profit organization independent of FEMA. NIBS will administer the SRPs, ensuring that proper guidelines and procedures are employed and maintaining a cadre of experts from which panel members are selected.

Panel Member Selection

Five panelists are convened for each appeal brought to the SRP request. Panel members are technical experts in surface water hydrology, hydraulics, coastal engineering, and other engineering and scientific fields that relate to the creation of FIRMs and Flood Insurance Studies (FIS) throughout the United States.

Based on the technical challenges associated with each request, NIBS develops a list of potential members with relevant expertise, from its cadre of experts. NIBS also checks that those listed are available to serve, do not reside in the state from which the appeal or data were filed, and have no personal or professional interest in its findings for the flood risk project.

NIBS provides the list to the community and FEMA to select the panel members. The community selects at least the simple majority (three), and FEMA selects the remaining panel members from the short list of cadre members, based on the technical challenges of the appeal or data submittal.

The Process

To request a review by an SRP, the community's Chief Executive Officer or designee completes an SRP Request Form and submits it to FEMA during the time periods outlined above. Once FEMA confirms that the situation and the conflicting technical and/or scientific data are eligible for an SRP, it forwards the SRP Request Form to NIBS, which will initiate the panel selection process and develop a list of potential members.

Once the panel is convened, panel members are provided with a summary of the issue, FEMA's data, and the data the community submitted during the 90-day appeal period. Panel members review the data and, on a point-by-point basis, deliberate and make a decision based on the scientific and/or technical challenges.

If the community feels it is necessary to make an oral presentation in support of its request, it must include a justification on the SRP Request Form.

Resolution

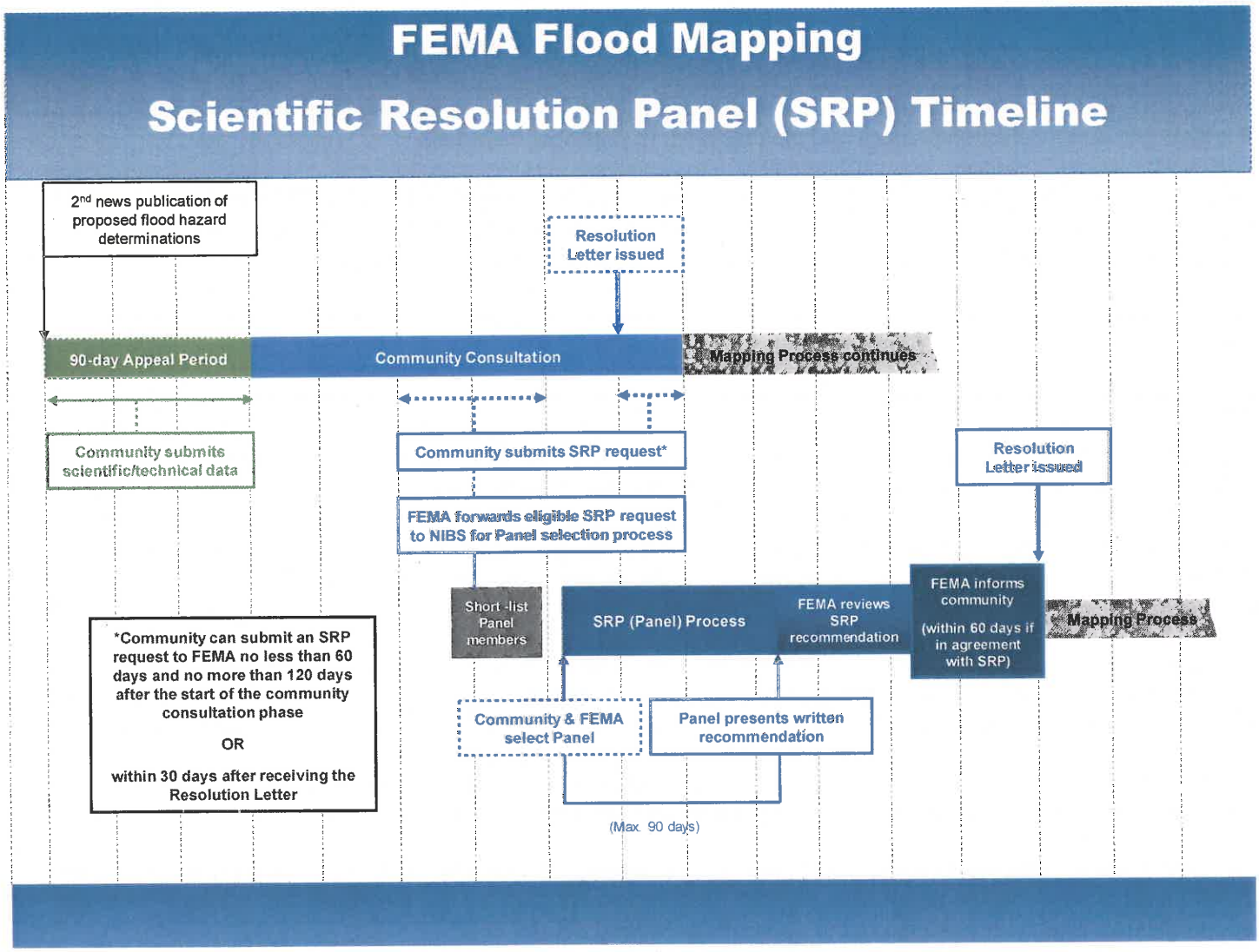
The panel must present its written report to the community and FEMA within 90 days of being convened, and that report will be used by the FEMA Administrator for making the final determination. A panel determination must be in favor of either FEMA or the community on each distinct element of the dispute, and the panel may not offer any alternative determination as a resolution. In the case of a dispute submitted by the community on behalf of an owner or lessee of real property in the community, the panel determination must be in favor of either FEMA, the community, or the owner/lessee on each distinct element of the dispute.

If changes to the maps are recommended in the panel's determination, and FEMA elects to implement the panel's determination, FEMA will incorporate the changes into a revised Preliminary FIRM and, if appropriate, FIS report. The revised products will be available to the community for review, with a resolution letter, before FEMA issues an LFD.

Once the SRP provides its determination and FEMA issues its resolution letter to implement the recommendations, the SRP recommendations are binding on all appellants and not subject to judicial review.

If the FEMA Administrator elects not to accept the panel's findings, the Administrator will issue a written justification within 60 days of receiving the report from the SRP. Under these circumstances, the appellants maintain their right to appeal FEMA's final determination to the appropriate Federal District Court.

Figure 1: SRP Timeline



US. Department of Homeland Security
500 C Street, SW
Washington, DC 20472

FEMA

Scientific Resolution Panel Request Form

This form is to be completed by the community's Chief Executive Officer (CEO) or the authorized representative of the community for which the appeal is being filed. The CEO will consolidate all unresolved appeals by private persons and submit them on their behalf. The CEO will also forward to FEMA copies of appeals not endorsed by the community and certify that no further appeals will be brought to FEMA for the community.

