CALIFORNIA COASTAL COMMISSION
NORTH CENTRAL COAST DISTRICT
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
PHONE: (415) 904-5200
FAX: (415) 904-5400
WEB: WWW.COASTAL.CA.GOV

F8a

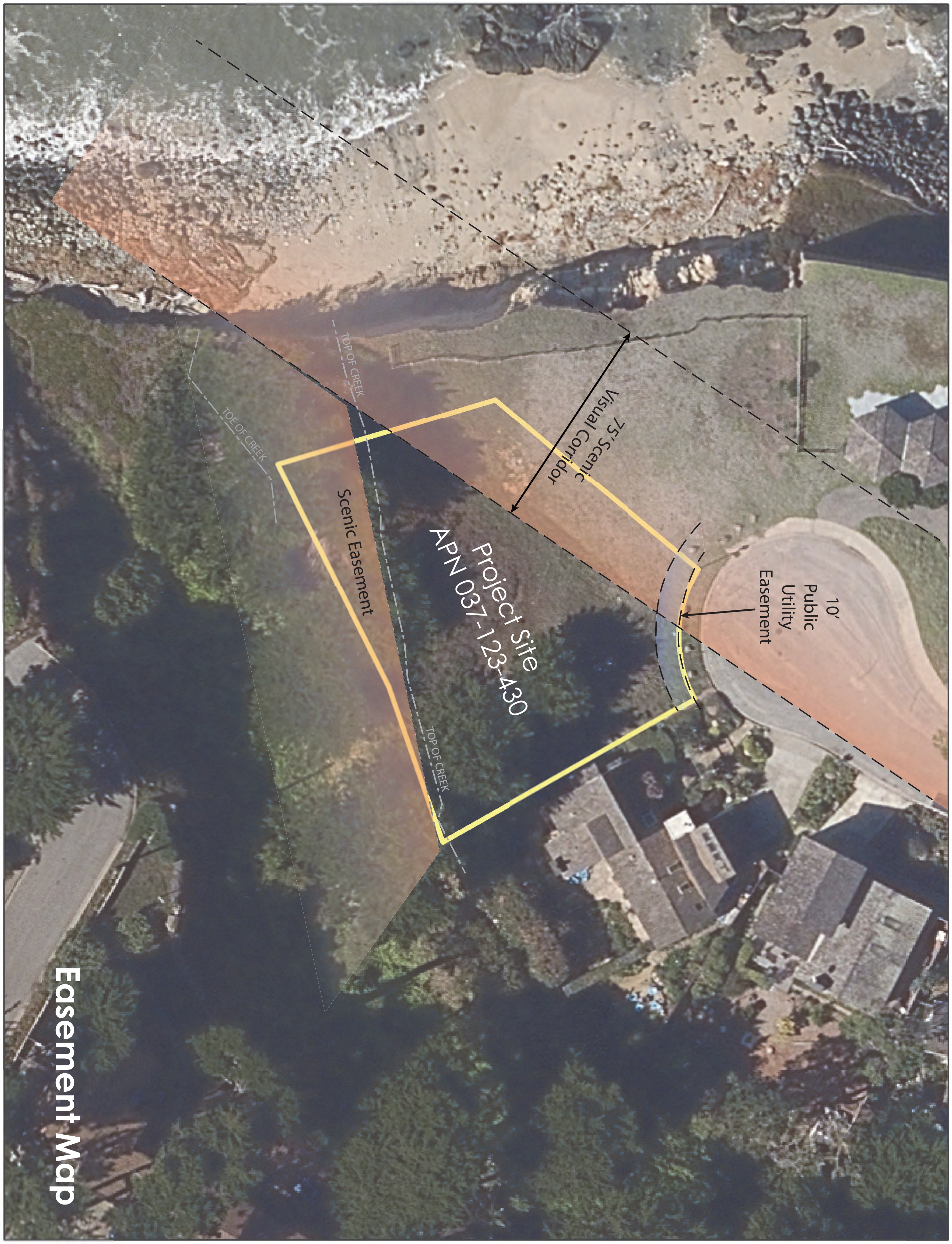
A-2-SMC-19-0002 (Zubieta SFD)

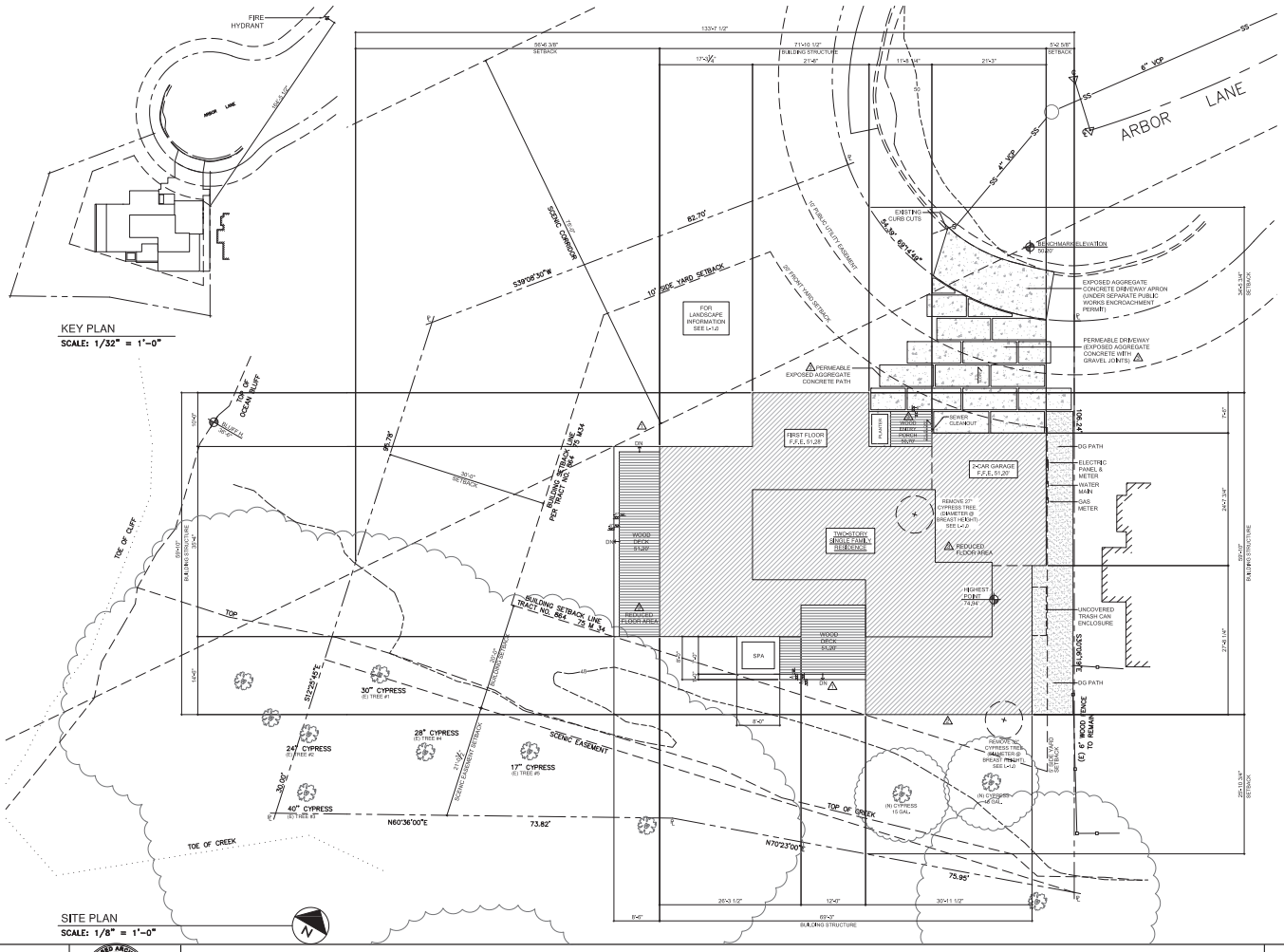
August 14, 2020

EXHIBITS

Table of Contents


Project Site
APN 037-123-430
DEAN CREEK
Nevada Ave
S Lagruna St
Elenodale St
Reef Point Rd
Arbor Ln
Wenke Way
California Ave
Virginia Av
Vermont Ave


Easement Map
75' Scenic
Visual Corridor
Project Site
APN 037-123-430
Scenic Easement
10'
Public
Utility
Easement
TOP OF CREEK
TOE OF CREEK
TOP OF CREEK



CARLOS ZUBIETA ARCHITECTS

LICENSED ARCHITECT C-33074 RENEWAL 08/31/2019 STATE OF CALIFORNIA

ASSESSOR'S PARCEL NUMBER: 037-123-430

PROJECT ADDRESS: 199 ARBOR LANE, MOSS BEACH, SAN MATEO COUNTY, CA

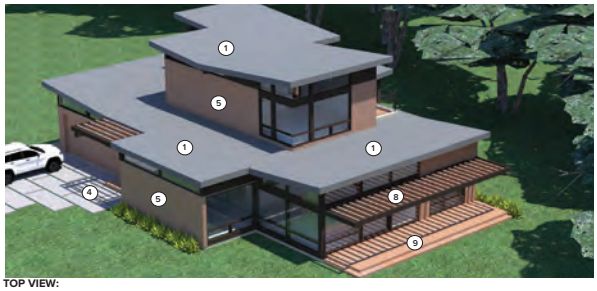
A1.0

3 REVISIONS PER CDRC HEARING COMMENTS 07.24.17

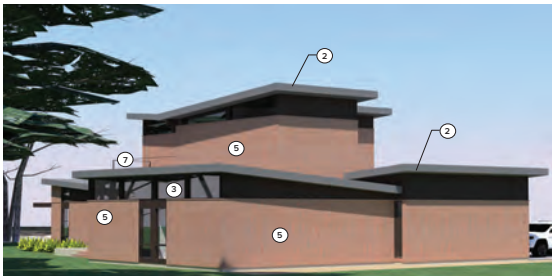
SITE PLAN

A-2-SMC-19-0002
Exhibit 2
Page 1 of 2

GOOGLE MAPS VIEW:



TOP VIEW:



EAST ELEVATION VIEW:

PROJECT LOCATION:

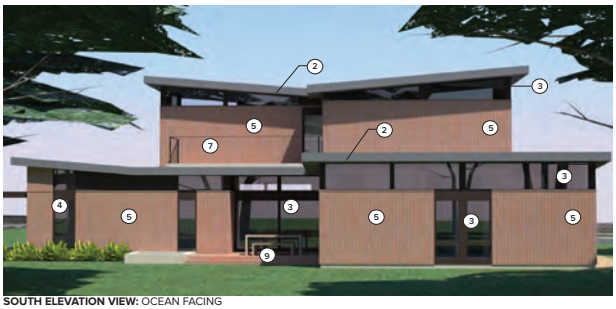
The project is located on a Cul-de sac approximately .17 miles West of Highway 1 in Moss Beach along the San Mateo County coastline. The coastal bluff is approximately 50 feet away from the property and overlooks the Fitzgerald Marine Reserve. The immediate surroundings of the project includes single family residences including one single family home to the immediate east and a vacant property owned by the home owners association to the North. The size of the site measures approximately 14,000 SF.

PROJECT DESCRIPTION:

The proposed project is of a new single family residence covering an estimated area of 3,200 square feet with an attached two car garage. The design and scale of the project was strategized to relate to the immediate neighborhood while the new structure uses contemporary strategies for incorporating passive solar, opening up the house to the outdoor spaces and retaining the native surrounding habitat as recommended by the biology report obtained. From the street the project scale is kept low to create visibility and reduce solid two-story wall surfaces.

The use of environmentally conscious materials throughout the house helps to emphasize the warmth and character as well as blend with the natural surrounding landscape. Western red cedar exterior walls, are reminiscent of Sea Ranch and the the surrounding materials. Large South facing windows will open to the views of the surrounding landscape while also providing passive solar heating within the home. Varying roof slopes allow the house to be nested into the low-lying neighborhood, while the granite on the exterior roofing reflects the rocks along the cliff.

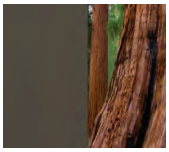
NORTH ELEVATION VIEW: ARBOR LANE



SOUTH ELEVATION VIEW: OCEAN FACING

MATERIALS AND FINISHES LEGEND:

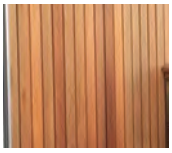
1. ROOFING: Class A 4 Ply Built up roofing finished with a layer of rock - Granite No. 4 by by A1 Grit Company



2.EXTERIOR TRIM: VM ZINC PIGMENTO zinc flat panels in "brown"

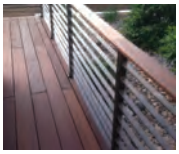
3. WINDOWS: Milgard Windows Aluminum Frame - color: dark bronze

4. EXPOSED AGGREGATE CONCRETE: Site concrete at driveway and pavers for pathways



5. EXTERIOR WALLS: Natural wood siding in 4" wide -Western Red Cedar siding - Benjamin Moore ARBORCOAT waterborne exterior stain semi-solid 639

6. GARAGE DOORS: Natural wood Roll up doors - Western Red Cedar - Clr. polyurethane finish



7. RAILINGS / BALCONY: Powder coated steel and natural wood top - bronze color to doors and windows and clr. polyurethane finsh

8. OVERHANGS: Natural wood trellis- 4x12 douglas fir beams with clear polyurethane finish

9.HARDSCAPE / DECKS: poured concrete and natural wood decks - 2x6 teak clr. polyurethane finish

CARLOS ZUBIETA ARCHITECTS

LICENSED ARCHITECT C-33074 RENEWAL 08/31/2017 STATE OF CALIFORNIA

ASSESSOR'S PARCEL NUMBER: 037-123-430

PROJECT ADDRESS: 199 ARBOR LANE, MOSS BEACH, SAN MATEO COUNTY, CA

PR-1.0

3 **REVISIONS PER CDRC HEARING COMMENTS 07.24.17**

PROJECT RENDERINGS AND MATERIALS

A-2-SMC-19-0002
Exhibit 2
Page 2 of 2

Photo 1 - View of project area from the northwest part of the parcel to northeast.

Photo 2 - View of project area from western edge of the parcel to north.

Photo 3 - View of project area from the northern part of the parcel to the west.

Photo 4 - View of project area from southern part of the parcel to the west.

Photo 5 - View of blufftop split rail fence from north to south.

Photo 6 - View of coastal bluff face from north to south.

Photo 7 - View of coastal bluff from south to north.

Photo 8 - Oblique photo of coastal bluff and project site.

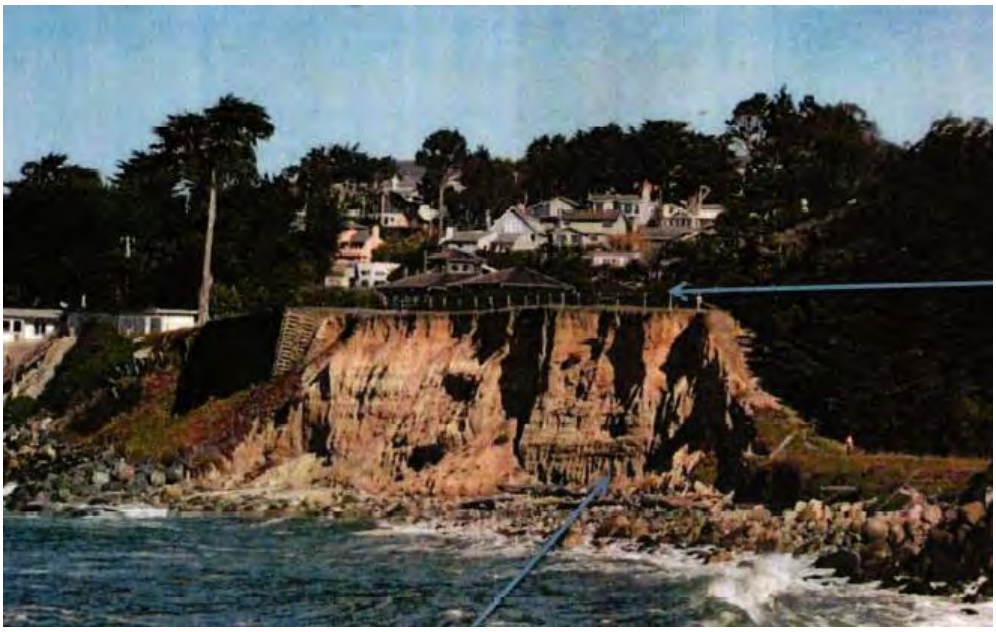


Photo 9 - View of Dean Creek herbaceous cover from midslope of arroyo.

County of San Mateo
Planning & Building Department
455 County Center, 2nd Floor
Redwood City, California 94063
650/363-4161 Fax: 650/363-4849

Mail Drop PLN122
plngbldg@smcgov.org
www.co.sanmateo.ca.us/planning

December 28, 2018

NOTICE OF FINAL LOCAL DECISION

Pursuant to Section 6328.11.1(f) of the San Mateo County Zoning Regulations

CERTIFIED MAIL

California Coastal Commission
North Central Coast District Office
Attn: Renée Ananda
45 Fremont Street, Suite 2000
San Francisco, CA 94105

RECEIVED
JAN 04 2019
CALIFORNIA
COASTAL COMMISSION

COUNTY FILE NO.:	PLN2016-00444
OWNER:	ZUBAR LLC
APPLICANT:	CARLOS ZUBIETA

The above listed Coastal Development Permit was conditionally approved by the County of San Mateo on 12/12/2018. The County appeal period ended on 12/27/2018. Local review is now complete.

This permit **IS** appealable to the California Coastal Commission.

If you have any questions about this project, please contact Carmelisa Morales at (650) 363-1873 or cjmorales@smcgov.org.

Carmelisa Morales, Project Planner

FINAL LOCAL ACTION NOTICE
REFERENCE # 2-SMC-19-0026
APPEAL PERIOD 1/7/19 - 1/18/19

COUNTY OF SAN MATEO
PLANNING AND BUILDING

455 County Center, 2nd Floor
Redwood City, CA 94063
650-599-7310 T
www.planning.smcgov.org

December 24, 2018

Carlos Zubieta
1725-A Abbott Kinney Blvd.
Venice, CA 90291

Dear Mr. Zubieta:

Subject: **LETTER OF DECISION**
File Number: PLN 2016-00444
Location: Arbor Lane, Moss Beach
APN: 037-123-430

On December 12, 2018 the San Mateo County Planning Commission considered an Initial Study and Mitigated Negative Declaration, pursuant to the California Environmental Quality Act, and a Coastal Development Permit, Design Review, and Grading Permit, pursuant to Sections 6328.4 and 6565.3 of the County Zoning Regulations and Section 9283 of the County Building Regulations, to allow construction of a new single-family residence with an attached garage on an undeveloped parcel located on Arbor Lane in the unincorporated Moss Beach area of San Mateo County. This project is appealable to the California Coastal Commission.

Based on information provided by staff and evidence presented at the hearing, the Planning Commission adopted the Initial Study and Mitigated Negative Declaration and approved the Design Review, Coastal Development Permit, and Grading Permit, County File Number PLN 2016-00444, by making the required findings and imposing the modified conditions of approval in Attachment A.

Any interested party aggrieved by the determination of the Planning Commission has the right of appeal to the Board of Supervisors within ten (10) business days from such date of determination. The appeal period for this matter will end at **5:00 p.m. on December 27, 2018.**

The approval of this project is appealable to the California Coastal Commission. Any aggrieved person may appeal this decision to the California Coastal Commission within 10 working days following the Coastal Commission's receipt of the notice of Final Local Decision. Please contact the Coastal Commission's North Central Coast District Office at 415/904-5260 for further information concerning the Commission's appeal process. The County and Coastal Commission appeal periods are sequential, not concurrent, and together total approximately one month. A project is considered approved when these appeal periods have expired and no appeals have been filed.

Sincerely,

Janneth Lujan
Planning Commission Secretary
Pcd1212cc (Item 2 Zubar, LLC)

cc: Building Inspection Section
Department of Public Works
Environmental Health Department
Planning Director, City of Half Moon Bay
California Coastal Commission
Coastside Fire Protection District
Montara Water and Sanitary District
Zubar, LLC, Owner
Midcoast Community Council
Mr. and Mrs. Vespremi
Lennie Roberts, Committee for Green Foothills
Melinda King
Tatiana Barhar
Steven R. King
John Petroff
Jim Scheinberg

Attachment A

County of San Mateo
Planning and Building Department

FINDINGS AND CONDITIONS OF APPROVAL

Permit or Project File Number: PLN 2016-00444 Hearing Date: December 12, 2018

Prepared By: Carmelisa Morales
Project Planner

Adopted By: Planning Commission

FINDINGS

Regarding the Environmental Review, Found:

1. That the Planning Commission does hereby find that this Mitigated Negative Declaration reflects the independent judgment of San Mateo County.

2. That the Mitigated Negative Declaration is complete, correct and adequate and prepared in accordance with the California Environmental Quality Act and applicable State and County guidelines.