Date: _____

Name of Community: _____

County and State of Community: _____

Name of Community CEO or authorized representative: _____

Mailing Street Address: _____

City: _____ State: _____ Zip: _____

Phone Number (Work): _____

Phone Number (Cell): _____

Email Address: _____

Does the data submitted constitute an **appeal**? (Y/N)

If yes, does the submitted data satisfy the data requirements outlined in 44 CFR Section 67.6 (b) of the National Flood Insurance Program (NFIP) regulations and demonstrate that FEMA's proposed flood hazard determinations (proposed flood hazard determinations may include the addition or modification of Base Flood Elevations (BFEs), base flood depths, Special Flood Hazard Area (SFHA) boundaries or zone designations, or regulatory floodways) are:

☐ (1) technically incorrect due to a mathematical or measurement error or changed physical conditions?

☐ (2) technically incorrect due to error in application of hydrologic, hydraulic or other methods or use of inferior data in applying such methods?

☐ (3) scientifically incorrect?

If an oral presentation to the SRP is necessary to support this appeal, please justify here.

_____

Community Commitment and Certification

The community certifies that:

1. the data provided for SRP review was entirely submitted to FEMA during the 90-day appeal period.
   ☐ Y ☐ N

2. no additional data will be submitted for this or any other appeal for SRP consideration.
   ☐ Y ☐ N

3. there may be no submission of any other appeals not consolidated with this submission.
   ☐ Y ☐ N

Location of Contested Flood Hazard Determination Data

4. *Identify the specific river reaches or coastal transects challenged by the data.*

   _____

5. *Please identify areas of expertise the community believes are pertinent for representation on the SRP.*

   _____

6. **Description of information to be submitted by the community indicating that the flood hazard data proposed by FEMA are scientifically or technically incorrect**
Please include on a separate page labeled "Attachment A: Summary of Appeal Information" a summary of the specific technical issues, errors in FEMA's data, or different technical processes submitted to contest the flood hazard determination data proposed by FEMA.

7. **Acceptance by Community of Terms and Conditions for the Initiation of an SRP**
To initiate the SRP process, the community's CEO or authorized representative must accept the following terms and conditions on behalf of the community and individuals whose appeals are consolidated with this submission.

   a) The community understands that the FEMA Administrator is not required to accept the recommendation of the SRP, and that upon the Administrator's final determination that no further consideration will be given to the community's appeals. The parties will maintain their right to appeal to the appropriate Federal District Court pursuant to 44 CFR Section 67.12 of the NFIP regulations.

   b) The community has read the FEMA-prepared Guidance Memorandum titled "Implementing the Scientific Resolution Panel Process" and agrees to work with the National Institute of Building Sciences (NIBS) in the timely completion of the SRP review, including timely selection of panel members and participation in additional review procedures if requested.

   c) The community agrees that no contact will be made with the Panel members except as expressly requested by NIBS before, during or after the SRP review is undertaken.

   d) The community agrees that they have read and signed the "Community Submittal Agreement."

_____

Signature of Community CEO or Authorized Representive

STARR II Strategic Alliance for Risk Reduction

Date:	**June 21, 2019**
To:	**Alison Kearns, Chief, Risk Analysis Branch, FEMA Region IX**
CC:	**Eric Simmons, Ed Curtis, Patrick Clancey, Michael Bishop, FEMA Region IX**
From:	**Nicole Metzger, STARR II**
Subject:	**Santa Clara County BAC Study Appeal Review (MIP Case No. 17-09-0342S)**

STARR II completed the review of the June 6, 2016 and June 8, 2016 appeal submittals from Valley Water (formerly known as the Santa Clara Valley Water District (SCVWD)) regarding the preliminary Flood Insurance Rate Map (FIRM) panels and Flood Insurance Study (FIS) report dated July 8, 2015 for Santa Clara County. The submission included the following data and information:

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- Report titled "Regional Coastal Hazard Modeling Study for South San Francisco Bay," prepared by DHI, dated January 2013, with Appendices A-E

Appeal Overview

Valley Water's appeal may be divided into two parts. The first focuses on the preliminary mapping behind the San Tomas Aquino Creek East Bank North Levee and the Highway (Hwy) 237 embankments. The second focuses on the preliminary mapping along the San Francisco Bay (Bay) coastline.

Appeal of the Preliminary Mapping Behind the San Tomas Aquino Creek East Bank North Levee and the Hwy 237 Embankments

STARR II reviewed the levee data package for the San Tomas Aquino Creek East Bank Levee north of Hwy 237 and the Hwy 237 embankments between Calabazas Creek and San Tomas Aquino Creek. This review assessed the compliance of the package with Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR Section 65.10).

The levee data package noted that FEMA's coastal hazard analysis assumed the San Tomas Aquino East Bank Levee would fail during the 1-percent-annual-chance event since it is not accredited by FEMA. Valley Water sought to certify a portion of the San Tomas Aquino Creek East Bank Levee and revise the preliminary FIRM panels to convert the proposed SFHA behind the levee to an area of reduced risk.

The levee data package also noted that FEMA's coastal hazard analysis assumed the Hwy 237 embankments would fail as they are not levees, allowing coastal flooding to extend south of Hwy 237. Valley Water sought to certify the Hwy 237 embankments and revise the preliminary FIRM panels to convert the proposed SFHA behind the non-levee embankment to an area of reduced risk.

The review of the submitted materials revealed that outstanding issues need to be resolved before the San Tomas Aquino Creek East Bank Levee north of Hwy 237 and the Hwy 237 embankments can be declared compliant with 44 CFR Section 65.10. These issues were documented in a memorandum dated January 17, 2019 and sent by FEMA's PTS contractor STARR II on behalf of FEMA to Emily Zedler with Valley Water.

Since these structures cannot be accredited by FEMA at this time, the proposed BFEs/base flood depths and SFHA zone designations are correct as shown on the Preliminary FIRM panels and in the Preliminary FIS report, and no changes are warranted.

Appeal of the Preliminary Mapping Along the San Francisco Bay Coastline

Valley Water contracted DHI to conduct an independent coastal flood hazard study of the Santa Clara County shoreline exposed to the Bay. Much of this shoreline includes former salt ponds constructed between upland developed areas and the Bay. These salt ponds are primarily owned and/or managed by the U.S. Fish and Wildlife Service (USFWS) who are in the process of restoring tidal wetlands to many of these areas. Currently, the salt pond complexes are in various states of conversion but are generally expansive open water areas separated by earthen berms. The condition of these earthen berms is variable, and no operations and maintenance plan or dedicated funding source has been established to repair and maintain these berms for flood protection.

Although these salt ponds were not constructed as flood protection measures, they may provide some ad hoc protection. Valley Water sought to characterize the flood protection benefits provided by the former

salt pond berms in their modeling and analysis of the coastal flood hazards along the Santa Clara County Bay shoreline. Valley Water's study used a two-dimensional (2-D) modeling approach to develop spatially varying 1-percent-annual-chance stillwater elevations within the former salt pond complexes. Partial failure of the earthen pond berms was modeled using sustained 100-foot breaches (removal of 100-foot sections from the 2-D surge model grid) at selected locations to allow water to flow throughout the system. This approach restricted the flow into each pond, resulting in a lower 1-percent-annual-chance stillwater elevation within each pond than in FEMA's preliminary study.

A synthetic coastal storm event was developed for use in the 2-D model simulation to evaluate coastal flood hazards. Wave dissipation and regeneration within the ponds were modeled using similar methods as in the preliminary FEMA study; the earthen berms were retained and dissipate wave energy, interrupting wave regeneration as the waves propagate onshore.