3. That, on the basis of the Initial Study, comments received hereto, and testimony presented and considered at the public hearing, there is no substantial evidence that the project, if subject to the mitigation measures contained in the Mitigated Negative Declaration, will have a significant effect on the environment. The Initial Study and Mitigated Negative Declaration identify potential significant impacts to biological resources, cultural resources, geology and soils, climate change, hydrology and water quality, and noise. The mitigation measures contained in the Mitigated Negative Declaration have been included as conditions of approval in this attachment. As proposed and mitigated, the project would not result in any significant environmental impacts.

4. That the mitigation measures in the Mitigated Negative Declaration and agreed to by the property owner and placed as conditions on the project have been incorporated into the Mitigation Monitoring and Reporting Plan in conformance with the California Public Resources Code Section 21081.6.

Regarding the Coastal Development Permit, Found:

5. That the project, as described in the application and accompanying materials required by Section 6328.7 and as conditioned in accordance with Section 6328.14, conforms with the plans, policies, requirements, and standards of the San Mateo County Local Coastal Program. The plans and materials have been reviewed against the application requirements of Section 6328.7 of the Zoning Regulations, and the project has been conditioned to minimize impacts to the location of new development, sensitive habitats, visual resources, hazards, and shoreline access in accordance with the components of the Local Coastal Program. The project was also recommended for approval by the

Coastside Design Review Committee on November 9, 2017 in which the CDRC determined that it is in compliance with all applicable Design Review Standards.

6. That where the project is located between the nearest public road and the sea, the project is in conformity with the public access and public recreation policies of Chapter 3 of the Coastal Act of 1976 (commencing with Section 30200 of the Public Resources Code). The project parcel is subject to a 75-foot wide scenic easement that crosses the front and right side yards of the project parcel. This easement was imposed by the California Coastal Commission and includes the declaration of Lot 11, the adjacent parcel west of the project parcel, within the easement for public access. The proposed project will not interfere with the public's right-of-access to the sea and therefore no provision for shoreline access is required.

7. That the number of building permits for construction of single-family residences other than for affordable housing issued in the calendar year does not exceed the limitations of Policies 1.22 and 1.23 as stated in Section 6328.19. Staff anticipates that the building permits to be issued for the 2018 calendar year will not exceed this limit, based on estimates of current applications for building permits for this calendar year and those received in 2017.

Regarding the Design Review, Found:

8. The project has been reviewed under and found to be in compliance with the Design Review Standards for One-Family and Two-Family Residential Development in the Midcoast under Section 6565.20 of the San Mateo County Zoning Regulations, specifically elaborated as follows:

    a. The size of the house was reduced in footprint in the interest of preserving the views of the neighborhood. The second story of the house was reduced and the deck was relocated to the back of the property to preserve privacy and minimize visual impacts from many of the neighboring homes. Additionally, the CDRC recommends reducing the rear doorway from double doors to a single door to allow for a reduction in square footage in the living and guest rooms and to shift the first floor by the width of the doorway. This minor modification will achieve a sizable reduction in square footage and will be more in line with neighboring structures.

    b. As proposed and conditioned, the project includes downward-directed exterior lighting that is architecturally integrated with the house's design, style, material and colors, and is designed and located so light and glare are directed away from neighbors and confined to the property. Condition No. 5.a. requires the reduction of Dark Sky-compliant light fixtures in the front entry by one light fixture. Condition No. 5.b. also limits the Dark Sky-compliant light fixtures in the front yard area to not exceed 12 inches in height.

    c. As proposed and conditioned, the landscape plan has been revised and is consistent with recommendations presented by the Coastside Design Review Committee in their July 13, 2017 meeting such as revising the plant plan to include only plants that are suitable for an exposed marine environment.

Regarding the Grading Ordinance, Found:

9. That the granting of the permit will not have a significant adverse effect on the environment. An Initial Study and Mitigated Negative Declaration was prepared and circulated for this project in compliance with the California Environmental Quality Act. Although the proposed project could have a significant effect on the environment, the impacts will be less than significant with the implementation of mitigation measures, included as conditions of approval.

10. That the project conforms to the criteria of Chapter 5 (*Regulations for Excavating, Grading, Filling, and Clearing on Lands in Unincorporated San Mateo County*) of the County Building Regulations including the standards referenced in Section 9296. The project, as proposed and conditioned, conforms to the standards in the County Building Regulations, including timing of grading activity, erosion and sediment control, and dust control. The project has also been reviewed and conditionally approved by the Department of Public Works and the Building Inspection Section's Geotechnical Consultant.

11. That the project is consistent with the General Plan. The project parcel has a General Plan land use designation of Medium Density Residential within an urban area (6.1 – 8.7 dwelling units per acre). Although the proposed single-family residence, an allowed use of this land use designation will have a lower density (3.04 dwelling units per acre) than the allowed density for this land use designation, the residence meets all other locational criteria including its location within an existing medium density area, near major transportation corridors, and outside of areas within high perceived noise levels, and the availability of adequate public services and facilities. Additionally, as proposed and conditioned, the project complies with all applicable General Plan policies regarding urban land use, visual resources, water supply and wastewater, and vegetative, water fish, and wildlife resources.

12. That the project is consistent with the provisions of the Significant Tree Removal Ordinance, the provisions of which must be considered and applied as part of the planning permit approval process (Significant Tree Removal Ordinance Section 12.020.1(e)). The applicant will plant three trees of at least 15-gallon stock each for the two significant-sized trees proposed for removal. One of the three trees will be planted in the rear yard area to help with creek bank stabilization. The species of all trees to be planted are required to be native and drought resistant and will be subject to the review and approval of the Community Development Director. Furthermore, as required by the County Arborist, a qualified arborist will recommend proper removal methods for the tree closest to the creek slope edge, supervise the removal of the two significant-sized trees, and prepare a report on the analysis and recommendations for the project that will be subject to review and approval by the County Planning Department.

CONDITIONS OF APPROVAL

Current Planning Section

1. The project shall be constructed in compliance with the plans approved and reviewed by the Coastside Design Review Committee on November 9, 2017. Any changes or revisions to the approved plans shall be submitted to the Design Review Officer for review and approval prior to implementation. Minor adjustments to the project may be approved by the Design Review Officer if they are consistent with the intent of and are in substantial conformance with this approval. Alternatively, the Design Review Officer may

refer consideration of the revisions to the Coastside Design Review Committee, with applicable fees to be paid.

2. The Coastal Development, Design Review, and Grading Permit final approval shall be valid for five (5) years from the date of approval, in which time a building permit shall be issued and a completed inspection (to the satisfaction of the Building Inspector) shall have occurred within 180 days of its issuance. The design review approval may be extended by one 1-year increment with submittal of an application for permit extension and payment of applicable extension fees sixty (60) days prior to the expiration date.

3. The construction of any shoreline protective device(s) for the purpose of protecting the development approved in this project including, but not limited to, the approved building and associated foundation, and all future development on this property in the event that these structures are threatened with imminent damage or destruction from coastal hazards including, but not limited to, episodic and long-term shoreline retreat and coastal erosion and bluff and geologic instability is prohibited. **Prior to the issuance of the building permit for this project**, the property owner shall record a deed restriction on the subject property prohibiting the construction of any shoreline protective devices for the subject project and any future development on the subject property and submit a copy of the recorded document to the Planning and Building Department.

4. The applicant shall include the approval letter on the top pages of the building plans.

5. The applicant shall indicate the following on plans submitted for a building permit, as stipulated by the Coastside Design Review Committee:

   a. Reduce front entry Dark Sky-compliant light fixtures by one light fixture.

   b. Dark Sky-compliant light fixtures in front yard area shall not exceed 12 inches in height.

   Recommendations for Applicant's Consideration

   c. Consider the environmental benefits of preserving instead of removing the 36" diameter at breast height (dbh) cypress tree at the rear of the property located close to the creek edge.

   d. Consider reducing the rear doorway from double doors to a single door to allow for a reduction in square footage in the living and guest rooms and to shift the first floor by the width of the doorway. This minor modification will achieve a sizable reduction in square footage and be more in line with neighboring structures.

6. The applicant shall apply for a building permit and shall adhere to all requirements from the Building Inspection Section, Department of Public Works, Coastside Fire Protection District, and Building Inspection Section's Geotechnical Consultant.

7. At the building permit stage, a boundary survey is required.

8. The applicant shall provide "finished floor elevation verification" to certify that the structure is actually constructed at the height shown on the submitted plans. The applicant shall have a licensed land surveyor or engineer establish a baseline elevation datum point in the vicinity of the construction site.

a. The applicant shall maintain the datum point so that it will not be disturbed by the proposed construction activities until final approval of the building permit.

b. This datum point and its elevation shall be shown on the submitted site plan. This datum point shall be used during construction to verify the elevation of the finished floors relative to the existing natural or to the grade of the site (finished grade).

c. Prior to the County Planning Department approval of the building permit application, the applicant shall also have the licensed land surveyor or engineer indicate on the construction plans: (1) the natural grade elevations at the significant corners (at least four) of the footprint of the proposed structure on the submitted site plan, and (2) the elevations of proposed finished grades.

d. In addition, (1) the natural grade elevations at the significant corners of the proposed structure, (2) the finished floor elevations, (3) the topmost elevation of the roof, and (4) the garage slab elevation must be shown on the plan, elevations, and cross-section (if one is provided).

e. Once the building is under construction, prior to the below floor framing inspection or the pouring of the concrete slab (as the case may be) for the lowest floor(s), the applicant shall provide to the Building Inspection Section a letter from the licensed land surveyor or engineer certifying that the lowest floor height, as constructed, is equal to the elevation specified for that floor in the approved plans. Similarly, certifications on the garage slab and the topmost elevation of the roof are required.

f. If the actual floor height, garage slab, or roof height, as constructed, is different than the elevation specified in the plans, then the applicant shall cease all construction and no additional inspections shall be approved until a revised set of plans is submitted to and subsequently approved by both the Building Official and the Community Development Director.

9. A survey verification letter will be required during the construction phase of this project. Once the building permit has been issued and the forms have been set, the surveyor of record shall field measure the setback dimensions of the set forms from applicable property lines and compose a survey verification letter, with stamp and signature, of the field measurements to be submitted to the Planning and Building Department for review and approval.

10. At the building permit stage, a Tree Protection Plan shall be submitted showing the accurate driplines of all trees within and near the project site. All trees that have been removed or are proposed for removal and all trees to be preserved shall be labeled.

11. Two (2) significant-sized trees (36-inch dbh and one 27-inch dbh Monterey cypress trees) have been approved for removal. Removal of these trees may occur upon final approval of the building permit for this project. At the building permit stage, a qualified arborist shall be consulted to recommend proper removal methods for the 36-inch dbh tree. The arborist's analysis and recommendations shall be submitted at the building stage in the form of a report and be subject to review and approval by the Planning Department.

12. The applicant shall be responsible for planting three (3) trees of at least 15-gallon stock each prior to obtaining the final building inspection for the associated building permit.

One of the three trees shall be planted in the rear yard area to help with creek bank stabilization. The species of all trees to be planted shall be native, drought resistant, and subject to the review and approval of the Community Development Director.

13. Installation of the approved landscape plan is required prior to final building inspection.

14. The landscape plan shall comply with the Water Efficient Landscape Ordinance (WELO):

    a. At the building permit application stage, the project shall demonstrate compliance with the Water Efficient Landscape Ordinance (WELO) and provide the required forms. WELO applies to new landscape projects equal to or greater than 500 sq. ft. A prescriptive checklist is available as a compliance option for projects under 2,500 sq. ft. WELO also applies to rehabilitated landscape projects equal to or greater than 2,500 sq. ft.

       The following restrictions apply to projects using the prescriptive checklist:

       (1) Compost: Project must incorporate compost at a rate of at least four (4) cubic yards per 1,000 sq. ft. to a depth of 6 inches into landscape area (unless contra-indicated by a soil test).

       (2) Plant Water Use (Residential): Install climate adapted plants that require occasional, little, or no summer water (average WUCOLS plant factor 0.3) for 75% of the plant area excluding edibles and areas using recycled water.

       (3) Mulch: A minimum 3-inch layer of mulch should be applied on all exposed soil surfaces of planting areas, except in areas of turf or creeping or rooting groundcovers.

       (4) Turf: Total turf area shall not exceed 25% of the landscape area. Turf is not allowed in non-residential projects. Turf (if utilized) is limited to slopes not exceeding 25% and is not used in parkways less than 10 feet in width. Turf, if utilized in parkways, is irrigated by sub-surface irrigation or other technology that prevents overspray or runoff.

       (5) Irrigation System: The property shall certify that Irrigation controllers use evapotranspiration or soil moisture data and utilize a rain sensor; Irrigation controller programming data will not be lost due to an interruption in the primary power source; and Areas less than 10 feet in any direction utilize sub-surface irrigation or other technology that prevents overspray or runoff.

15. The exterior color samples submitted to the Coastside Design Review Committee are approved. Color verification shall occur in the field after the applicant has applied the approved materials and colors but before a final inspection has been scheduled.

16. All new power and telephone utility lines from the street or nearest existing utility pole to the main dwelling and/or any other structure on the property shall be placed underground.

17. The applicant shall include an erosion and sediment control plan to comply with the County's Erosion Control Guidelines on the plans submitted for the building permit. This plan shall identify the type and location of erosion control measures to be installed upon the commencement of construction in order to maintain the stability of the site and

prevent erosion and sedimentation off-site. A separate tree protection plan may also be required as part of the building permit. Species and size of trees shall be indicated on the plan (size shall be measured by diameter at breast height (dbh) method).

18. Once approved, erosion and sediment control measures of the erosion control plan shall be installed prior to beginning any work and maintained throughout the term of the grading permit and building permit as confirmed by the County through a pre-site inspection if project initiation occurs immediately prior to or during the wet season. Failure to install or maintain these measures will result in stoppage of construction until the corrections have been made and fees paid for staff enforcement time.

19. An Erosion Control and/or Tree Protection Pre-Site Inspection shall be conducted prior to the issuance of a grading permit "hard card" and building permit to ensure the approved erosion control and/or tree protection measures are installed adequately prior to the start of ground disturbing activities.

20. No site disturbance shall occur, including any grading, until a building permit has been issued.

21. The proposed project is subject to Provision C.3.i of the County's Municipal Regional Stormwater Permit and therefore shall implement at least one of the following site design measures listed below:

    a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.

    b. Direct roof runoff onto vegetated areas.

    c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.

    d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.

    e. Construct sidewalks, walkways, and/or patios with permeable surfaces.

    f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.

22. No grading activities shall commence until the applicant has been issued a grading permit "Hard Card," which will only be issued concurrently with the associated building permit.

23. No grading shall be allowed during the wet weather season (October 1 through April 30) to avoid increased potential soil erosion, unless the applicant applies for an Exception to the Winter Grading Moratorium and the Community Development Director grants the exception. Exceptions will only be granted if dry weather is forecasted during scheduled grading operations, and the erosion control plan includes adequate winterization measures (amongst other determining factors).

24. The site is considered a Construction Stormwater Regulated Site (SWRS). Any grading activities conducted during the wet weather season (October 1 to April 30) will require monthly erosion and sediment control inspections by the Building Inspection Section, as well as prior authorization from the Community Development Director to conduct grading during the wet weather season.

25. The provision of the San Mateo County Grading Ordinance shall govern all grading on and adjacent to this site. Per San Mateo County Ordinance Section 9296.5, all equipment used in grading operations shall meet spark arrester and firefighting tool requirements, as specified in the California Public Resources Code.

26. The engineer who prepared the approved grading plan shall be responsible for the inspection and certification of the grading as required by Section 9297.2 of the Grading Ordinance. The engineer's responsibilities shall include those relating to non-compliance detailed in Section 9297.4 of the Grading Ordinance.

27. Erosion and sediment control during the course of grading work shall be installed and maintained according to a plan prepared and signed by the engineer of record, and approved by the Department of Public Works and the Current Planning Section. Revisions to the approved erosion and sediment control plan shall be prepared and signed by the engineer, and must be reviewed and approved by the Department of Public Works and the Current Planning Section.

28. It shall be the responsibility of the engineer of record to regularly inspect the erosion control measures for the duration of all grading activities, especially after major storm events, and determine that they are functioning as designed and that proper maintenance is being performed. Deficiencies shall be immediately corrected, as determined by and implemented under the observation of the engineer of record.

29. To reduce the impact of construction activities on neighboring properties, comply with the following:

    a. All debris shall be contained on-site; a dumpster or trash bin shall be provided on site during construction to prevent debris from blowing onto adjacent properties. The applicant shall monitor the site to ensure that trash is picked up and appropriately disposed of daily.

    b. The applicant shall remove all construction equipment from the site upon completion of the use and/or need of each piece of equipment which shall include but not be limited to tractors, back hoes, cement mixers, etc.

    c. The applicant shall ensure that no construction related vehicles impede through traffic along Arbor Lane. All construction vehicles shall be parked on-site outside of Arbor Lane, or in locations which do not impede safe access along Arbor Lane. There shall be no overnight storage of construction vehicles or equipment on Arbor Lane.

30. During project construction, the applicant shall, pursuant to Chapter 4.100 of the San Mateo County Ordinance Code, minimize the transport and discharge of stormwater runoff from the construction site into storm drain systems and adjacent water bodies by:

    a. Stabilizing all denuded areas and maintaining erosion control measures continuously between October 1 and April 30.

    b. Storing, handling, and disposing of construction materials and wastes properly, so as to prevent their contact with stormwater and watercourses.

c. Controlling and preventing the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, wash water or sediments, and non-stormwater discharges, to storm drains and watercourses.

d. Using sediment controls or filtration to remove sediment when dewatering site and obtaining all necessary permits.

e. Avoiding cleaning, fueling, or maintaining vehicles on-site, except in a designated area where wash water is contained and treated.

f. Delineating with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.

g. Protecting adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.

h. Performing clearing and earth moving activities only during dry weather.

i. Limiting and timing application of pesticides and fertilizers to prevent polluted runoff.

j. Limiting construction access routes and stabilizing designated access points.

k. Avoiding tracking dirt or other materials off-site; cleaning off-site paved areas and sidewalks using dry sweeping methods.

l. The contractor shall train and provide instruction to all employees and subcontractors regarding the Construction Best Management Practices.

31. **Mitigation Measure 1**: The applicant shall submit an Air Quality Best Management Practices Plan to the Planning and Building Department prior to the issuance of any grading permit "hard card" or building permit that, at a minimum, includes the "Basic Construction Mitigation Measures" as listed in Table 8-1 of the BAAQMD California Environmental Quality Act (CEQA) Guidelines (May 2011). The following Bay Area Air Quality Management District Best Management Practices for mitigating construction-related criteria air pollutants and precursors shall be implemented prior to beginning any grading and/or construction activities and shall be maintained for the duration of the project grading and/or construction activities:

a. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

b. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

c. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day.

d. All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.

e. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxics Control Measure Title 13, Section 2485, of California Code of Regulations). Clear signage shall be provided for construction workers at all access points.

f. Roadways and building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

g. Idling times shall be minimized either by shutting equipment or vehicles off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxics Control Measure Title 13, Section 2485, of California Code of Regulations). Clear signage shall be provided for construction workers at all access points.

h. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications.

i. Minimize the idling time of diesel powered construction equipment to two minutes.

j. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

32. **Mitigation Measure 2:** The applicant shall submit a dust control plan to the Planning Department for review and approval prior to the issuance of a building permit for the project. The approved plan shall be implemented for the duration of any grading, demolition, and construction activities that generate dust and other airborne particles. The plan shall include the following control measures:

a. Water all active construction areas at least twice daily.

b. Water or cover stockpiles of debris, soil, sand, or other materials that can be blown by the wind.

c. Cover all trucks hauling soil, sand, and other loose materials, or require all trucks to maintain at least 2 feet of freeboard.

d. Apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking, and staging areas at the construction sites. Also, hydroseed or apply non-toxic soil stabilizers to inactive construction areas.

e. Sweep daily (preferably with water sweepers) all paved access roads, parking, and staging areas at the construction sites.

f. Sweep adjacent public streets daily (preferably with water sweepers) if visible soil material is carried onto them.

g. Enclose, cover, water twice daily, or apply non-toxic soil binders to exposed stockpiles (dirt, sand, etc.).

h. Limit traffic speeds on unpaved roads within the project parcel to 15 miles per hour (mph).

i. Install sandbags or other erosion control measures to prevent silt runoff to public roadways.

j. Replant vegetation in disturbed areas as quickly as possible.

33. **Mitigation Measure 3:** Within 48 hours prior to the onset of any project-related activities, a qualified biologist should conduct a pre-construction survey of the project area to ensure that no California red-legged frogs or San Francisco garter snakes are present. In addition, immediately prior to vegetation removal or other construction activities, a qualified biologist familiar with the habitat requirements of California red-legged frogs and San Francisco garter snakes shall conduct a pre-construction survey to determine whether any of these species is located within the project area.

34. **Mitigation Measure 4:** A minimum 3-foot high exclusion fence shall be installed around the limits of construction, including clearing, grading, and staging, unless otherwise directed by San Mateo County, United States Fish and Wildlife Service, or California Department of Fish and Wildlife, to create a barrier to prevent the California red-legged frog and San Francisco garter snake from entering the project site. No polymesh or similar materials shall be used as fencing materials. The fencing should be removed only when all construction equipment is removed from the project site. Fencing shall be inspected and any opening shall be repaired immediately. If openings are found, the project area shall be inspected by a biological monitor to ensure that special-status species have not entered the project area. The designated biological monitor may be a construction team manager or supervisor trained in the identification of special-status species.

35. **Mitigation Measure 5:** Vegetation or other materials shall not be stockpiled at the project site as it provides potential hiding areas for California red-legged frogs, San Francisco garter snakes, and other wildlife species. Vegetation shall be placed directly into a disposal container and removed from the construction area, as practicable. If vegetation is stockpiled on the ground, removal shall be conducted under the supervision of a qualified biologist.

36. **Mitigation Measure 6:** To avoid, minimize, and mitigate impacts to the California red-legged frogs, San Francisco garter snakes, and their respective habitats; a worker education program and/or education materials prepared by a qualified biologist shall be provided to all workers prior to onset of construction activities.

37. **Mitigation Measure 7:** If required by San Mateo County, California Department of Fish and Wildlife, or United States Fish and Wildlife Service, a biological monitor shall inspect the project area prior to the beginning of construction activities to ensure that the California red-legged frogs and San Francisco garter snakes have not entered the project area. The designated biological monitor may be a construction team manager or supervisor trained in the identification of special-status species.

38. **Mitigation Measure 8:** Under no circumstances should California red-legged frogs and San Francisco garter snakes be handled, relocated, or otherwise harmed or harassed at any time. San Mateo County, United Stated Fish and Wildlife Service, and California

Department of Fish and Wildlife shall be notified immediately upon discovery of these species in the project site or surrounding area.

39. **Mitigation Measure 9:** Prior to the start of vegetation removal, a qualified biologist familiar with the San Francisco dusky-footed woodrat and its habitat requirements shall survey for their nests within or immediately adjacent to the potential habitat (i.e., poison oak scrub).

    a. If no nests are observed, no further mitigation is required.

    b. If nests are observed, but would not be directly impacted by construction activities, a qualified biologist shall establish a 10-ft. buffer around the nests using exclusion fencing to ensure that they are not accidentally destroyed by construction activities. Exclusion fencing shall remain in place until project completion.

    c. If a nest is observed within the vegetation clearing area, a qualified biologist shall disassemble the nest by hand and relocate and reconstruct the nest away from the construction area.

40. **Mitigation Measure 10:** If trees are removed or pruned, a qualified biologist shall conduct a pre-construction bat roost survey to determine if bats are present in the trees on or near the project parcel. If bats are detected, suitable measures to avoid and/or exclude bats shall be determined by the California Department of Fish and Wildlife.

41. **Mitigation Measure 11:** Where sediment and erosion control materials are installed, repaired, or removed (i.e., wattles, silt fences, etc.), a qualified biologist should check the work area to ensure that sensitive species are not present or entrapped. Polymesh and/or other similar materials should not be used as these can entrap or snag reptiles, amphibians, or other small animals.

42. **Mitigation Measure 12:** If the construction activities coincide with the nesting bird season (February 1 to September 15), pre-construction nesting bird surveys shall be conducted by a California Department of Fish and Wildlife-approved biologist no more than 10 days prior to planned construction activities in order to locate nests within and adjacent to the proposed construction area. For all migratory bird species, the survey will include nesting birds within a 100-ft. radius from the project site.

    a. If no active nests are detected, construction activities may take place as scheduled.

    b. If an active nest is observed, the project shall be modified as necessary to avoid direct take of identified nest, eggs, and/or young. Modifications may include establishment of protective buffer as determined by a qualified biologist. Typical protective buffer zones are 50 feet for passerine nests and 250 feet for raptors. If construction activities are significantly impacted by the buffer zones, California Department of Fish and Wildlife shall be contacted to request a reduced buffer that would still protect nesting birds.

43. **Mitigation Measure 13:** In the event that should cultural, paleontological, or archaeological resources be encountered during site grading or other site work, such work shall immediately be halted in the area of discovery and the project sponsor shall immediately notify the Community Development Director of the discovery. The applicant shall be required to retain the services of a qualified archaeologist for the purpose of

recording, protecting, or curating the discovery as appropriate. The cost of the qualified archaeologist and of any recording, protecting, or curating shall be borne solely by the project sponsor. The archaeologist shall be required to submit to the Community Development Director for review and approval a report of the findings and methods of curation or protection of the resources. No further grading or site work within the area of discovery shall be allowed until the preceding has occurred. Disposition of Native American remains shall comply with CEQA Guidelines Section 15064.5(e).

44. **Mitigation Measure 14**: The design of the proposed development (upon submittal of the building permit) on the subject parcel shall generally follow the recommendations cited in the Geotechnical and Geologic Investigation prepared by Michelucci & Associates, Inc. and its subsequent updates regarding seismic criteria, grading, drilled piers, slab-on grade construction, and surface drainage. Any such changes to the recommendations by the project geotechnical engineer cited in this report and subsequent updates shall be submitted for review and approval by the County's geotechnical engineer.

45. **Mitigation Measure 15**: Prior to the issuance of the building permit for the proposed project, the applicant shall submit to the Planning Department and the Department of Public Works, for review and approval, erosion and drainage control plans that show how the transport and discharge of soil and pollutants from and within the project site will be minimized. The plans shall be designed to minimize potential sources of sediment, control the amount of runoff and its ability to carry sediment by diverting incoming flows and impeding internally generated flows, and retain sediment that is picked up on the project site through the use of sediment-capturing devices. The plans shall also limit application, generation, and migration of toxic substances, ensure the proper storage and disposal of toxic materials, and apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters. Said plan shall adhere to the San Mateo Countywide Stormwater Pollution Prevention Program "General Construction and Site Supervision Guidelines," including:

    a. Sequence construction to install sediment-capturing devices first, followed by runoff control measures and runoff conveyances. No construction activities shall begin until after all proposed measures are in place.

    b. Minimize the area of bare soil exposed at one time (phased grading).

    c. Clear only areas essential for construction.

    d. Within five (5) days of clearing or inactivity in construction, stabilize bare soils through either non-vegetative Best Management Practices (BMPs), such as mulching, or vegetative erosion control methods, such as seeding. Vegetative erosion control shall be established within two (2) weeks of seeding/planting.

    e. Construction entrances shall be stabilized immediately after grading and frequently maintained to prevent erosion and to control dust.

    f. Control wind-born dust through the installation of wind barriers such as hay bales and/or sprinkling.

    g. Soil and/or other construction-related material stockpiled on-site shall be placed a minimum of 200 feet, or to the extent feasible, from all wetlands and drain courses. Stockpiled soils shall be covered with tarps at all times of the year.

h. Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drains by using earth dikes, perimeter dikes or swales, or diversions. Use check dams where appropriate.

i. Provide protection for runoff conveyance outlets by reducing flow velocity and dissipating flow energy.

j. Use silt fence and/or vegetated filter strips to trap sediment contained in sheet flow. The maximum drainage area to the fence should be 0.5 acres or less per 100 feet of fence. Silt fences shall be inspected regularly and sediment removed when it reaches 1/3 the fence height. Vegetated filter strips should have relatively flat slopes and be vegetated with erosion-resistant species.

k. Throughout the construction period, the applicant shall conduct regular inspections of the condition and operational status of all structural BMPs required by the approved erosion control plan.

l. No erosion or sediment control measures will be placed in vegetated areas.

m. Environmentally-sensitive areas shall be delineated and protected to prevent construction impacts.

n. Control of fuels and other hazardous materials, spills, and litter during construction.

o. Preserve existing vegetation whenever feasible.

46. **Mitigation Measure 16:** Noise sources associated with demolition, construction, repair, remodeling, or grading of any real property shall be limited to the hours from 7:00 a.m. to 6:00 p.m., weekdays and 9:00 a.m. to 5:00 p.m., Saturdays. Said activities are prohibited on Sundays, Thanksgiving, and Christmas (San Mateo Ordinance Code Section 4.88.360). Noise levels produced by construction activities shall not exceed the 80-dBA level at any one moment.

47. **Mitigation Measure 17:** Should any traditionally or culturally affiliated Native American tribe respond to the County's issued notification for consultation, such process shall be completed and any resulting agreed upon measures for avoidance and preservation of identified resources be taken prior to implementation of the project.

48. **Mitigation Measure 18:** In the event that tribal cultural resources are inadvertently discovered during project implementation, all work shall stop until a qualified professional can evaluate the find and recommend appropriate measures to avoid and preserve the resource in place, or minimize adverse impacts to the resource, and those measures shall be approved by the Current Planning Section prior to implementation and continuing any work associated with the project.

49. **Mitigation Measure 19:** Any inadvertently discovered tribal cultural resources shall be treated with culturally appropriate dignity taking into account the tribal cultural values and meaning of the resource, including, but not limited to, protecting the cultural character and integrity of the resource, protecting the traditional use of the resource, and protecting the confidentiality of the resource.

Department of Public Works

50. Prior to the issuance of the building permit, the applicant shall have prepared, by a registered civil engineer, a drainage analysis of the proposed project and submit it to the Civil Section of the County Planning and Building Department for review and approval. The drainage analysis shall consist of a written narrative and a set of plans. The flow of the stormwater onto, over, and off of the property shall be detailed on the plan and shall include adjacent lands as appropriate to clearly depict the pattern of flow. The analysis shall detail the measures necessary to certify adequate drainage. Post-development flows and velocities shall not exceed those that existed in the pre-developed state. Recommended measures shall be designed and included in the improvement plans and submitted to the Civil Section of the County Planning and Building Department for review and approval.

51. Prior to the issuance of the building permit, the applicant shall submit a driveway "Plan and Profile," to the Department of Public Works, showing the driveway access to the parcel (garage slab) complying with County Standards for driveway slopes (not to exceed 20%) and to County Standards for driveways (at the property line) being the same elevation as the center of the access roadway. When appropriate, as determined by the Department of Public Works, this plan and profile shall be prepared from elevations and alignment shown on the roadway improvement plans. The driveway plan shall also include and show specific provisions and details for both the existing and the proposed drainage patterns and drainage facilities.

52. No proposed construction work within the County right-of-way shall begin until County requirements for the issuance of an encroachment permit, including review of the plans, have been met and an encroachment permit issued. Applicant shall contact a Department of Public Works Inspector 48 hours prior to commencing work in the right-of-way.

53. Prior to the issuance of the building permit, the applicant will be required to provide payment of "roadway mitigation fees" based on the square footage (assessable space) of the proposed building per Ordinance No. 3277.

54. The applicant shall provide sidewalks along the edge of the property to conform with existing sidewalks pursuant to County Standards.

Coastside Fire Protection District

55. At the building permit stage, all Coastside Fire Protection District (Fire) conditions of approval and requirements shall be incorporated into the building plans. The applicant shall be responsible for notifying the project's contractor, architect, and engineer of these conditions of approval and requirements.

56. All buildings with a street address shall have the number of that address on the building, mailbox, or other type of sign at the driveway entrance in such a manner that the number is easily and clearly visible from either direction of travel from the street. New residential buildings shall have internally illuminated address numbers contrasting with the background so as to be seen from the public right-of-way fronting the building. Residential address numbers shall be at least 6 feet above the finished surface of the driveway. An address sign shall be placed at each break of the road where deemed applicable by Fire. Numerals shall be contrasting in color to their back-ground and shall

be no less than 4 inches in height, and have a minimum 3/4-inch stroke. Remote signage shall be a 6-inch x 18-inch green reflective metal sign.

57. A fire flow of 1,000 gallons per minute (gpm) for 2 hours with a 20 pounds per square inch (psi) residual operating pressure must be available as specified by additional project conditions to the project site. The applicant shall provide documentation including hydrant location, main size, and fire flow report at the building permit application stage. An Inspection is required prior to Fire's final approval of the building permit or before combustibles are brought on site.

58. A fuel break/fire break shall be maintained around and adjacent to such buildings or structures by removing and clearing away flammable vegetation for a distance of not less than 30 feet and up to 100 feet around the perimeter of all structures, or to the property line, if the property line is less than 30 feet from any structure.

59. The applicant shall install the proper occupancy separations pursuant to current California Building and Residential Codes. At the building permit stage, building plans shall include listing and construction details. Inspections will occur throughout construction and prior to Fire's final approval of the building permit.

60. All roof assemblies shall have a minimum CLASS-B fire resistive rating and be installed in accordance with the manufacturer's specifications and current California Building and Residential Codes.

61. Smoke alarms and carbon monoxide detectors shall be installed in accordance with the California Building and Residential Codes. This includes the requirement for hardwired, interconnected detectors equipped with battery backup and placement in each sleeping room in addition to the corridors and on each level of the residence.

62. An approved Automatic Fire Sprinkler System meeting the requirements of National Fire Protection Association (NFPA)-13D shall be installed for this project. The fire sprinkler plans shall be submitted to the San Mateo County Building Department for review and approval.

63. An interior horn/strobe and exterior audible alarm activated by automatic fire sprinkler system water flow shall be installed in all residential systems. All hardware must be included on the submitted fire sprinkler plans.

64. The applicant shall contact the Fire Marshal's Office at 650/726-5213 to schedule a Final Inspection prior to occupancy and final inspection by a Building Inspector. A minimum 72-hour notice is required.

Environmental Health Services

65 Upon obtaining approval of the planning permits required for this project, the applicant shall obtain a well abandonment permit from the Environmental Health Services and properly abandon the existing well on the property to the satisfaction of the Environmental Health Services.

Building Inspection Section's Geotechnical Consultant

66. At the building permit stage, the applicant shall submit a payment of $940.00 for the additional geotechnical review conducted during the planning permit stage.

67. At the building permit stage, the project geotechnical engineer shall provide a finalized foundation design that will take into account bluff retreat and creek slope stability. The design shall be submitted to the Building Inspection Section for review and approval.

68. At the building permit stage, the project geotechnical engineer shall review the drainage design to ensure there is no adverse impact on either the bluff side or creek side of the subject parcel since no piezometer will be established on the parcel.

69. Prior to the start of construction, a licensed surveyor shall locate and stake the positions of two monuments located along the projected 2:1 creek setback line as recommended by the project geotechnical engineer and outlined in the Post-Construction Creek Bank Observation letter prepared by Michelucci & Associates, Inc. dated September 17, 2018. The project contractor shall drive and set flush to the finish grade a minimum of 3-foot long metal stake at these two locations.

70. Prior to the start of construction, a licensed civil engineer or geologist or designated member of the professional's staff shall visit the project site and confirm the monument placement and measure the distance of each monument to the face of the adjacent residence foundation. The closest point of the residence to the creek setback line shall also be surveyed so that monitoring can begin as construction commences and during the course of construction. A letter documenting the monument placement and measurements shall be prepared and submitted to the County. The letter shall be reviewed and approved by the County prior to the issuance of the building permit.

71. A California licensed professional shall visit the project site in February and May of each year of the subsequent 10 years after project completion. The professional shall measure the approximate distance to the top of the creek bank and document the top of the bank with photographs. The professional shall prepare a letter with photographs detailing the observations and recommendations, if any. The letter and payment of applicable review fees shall be submitted to the County for review and approval. If the letter and payment are not submitted to the County within 30 days of the site visit, a Notice of Violation on the property shall be recorded in the Office of the County Recorder for noncompliance. If slope movement of more than 2 feet is observed during a site visit, the project geotechnical engineer shall prepare and implement an emergency response program for review and approval by the County. If there are no significant changes to the creek bank slope after 10 years, the observation interval may be reduced to an annual event in May of each year.

72. The property owner may submit a formal written request to the County to terminate the required site visits detailed in Condition No. 71 following the 10-year period. The request shall be reviewed and approved by the County.

73. If there is any change in ownership of the subject parcel, the current property owner shall be responsible for notifying the County within 30 days of deed recordation. The current property owner shall be responsible for disclosing the creek slope monitoring program outlined in Condition Nos. 69-72 to the new property owner.

Montara Water and Sanitary District

74. Prior to the issuance of the building permit, the applicant shall obtain a Domestic Water Connection Permit (Connection Permit) from the Montara Water and Sanitary District (District). The connection fee for domestic water must be paid prior to the issuance of the Connection Permit. Proof of well abandonment to the County Environmental Health Services standards may be required. A mainline extension may also be required.

75. Prior to the issuance of the building permit, the applicant shall obtain a Sewer Permit from the District. Sewer connection fees must be paid prior to issuance of the Connection Permit. A sewer grinder pump and/or a sewer mainline extension may be required.

76. Connection to the District's fire protection system is required. A certified Fire Protection Contractor must certify adequate fire flow calculations. Connection fees for the fire protection system is required and must be paid prior to the issuance of the permit for the fire sprinklers.

77. The applicant must first apply directly to the District for the required permits and not their contractor.

CM:pac - CJMCC0565_WPU.DOCX

STATE OF CALIFORNIA – THE RESOURCES AGENCY

CALIFORNIA COASTAL COMMISSION
NORTH CENTRAL COAST DISTRICT OFFICE
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE (415) 904-5260
FAX (415) 904-5400
TDD (415) 597-5885

RECEIVED
JAN 16 2019
CALIFORNIA
COASTAL COMMISSION

EDMUND G. BROWN JR., *Governor*

APPEAL FROM COASTAL PERMIT DECISION OF LOCAL GOVERNMENT

Please Review Attached Appeal Information Sheet Prior To Completing This Form.

SECTION I. Appellant(s)

Name: Lennie Roberts / Committee for Green Foothills

Mailing Address: 339 La Cuesta

City: Portola Valley CA Zip Code: 94028 Phone: 650-854-0449

SECTION II. Decision Being Appealed

1. Name of local/port government: San Mateo County

2. Brief description of development being appealed: New 3,338 sq. ft. two-story single family residence with 468 sq. ft. attached two car garage on an undeveloped 14,320 sq. ft. parcel at the western end of Arbor Lane (a cul-de-sac). Proposal includes removal of 2 Monterey cypress trees (27" + 36" dbh) and 364 c.y. of grading.

3. Development's location (street address, assessor's parcel no., cross street, etc.):
   199 Arbor Lane, Moss Beach
   APN: 037-123-430

4. Description of decision being appealed (check one.):

- ☐ Approval; no special conditions
- ☒ Approval with special conditions:
- ☐ Denial

Note: For jurisdictions with a total LCP, denial decisions by a local government cannot be appealed unless the development is a major energy or public works project. Denial decisions by port governments are not appealable.

TO BE COMPLETED BY COMMISSION:

APPEAL NO: A-2-SMC-19-0002

DATE FILED: 1/16/19

DISTRICT: North Central Coast

APPEAL FROM COASTAL PERMIT DECISION OF LOCAL GOVERNMENT (Page 2)

5. Decision being appealed was made by (check one):

- ☐ Planning Director/Zoning Administrator
- ☐ City Council/Board of Supervisors
- ☒ Planning Commission
- ☐ Other

6. Date of local government's decision: December 12, 2018

7. Local government's file number (if any): PLN 2016-00444

SECTION III. Identification of Other Interested Persons

Give the names and addresses of the following parties. (Use additional paper as necessary.)

a. Name and mailing address of permit applicant:

Carlos Zubieta
1725-A Abbott Kinney Blvd.
Venice, CA 90291

b. Names and mailing addresses as available of those who testified (either verbally or in writing) at the city/county/port hearing(s). Include other parties which you know to be interested and should receive notice of this appeal.

(1) Please see County File

(2)

(3)

(4)

APPEAL FROM COASTAL PERMIT DECISION OF LOCAL GOVERNMENT (Page 3)

SECTION IV. Reasons Supporting This Appeal

PLEASE NOTE:

- Appeals of local government coastal permit decisions are limited by a variety of factors and requirements of the Coastal Act. Please review the appeal information sheet for assistance in completing this section.
- State briefly **your reasons for this appeal**. Include a summary description of Local Coastal Program, Land Use Plan, or Port Master Plan policies and requirements in which you believe the project is inconsistent and the reasons the decision warrants a new hearing. (Use additional paper as necessary.)
- This need not be a complete or exhaustive statement of your reasons of appeal; however, there must be sufficient discussion for staff to determine that the appeal is allowed by law. The appellant, subsequent to filing the appeal, may submit additional information to the staff and/or Commission to support the appeal request.

APPEAL FROM COASTAL PERMIT DECISION OF LOCAL GOVERNMENT (Page 4)

SECTION V. Certification

The information and facts stated above are correct to the best of my/our knowledge.

Committee for Green Foothills
Lennie Roberts

Signature of Appellant(s) or Authorized Agent

Date: January 14, 2019

Note: If signed by agent, appellant(s) must also sign below.

Section VI. Agent Authorization

I/We hereby authorize _____
to act as my/our representative and to bind me/us in all matters concerning this appeal.