Review Summary

STARR II reviewed the materials submitted which form the basis of assertions that Valley Water's modeling provides a more refined definition of the existing conditions 1-percent-annual-chance flood hazard using this 2-D time-varying approach and earthen berm treatment. Following is a discussion of these assertions, the overall study, and the deficiencies identified in the review.

1. Valley Water did not provide any analysis, information, or evidence to satisfy the 44 CFR Part 67 requirement to prove that the analysis and results used in FEMA's study to inform the preliminary FIRM panels and FIS are scientifically or technically incorrect.
2. Valley Water's approach generally follows the "Structural Based Inundation Procedure" described in FEMA's July 2013 report "Analysis and Mapping Procedures for Non-Accredited Levee Systems," also known as the Levee Analysis and Mapping Procedure (LAMP). The Structural Based Inundation Procedure identifies the limits of the 1-percent-annual-chance flood that may result from levee failure by relying on the modeling of levee breaches. While this procedure does not require as much documentation from levee owners as other procedures within LAMP, it does require that levee reach segments be sufficiently characterized to support the calculations, and it requires operations and maintenance plans, structural design standards, and inspection reports be provided in accordance with 44 CFR Section 65.10. The documentation submitted for the pond berms does not satisfy 44 CFR Section 65.10. According to the documentation submitted, USFWS does not have adequate maintenance plans for the pond berms, and it does not have a funding source dedicated to maintaining the berms. The majority of existing maintenance efforts focus only on berms that are in critical need of repair. A 2015 field assessment prepared by the United States Army Corps of Engineers noted a high potential for berm failure due to settlement, rodent tunneling, and drainage structures, and a 2015 levee survey noted observed deterioration of the berms due to subsidence and wave damage.

   Furthermore, there is an active plan to restore the flow into the former salt ponds by manually breaching and lowering the height of the berms. The South Bay Salt Pond Restoration Project (SBSPRP) is currently implementing restoration actions, with a long-term plan of restoring between 50 and 90 percent of the pond complex to tidal action to create tidal marsh habitat. Valley Water is an active participant in the SBSPRP and serves on the Project Management Team. The former salt pond complex is not destined to be a static landscape over the upcoming decades; therefore, the assumption in Valley Water's study that the ponds will remain as fixed features providing flood protection in perpetuity is not correct.

3. Valley Water's levee breaching approach includes the use of 100-foot breach widths in each pond berm segment. The size of the breaches and the number and location of the breaches are not consistent with the Structural Based Inundation Procedure described in FEMA's July 2013 report "Analysis and Mapping Procedures for Non-Accredited Levee Systems," also known as LAMP. Sensitivity analyses were not submitted to support the assumptions of breach width, location, or the number of breaches. For reference, the average width of the breaches observed in the Bay by GEI Consultants (2013) was 195 feet, and the maximum width observed was 675 feet, both significantly greater than the 100-foot breaches applied in Valley Water's study. The differences of up to 2 feet in the stillwater elevations between the Bay and inside the outer breached ponds also support the need for sensitivity testing of a range of breach characteristics and locations.

   Valley Water asserts that FEMA's study ignores the presence of the salt ponds and pond berms and dismisses the ad hoc protection they afford the inland areas behind them. FEMA's study did acknowledge some ad hoc protection afforded by the earthen berms by including them in the onshore modeling in which they dissipate wave energy as described in the "Natural Valley" method described in LAMP.

4. Valley Water used a mixture of response- and event-based approaches, which a previous Scientific Resolution Panel for San Mateo County (SRP CASMC120916) found did not result in a flood scenario that can be characterized as a 1-percent-annual-chance flood event. When using a combined response- and event-based approach, it is necessary to demonstrate that the selected storm event(s) are representative of the 1-percent-annual-chance event. These events must consider all contributing factors to the 1-percent-annual-chance coastal flood event over the full duration of the event. Valley Water did not provide an analysis demonstrating that the statistical probability of the flood elevations and durations for the two selected storm events sufficiently characterized a 1-percent-annual-chance storm event. As described in FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016), additional analysis which considers water levels (including El Niño effects), storm duration, windspeed and direction, and accompanying rainfall must be considered when selecting or developing the modeled storm event(s).

5. Justification to support the decision to use a 5-year maximum discharge for freshwater riverine inflows in the 2-D modeling was not submitted. This approach deviates from other FEMA studies, and, as noted in Item 4, accurately accounting for companion precipitation is required when simulating an approximated 1-percent-annual-chance event.

   Although the response-based approach completed by FEMA did not consider rainfall and the associated riverine hazards, the consideration of discrete events should consider all relevant processes that occurred during the event that contribute to local flooding. FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016) notes that where streams are tributary to a sheltered water body, the definition of the 1-percent-annual-chance flood event should consider the effects of both riverine and tidal flooding. Valley Water assessed the sensitivity of the large-scale regional hydrodynamic model to riverine inflows, showing varying regional influences of the different river systems. The sensitivity analyses, however, did not include any breaches into the former and current salt ponds.

6. A detailed review of the Wave Height Analysis for Flood Insurance Studies (WHAFIS) modeling submitted by Valley Water noted several errors and inconsistencies.

- Wave inputs on the outboard side of the salt pond berm system were reduced at the start of the transects. Although the outermost berm will dissipate the wave energy, appropriate input conditions should be used to evaluate wave runup and potential wave overtopping along the berms.
- WHAFIS carding errors were noted throughout the study area and should be reviewed and revised for subsequent submittals.

7. A detailed review of the floodplain mapping for the Valley Water study revealed inconsistencies with regards to FEMA's mapping guidelines for flood hazard zone designations and base flood elevations.
    - WHAFIS modeling results did not support the mapped flood zones in several areas. One example occurs in the vicinity of Valley Water Transects 39-41 where a Zone VE (EL 11) is mapped in an area for which the WHAFIS results indicate no wave heights greater than 3 feet. The Valley Water SWEL is 9.4 feet NAVD88 within this area, and the WHAFIS results support mapping a Zone AE (EL 10).
    - There are several areas in the Valley Water mapping in which zones with BFEs greater than 3 feet above the FEMA statistical SWEL are labeled as AE Zones instead of VE Zones. This highlights a potential issue with using a time-varying SWEL instead of the statistical SWEL as a reference for the base flood, since SFHAs can theoretically have a lower BFE than a neighboring zone yet have a more restrictive zone designation. One example of this situation occurs at Valley Water Transect 48 which is near FEMA Transect 13, where the same SFHA that is classified as a VE Zone (EL 12) in the Valley Water study is classified in the FEMA study as a Zone AE (EL 13).

Detailed Comments

The following comments provide additional details to substantiate the deficiencies noted above.

1. Valley Water did not provide any analysis, information, or evidence to satisfy the 44 CFR Part 67 requirement to prove that the analysis and results used in FEMA's study to inform the preliminary FIRM panels and FIS are scientifically or technically incorrect.

2. Valley Water asserts that FEMA's study approach to mapping coastal flooding limits using a static 1-percent-annual-chance stillwater elevation by projecting it onshore to controlling ground elevations is overly simplistic and overstates the Special Flood Hazard Area boundaries. Valley Water presents an alternate, more computationally sophisticated approach, with a goal of more accurately capturing the ad hoc level of flood protection provided by the former and current salt pond complexes. However, a more complex approach is not necessarily more scientifically or technically correct, particularly in the absence of validation data. FEMA's approach is consistent with FEMA guidelines and specifications, and no specific errors or scientific or technical inaccuracies were noted in the submission.