_____
Signature of Appellant(s)

Date: _____

Summary of Reasons for Appeal – by Committee for Green Foothills

San Mateo County File No. PLN 2016-00444
Applicant/Owner: Carlos Zubieta/Zubar LLC
Location: 199 Arbor Lane, Moss Beach
APN: 037-123-430

The Coastal Development Permit (CDP) for this project, as narrowly approved by the San Mateo County Planning Commission (by a 3-2 vote), does not comply with the County certified Local Coastal Program. In particular, the project is not in compliance with LCP Policy 9.8.

Project Description: The project is a new 3,338 sq. ft. two-story single-family residence with a 468 sq. ft. attached two-car garage on an undeveloped 14,320 sq. ft. parcel at the western end of Arbor Lane. The proposal includes the removal of two Monterey cypress trees (27-inch and 36-inch dbh) and 368 cubic yards of grading (186 cy of excavation and 192 cy of fill).

Due to the site's location on coastal bluffs on land subject to coastal bluff erosion, both along the shoreline and the bank of Dean Creek, as well as its location only .1 mile from the active Seal Cove Fault, there are extraordinary natural hazards that pose long-term threats to development of this property. The site is also adjacent to the Fitzgerald Marine Reserve, an Area of Special Biological Significance.

LCP Hazards Policy 9.8 a. requires that bluff and cliff top development may be permitted only if design and setback provisions are adequate to assure stability and structural integrity for at least 50 years, and if the development, including storm water runoff, will neither create nor contribute significantly to erosion problems or geologic instability of the site or surrounding area. Hazards Policy 9.8 b. requires the submittal of a site stability evaluation report. Hazards Policy 9.8 d. prohibits new structures that would require the need for bluff protection work.

Committee for Green Foothills ("CGF") does not believe the applicant has fully complied with the above cited LCP policies. In particular, CGF questions whether the approved project is adequately set back from the near-vertical sea cliff to the west and the steep bank of the Dean Creek ravine to the south, per LCP Policy 9.8 a., b., and d., and fully considering Coastal Commission Guidance on Sea Level Rise, as detailed below. Also please refer to the attached Vallemar Bluffs Coastal Hazards Assessment: Estimate of Accelerated Bluff Erosion due to Seal Level Rise, dated October 26, 2016, for the proposed project at Vallemar Bluffs just to the north of the subject property, that was prepared by ESA for CGF.

Ocean cliff/bluff retreat analysis for the project used bluff setback measured perpendicular to the west side of the residence (78 feet), but the top of bluff is not parallel to the residence. Per the site plan, the shortest distance from top of bluff to NW corner of development is only 72 feet. Coastal bluff episodic erosional process was demonstrated most recently with the major bluff retreat measured after winter 2016/17 storms (noted in MIchelucci 8/29/17 report, but not updated on the site plan survey). Reported measurements indicate six feet of bluff were lost on the south end and 11 feet were lost on the north end of the proposed development area. Using this information, the NW corner of the proposed development is now 61 feet from the bluff top. Accordingly, the calculations for estimated bluff retreat timeline should use 61 feet instead of 78 feet for the existing setback from the top of bluff:

49 yrs @ 1.25 ft/yr per Griggs/Savoy 1985
62 yrs @ 0.98 (0.78 plus 25% for SLR per MIchelucci)

The minimum 50-year life span projection should account for the episodic nature of bluff retreat which would potentially render the single family residence unsafe to occupy well before the top of bluff reaches the structure's foundation and/or walls.

Coastal Commission Senior Geologist concluded the recommended 50-year coastal bluff-top setback at nearby 263 Nevada, Moss Beach, should be 80 feet, including 63 feet due to erosion (at 1.26 ft/yr), 12 feet due to slope stability, and 5 feet due to sea level rise.[1]

Cliff/bluff/streambank retreat at Dean Creek ravine should be more carefully analyzed for recommended setback for the economic life of the project without the possibility of armoring the bluff. Portions of the upper bank are very steep and undercut in places, with tree roots exposed. Two large Monterey cypress trees are proposed for removal. If and when any of the large Monterey cypress trees in close proximity to the creek bank/bluff fail, they will likely take a large chunk of the bluff with them, leaving bare loose soil exposed. Neighbors report that developed parcels on both sides of the ravine have experienced both gradual and episodic bluff retreat.

The Michelucci 7/6/16 report indicates periodic sloughing and minor bluff retreat along the Dean Creek bluff face, but proposes no calculation for future bluff retreat. Evidence of 1980's major episodic bluff retreat at 191 Arbor Lane was not acknowledged. The report does not analyze historic 1908 and 1972 surveys as required by LCP Policy 9.8. b.(1). The 1908 Moss Beach subdivision map includes 40-ft-wide North and South Laguna Streets along either side of the ravine. South Laguna has mostly eroded away and North Laguna was never built. The Arbor Lane 1972 "Cypress Cliffs" subdivision, which supersedes the

[1] California Coastal Commission staff report, 12/13/2012, p. 18, http://documents.coastal.ca.gov/reports/2012/12/Th12b-12-2012.pdf

1908 subdivision map, includes a 20-ft-wide scenic easement along the north bank of Dean Creek ravine. This was the northern half of the 1908 street easement, and several feet of it are now below the top-of-bank per the project survey. The 2016 survey for the project compared to the 1908 subdivision map indicates the top-of-bank of Dean Creek ravine at the site has retreated about 30 feet over 110 years (average 0.27 ft/yr). The approved 18-ft development setback is not an adequate leeway next to a 28-ft drop-off. This estimate indicates that the top-of-bank would retreat to within 10 ft of the house in 30 years.

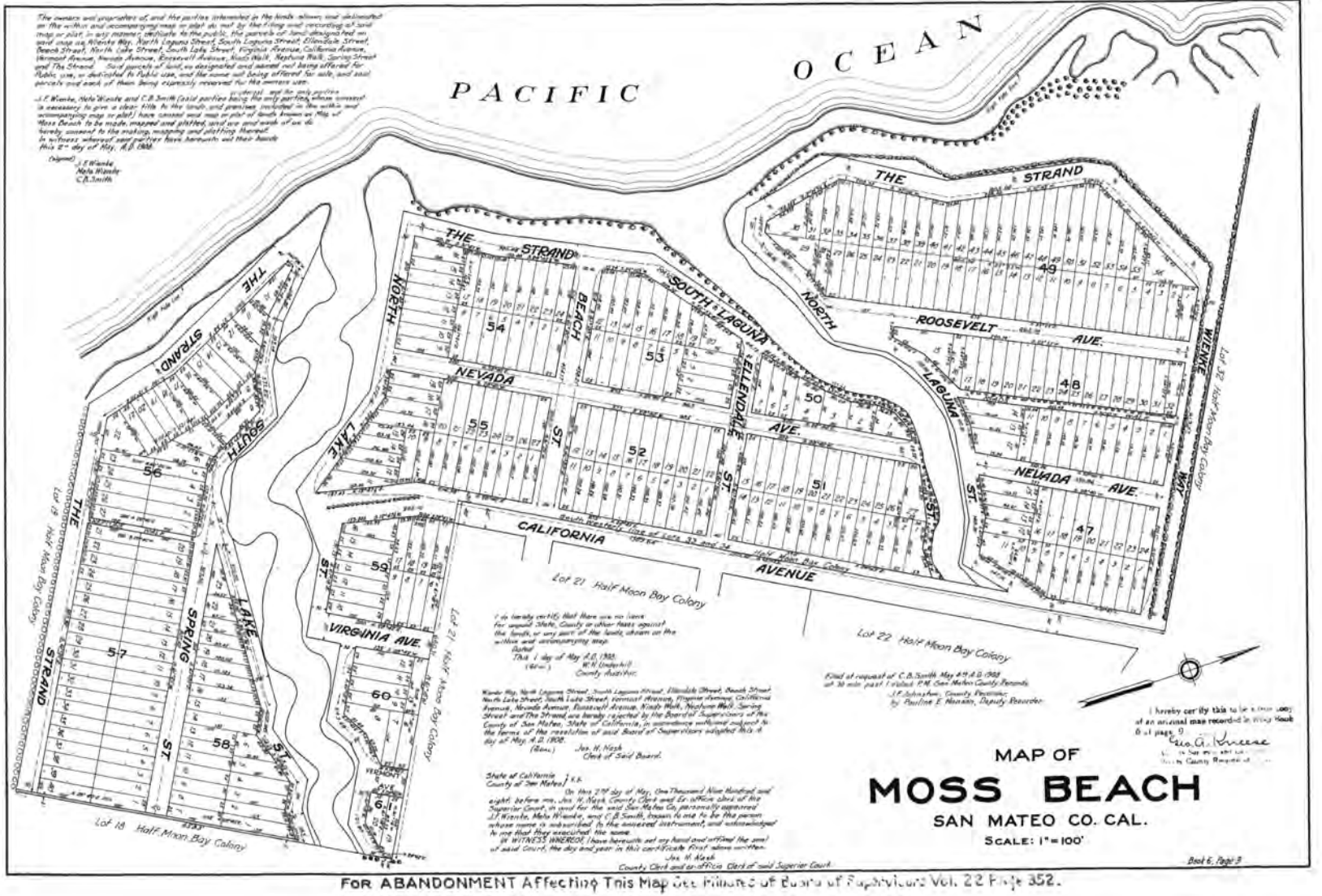
The blufftop setback above Dean Creek ravine is instead established in relation to slope stability with a minimum 2:1 slope requirement from top to toe of bank. The staff report states this is approximately 9 feet from the approved residence, but has not been included on the site plan so that distance cannot be verified. This is of concern given that the "top-of-bank" of the ravine is shown on the site plan 18 feet from the nearest point of the proposed residence, but the Michelucci 9/17/18 geotechnical update erroneously indicates the existing setback is 25 feet. These inconsistencies must be clarified, and an appropriately sufficient setback should be required. An additional concern is that with climate change, rainfall intensity of individual storm events is projected to increase, even though the total volume of precipitation per year may decrease; therefore, the potential for increased erosion of the streambank of Dean Creek should be analyzed.

Dean Creek is shown as a blue line (perennial) stream on the USGS 7.5 minute series topo maps (1993), contrary to the Staff Report's description of the creek as an intermittent stream. This may affect the setback of the southern edge of the building envelope from the creek, per LCP Policy 7.11 (b) which requires buffer zones to be extended 50 feet from the predictable high water point for perennial streams.

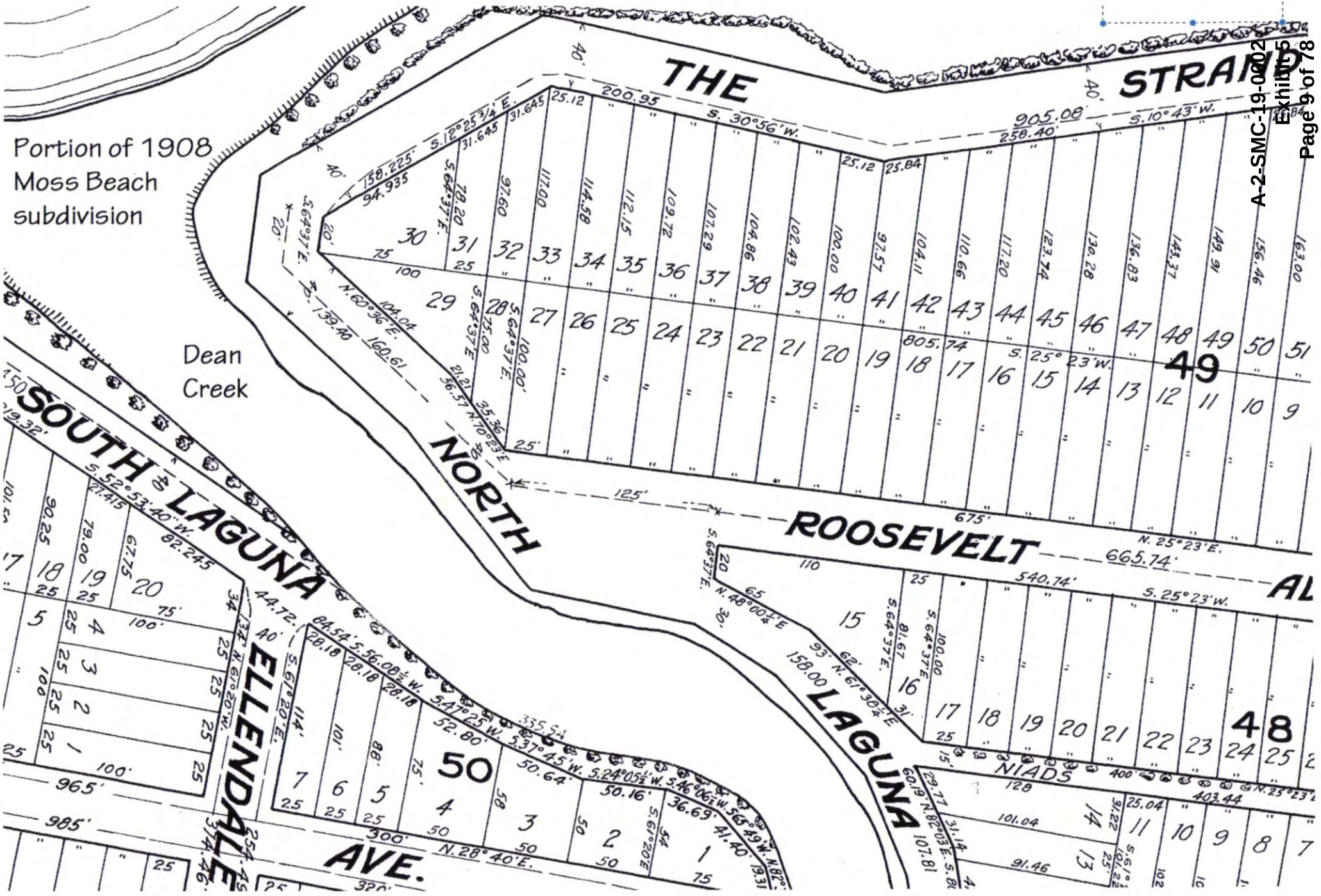
Foundation design alternatives. There is no discussion of impacts of foundation design alternatives (spread footing vs drilled piers) on bluff stability, future bluff retreat, removal of development, and site restoration. That analysis has been impermissibly deferred to the building permit stage. LCP Zoning Regulations Section 6328.15 requires that LCP issues be fully addressed prior to CDP approval.

Deed restriction prohibiting future armoring (Condition of Approval #3) should specifically state this restriction also applies to the bluff/streambank along the south side of the parcel from the mouth of Dean Creek to the eastern property line. Future Sea Level Rise and increased intensity of storm events may well accelerate erosion of this bluff/streambank. CGF is further concerned that the County staff indicated at the Planning Commission hearing, that if, in the future, the residence becomes unsafe to occupy due to bluff retreat, the owner could apply for a CDP amendment to allow armoring of the bluff. Such an amendment would be inconsistent with LCP policy 9.8 and Coastal Act Section 30253 (b).

9.



FOR ABANDONMENT Affecting This Map See Minutes of Board of Supervisors Vol. 22 Page 352.


Portion of 1908
Moss Beach
subdivision
Dean
Creek
THE STRAND
NORTH
ROOSEVELT
SOUTH LAGUNA
LAGUNA
ELLENDALE AVE.
NIADS
49
48
50
905.08'
S. 10° 43' W.
665.74'
S. 25° 23' W.
N. 25° 23' E.
S. 30° 56' W.
200.95'
S. 12° 25 3/4' E.
158.225'
94.935'
S. 64° 37' E.
N. 60° 36' E.
104.04'
160.61'
139.40'
S. 52° 53' 40" W.
82.245'
N. 61° 20' W.
S. 61° 20' E.
N. 28° 40' E.
300'
965'
985'
S. 56° 08½' W.
S. 47° 25' W.
S. 37° 45' W.
S. 24° 05½' W.
S. 46° 06½' W.
S. 65° 49' W.
335.54'
N. 82°
N. 61° 30¼' E.
158.00'
107.81'
S. 61° 20' E.
N. 25° 23' E.
403.44'

34

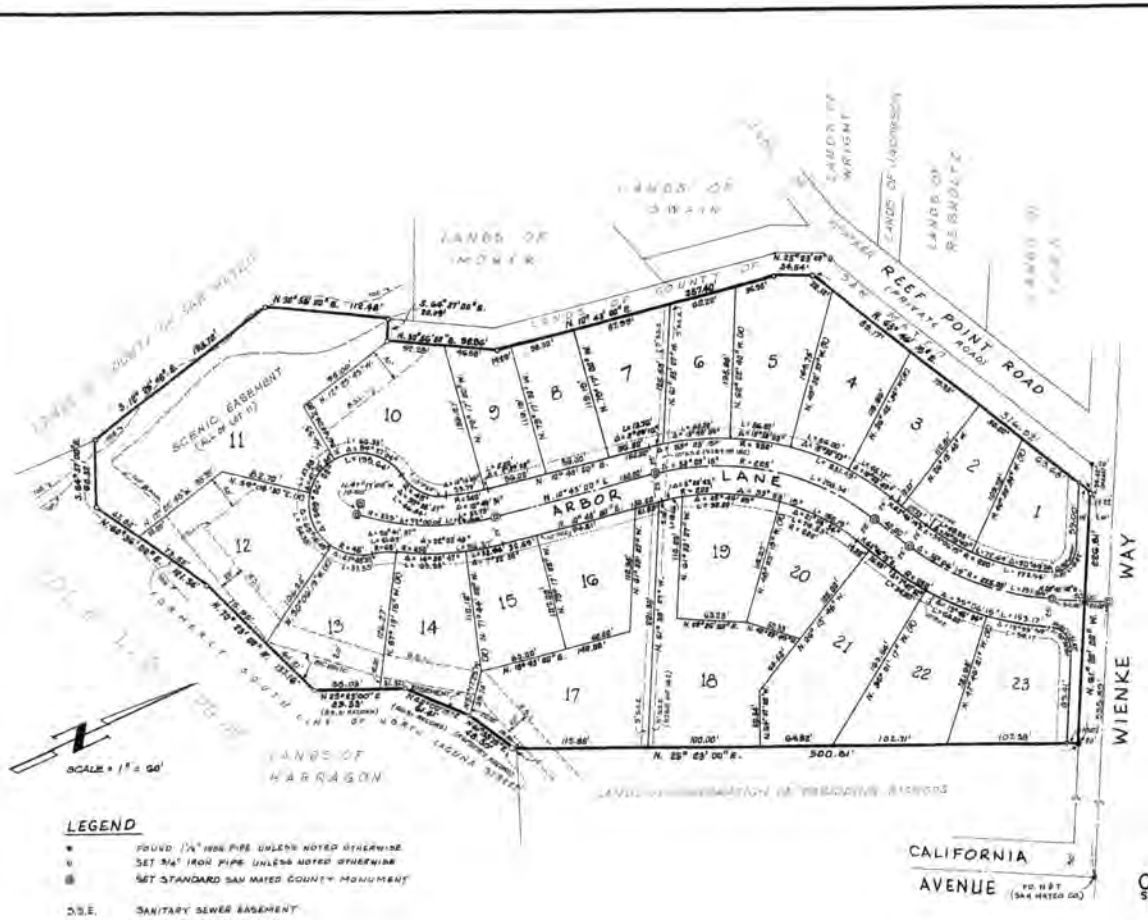
34

Vol. 75

Vol. 75

NOTES :

- THE BLUE BORDER INDICATES THE BOUNDARY OF THE LAND SUBDIVIDED BY THIS MAP.
- ALL DISTANCES ARE GIVEN IN FEET AND DECIMALS THEREOF.



LEGEND

- ● FOUND 1/4" IRON PIPE UNLESS NOTED OTHERWISE
- ○ SET 3/4" IRON PIPE UNLESS NOTED OTHERWISE
- ◉ SET STANDARD SAN MATEO COUNTY MONUMENT

S.S.E. SANITARY SEWER EASEMENT
B.S.L. BUILDING SETBACK LINE
P.U.E. PUBLIC UTILITY EASEMENT

BASIS OF BEARING

THE BEARING N 61°20'00"W OF THE SOUTHERLY LINE OF WIENKE WAY AS SHOWN ON THAT CERTAIN "MAP OF MOSS BEACH, SAN MATEO COUNTY, CALIFORNIA" RECORDED MAY 4, 1908 IN BOOK 6 OF MAPS AT PAGE 5, SAN MATEO COUNTY RECORDS

TRACT NO. 864

CYPRESS CLIFFS SUBDIVISION

SAN MATEO COUNTY CALIFORNIA

PARCEL DESCRIBED BY DEED RECORDED IN BOOK 1971 OFFICIAL RECORDS AT PAGE 114. BEING A RESUBDIVISION OF ALL OF BLOCK 49; LOTS 15-32 OF BLOCK 48 AND THOSE PORTIONS OF ROOSEVELT AVENUE, NORTH LAGUNA STREET, WIENKE WAY, AND THE STRAND, ALL ABANDONED, AS SAID LOTS, BLOCKS AND STREETS ARE DESCRIBED IN VOLUME 9 OF RECORDS AT PAGE 148

BEING A PORTION OF "MAP OF MOSS BEACH, SAN MATEO COUNTY, CALIFORNIA" FILED IN BOOK 6 OF MAPS AT PAGE 5, MAY 4, 1908, SAN MATEO COUNTY RECORDS

SCALE: 1" = 50' APRIL, 1978

SHEET TWO OF TWO SHEETS

WM. JAY HAMMOND
CIVIL ENGINEER
PALO ALTO CALIFORNIA

ESA

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900 phone
415.896.0332 fax

www.esassoc.com

memorandum

date October 26, 2016

to Lennie Roberts (Committee for Green Foothills)

from Louis White, PE

subject Vallemar Bluffs Coastal Hazards Assessment: Estimate of Accelerated Bluff Erosion due to Sea Level Rise (ESA Ref. #D160715.00)

1. Introduction

This memorandum presents the findings of a coastal hazards assessment, including estimates of future bluff erosion and wave uprush elevations, at an undeveloped bluff top site in Moss Beach, California. The Committee for Green Foothills (CGF) retained Environmental Science Associates (ESA) to review existing studies for the site by others and to conduct a technical analysis to estimate the potential future erosion limits associated with sea level rise (SLR). The analysis is based on information reported by others, as well as site observations and topographic data collected by ESA, and tide and wave data accessed from National Oceanic and Atmospheric Administration (NOAA) and Coastal Data Information Program (CDIP), respectively. Although the findings presented in this memorandum are intended to be used as a comparison to recommendations by others, they are not sufficient for locating structures, and this memorandum is not intended to do so.

The work described in this memorandum was completed by ESA staff members Hannah Snow, James Jackson, PE, Damien Kunz, Matt Norcott, and Louis White, PE, with review by Bob Battalio, PE. The information presented in this memorandum is intended solely for the use and benefit of the Committee for Green Foothills. No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of ESA, 550 Kearny Street, Suite 800, San Francisco, CA 94108.

Background

A proposed residential development project in Moss Beach, at Vallemar Bluffs, is required by the San Mateo County Local Coastal Program (LCP), Section 9.8, to consider coastal bluff erosion for a 50 year time period. The 2.5-acre site, at the intersection of Vallemar Street and Juliana Avenue, is the last undeveloped private land in the San Mateo Midcoast area (Figure 1). Seven lots, which were consolidated from a 1908 subdivision, have multiple owners who have all agreed to submit an application for development of the property as a whole. The application was recently submitted to San Mateo County Planning (County) and is now undergoing a formal review process. The Applicant has reduced the number of proposed houses to five, eliminating development on

one lot closest to the cliffs. The County plans to prepare an Initial Study/Mitigated Negative Declaration for the project.

Source: Google 2016

Figure 1
Project Site (in red), located in Moss Beach at Juliana Avenue and Vallemar Street

CGF retained ESA to provide professional engineering advice on coastal erosion issues at the site, as they relate to the future potential exposure of the proposed development to coastal erosion hazards. Specifically, CGF has opined that revisions to the project are needed because the proposed development on Lot D is too close to the bluffs and will likely be subject to bluff erosion over the 50-year life of the project. CGF has also indicated that allowing this lot to be developed will severely impact coastal access along the existing informal public access trail, impact public views of the coast from Juliana Avenue, as well as impact coastal prairie habitat, which is protected under the Coastal Act and San Mateo County LCP as Environmentally Sensitive Habitat Area (ESHA).

A coastal erosion study was prepared by Haro, Kasunich & Associates (HKA) in 2015 that recommended incorporating a 28-foot bluff setback distance from the top of a slope they estimated to be stable into the development plans (HKA 2015). The recommended setback distance included the projection of their estimated historic erosion rate plus a 25% increase in the historic erosion rate to account for the effects of sea level rise (SLR) over a 50-year project design life. The HKA (2015) study estimated a historic bluff erosion rate of 0.45 feet per year, which has been questioned by project stakeholders as being too low.

Erosion gullies, or swales, filled with imported materials, including soil, concrete debris, and tree trunks, located to the north and south of the promontory immediately opposite Lot D, may introduce additional erosion hazards to the proposed project. JCP (1990) describes a gully on the south side of the promontory as an active landslide approximately 40 feet in diameter and affecting an area approximately 18 feet inland from the existing bluff top. GeoForensics (2001) describes these features as erosion gullies, or drainage swales that extend from the bluff edge toward Lot D, based on photography from 1946. They report that the gullies were filled between 1946 and 1955 according to inspection of aerial imagery.

Several technical topics were identified by CGF as needing additional consideration in the analysis, including the following:

- Historic erosion rate seems low, and should consider additional aerial photographs and methods
- Erosion process with the stratified geology, and influence of the bedrock geometry on erosion of the bluff
- Low stability of the bluffs in the vicinity of Lot D as mapped in a San Mateo County Geologic Hazards Map
- Influence of the groundwater seeps in the bluff face on erosion and stability
- Influence of the gullies and landslides in the area on erosional hazards

Organization of this Memorandum

This memorandum is organized as follows:

- Section 2: Site Observations and Data Collection – a summary of the observations during site visits, topographic survey data, and other data used in the analyses
- Section 3: Climate Change and Sea Level Rise Background – describes guidance recommendations by the State of California, including scenarios, planning horizons, and amounts of sea level rise to be assessed
- Section 4: Analysis and Results – summarizes the technical methods and results of wave runup modeling and bluff erosion modeling

Summary of Findings and Recommendations

Based on the technical analyses conducted by ESA, we present the following findings:

- Erosion is projected to be greater than shown by HKA (2015). Impacts associated with a greater amount of erosion should be considered to avoid potential future hazards to proposed development.
- The historic erosion rate estimated by HKA (2015) should be reviewed in greater detail, and the project applicant should use a higher erosion rate not lower than the higher end of the range of estimates reported by HKA (2015). Additional information and aerial imagery should be used to establish the historic erosion rate.
- Incorporate a factor of safety into the setback distance calculation, or use a higher historic erosion rate.
- Consideration of the erosion gullies is important in assessing the potential hazards at Lot D. The gullies may not behave according to the historic erosion rate, and the presence of fill and concrete debris suggests that a landslide may be deeper than perceived from visual inspection. The potential migration of the gully into Lot D should be assessed in greater detail. Further study should assess whether the gully identified previously as a landslide would be considered active.
- Drainage of the site on the surface and through existing underground infrastructure should be considered in the stability of the bluff as it contributes to rapidly forming gullies and landslides. Future development should not place structures or drainage features in areas that are subject to future coastal erosion.
- Although a project design life established by the developers is 50 years, structures often exceed the design life, and the California Coastal Commission typically requires assessment of the hazard exposure through the end of the century at 2100 so that the project incorporates acceptable adaptation strategies.
- The future coastal flood hazard zone associated with the 100-year total water level is expected to increase in the future with sea level rise, and should be considered in the project planning and design. Results of the modeling described in this memorandum suggest that the bluff may be overtopped by 2065, with significant overtopping by 2100.

2. Site Observations and Data Collection

We based the analysis and findings presented herein on observations and data collected at the site by ESA staff, as well as publically available meteorological data archived by government agencies. The following sections summarize the site observations and the various data collected to support the analysis.

2.1 Site Observations

ESA staff observed the site conditions on September 28, 2016 and October 18, 2016. The first visit, during a low tide, included site reconnaissance and discussion of the proposed project with CGF staff and other stakeholders. At the second visit, ESA field staff collected topographic survey data of the bluff geometry, described in more detail below. Several key observations were made, which we compared to existing studies and incorporated into our bluff erosion and sea level rise analysis.

The geology of the site is stratified, with a layer of marine terrace deposits that overlays a bedrock layer known as the Montara Quartz Diorite (JCP 1990). Figure 2 shows a sandy beach with large granite cobbles and boulders is located in front of the exposed bedrock layer, which is approximately 5 to 15 feet above the top of the beach, and overlain by the marine terrace layer. Inspection of oblique aerial photography of the site archived by the California Coastal Records Project[1] indicates the sandy beach is seasonal. Photographs taken during winter and spring months show a rocky beach with waves breaking at the base of the bedrock bluff. Furthermore, the project area is mapped as an area of "low stability" and classified as unstable bluff material with erosion rate greater than one foot per year in a San Mateo County Geologic Hazards Map (San Mateo County 1975).

Figure 2
Photograph of site on beach looking north, showing the stratified geology of the bluff

[1] http://www.californiacoastline.org/

The promontory opposite Lot D is located between two gullies: one relatively large gully filled with imported soil and debris, and a smaller gully that appears to have been formed by surface drainage and an exposed pipe. The locations of these gullies are shown in Figure 2. The large gully was described by JCP (1990) as an active landslide approximately 40 feet in diameter and affecting an area approximately 18 feet inland from the existing bluff top. JCP (1990) considered this an active landslide because signs of erosion along the bluff face were observed at the time of their study. A study by GeoForensics (2001) stated that several erosion gullies were present along the bluffs in a photograph from 1946, and extended inland from the face of the bluff as much as 90 feet. GeoForensics (1990) indicates that the gullies were filled by 1955, but have more recently been eroding. The left photo of Figure 3 shows imported concrete debris and fill located at the top of the gully that was described as an active landslide by JCP (1990). The photo on the right of Figure 3 shows the location of the "small" gully on the north of the promontory opposite Lot D, thought to be formed by surface drainage. An exposed metal pipe appears to have contributed to the erosion of the "small" gully (right panel, Figure 4). This implies that erosional factors other than average bluff retreat may contribute to future erosion hazards into Lot D.

Figure 3
Photos of the bluff top showing concrete debris and fill at the top of an active landslide (left) and the variability in the bluff edge caused by gullies (right)

Several fissures were observed in the bluff top, which indicate that the bluff edge is in an unstable geometry and is prone to failure (left panel, Figure 4). The fissures are likely a result of the overly steep geometry of the marine terrace deposit layer, and indicative of the episodic nature of erosion. The photo on the right in Figure 4 shows the gully located immediately north of the promontory opposite Lot D.

Figure 4
Photos of bluff top showing a fissure or crack in the bluff (left) and a gully presumably caused by surface drainage (right)

Areas of active erosion on the bluff, as well as groundwater seeps, were observed along the bluff. The photograph in Figure 5 shows a grayish layer of sediment with water seeping out of the face of the bluff. Areas of active erosion were observed adjacent to the wet bluff face, which may be contributing to the instability of the bluff. Areas along the bluff are also vegetated by a mix of native and non-native invasive species that may play a role in surface erosion.

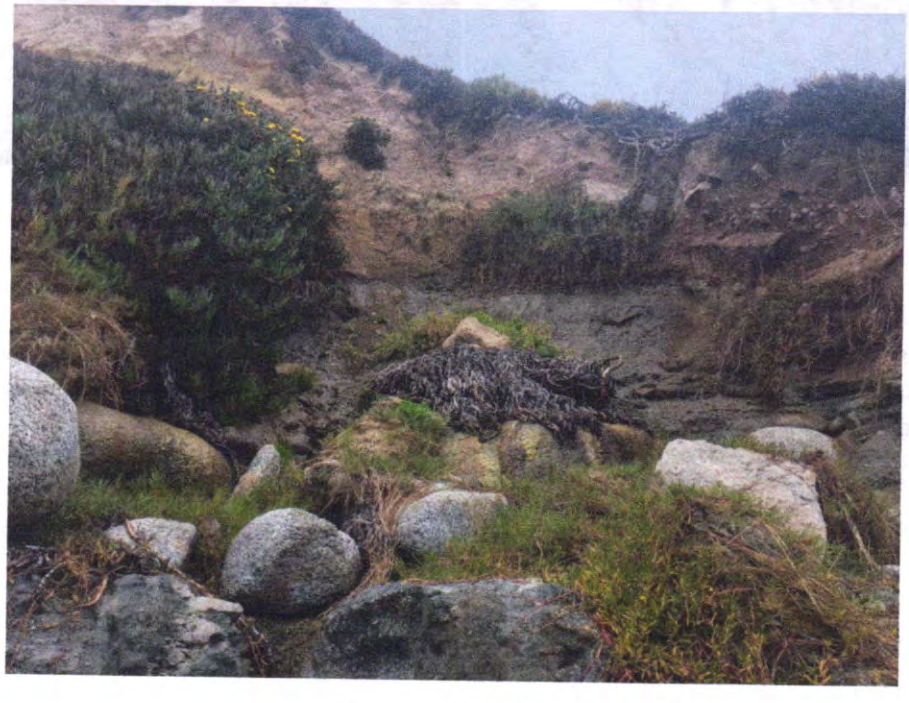


Figure 5
Active erosion and seepage of groundwater on the bluff face

The photographs in Figure 6 show additional groundwater seeps and erosion that was observed below the promontory opposite Lot D. The water seeping out of the bluff runs down the slope and over the bedrock. Algae growths were observed at locations where the groundwater seeps run over the bedrock, possibly indicating that the seeps are active most of the year, and not only in the rainy season.

Figure 6
Groundwater seeps and erosion on the bluff face below the promontory opposite Lot D

A sewer manhole was observed close to the bluff edge at the project site, indicating the presence of an abandoned sewer main. The sewer main likely has little impact on the bluff and erosion unless it is actively leaking and contributing to the moisture observed in the bluff face. The primary issue with the abandoned sewer main will be in the future, when it becomes exposed by erosion of the bluff, which will require removal of debris after it is exposed or in anticipation of future erosion. The geometry of the abandoned sewer infrastructure is not known, and therefore more information is needed to make a recommendation on proposed approach to removing the infrastructure from the bluff.

2.2 Data Collection

Data collection for the project included collecting of topography at the site, reviewing existing studies, and acquiring publically available meteorological data. The following sub-sections describe the data collection.

Survey Data and Measurements

ESA collected a limited amount of topographic data at the project site on October 18, 2016, using a total station and RTK GPS equipment.[2] The survey measured the horizontal and vertical location of several site features relative to the North American Vertical Datum of 1988 (NAVD), including the:

- Edge of bluff (marine terrace layer)
- Top of bedrock
- Edge of bedrock (also called "crest" in this document)

[2] ESA performs land surveys and collects hydrographic data to augment traditional surveying services for the purposes of geomorphic interpretation, monitoring of project performance, and other specific uses consistent with Geologic and Landscape Surveys as defined in the Professional Land Surveyors' Act (California Business and Professionals Code). ESA does not provide traditional land survey services such as property boundaries and maps for general use by others. ESA recommends that a licensed, professional land surveyor accomplish these traditional surveying services under direct contract either with the client or as a sub-consultant to ESA.

- Top of beach
- Profile through promontory opposite Lot D, following Section 3 of HKA (2015)

Figure 7 summarizes the key information from the topographic survey, including dimensions, elevations, and slopes of features. The dashed blue line is located approximately where we surveyed a profile across the bluff and beach. The elevation of the edge of the bluff was measured to be approximately 43 feet NAVD, with some variability along the shore. The marine terrace deposits in this location stand almost vertical and are approximately 25 feet tall. The elevation of the bedrock layer was approximately 18 feet NAVD, although it also varied along the shore, and was approximately 7 feet above the top of the beach. A small "bench" was formed on the bedrock top as it extends seaward from the base of the bluff. The bedrock bench from the bluff toe varied between about 5 feet and 15 feet along the shore, likely a function of the relative exposure to waves breaking near the bedrock and bluff. The bench was not observed toward the north end of the beach, likely because of the presence of a large promontory that extends into the surf zone and protects the northern pocket of the beach from the larger breaking waves. Boulders and large cobbles were observed in the surf zone at approximately the low tide platform, and along the beach. Several boulders were sitting on top of the bench formed by the bedrock, which were likely moved by waves during extreme coastal conditions.

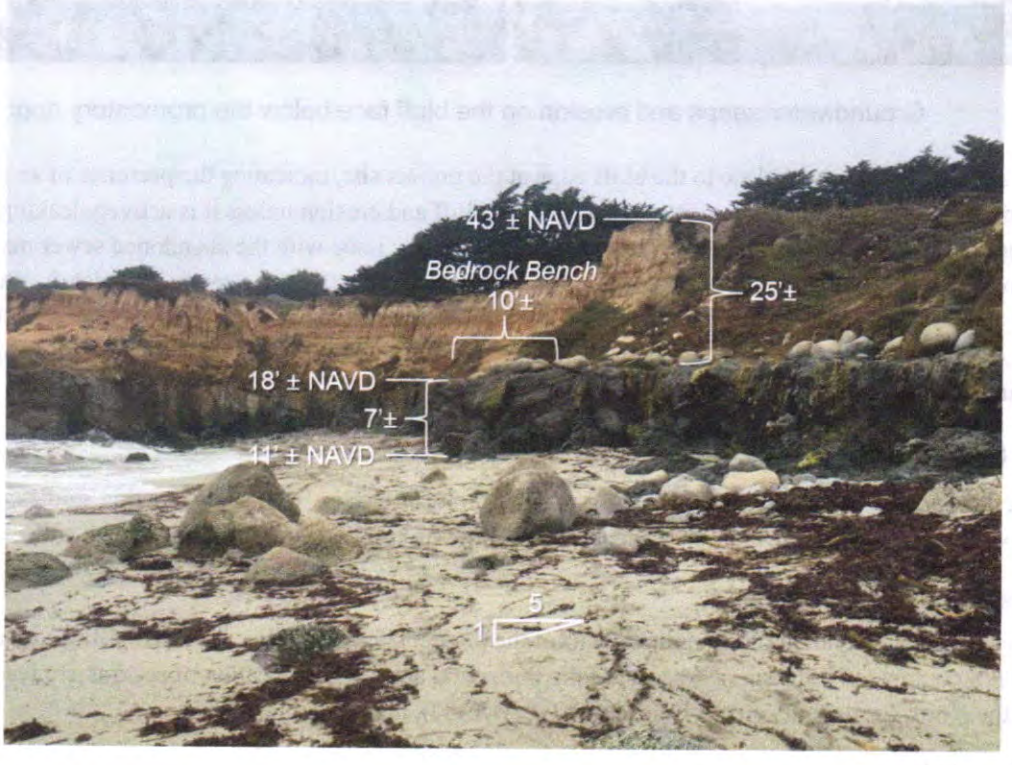


Figure 7
Approximate geometry of beach and bluff

Tidal Water Levels

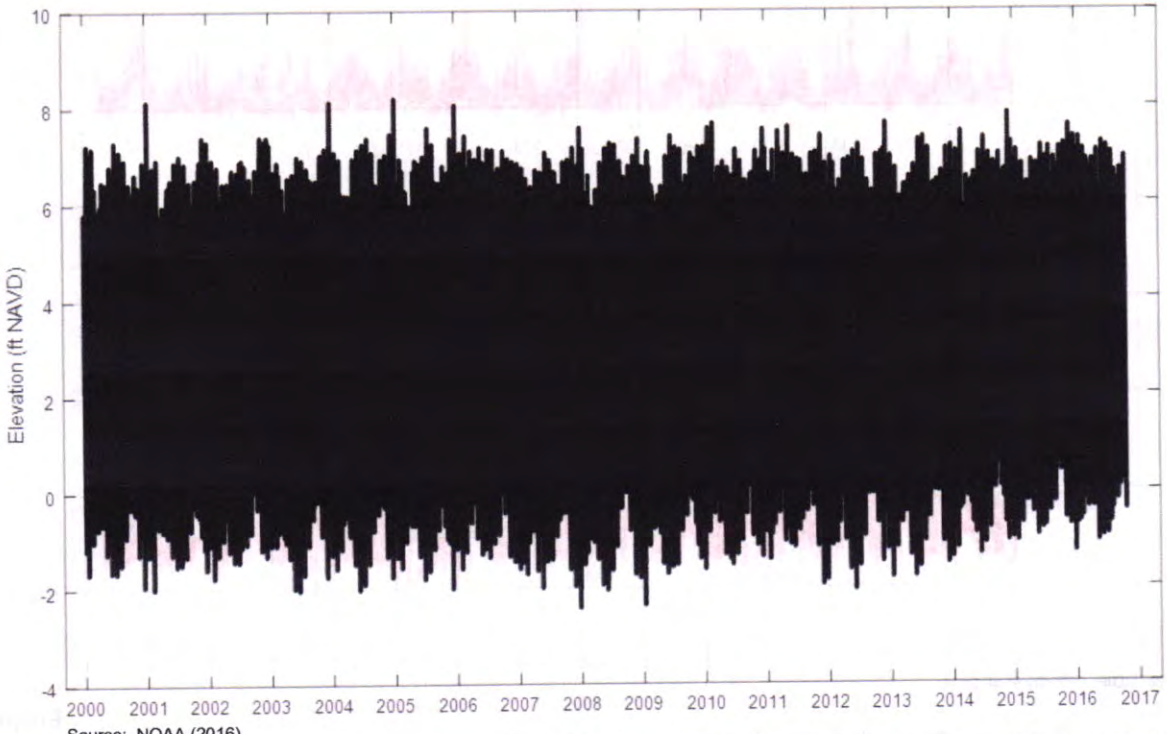
Tides at the site are characterized by a mixed semi-diurnal tide signal, typical of the California coast, with two high tides and low tides occurring per day, each with unequal heights. The diurnal tide range, or the difference between mean higher high water (MHHW) and mean lower low water (MLLW), is approximately 5.8 feet. Table 1 presents the tidal datums used for the technical analyses described in this report. Tide data and tidal datums

were based on the NOAA Tide Gage Station 9414290 at San Francisco, California, located at the Golden Gate about 20 miles from the project site, but assumed to be representative of the actual conditions at the site. Comparison to a short record of tide data collected at Pillar Point show a small difference in the tide elevations, but was assumed negligible for the analysis we conducted. Figure 8 presents a time series of the tide data that was used in the analysis described below.