    The FEMA study employs the "Natural Valley" or "Without Levee" procedure described in LAMP, which extends the 1-percent-annual-chance stillwater elevation behind (shoreward) non-accredited structures and non-levee berms to the point where the stillwater elevation floodplain boundaries are equal to the controlling ground elevations. However, the "Natural Valley" approach that FEMA implemented does consider the wave hazard protection that the berms provide by accounting for wave dissipation in the WHAFIS modeling. FEMA considers the "Natural Valley" approach implemented for the preliminary FIRM panels to be the appropriate

procedure for application landward of the San Francisco Bayfront because it can be applied to all non-accredited levee reaches, there is no structural data required from the community to proceed with this approach, it does not rely on assumed breaching locations, and it does not rely on assumed long-term maintenance of the pond berms in the current or status quo condition.

Valley Water's method generally follows the "Structural Based Inundation Procedure" described in LAMP, which identifies the limits of the 1-percent-annual-chance flood that may result from potential levee failure by relying on the modeling of levee breaches along the levee reach. Although the Structural Based Inundation Procedure does not require the same level of documentation from levee owners as other procedures within LAMP, it does require that levee reach segments are described sufficiently to support the calculations that are provided, and in certain cases, additional documentation such as operations and maintenance plans, structural design standards, and inspection reports may be required. The additional documentation available for the pond berms does not support the breaching assumptions made by Valley Water.

The majority of the former salt pond complex in Santa Clara County is owned by USFWS as part of the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge), which is included in the SBSPRP. The SBSPRP is currently implementing Phase 2 of the restoration actions, with a long-term plan of restoring between 50 and 90 percent of the pond complex to tidal action, with a goal of creating tidal marsh habitat and promoting the capacity of wetlands to serve as natural flood protection elements. Valley Water is an active participant in the restoration program and serves on the Project Management Team. According to the SBSPRP Final Environmental Impact Statement Report[1], if tidal action is introduced to the former salt ponds, the effectiveness of the ponds as flood protection mechanisms would be substantially reduced. The restoration activities include breaching ponds and lowering pond berms to enhance tidal flows. If a restoration action results in a potential increase in flood risk for inland developed areas, then the project must include flood protection improvements. For example, in the town of Alviso in Santa Clara County, Valley Water partnered with USACE on the South Bay Shoreline Study. Through this project, USACE designed a levee improvement plus habitat creation project that includes a 4-mile long levee that will provide protection for ~5,500 people, ~1,100 structures, and the regional wastewater facility, while allowing the restoration of 2,900 acres of tidal wetlands within the pond complex[2]. The USACE Shoreline Study found that restoration of 2,900 acres of the former salt ponds would result in increased inland flood risk, and the project could not move forward without the construction of new flood protection levees.

As the SBSPRP moves forward with restoration actions, it will be necessary to re-evaluate the level of flood protection provided by the ponds and the restoring ponds, and additional new flood protection features may be required over time. The former salt pond complex is not destined to be a static landscape over the upcoming decades; therefore, the assumption in Valley Water's study that the ponds will remain as fixed features providing flood protection in perpetuity in a manner that is consistent with their historic salt producing legacy is not correct.

The level of flood protection provided by the ponds and their berms is contingent upon the active maintenance of the pond berms. Cargill, the former owner of the pond complex, provided summary maintenance records to the SBSPRP to assist with estimating future pond berm

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[1] US Fish and Wildlife Service & California Department of Fish and Game (2007) *Final Environmental Impact Statement/Report: Volume 1.*

[2] http://www.bcdc.ca.gov/cm/2018/0118SouthBayShorelineLeveeProjectEx.pdf

maintenance needs (see Table 1). These records indicate that Cargill provided frequent berm maintenance to address subsidence and erosion. However, the current owner (USFWS) does not have the necessary maintenance programs, and the Refuge does not receive specific funding dedicated to maintaining the ponds and pond berms. The USFWS maintenance efforts are reactive, focusing on berms that are in critical need of repair. Projects that cannot be accomplished under annual operations and maintenance budgets are submitted to Congress and prioritized nationally within a five-year plan for deferred maintenance needs and capital improvement projects.

Table 1: Summary of maintenance for the Alviso ponds complex from 1995 – 2005 (Geomatrix, 2006)[3]

Maintenance Type	Total Number of Events	Total Linear Feet	Total Cubic Yards
Subsidence Repair	397	413,179	3,780
Erosion Repair	66	20,970	13,465
All Repair	463	434,149	17,245

In addition to the lack of appropriate maintenance plans, it also appears that many of the berms are currently in poor condition. A geotechnical field assessment[4] of the pond berms in the pond complex (referred to as a 'dike system' in the USACE report) notes that potential failure of berms in the future is likely for both historically high-water levels as well as lower water levels due to a range of geotechnical issues, including settlement, rodent tunneling, and drainage structures. Based on the information from the field assessment, and the fact that the berms have not been regularly maintained, the USFWS concluded that the berms are shorter and narrower (compared to previous surveys) due to subsidence and wave and storm damage.

Valley Water asserts that berms can likely withstand a 1-percent-annual-chance coastal storm event based on historical observations that no failures occurred over the last 100 years that resulted in inland flooding of developed areas. However, this assertion does not consider the change in ownership of the pond complex from an actively managed salt production center to a reactively managed long-term wetland restoration site.

3. Valley Water's levee breaching approach includes the use of 100-foot breach widths in each pond berm segment. The size, location, and number of breaches are not consistent with the Structural Based Inundation Procedure.

   Valley Water established the modeled breach width as 100 feet for all breaches based on LAMP guidance, which recommends a breach width for partial failure of 100 feet for clay and 500 feet for sand. Soil analysis[5] performed by GEI Consultants (2013) concluded that the berms were composed of consolidated clay to silty clay material. During the USACE (2015) field assessment of the South Bay pond berms[4], it was found that the soil composition of the dike crests ranged from loose silt to a loose soil mixture with high organic fiber content, indicating that there is a high potential for erosion at points along the berm crests; therefore, modeling a range of breach widths would be more appropriate to account for the variations in soil type from silt to clay.

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[3] Geomatrix Consultants (2006). *Levee Assessment.*
[4] USACE (2015). Geotechnical Field Assessment of the San Francisco South Bay Dike System.
[5] GEI Consultants (2013). Summary Memo: Review of Existing San Francisco Bay Restoration Breaches.

The pond complex includes external berms (e.g., along the Bayfront) and internal berms (e.g., between the Bayfront and the inland developed areas). Table 2 from the GEI (2013) suggests that external breaches are likely to be significantly larger than internal breaches[5]; therefore, the use of different breach widths for internal and external breaches may also be more appropriate.

Table 2: Summary Table of Average Current Breach Widths (GEI, 2013)[5]

Breach Type Category	Number of Breaches Included	Average Current Breach Width (ft)	Minimum Current Breach Width (ft)	Maximum Current Breach Width (ft)
External	15	195	45	675
Tidal-Fluvial	19	101	45	240
Internal	18	74	25	160
Armored	8	161	50	525
Unplanned	2	115	50	180

The largest difference in the 1-percent-annual-chance stillwater elevation submitted by Valley Water between the Bay and the first salt pond, as seen in Figure 1, is nearly 2 feet. This difference in the stillwater elevation is evidence that the approach being used by Valley Water is giving the berms credit for flood protection that has not been proven based on available documentation. The use of a wider external berm breach and additional breach locations could reduce this difference and should be explored through sensitivity analysis.

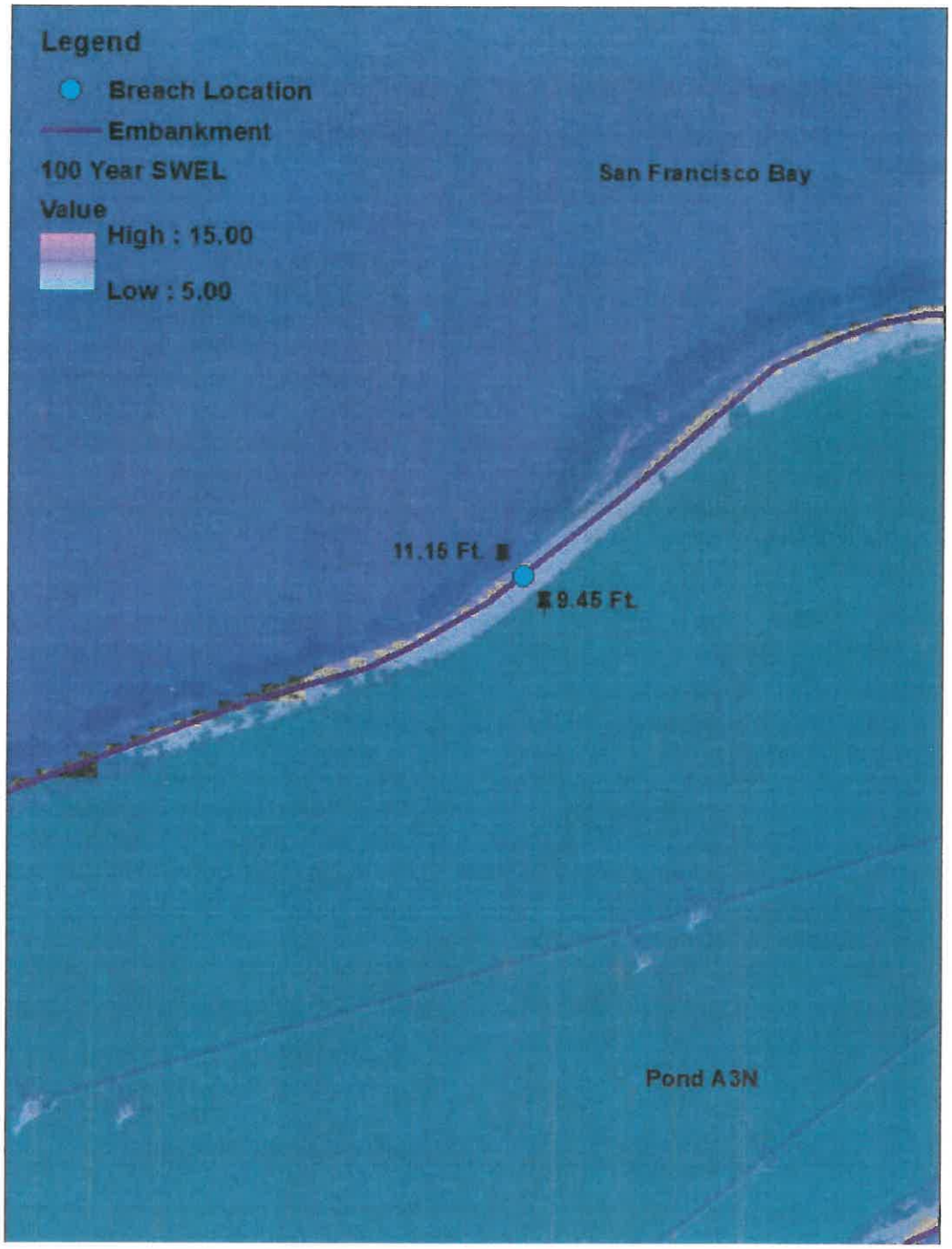

Figure 1: 1-percent-annual-chance Stillwater Elevation of San Francisco Bay and Bayfront pond (Pond A3N)

Valley Water generally placed breaches where historic tidal channels were located and sometimes where levee crests appeared to be low and susceptible to erosion. According to the Structural Based Inundation Procedure, breach locations should be selected using one of the following criteria/methods listed in Table 3. The method used by Valley Water to select breach locations does not follow the methods described in the LAMP Guidance for this type of structural

breaching analysis. The deficiencies in Valley Water's approach for each method from the LAMP Guidance are described in Table 3.

Table 3: Structural Based Inundation Procedure method vs. Valley Water method

Structural Based Inundation Procedure method	**Application or deficiency of Valley Water's method**
Select initial breach locations for each levee reach, one representing breach location near the downstream end of the levee reach and another near the upstream end of the reach	Although this is most applicable for riverine applications, in this application, it can specify the need for pond berm breaches along the tributaries both near the Bayfront and inland near the upstream end of the pond complex. However, some tributaries have limited pond berm breaches.
Determine the breach hydrograph associated with the 1-percent-annual-chance flood as though it occurs independently and combine the results into a composite SFHA delineation	The 2-D simulation assumed all pond breaches occur concurrently and the breaches are open throughout the entire simulation. It is unclear if a series of "worst case" scenarios of pond berm breaches could have been modeled to create a composite SFHA delineation. Additional sensitivity analysis is likely required.
Make an initial judgement, through examination of terrain landward of the levees and/or prelim modeling results, on whether selected breach locations will be considered to have been reasonably identified when all potential storage areas and flow paths that can be reached by breach flows reflect potential hazard	It appears that the breach locations were selected to allow all ponds within the complex to circulate Bay water. However, it is unclear if additional breach locations would have enhanced circulation and resulted in higher 1-percent-annual-chance stillwater elevations. Additional sensitivity analysis is likely required.
Add additional breach locations to initial locations if additional breaches can change the flood elevations or the extent of the composite floodplain significantly	Sensitivity testing of the breach sizes and breach locations was not completed. However, based on the difference in 1-percent-annual-chance stillwater elevation between the Bay and the ponds (see Figure 1) it is likely that additional breaches would change both the water levels in the ponds and composite floodplain.

Valley Water asserts that the FEMA study ignores the presence of the salt ponds and pond berms and dismisses the ad hoc protection they afford the inland areas behind them. FEMA's use of the Natural Valley approach assumes that the pond berms will not provide flood protection during a 1-percent-annual-chance event. However, the FEMA study assumes that pond berms would not fail along their entire length, and the pond berms remain in the analysis to dissipate wave hazards. The ponds and pond berms are considered within the one-dimensional (1-D) wave modeling completed by FEMA, and wave regeneration is generally interrupted by the presence of the pond berms. This approach is consistent with the Natural Valley procedure.