TABLE 1
TIDAL DATUMS FROM SAN FRANCISCO TIDE STATION 9414290

Datum	Elevation (feet NAVD)
Highest Observed Water Level (HOWL)	8.7
Mean Higher High Water (MHHW)	5.9
Mean High Water (MHW)	5.3
Mean Tide Level (MTL)	3.2
Mean Sea Level (MSL)	3.2
Mean Low Water (MLW)	1.2
Mean Lower Low Water (MLLW)	0.1
Lowest Observed Water Level (LOWL)	-2.8

Source: NOAA NOS Station 9414290, San Francisco, CA



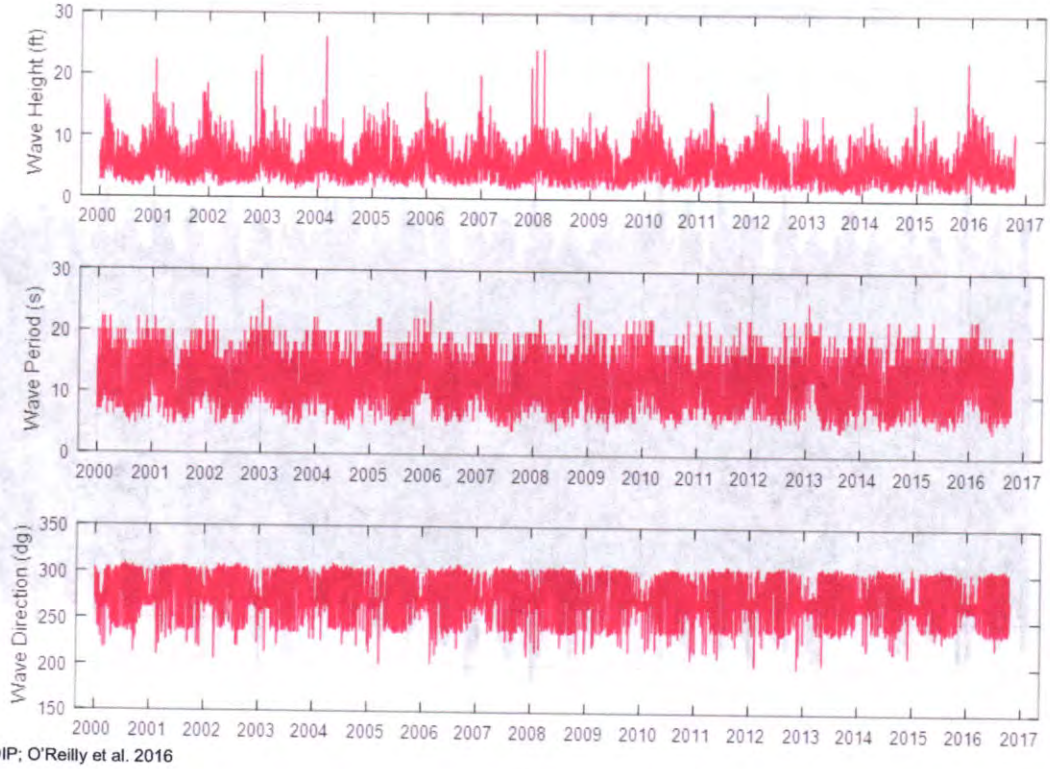
Source: NOAA (2016)

Figure 8
Measured tide elevation at San Francisco, Golden Gate, NOAA NOS 9414290

Wave Climate

Hourly wave height, period, and direction near the project site were obtained from nearshore transformed wave data provided by the Coastal Data Information Program (CDIP) California Coastal Wave Monitoring and Prediction System (O'Reilly et al. 2016). The data comprises the output of a spectral transformation model, at a virtual point located in about 45 feet of water approximately one-half mile offshore of the project site. Figure 9 presents hourly wave data, transformed from deep-water measurements using transformation coefficients computed by CDIP.[3] Note the seasonal patterns, with large wave heights and long periods approaching the site with a narrow band from the west-northwest in the winter, and smaller waves with shorter periods approaching from a wide band ranging from west-southwest to northwest. The wave data is an important consideration in the analysis, as it is a driver of the beach elevations, flood elevations and erosion processes.

Recent nearshore wave data from CDIP and historic water levels at the San Francisco tide gauge (NOAA station 9414290) were used as input to the coastal erosion model and flooding calculations. Since these same meteorological and climatic conditions affect water levels and waves, these conditions are correlated. In fact, the worst coastal hazards are typically associated with coincident occurrences of high waves and high storm surge and the effect on coastal hazard responses such as total water level are not necessarily linear (FEMA 2005; Garrity et al. 2006).



Source: CDIP; O'Reilly et al. 2016

Figure 9
Wave height, period and direction record for offshore of the project site at depth of 15 meters

[3] Data were furnished by the Coastal Data Information Program (CDIP), Integrative Oceanography Division, operated by the Scripps Institution of Oceanography, under the sponsorship of the U.S. Army Corps of Engineers and the California Department of Parks and Recreation, http://cdip.ucsd.edu/

Historic Erosion Rate

Estimation of the historic erosion rate for the project site was beyond the scope of our study, and therefore we relied on prior estimates by others. Our primary source for the historic erosion rate was the HKA (2015) study, which estimated the historical bluff recession rates over time using a 1908 surveyed subdivision map, a vertical photo from 1986, and 2014 field measurements. The HKA (2015) study based their setback analysis on a historic erosion rate of 0.45 feet per year, based on comparing the 1908 survey to the 2014 field measurements, and also reported a range in the erosion rate between 0.36 and 0.64 feet per year based on comparing the 1986 photograph to the 2014 field measurements.

Through comments provided to ESA by CGF, stakeholders have expressed concern in using the 1908 subdivision map as the baseline for the erosion rate calculations because it is not known how accurately the coast was surveyed, including the actual location of the bluff edge at the time of the mapping. GeoForensics (2001) performed a "least-squares regression" analysis on several aerial images acquired for the project site, and projected the computed erosion rates into the future to estimate the future location of the bluff edge. However, it appears that the GeoForensics (2001) study did not consider SLR, and it does not explicitly report the computed historic erosion rates, although the data and linear fits are presented in graphical format. Inspection of the graphs suggests historical erosion rates that vary from about 0.3 feet per year up to 0.75 feet per year in some locations. Selection of the cross-section plays an important role in the calculated erosion rates, because the location of the bluff edge is variable. Other studies nearby for the Fitzgerald Marine Reserve estimate historic bluff erosion rates of over one foot per year and recommend a minimum setback of 100 feet for new development (Brady/LSA 2002).

Overall, we recommend the conducting a more complete bluff erosion analysis to estimate the historical erosion rates at the site. This study should utilize all available aerial images of adequate quality, and use different standard methods to estimate the rate, including a least squares regression and other available software, such as Digital Shoreline Analysis System (DSAS) (Thieler et al. 2009).

In the analysis described in this memorandum, we used the HKA (2015) erosion rate of 0.45 feet per year so that the results from the ESA methods can be compared to HKA (2015). We also considered the implications of a higher erosion rate of 0.64 feet per year reported by HKA (2015) in our analysis. Finally we also considered the implications of a higher historic erosion rate, for which we selected one foot per year.

3. Climate Change and Sea Level Rise Background

3.1 Climate change scenarios

The accumulation of greenhouse gases in the Earth's atmosphere is causing and will continue to cause global warming and resultant climate change. For the coastal setting, the primary exposure will be an increase in mean SLR due to thermal expansion of the ocean's waters and melting of ice sheets.

State planning guidance for coastal flood vulnerability assessments call for considering a range of scenarios (OPC 2013; CCC 2015). These scenarios bracket the likely ranges of future greenhouse gas emissions and ice sheet loss, two key determinants of climate whose future values cannot be precisely predicted. Scenario-based analysis promotes the understanding of impacts from a range of scenarios and identifies the amounts of climate change that would cause impacts.

The guidance recommends using scenarios that represent low, medium, and high rates of climate change. Recent studies of current greenhouse gas emissions and projections of future loss of ice sheet indicate that the low scenario probably underrepresents future SLR (Rahmstorf et al. 2012; Horton et al. 2014). Also, note that even if SLR does not increase as fast as projected for the high scenario, SLR will undoubtedly continue beyond 2100, such that the medium scenario is likely to yield the same amount of SLR. It just would occur a few decades after 2100 instead of at the turn of the century.

While the interim state recommended SLR scenarios have not yet been finalized, we are expecting the state to recommend dropping the "low" SLR scenario. This study thus focuses on the Medium and High SLR scenarios. The assumptions that form the basis for these scenarios are:

- ***High Scenario*** – The high scenario assumes population growth that peaks mid-century, high economic growth, and development of more efficient technologies. The associated energy demands would be met primarily with fossil-fuel intensive sources.

- ***Medium Scenario*** – The medium scenario assumes same population, economic, and technologic growth as the high scenario, but also assumes that energy would be derived from a balance of sources, thereby reducing greenhouse gas emissions.

3.2 Planning Horizons

The planning horizons analyzed for this project are 2065 and 2100, selected to inform the potential impacts to the project site for mid- and late-century conditions, and consistent with the CCC (2015) SLR Policy Guidance document. This set of planning horizons is recommended so that decisions about land use can be matched to the timeframe for project lifespans and to facilitate the identification of triggers for adaptation measures. Although HKA (2015) reported that the design life of the project is 50 years, which will occur much earlier than the 2100 planning horizon, it is unlikely that the development would be removed at the end of this project life. Therefore, planning horizons for a SLR analysis are typically longer than the periods associated with near-term decision-making.

3.3 Relative Mean Sea Level Rise Amounts

Two SLR scenarios were evaluated to estimate the change in coastal water levels under medium and high degrees of climate change. This conforms to state planning guidance for coastal flood vulnerability, which recommends

analyzing a range of climate scenarios due to uncertainty about future climate predictions (OPC 2013; CCC 2015). For assessing the impacts of SLR on the project site, we used mean SLR projections through 2100 based on a recent study by the National Research Council (NRC 2012) for the West Coast, which was adopted by the State of California (OPC 2013; CCC 2015). Table 3 presents the values for relative mean SLR at 2065[4] and 2100 for the San Francisco Region relative to 2000. The relative mean SLR includes regional projections of both mean SLR and vertical land subsidence of 1.5 millimeters per year for the San Andreas region south of Cape Mendocino (see OPC 2013). These values of relative SLR were used in the analysis described in this memo.

TABLE 2
RELATIVE MEAN SEA LEVEL RISE PROJECTIONS FOR THE SAN FRANCISCO REGION FOR MEDIUM AND HIGH SCENARIOS

Year	Medium SLR	High SLR
2065	17 inches	35 inches
2100	36 inches	66 inches

[4] Although the SLR projections are tabulated at years 2050 and 2100, the CCC (2015) includes a polynomial fit for the High Scenario (Equation B-3 of CCC 2015), which was used to define the SLR value projected for 2065. Similarly, we used a polynomial fit to the NRC (2012) values for the Medium Scenario to define the SLR value projected for 2065.

4. Analysis and Results

The following sections describe the technical analyses conducted to model the bluff erosion and wave runup elevations as a function of sea level rise. The bluff recession model calculates the increase in the historical erosion rate due to SLR as a function of the change in exceedance of a selected wave runup event. Therefore, this section presents the analysis and results of the total water level analysis, followed by the bluff erosion analysis and results.

4.1 Wave Uprush and Total Water Level

The total water level (TWL), defined as the maximum elevation of the wave runup or wave uprush, was estimated using methods described in a Technical Methods Manual titled *Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps*, recently prepared for the California Department of Water Resources (Battalio et al. 2016), and consistent with FEMA mapping guidelines (FEMA 2005). The "modified TAW" method computes the wave runup height above a reference water level using the TAW equation[5] with a composite slope of the backshore (i.e. an average slope is calculated over a distance between the breaker location and a point on the bluff), similar to methods described in the *Shore Protection Manual* (USACE 1984).

The modified TAW method computes a reference water level by increasing the observed tidal still water level (SWL) to include the static and dynamic wave setup as caused by waves breaking further offshore. We used the DIM method to calculate the wave setup at the breaker location to establish the reference water level for each wave runup computation. The final step is to compute the wave runup elevation with a depth-limited wave at a selected breaker location. We selected a breaker location as the mean sea level (MSL) contour on the surveyed shore profile.

Using the concurrent time series of tide elevations and offshore wave heights, we generated a time series of TWLs. Figure 10 presents an exceedance curve of the computed TWLs, which relate the TWL elevation (vertical axis) to the percent of time that the value is exceeded (horizontal axis). As shown in Figure 10, elevation 0 feet NAVD is exceeded 100% of the time for the period of observations, and the TWL of 22 feet NAVD is exceeded approximately 1% of the time for the period of observations. Note that the crest of the bedrock bluff is located at approximately 18 feet NAVD, and thus is anticipated to be overtopped approximately 3 to 4% of the time.

[5] TAW refers to the Technical Advisory Committee on Flood Defence in the Netherlands; the TAW equation was developed by the for estimating wave runup and overtopping as part of a set of guidelines for safety assessment and design of dikes. Application of the TAW equation is also described in FEMA's Guidelines for Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States (FEMA 2005).

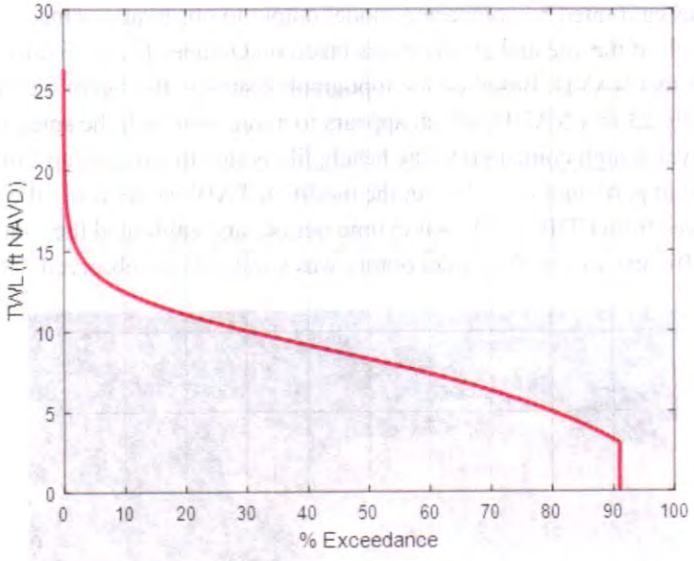


Figure 10
Exceedance curve of the total water level calculated at the site for existing conditions

We estimated the 100-year TWL for existing conditions to be approximately 31±2 feet NAVD. Figure 11 presents several extreme value distributions fit to the annual maximum TWL data for the period of record. This is slightly higher than the base flood elevation (BFE) of 26 feet NAVD mapped in the Preliminary 2015 FEMA FIRM for the project area. However, the FEMA BFE values are calculated on a limited number of transects, with values that range from 26 to 34 feet NAVD along this section of coast with similar shore morphology and wave exposure, and therefore the estimate of the 100-year TWL in this report seems in-line with the FEMA study.

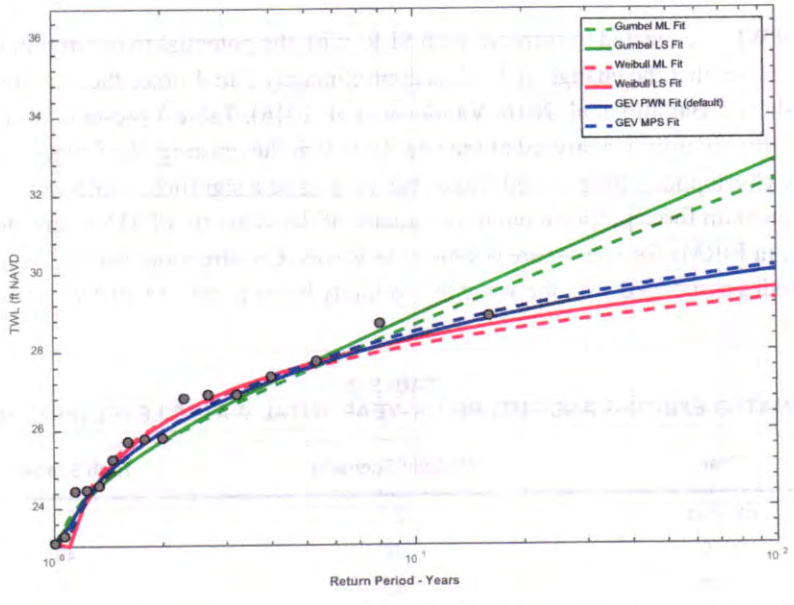
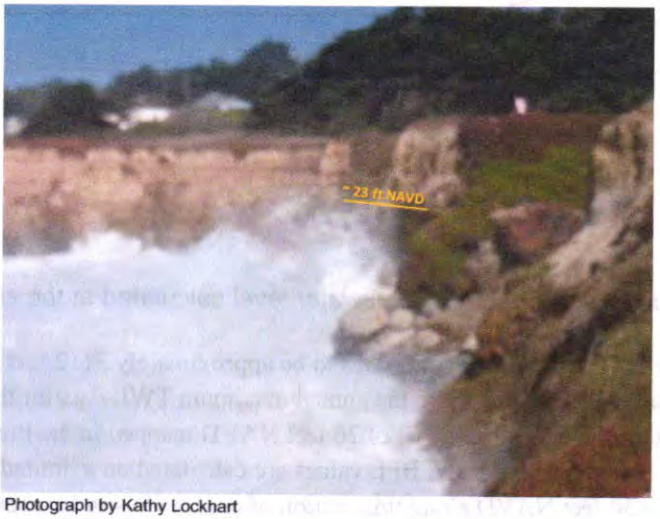


Figure 11
Extreme value analysis of the total water level time series shows a 100-year total water level up to 33 feet NAVD

The wave runup model was calibrated by comparing model output to observations made at the site on October 17, 2016. We used a photograph of the site and observations taken on October 17, 2016 during high tide to estimate a TWL of approximately 23 feet NAVD. Based on the topographic survey, the top of the vegetation shown in the photograph is approximately 23 feet NAVD, which appears to agree well with the spray of the wave. Also note that the reference water level is high compared to the beach, likely due to wave setup caused by the long period swell hitting the coast on that particular day. We ran the modified TAW model using the measured tides from NOAA and nearshore waves from CDIP for the same time period, and calibrated the runup component by adjusting a roughness coefficient so that the model output was similar to the observed data.



Photograph by Kathy Lockhart

Figure 12
Estimate of total water level based on observations made on October 17, 2016

The future 100-year TWL is expected to increase with SLR, with the potential to overtop the bluff by 2065. Recent studies have shown that the change in TWL is approximately 3 to 4 times the amount of SLR at erosion-resistant, steep backshores (Battalio et al. 2016, Vandever et al. 2016). Table 3 presents values of the existing and future 100-year TWL for the profile analyzed at the site. Note that the existing bluff edge is approximately 43 feet NAVD. During wave overtopping, long period waves can propagate a significant landward distance and impact structures with a momentum force proportional to the square of the velocity. FEMA maps the "V" zone, or velocity hazard zone, in FIRMs for coastal areas subject to waves. Construction in a "V" zone is required to meet additional building codes associated with the wave and velocity hazards. FEMA FIRMs are subject to future revisions.

TABLE 3
ESTIMATED EXISTING AND FUTURE 100-YEAR TOTAL WATER LEVEL (FEET NAVD)

Year	Medium Scenario	High Scenario
Existing	31	31
2065	37	43
2100	43	53

4.2 Bluff Retreat Estimate

The estimate of future bluff retreat was completed using an approach first established by ESA (formerly Philip Williams and Associates) and applied to several studies on the coast of California. The method estimates the increase in the erosion rate of the base or toe of the bluff as a function of the change in the TWL exceedance above the toe for future conditions. For this particular site and application, the layered geology was assessed using an additional step and assumptions. A key assumption in this analysis is that for a static sea level, the bedrock layer and the marine terrace layer erode at the same rate. We assume that the bench between the edge of the bedrock and the base of the bluff is a result of variable wave exposure and is not expected to change significantly for a static sea level. As sea level changes, the base erosion rate of the bedrock will increase, due to the change in TWL exceedance above the toe, and the bedrock bench will increase due to the increased impacts of waves on the marine terrace materials. Therefore, we computed the accelerated erosion of the bluff top as a function of the acceleration in the base erosion at the toe of the bedrock, and the increase in the bench width between the bedrock edge and the bluff. Figure 13 presents a schematic that illustrates the conceptual model of the bluff erosion for the site, where X_1 is the base erosion distance of the toe of the bedrock for a given time period and X_2 is the total erosion distance of the bluff edge for the same time period. Note that X_2 is the sum of the base erosion distance X_1 and the change in width of the bench.