Valley Water's method (as noted in Item 2) restricts the flow of water into and out of the former salt ponds, resulting in stillwater elevations within the pond complex that are lower than the 1-percent-annual-chance stillwater elevation in the Bay. These reduced stillwater elevations in turn support smaller wave heights, resulting in significantly lower base flood elevations in the inland developed areas onshore (up to 5 feet lower). Except for the lower stillwater elevation inputs, the overland transect-based wave analysis is conducted using the same methods as used in FEMA's study. In the absence of sensitivity analysis, Valley Water likely over estimates the ad hoc protection afforded by the pond complex.

4. Valley Water asserts that a synthetic "design storm" hydrograph adequately represents the 1-percent-annual-chance event. The Valley Water design storm is based upon two historical events in January 1983 and December 1983 which are "scaled" to match the peak storm surge used in the FEMA study. However, these two events were selected based solely on water elevation and may not adequately represent the 1-percent-annual-chance event if all relative contributing processes are considered and evaluated.

   Valley Water's approach uses a combined response- and event-based approach (e.g., water level based on probability analysis and duration selected from two discrete events from the observation record). To use this approach, it is necessary to justify the selection of storm event(s) as being representative of the 1-percent-annual-chance event. In addition, all contributing factors to the 1-percent-annual-chance coastal flood event over the full duration of the event must be considered, including (but not limited to) stillwater elevations, storm duration, windspeed and direction, precipitation, and wave effects. Valley Water did not provide analysis demonstrating that the statistical probability of the synthetic design storm used sufficiently characterized a 1-percent-annual-chance storm event. As described in FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016), additional analysis which considers water levels (including El Niño effects), storm duration, windspeed and direction, and accompanying rainfall must be considered when selecting or developing the modeled storm event(s). Sufficient documentation of how the selected synthetic storms were evaluated and scaled for use as boundary conditions for the 2-D modeling simulations and information regarding storm duration has not been submitted.

   A recent Scientific Resolution Panel (SRP CASMC120916) evaluated a similar analysis approach for a portion of the San Mateo County shoreline. The Scientific Resolution Panel recommended the use of joint probability analysis with respect to flood event duration and elevation to better quantify the storm event probability. Additional assessment of storm characteristics would be required to adequately assess whether a full joint probability analysis is required. The Scientific Resolution Panel also found that "existing FEMA mapping procedures and guidelines for the Pacific Coast (FEMA 2005) call for the use of 'system response analyses' because of the nature of processes that control extreme water levels in the region." Similar to San Mateo, Valley Water's approach results in a "mixture of response- and event-based approaches [that] ultimately results in a flood scenario that cannot be characterized as a 1% annual chance flood event." Because the model forcing conditions are ill-defined in terms of probability (e.g., water level based on probability analysis and duration selected from two discrete events from the observation record), the approach may be inadequate for use in defining the resulting 1-percent-annual-chance floodplain.

5. Freshwater inflows were considered in the Valley Water model from sixteen tributaries that discharge into the Bay. It is unclear why the 5-year maximum discharge was used combination with the 1-percent-annual-chance coastal flooding in the 2-D modeling instead. Valley Water

references a report on the combined probability of riverine flooding levels and Bay flooding; however, this report was not provided to FEMA. The use of a 5-year maximum discharge deviates from other FEMA studies, and, as noted in Item 4, accurately accounting for companion precipitation is required when simulating an approximated 1-percent-annual-chance event.

Although the response-based approach completed by FEMA did not consider rainfall and the associated riverine hazards, the consideration of discrete events should consider all relevant processes that contribute to local flooding. FEMA's Guidance for Flood Risk Analysis and Mapping: Coastal General Study Considerations (February 2018) and Coastal Water Levels (May 2016) notes that where streams are tributary to a sheltered water body, the definition of the 1-percent-annual-chance flood event should consider the effects of both riverine and tidal flooding. This is especially relevant in sheltered waters such as the Bay where effects of flood discharges from rivers can modify local tidal and storm surge elevations and relatively strong fluvial and/or tidal currents can combine to create unique and locally-impactful hydrodynamic conditions.

It should be noted that the two storms selected in Valley Water's modeling were both accompanied by heavy precipitation. The January 22-28 storm event in 1983 was driven by an atmospheric river coupled with a cyclone, with over a week of high tides that caused widespread flooding in parts of the Bay area. Storm surge and high tides reduced the ability of the storm drain systems to convey rainfall runoff to the Bay, exacerbating inland flooding. The December 2-5 storm event in 1983 combined heavy rain, high winds, and one of the highest water levels on record. A more recent example is one of the strongest El Niño events on record from February 1998, in which a low-pressure offshore cyclone coincided with an atmospheric river originating in the tropics. The storm persisted for over a week, when heavy winds and rains combined with over 3 feet of storm surge to cause widespread flooding throughout the Bay Area. In San Francisco, a total precipitation accumulation over 9.2 inches of rainfall was recorded with a maximum 24-hour rainfall of 3.6 inches. These events suggest that observed water levels, rainfall records, and other storm characteristics should be evaluated in more detail to justify the selection or definition of an appropriate 1-percent-annual-chance-event.

6. Wave Height Analysis for Flood Insurance Studies (WHAFIS) was used to evaluate overland wave propagation across the former salt ponds in both the FEMA study and the Valley Water study. However, Valley Water developed a different transect layout, resulting in a model setup and approach that differs slightly from the FEMA study. A detailed review of the WHAFIS modeling completed by Valley Water noted several potential errors and inconsistencies in application:

    a. Wave inputs for four roughly co-located transects (FEMA Transects 2, 5, 7, and 8) showed significant and unexplained differences (see Table 4 and Figure 2 below). The wave inputs to the WHAFIS modeling for FEMA studies were higher in all instances. The greatest difference was 2.7 feet, and the smallest difference was 1.2 feet. In many cases, the Valley Water wave inputs were close to zero, even in areas that are exposed to long fetches in the Bay and therefore would be expected to have larger waves, especially during a 1-percent-annual-chance event. For example, at FEMA Transect 5, the wave input is 2.7 feet whereas the Valley Water Transect 19 has a wave input of 0.01 feet at the same location. The Valley Water wave inputs do not seem to reflect actual storm conditions within the Bay, let alone 1-percent-annual-chance storm conditions.

Although the outermost earthen berm will greatly reduce these waves, the correct input conditions occurring in the Bay should be used to evaluate the runup and potential overtopping of the waves on these berms. Wave hazards are a significant hazard along the Bayfront berms and can cause significant erosion. This evaluation on the outboard earthen berms should be included as part of the coastal study.

Table 4: Comparison of wave inputs between Valley Water and FEMA studies at the Bayfront levees

Valley Water Transect	Valley Water Input Wave Height (feet)	FEMA Transect	FEMA Input Wave Height (feet)	Difference (feet)
6	0.26	2	1.5	1.2
19	0.01	5	2.7	2.7
23	1.11	7	2.6	1.5
28	0.79	8	2.6	1.8

Figure 2: Comparison of co-located transects between FEMA (red) and Valley Water (blue)

b. Four transects were roughly co-located between the two studies, offering the chance to directly compare the inputs and results from each. Resultant BFEs at the shoreline at these co-located transects were 0-3 feet lower in the Valley Water study as compared to the FEMA study.

c. The greatest difference in BFEs between the two studies was observed onshore in a developed area in the vicinity of FEMA Transect 11, where the Valley Water BFE was 5 feet lower than the FEMA BFE. This area is highlighted in turquoise in the Figure 3 below.