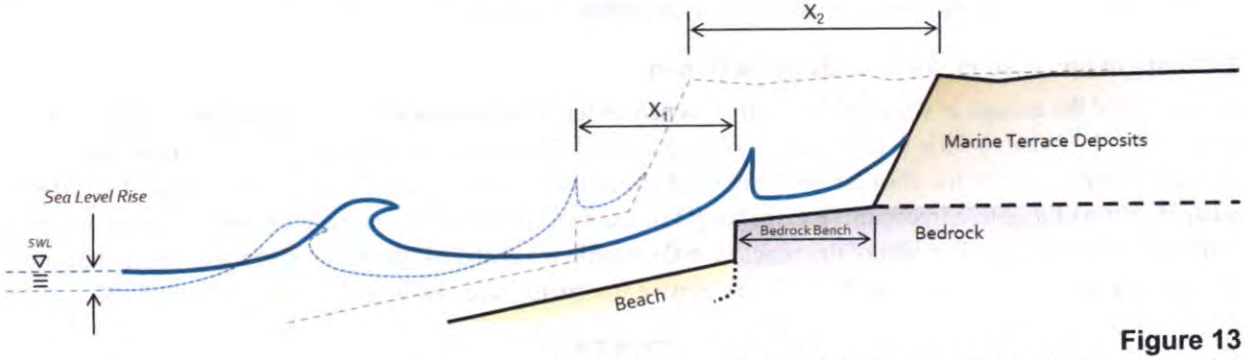


Figure 13
Conceptual model of bluff erosion at the site (not to scale)

Estimate of Accelerated Base Erosion

Methods to estimate future erosion rates that consider sea level rise are described by a limited number of studies. The Pacific Institute study (PWA 2009, Revell et al. 2011) estimated future erosion rates using the following equation,

$$Erosion\ Rate_{future}(t) = Erosion\ Rate_{historic} * \left(1 + \alpha \frac{P_f - P_e}{P_e}\right) \quad (1)$$

where P_f and P_e are the future and existing probability of total water level exceedance above the cliff toe elevation, respectively. Since the Pacific Institute study, a number of studies have proposed additional relationships for estimating cliff/bluff erosion rates under accelerated sea level rise (Walkden and Dickson 2008, Ashton et al. 2011). Walkden and Dickson (2008) found that the following equation applied well for the cliff backed/low volume beaches undergoing a historic trend in sea level rise at the Naze Peninsula on the Essex coast in Southern England:

$$Erosion\ Rate_{future}(t) = Erosion\ Rate_{historic} * \left(\frac{Rate\ of\ Sea\ Level\ Rise\ (t)}{Rate\ of\ Sea\ Level\ Rise\ (historic)}\right)^m \quad (2)$$

In this equation m =0.5. Ashton et al. 2011 investigated the value of m using various data sets for calibration and confirmed that m = 0.5 applies to cliffs/bluffs dominated by wave-driven erosion. In particular, rocky shore platforms and cliffs fronted by low-sediment-volume beaches, both of which apply for the cliffs at the project site.

ESA has further adapted the Walkden and Dickson (2008) equation, as follows:

$$Erosion\ Rate_{future}(t) = Erosion\ Rate_{historic} * \left(\frac{A\,(t)}{A\,(historic)}\right)^{m} \quad (3)$$

where A is the area below the total water level exceedance curve and above the existing toe elevation. This area is a combination of the duration of wave impact above the toe elevation and the intensity of that contact (how high above the toe the waves and wave runup are reaching). The exponent, m, was kept at 0.5, in agreement with the previous studies.

Application of this method to the profile at the site yielded increased erosion rates as a function of time. We computed the accelerated erosion rates for three different historic erosion rates as described in Section 2.2, and for the medium and high sea level rise scenarios as described in Section 3.

Estimate of Increase in Width of Bedrock Bench

We estimated the change in width of the bedrock bench on top of the bedrock by accounting for the change in future TWL for events with a 1- to 5-year recurrence interval. The recurrence interval of 1- to 5-years was selected to correspond to the episodic nature of bluff erosion. We modified Equation 5 of Battalio et al. (2016) to relate the ratio of negative freeboard (e.g. the height of the wave runup above the bedrock) for future and existing conditions to the change in width of the bench. For the profile we analyzed, the bench width was approximately 10 feet, and increased over time as the relative negative freeboard increased with the acceleration in SLR.

TABLE 4
ESTIMATED EXISTING AND FUTURE BEDROCK BENCH TOP WIDTH AT ANALYZED PROFILE (FEET)

Year	Medium Scenario	High Scenario
Existing	10	10
2065	20	26
2100	27	35

Calculation of Setback Distance

The setback location was estimated by adding the results of the base erosion estimate with the increase in the width of the bench, and then projecting a slope of 1.5 to 1 (horizontal to vertical) to the existing ground surface, consistent with the method described by HKA (2015) for locating the top of the stable slope.

Figure 14 presents a plan view of the stable slope location and the computed setbacks associated with the medium and high SLR scenarios at 2065 and 2100 for two historic erosion rates. The setbacks shown with the solid lines are based on a historic erosion rate of 0.45 feet per year, and those with the dashed line are based on a historic erosion rate of 0.64 feet per year. These setback distances are applicable to the surveyed profile location only, and may not be representative of appropriate setback distances along the shore. Additional work is required to

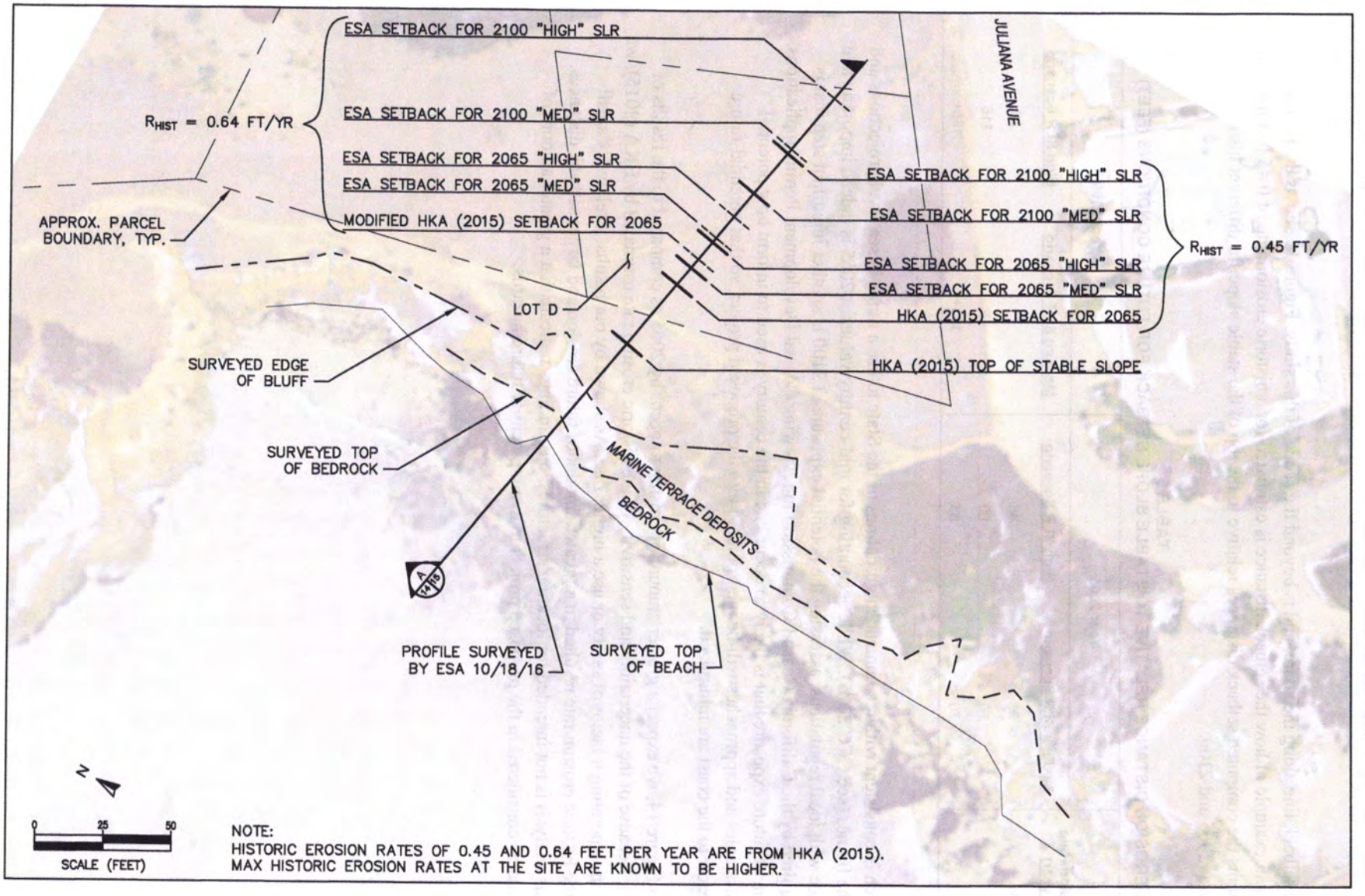
compute the setback line along the shore, and is beyond the scope of this study. Figure 15 shows the profile section, with an example of how the setback distance is estimated for a historic erosion rate of 0.45 feet per year. Table 5 presents the computed setback distances relative to the top of the stable slope for different historic erosion rates at 2065 and 2100.

TABLE 5
TOTAL EROSION DISTANCE RELATIVE TO STABLE SLOPE SETBACK FOR FUTURE CONDITIONS (FEET)

Historic Erosion Rate (feet per year)	Year 2065		Year 2100	
	Medium SLR Scenario	High SLR Scenario	Medium SLR Scenario	High SLR Scenario
0.45	36	48	71	90
0.64	50	60	92	116
1.0	70	83	133+	165+

This approach is consistent with recommended guidelines of the State to use a range in sea level projections and different time frames (see CCC 2015). While accounting for mid-century values at 2065 is indeed important and in compliance with local regulations, assessing the potential exposure at 2100 is another important step that is typically required by the California Coastal Commission in reviewing Coastal Development Permit applications. Identification of future exposure that is likely to occur late in the century is used to inform how potential adaptation strategies and approaches will be incorporated into the proposed project, so that potential future adverse impacts to the coast are minimized.

As shown in Figure 14, we expect a greater amount of erosion to occur by 2065 as compared to the results of HKA (2015). Because of the uncertainty and sensitivity of the historic erosion rate estimated by HKA (2015), we recommend incorporating a factor of safety or use a higher rate. As shown by our results, a relatively small increase in the historic erosion rate resulted in a greater amount of future erosion and larger setback distances. Although this analysis is not intended for locating structures, our findings indicate that a greater amount of erosion should be considered in the proposed project to avoid potential future hazards.



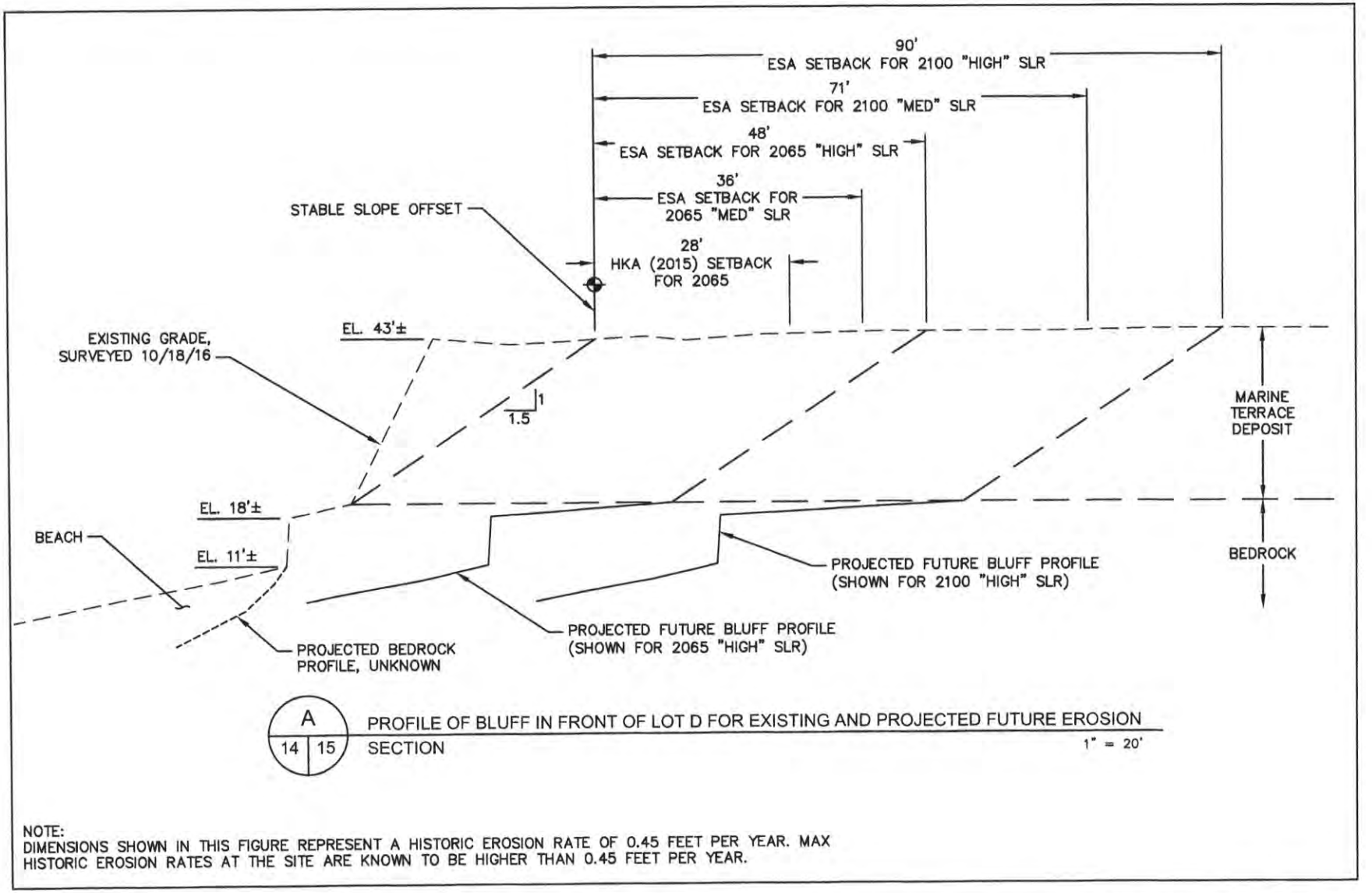
SOURCE: Imagery from California Coastal Conservancy (2012); ESA Survey on 10/18/16; Parcel data from San Mateo County

Vallemar Bluffs Coastal Hazards . 160715.00

Figure 14

Estimated Setback Distances for Future Bluff Erosion at 2065 and 2100 for Medium and High Sea Level Rise Scenarios

ESA



NOTE:
DIMENSIONS SHOWN IN THIS FIGURE REPRESENT A HISTORIC EROSION RATE OF 0.45 FEET PER YEAR. MAX HISTORIC EROSION RATES AT THE SITE ARE KNOWN TO BE HIGHER THAN 0.45 FEET PER YEAR.

SOURCE: ESA Survey 10/18/16

ESA

Vallemar Bluffs Coastal Hazards . 160715.00

Figure 15

Projected Future Erosion on Bluff Profile for Historic Erosion Rate of 0.45 Feet per Year

5. References

Ashton, A., Walkden, M., Dickson, M., 2011, Equilibrium responses of cliffed coast to changes in the rate of sea level rise, *Marine Geology*, 284, 217-229.

Battalio, R.T., Bromirski, P.D., Cayan, D.R., and White, L.A., 2016, Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps: Technical Methods Manual, Prepared for California Department of Water Resources and California Ocean Science Trust, Prepared by Environmental Science Associates (ESA), pp. 114.

Brady/LSA, 2002, Fitzgerald Marine Reserve Master Plan, Prepared for San Mateo County Parks and Recreation Division, May 2002.

California Coastal Commission (CCC), 2015, Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits, Adopted August 12, 2015, accessed online: http://www.coastal.ca.gov/climate/slrguidance.html.

Federal Emergency Management Agency (FEMA), 2005, Final Draft Guidelines for Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States, prepared by FEMA Region IX, FEMA Region X, FEMA Headquarters, and FEMA Study Contractor Northwest Hydraulic Consultants, Inc., January 2005.

Garrity, N.J., Battalio, R. Hawkes, P.J., and Roupe, D., 2006, Evaluation of event and response approaches to estimate the 100-year coastal flood for Pacific coast sheltered waters, In: International Conference on Coastal Engineering 2006.

GeoForensics, Inc., 2001, Preliminary Geotechnical/Geologic Assessment for Proposed New Residence at the Mesa Property, Lot D, Juliana Avenue, Prepared for Mesa LLC, January 31, 2001.

JCP Geologists & Engineers (JCP), 1990, Engineering Geologic Reconnaissance Study for Proposed Development of Seven Homes on Vallemar Street and Juliana Avenue, Moss Beach, California, Prepared for Richard Charnock, November 15, 1990.

Haro, Kasunich & Associates, Inc. (HKA), 2015, Coastal Bluff Recession Study, Juliana Avenue and Vallemar Street, Project No. SM10391.1, Prepared for Moss Beach Associates LLC, April 24, 2015.

Haro, Kasunich & Associates, Inc. (HKA), 2016, Geotechnical Investigation for Five Home Residential Development, Vallemar Street and Juliana Avenue, APN 037-086-23, -26, -27, -28, -29, Lots A, D, E, F, G, Moss Beach, California, Prepared for Moss Beach Associates LLC, August 12, 2016.

Horton, B.P., Rahmstorf, S., Engelhart, S.E., and Kemp, A.C., 2014, Expert assessment of sea-level rise by AD 2100 and AD 2300, *Quaternary Science Review*, 84: 1-6, doi: 10.1016/j.quascirev.2013.11.002.

National Oceanic and Atmospheric Administration (NOAA), 2013, 2009-2011 CA Coastal California TopoBathy Merged Project Digital Elevation Model (DEM), Department of Commerce, NOAA's National Ocean Service, Office for Coastal Management, Charleston, SC.

National Research Council (NRC), 2012, Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, the National Academies Press, Washington, DC.

Ocean Protection Council (OPC), 2013, State of California Sea-Level Rise Guidance Document, Developed by the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust, March 2013 update.

O'Reilly, W.C., Olfe, C.B., Thomas, J., Seymour, R.J., and Guza, R.T., 2016, The California Coastal Wave Monitoring and Prediction System, *Coastal Engineering*, Vol. 116, October 2016, pp. 118-132.

Philip Williams and Associates (PWA), 2009, California Coastal Erosion Response to Sea Level Rise - Analysis and Mapping, Prepared for the Pacific Institute.

San Mateo County (SMC), 1975, San Mateo County Geologic Hazards Map, Prepared by Leighton & Associates Geotechnical Engineers and the San Mateo County Planning Department, June 1975.

Thieler, E.R., Himmelstoss, E.A., Zichichi, J.L., and Ergul, Ayhan, 2009, Digital Shoreline Analysis System (DSAS) version 4.0 – an ArcGIS extension for calculating shoreline change: U.S. Geological Survey Open-File Report 2008-1278.

Rahmstorf, S., Foster, G., and Cazenave, A., 2012, Comparing climate projections to observations up to 2011, *Environmental Research Letters*, 7: 044035, doi:10.1088/1748-9326/7/4/044035.

Revell, D.L., Battalio, R.T., Spear, B., Ruggiero, P., and Vandever, J., 2011, A Methodology for Predicting Future Coastal Hazards due to Sea-Level Rise on the California Coast, *Climatic Change*, 109:S251-S276. DOI 10.1007/s10584-011-0315-2.

U.S. Army Corps of Engineers (USACE), 1984, *Shore Protection Manual*, 4th ed., 2 Vol., U.S. Army Engineer Waterways Experiment Station, U.S. Government Printing Office, Washington, D.C., 1,088 pp.

Vandever, J., Mull, J., Hatheway, D., Geronimo, V., and May, K., 2016, Conceptual response of runup-dominated coastlines to sea level rise and anthropogenic adaptation measures, Proceedings of the Coastal Structures & Solutions to Coastal Disasters Joint Conference, American Society of Civil Engineers, September 9-11, 2015, Boston, MA (in press).

Walkden, M. and Dickson, M., 2008, Equilibrium erosion of soft rock shores with a shallow or absent beach under increased sea level rise, *Marine Geology*, 251, p. 75-84.

memorandum

date	May 27, 2020
to	Lennie Roberts (Green Foothills)
from	Louis White, PE
subject	Arbor Lane Coastal Bluff Erosion Review and Study (ESA Ref. #D191384.00)

Introduction

Per request of the Green Foothills, ESA reviewed existing studies related to coastal and bluff erosion that were prepared for a proposed residential development at 199 Arbor Lane in Moss Beach, California. This memo presents a summary of ESA's review of the relevant studies and recommendations for consideration.