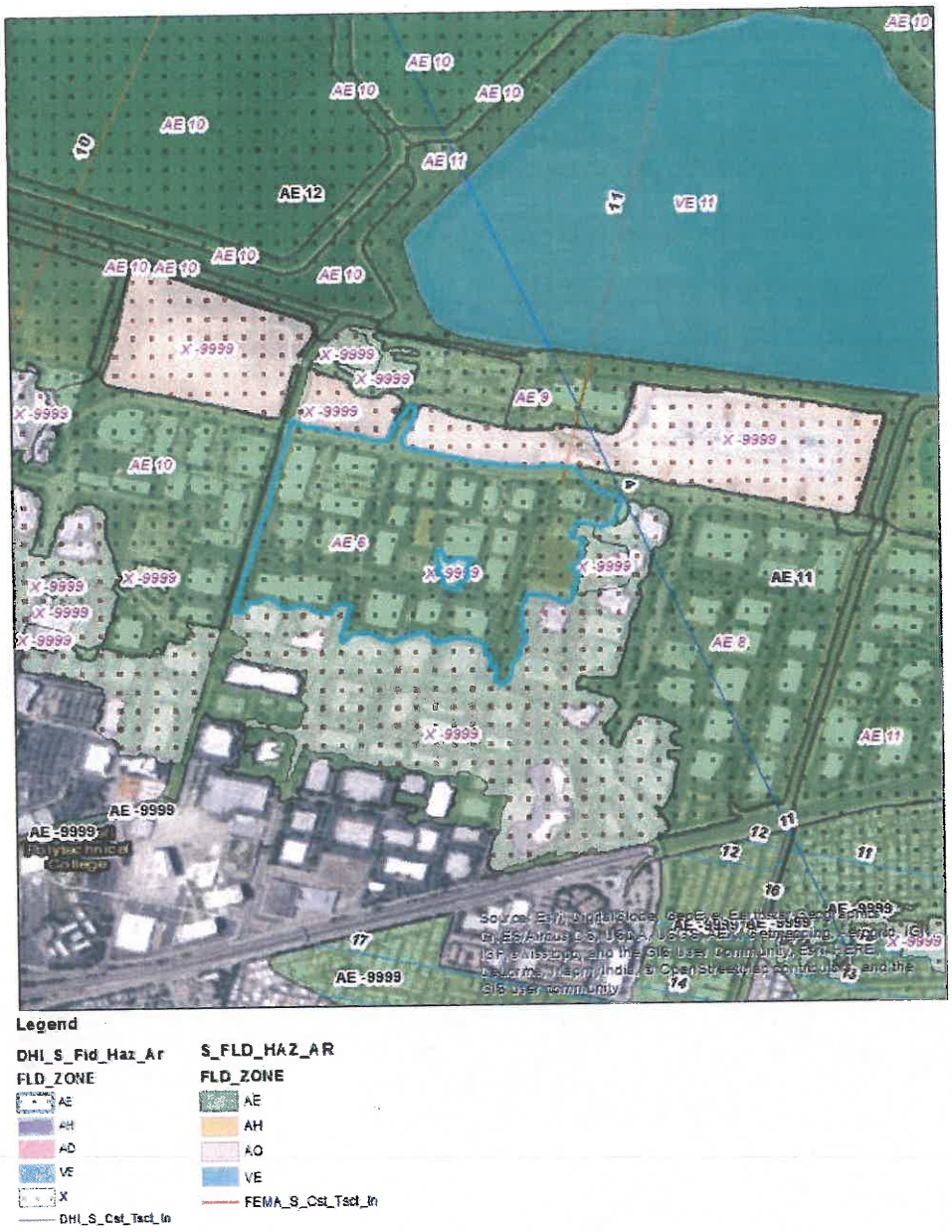

Figure 3: Onshore region of Valley Water (BFE in red) AE (EL 6) versus FEMA (BFE in black) AE (EL 11) flood hazard areas

Figure 4: Screen Capture of transect locations: Yellow = FEMA Transect 13; Green = Valley Water Transect 48

d. A comparison of the Valley Water and FEMA study results suggests that the Valley Water method may be underestimating the 1-percent-annual-chance base flood elevations onshore. An example which is typical across the study area is Valley Water Transect 48, which informs the onshore mapping in the vicinity of FEMA Transect 13 (See Figure 4). Due to differences in transect orientation between the two studies, these transects do not correlate directly, so the WHAFIS results cannot be compared side by side. Instead, the mapping results from both studies were assessed along the Valley Water transect for comparative purposes.

Comparing the mapped hazards along Valley Water Transect 48 with the Valley Water study results and the mapped hazards using the FEMA study results along this same transect yields the following differences (see Table 5):

Table 5: Comparison of mapping results between the Valley Water and FEMA studies at Valley Water Transect 48

Valley Water Transect 48 Mapping Results	Mapping Results Along Valley Water Transect 48 Using FEMA Mapped Flood Hazard Zones	Elevation Difference (feet) Between Valley Water and FEMA at Same Location
VE12	AE13	-1
VE12	AE12	0
VE12	AE11	1
AE10	AE11	-1
AE10	AE12	-2
AE9	AE13	-4
AE10*	AE13*	-3*
AE9	AE12	-3
AE9	AE11	-2
AE9	AE12	-3
AE10	AE12	-2
Shaded X	AE12	N/A
AE9	AE11	-2
Shaded X	X - reduced flood risk due to levee	N/A
Shaded X	AE11	N/A

*shoreline

Along the shoreline and approaching the inland developed areas, the difference between the two studies is 3-4 feet, which is not unusual when comparing the results of these two studies. It should be noted that the largest difference between the two studies is 5 feet, noted at FEMA Transect 11, where the BFE for the Valley Water study is 6 feet NAVD88 and the BFE for the FEMA study is 11 feet NAVD88. These large differences raise further questions about the need to validate the Valley Water 2-D model results which provide inputs to the transect-based analysis and/or to review additional sensitivity analysis to justify and support the Valley Water results.

e. There are several areas, for example on Valley Water Transect 43, where the SWEL changes radically across the shoreline. In this case, the SWEL changes from 9.61 offshore to 0 at the shoreline to 12.36 immediately onshore (but is not mapped as such). No runup is indicated at this location, so the results are confusing. At the end of the transect the SWEL jumps up to around 16 feet in the vicinity of a berm over a linear distance of less than 100 meters along the transect.

f. There were many areas in which the carding did not seem appropriate given the terrain and land use of the location. DU cards did not always correspond to the centerline of berms. In several instances, DU cards were identified in locations within urbanized developed areas or where no berm exists. Examples include DU cards located on top of structures or buildings, in the middle of roadways, or in other inappropriate locations. DU cards should only be used at crests of very steep sloped or vertical features.

In several instances, different vegetation cards were identified in inappropriate locations. For illustration purposes, examples include, but are not limited to, the airport runway on Valley Water Transect 30 carded as VE (trees) and areas of open ground with sparse tree coverage classified as VH (marsh vegetation) on Valley Water Transect 28 and on the golf course at Valley Water Transects 31-33.

A thorough QC review of the WHAFIS modeling for all transects should be completed.

7. The floodplain mapping for the Valley Water study revealed inconsistencies with regards to FEMA's mapping guidelines. Specifically,

   a. WHAFIS modeling results did not always support the mapping. For example, in the vicinity of Valley Water Transects 39-41, there is a VE (EL 11) zone mapped in an area for which the WHAFIS results indicated no wave heights greater than 3 feet. The Valley Water SWEL is 9.4 feet NAVD88 within this zone, which would mean a VE Zone would be mapped for elevations greater than 12.4 feet NAVD88. The WHAFIS mapping for all three transects indicate this zone should be mapped as an AE (EL 10). To the southeast of this mapped zone VE (EL 11) is an area mapped to AE (EL 12).

   b. In several areas, Valley Water zones with BFEs greater than 3 feet above the FEMA statistical SWEL are labeled as AE Zones. This highlights a potential issue with using a time-varying SWEL instead of the statistical SWEL as a reference for the base flood, since SFHAs can theoretically have a lower BFE than a neighboring zone yet have a more restrictive zone designation. An example of this situation occurs at Valley Water Transect 48 which is near FEMA Transect 13, where the same SFHA that is classified as a VE Zone with a BFE of 12 feet NAVD88 in the Valley Water study is classified in the FEMA study as a Zone AE with a higher BFE of 13 feet NAVD88.

   A thorough QC review of the mapping for the entire study area should be completed.

STARR II Strategic Alliance for Risk Reduction

Date:	**January 17, 2019**
To:	**Emily Zedler, Santa Clara Valley Water District**
CC:	**Eric Simmons and Patrick Clancey, FEMA Region IX**
	Pani Ramalingam, STARR II
From:	**Seth Ahrens, STARR II**
Subject:	**44 CFR 65.10 Review for the San Tomas Aquino Creek East Bank Levee and for the Highway 237 Embankments, Santa Clara County, CA**

STARR II has completed a review of the levee certification package for the San Tomas Aquino Creek East Bank Levee north of Highway (Hwy) 237 and the Hwy 237 embankments between Calabazas Creek and San Tomas Aquino Creek in Santa Clara County, CA. This review assessed the compliance of the package with Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR 65.10). Documentation for these embankments was submitted as part of an appeal package dated June 6, 2016 by the Santa Clara Valley Water District (District). The appeal was filed in response to the California Coastal Analysis and Mapping Project's (CCAMP) preliminary floodplain maps for Santa Clara County. This appeal is currently being processed by FEMA Region IX.

The levee certification package states that the CCAMP study assumed the San Tomas Aquino East Bank Levee would fail during the 1%-annual-chance event since it is not accredited by FEMA. The District seeks to certify a portion of the San Tomas Aquino Creek East Bank Levee and replace the preliminary CCAMP floodplain behind the levee with the effective FEMA floodplain.

The levee certification package also states that the CCAMP study assumed the Hwy 237 embankments failed as they are not levees, allowing coastal flooding to extend south of Hwy 237. The District seeks to certify the Hwy 237 embankments and replace the preliminary CCAMP floodplain behind the embankments with the effective FEMA floodplain.

The conclusion of the review is that there are outstanding issues that need to be resolved before the San Tomas Aquino Creek East Bank Levee north of Hwy 237 and the Hwy 237 embankments can be declared compliant with 44 CFR 65.10.

If you have any questions or comments regarding this memorandum, please contact me at Seth.Ahrens@atkinsglobal.com or (415) 671-7185.

The following documents, submitted by the Santa Clara Valley Water District, were reviewed in the preparation of this memorandum:

- A letter dated June 6, 2016 and prepared by the Santa Clara Valley Water District, appealing the preliminary floodplain maps for Santa Clara County, California and Incorporated Areas;
- MT-2, Forms 1 and 3 dated June 3, 2016 and prepared by the Santa Clara Valley Water District for the San Tomas Aquino East Bank Levee;
- A report titled, "Geotechnical Investigation Report, San Tomas Aquino Levee Evaluation Project" dated April 2016 and prepared by PARIKH Consultants;

- A Technical Memorandum titled, "Embankment Construction and Freeboard Evaluation" dated June 3, 2016 and prepared by the Santa Clara Valley Water District;
- An operations and maintenance plan titled "Levee Operation and Maintenance Plan" dated June 6 2016 and prepared by the Santa Clara Valley Water District;
- Engineering construction drawings titled "Construction Plans of San Tomas Aquino Creek from Calabazas Basin to (Old) Mt. View-Alviso Road" dated August 13, 1962 and prepared by the Santa Clara Valley Water District;
- A technical memorandum dated June 6, 2016 and prepared by the Santa Clara Valley Water District: Subject: "Santa Clara Valley Water District's Position on the Embankment [Highway 237] as a Flood Barrier;"
- Hwy 237 As-Built construction plans dated September 23, 1996 and, prepared by Caltrans; and
- Standard Specifications – Earthwork Section (Caltrans, 1992).

Comments for the San Tomas Aquino Creek East Bank Levee

1. The downstream end of the levee ties-in to an area identified as high-ground in the preliminary mapping on panel 06085C0061J. However, the upstream end of the levee ties into the Baylands Park Trail ramp which is a non-levee reach. Section 7.0 of FEMA's Levee Guidance (Guidance for Flood Risk and Analysis and Mapping for Levees, February 2018) requires that this non-levee reach meets the requirements of 44 CFR 65.10.

   Please provide documentation demonstrating that the Baylands Park Trail embankment complies with the requirements of 44 CFR 65.10. This documentation should include an operations and maintenance (O&M) manual for the trail. Please confirm whether Caltrans maintains the trail as part of its maintenance of Hwy 237 or whether another agency is responsible for the trail's maintenance.

2. An O&M manual dated June 2016 has been adopted by the District, but no current or historic inspection reports have been provided. The O&M manual stipulates that annual inspections of the levee must be performed. Please provide a copy of the most recent inspection report as well as any other historic inspection reports that are available.

3. MT-2, Form 1, Overview & Concurrence Form, was not signed by a community official. Please resubmit MT-2, Form 1 with the date and signature of a community official with responsibility for floodplain management in the community.

4. MT-2, Form 3, page 10/10, Certification of the Levee Documentation, was not signed and dated by a registered professional engineer. Please resubmit MT-2, Form 3 signed and dated by a registered professional engineer.

STARR II Strategic Alliance for Risk Reduction

Comments for the Hwy 237 Embankments

1. The Hwy 237 embankments are a non-levee reach. Section 7 of FEMA's Levee Guidance requires this non-levee reach to meet the requirements of 44 CFR 65.10. The District has submitted a technical memorandum titled "Santa Clara Valley Water District's Position on the Embankment as a Flood Barrier," which states that the Hwy 237 embankments would act as a flood barrier during a 1%-annual-chance flood event.

   The information presented in the memorandum is not sufficient for demonstrating compliance with 44 CFR 65.10. Per FEMA's Levee Guidance, "[c]ertified summary reports without back-up data are not acceptable." Please see Section 4.3.1 in this guidance document for additional details regarding what must be submitted in a complete levee certification package.

2. Since the District is not the owner of the non-levee Hwy 237 embankments, operations and maintenance of the embankments can only be carried out through a co-operative agreement between the District and Caltrans. Please describe what approach the District has considered for providing for the operation and maintenance of the Hwy 273 embankments as a component of the overall levee system.