Background

A coastal development project is proposed on an undeveloped bluff top location at 199 Arbor Lane, Moss Beach, California. The project design, environmental review, and permitting was based on geotechnical and geological evaluations by Michelucci & Associates, Inc. (MAI) in 2016 and updated in 2017, which assessed geologic conditions at the site but did not evaluate the effects of sea-level rise on bluff retreat rates. A third-party assessment of coastal bluff erosion was conducted by GeoSoils, Inc. (GSI) in July 2019, which estimated future bluff retreat with sea-level rise. Green Foothills has requested that ESA conduct a review of the technical reporting related to coastal hazards, including flooding and erosion, and to offer additional recommendations if needed.

Consultants retained by the developer prepared geotechnical and coastal erosion studies between 2016 and 2019 to inform design and permitting of the proposed project. The key studies include following:

- Michelucci & Associates, Inc. (MAI 2016) – a geotechnical and geologic investigation of the site, including estimates of bluff erosion rates, site geology, recommendations for design. This study provides a basis for the historic erosion rate that was used by subsequent studies.

- Michelucci & Associates, Inc. (MAI 2017) – an update to the 2016 geotechnical and geologic investigation that describes bluff erosion on the order of 10 feet but asserts that the previously computed historic erosion rates are unchanged.

- GeoSoils, Inc. (GSI 2019) – a third-party coastal bluff retreat and slope stability evaluation that presents approximate projected bluff erosion distances at the end of a 50-year period with sea-level rise.

ESA understands that these three studies represent only a partial amount of the work that has been completed for the project, and that discussion between the project design team, permitting agencies, and other stakeholders are ongoing.

Purpose

The purpose of this memorandum is to provide Green Foothills with ESA's comments on the technical analyses used by MAI (2016 & 2017) and GSI (2019) to assess the proximity of the proposed development to projected bluff erosion hazards in the future with sea-level rise.

Scope

ESA completed the following scope of work for the project per our contract with Green Foothills:

1. Site Reconnaissance: ESA staff visited the site to conduct a reconnaissance-level survey of the site, including visual observations of the bluff top and beach. ESA's observations and photographs were used to inform the review of the relevant studies.

2. Review & Comment of Relevant Studies: ESA reviewed the relevant studies that were prepared for the proposed residential development project at the site, with a focus on the Coastal Bluff Retreat and Slope Stability Evaluation by GSI (2019), as well as two earlier geotechnical and geologic reports by MAI (2016; 2017). ESA focused the review on the methods used by MAI and GSI to assess the future geomorphic conditions resulting from sea-level rise.

3. Supplemental Calculations: ESA performed supplemental calculations to help inform recommendations to refine and assess the risk of the site to coastal flooding and erosion hazards for existing and future conditions with sea-level rise.

Site Observations

ESA staff visited the site at approximately 1:00 PM on December 23, 2019 during a clear and calm day. The tidal conditions were low, with the intertidal reef exposed in front of the project site. The tide elevation was approximately 0.5 feet NAVD according to NOAA predicted tide at Pillar Point Harbor (NOAA Sta. 9414131). The proposed development is located on a small bluff top area that is bounded by a creek drainage to the south and an actively eroding coastal bluff to the west (Figure 1). Areas of active and recent bluff erosion were evident, and talus piles appear to be from the bluff and feed sand to the beach (Figure 2). The site is located adjacent to the Fitzgerald Marine Reserve, which includes an extensive intertidal reef that extends from the beach through the surf zone. This specific reef is locally known as Horseshoe Reef (Morrall 2010). The shore is characterized by alternating reaches of unarmored bluff and large coastal armor structures.

Source: ESA

Figure 1
Panoramic photo of proposed residential development looking south:
Creek drainage behind trees, eroding bluff along western edge of site, and offshore reef

Source: ESA

Figure 2
Photo of the coastal bluff at west side of project site:
Indications of recent and active erosion

In contrast to unarmored reaches of shore that have a beach present, armored reaches of shore adjacent to the site have beaches that are very narrow or not present at all. The unarmored reaches of shore in between existing armor structures are located much further landward than armored shores, and show signs of active and ongoing erosion. Our opinion is that the armoring on the adjacent shores reduces the sand supply and increases the erosion of the unarmored parcels. Also, it appears that bluff erosion helps to maintain a beach fronting the bluff.

The beach comprises a mix of boulders, cobbles, and covered with a relatively thin layer of sand, similar to other beaches in the area (see ESA 2016). In the intertidal zone, the reef formations appear to be composed of a

mudstone that is persistent, although not entirely erosion resistant. The existing reef extending from the beach through the nearshore zone dissipates wave energy and limits the maximum depth-limited wave height that can directly impact the bluff. With sea-level rise, the depths over the reef will increase and therefore we expect the depth-limited wave heights will increase and wave exposure to the bluff. As the amount of wave action incident to the bluff increases, the bluff erosion rates will increase also.

Assessment of GSI (2019) Study on Coastal Erosion

The GSI (2019) study of projected bluff erosion over the selected design life of the project appears to yield a conservatively low bluff recession estimate that is based on parameters likely to result in lower recession values. The primary parameters used in the selected analysis method include the following list, for which we have provided some discussion and recommendation on additional calculations to explore the sensitivity of the results.

- **Historic erosion rate of 0.78 feet per year**
  The erosion rate of 0.78 feet per year (fpy) was based on the value selected by MAI (2016). However, this value of 0.78 fpy was selected without applying a rigorous and standard methodology of calculation of erosion rates, and was included in a set of values computed by MAI or others, with ranges up to 1.25 fpy. We note that MAI computed values as high as 0.96 fpy at one of the transects at the project site, suggesting that a value of about one fpy would be a reasonable value to check.

- **Historic sea-level rise rate of 0.006595 feet per year, cited as the average over a 110 year period at the San Francisco tide gauge**
  The NOAA published value of the relative sea-level rise trend at the San Francisco tide gauge is 1.99 mm per year, equivalent to 0.006529 feet per year. Although only slightly lower (0.006595 - 0.006529 = 0.000066), this difference propagates through the calculations and yields bluff recession results that are slightly greater than those reported by GSI. However, we think this discrepancy is of small consequence relative to the effect of other values selected by GSI.

- **"Future" sea-level rise rate of 0.072 feet per year computed using the simplified formulation of the SCAPE model and implications on projected erosion rate**
  The description of this value as a future condition is an interpretation that we believe to be erroneous: really, it is an *average* rate of sea-level rise between present day and year 2069. Due to the acceleration of sea-level rise, the future rate would exceed the average value over the planning horizon, and therefore the subsequent calculations of average erosion rate over the planning horizon should use this value of sea-level rise rate equal to 0.072 fpy or similar. GSI's application of the simplified SCAPE equation deferred this calculated average erosion rate to the final 13 years of the planning horizon, which yields an equivalent rate of sea-level rise of 0.033 fpy over the 50-year planning horizon. By inspection, this yields a much lower amount of sea-level rise as compared to the State Guidance, which projects approximately 3.5 feet of sea-level rise by 2070 under the medium-high risk aversion scenario (OPC 2018; CCC 2018). Therefore, we disagree with the approach taken to split the planning horizon into two periods, where the first 37 years used an arbitrary selection of erosion rate (1.09 fpy) and the last 13 years used the rate of 1.72 fpy computed using the average sea-level rise rate over the planning horizon: We recommend use of the average erosion rate for the forecasting period (in this case with other parameters selected by GSI, 1.72 fpy and 50 years, respectively).

- **Selection of the site-specific response parameter $m = 1/3$**
  GSI asserts that the presence of the beach in front of the eroding bluff justifies using a lower response parameter m equal to 1/3. However, the authors that formulate the simplified SCAPE equation used m equal to 1/2, and as reported by Ashton et al. (2011). Because selection of the value is somewhat arbitrary, we suggest at minimum exploring the sensitivity of the results by using a value of m equal to 1/2.

- **Role of wave action on bluff and resulting erosion**
  Although waves are not directly a parameter of the simplified SCAPE equation applied to the project, we think that the expected change in wave exposure will play a major role in erosion over the planning horizon. As described by MAI (2016), the primary failure mechanism of the bluff is undercutting at the toe by wave action. As sea-levels rise, the depth of water across the reef will increase, the depth limited waves incident to the bluff will increase, the wave runup and energy dissipated on the bluff will increase, and the erosion rate will increase. Therefore, use of the simplified SCAPE equation, which is based on steady coastal hydrology, is likely to under-predict future bluff erosion at this site. Other similar bluff erosion models that consider the waves are available, such as the full SCAPE numerical approach and methods developed by ESA (see ESA 2016, where this approach was used at Vallemar Bluffs in Moss Beach, California).

Assessing the sensitivity of the parameters listed above is expected to increase the erosion rates and therefore the total recession over a period of 50 years. ESA applied these modified values to the equation and found that the total recession amounts increased significantly (Table 1). We note that the GSI (2019) calculations apply the average rate of sea-level rise to the last 13 years of the planning horizon, and so, for comparison purposes only, we report the equivalent average sea-level rise rate and average erosion rates over the 50-year planning period using their reported totals. Recession results increase by almost 20 feet when utilizing the computed average sea-level rise rate over the whole planning horizon (Calc 1b). Increasing the response parameter *m* to 1/2 results in almost twice the amount of recession as reported by GSI (2019) (Calc 2). Finally, the recession totals are even greater when considering a slightly higher historic erosion rate of 1 fpy. Review of Plates 1 and 2 of the GSI (2019) study indicate that the reported bluff recession plus factor of safety of 1.3 and 1.5 result in a proximity of approximately 10 feet and less than 5 feet to the proposed structure, respectively. This suggests that the increase of the recession totals by 10 feet would result in the 50-year bluff recession intersecting the proposed structure, and that all of the parameters selected below increase the results beyond this threshold.

TABLE 1
SENSITIVITY OF RECESSION AMOUNTS TO PARAMETERS USED IN SIMPLIFIED SCAPE MODEL

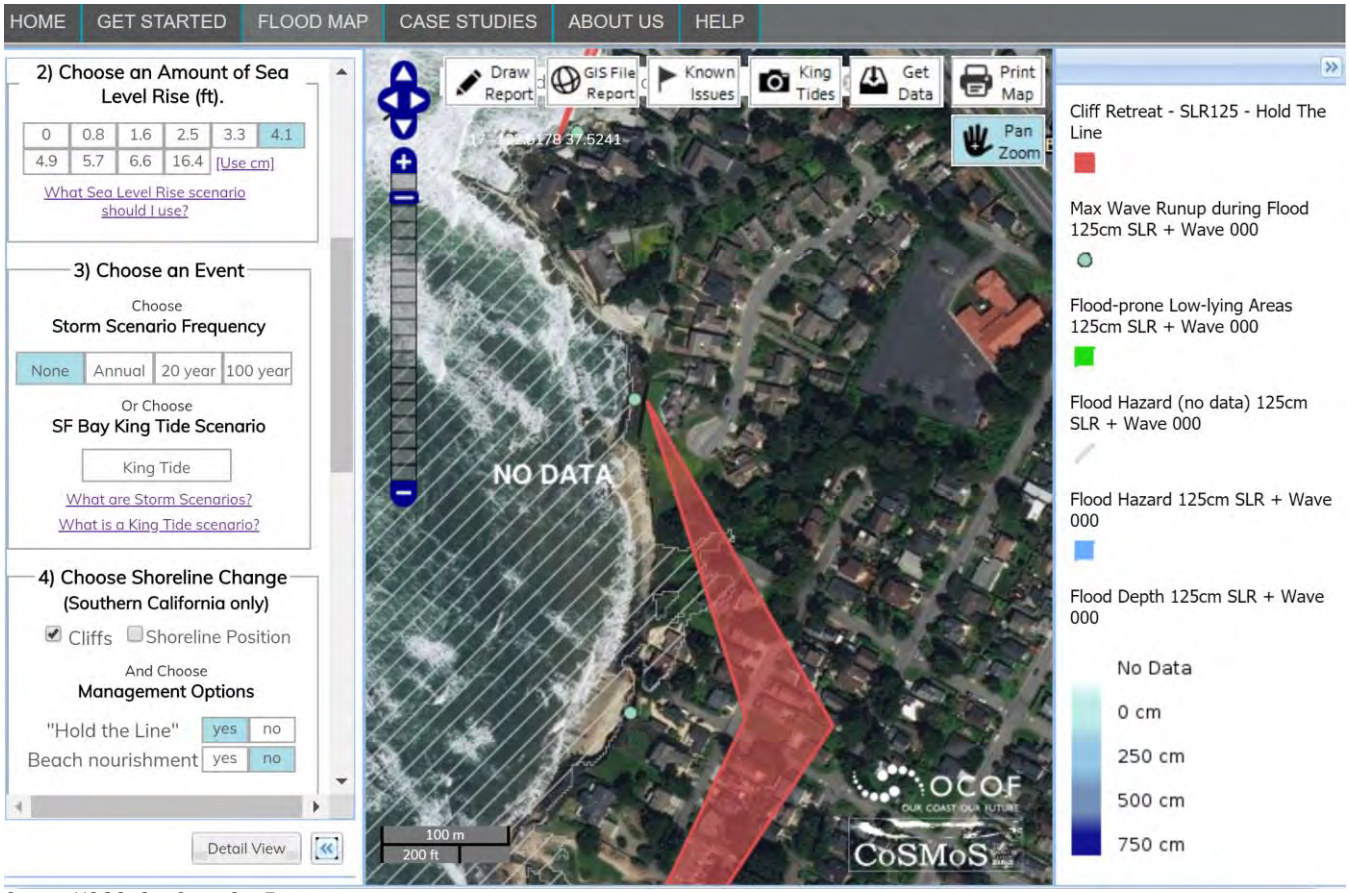
Parameter	1a - GSI Calc as presented (R2 = effective average)	1b - GSI Calc (R2 = average)	2 - modification (average R2, m=1/2)	3 - modification (average R2, m=1/3, R1=1 fpy)	4 - modification (average R2, m=1/2, R1=1 fpy)
S1 (fpy)	0.006595	0.006595	0.006595	0.006595	0.006595
S2 (fpy)	0.033[a]	0.0682	0.0682	0.0682	0.0682
m (const)	1/3	1/3	1/2	1/3	½
R1 (fpy)	0.78	0.78	0.78	1	1
R2 (fpy)	1.34[b]	1.70	2.51	2.18	3.22
delta t (years)	50	50	50	50	50
Retreat (ft)	66.8	85.0	125.4	108.9	160.8

a Equivalent value of projected average sea-level rise rate computed using equivalent projected average erosion rate resulting in total recession as presented by GSI (2016)
b Equivalent value of projected average erosion rate computed using the total recession value reported by GSI (2019) over the 50-year planning horizon.
Note: S1 = historic rate of sea-level rise; S2 = average rate of projected future sea-level rise over planning period; m = constant response parameter; R1 = historic rate of erosion; R2 = computed average rate of projected erosion over planning period, delta t is the planning period, Retreat is the total projected amount of bluff erosion.

The project proponents indicate with slope stability analysis that the proposed structure is within about 20 feet of the future bluff edge with a factor of safety of 1.3, and less than 10 feet from the future bluff edge with a factor of

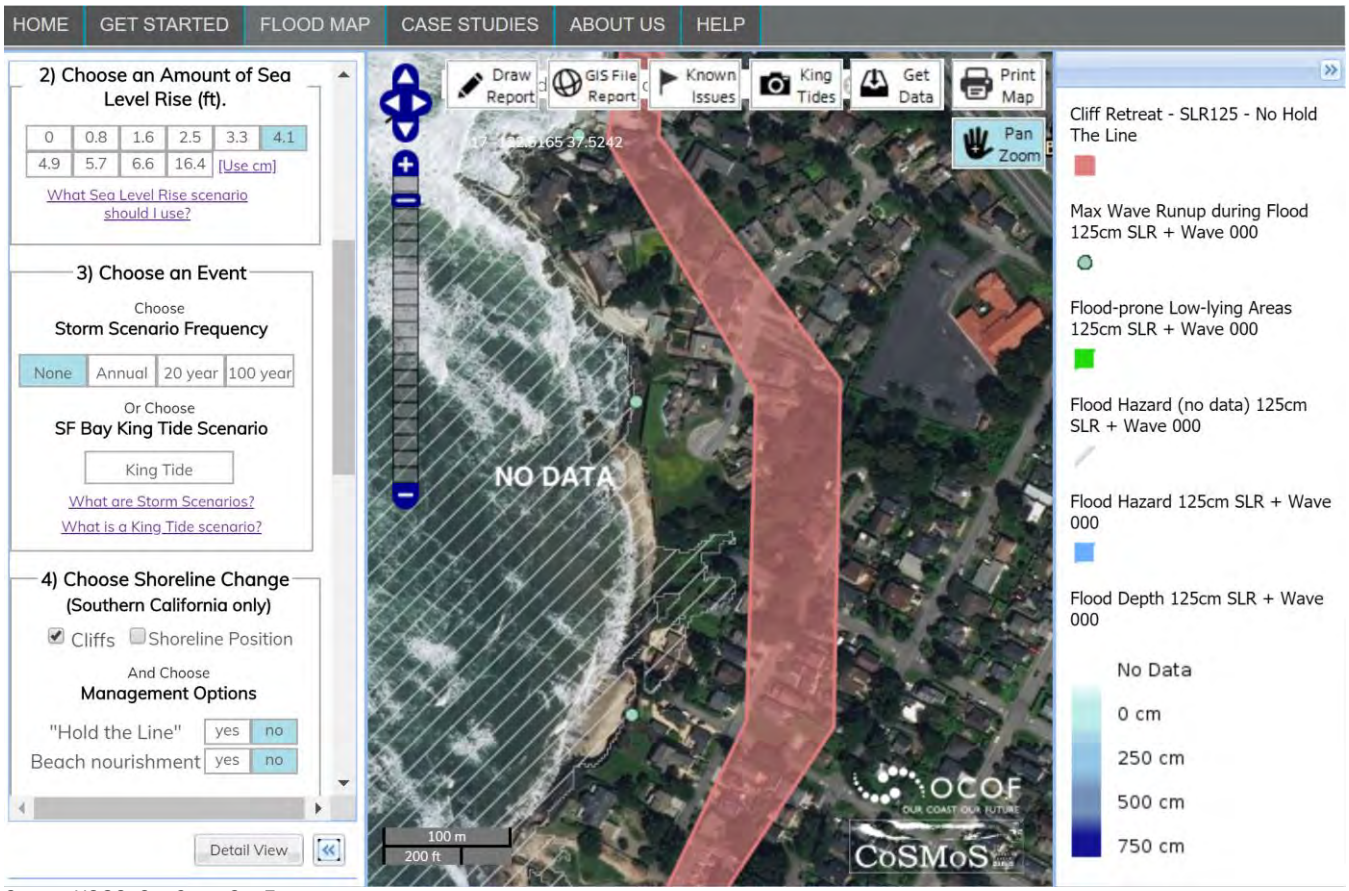
safety of 1.5 (GSI 2019), and the proposed structure is at risk if erosion encroaches within these distances. Based on the sensitivity analysis (described above), the GSI (2019) erosion projections are optimistic, leading us to conclude that it is very likely that the development is within the zone of future bluff erosion by 2069. Other methods, including those developed by ESA (e.g., ESA 2016; Battalio et al 2016), and others (e.g. Barnard et al. 2018), and including SCAPE, are expected to show that future erosion would intersect the proposed development within 50 years.

Note that the GSI (2019) study reports erosion projections by the USGS's Coastal Storm Modeling System (CoSMoS) for "hold the line" scenario only, in which areas with existing coastal armoring do not erode in the future (Figure 3). GSI (2019) does not describe the results for the scenario where erosion is allowed, which is presented in Figure 4. Note that the project site is located between two transects and so erosion at the site is computed as an interpolation between these points: the transect to the north is located at an existing coastal armor structure and the transect to the south is at an unarmored location. Although the USGS hazard mapping is a coarse and regional approach to assessing the coastal response to sea-level rise, the results provide an independent assessment produced by a credible federal agency.



Source: USGS, Our Coast Our Future

Figure 3
USGS CoSMoS erosion hazards with 4.1 feet of sea-level rise: "Hold the Line" scenario



Source: USGS, Our Coast Our Future

Figure 4
USGS CoSMoS erosion hazards with 4.1 feet of sea-level rise: "Allow Erosion" scenario

Recommendations

We recommend that the assessment of future bluff erosion amounts consider the sensitivity of the parameters used in the selected technical methods. As noted above, the values of the parameters selected in the analysis by GSI (2019) result in a conservatively low amount of total recession, and we think that a greater range in parameters should be considered, including a historic erosion rate of one foot per year, response parameter *m* of 1/2, and application of the average projected sea-level rise rate over the 50-year planning period rather than limiting this to the last 13 years of the planning period. Alternative technical methods that include the relative increase of wave action on the bluff with sea-level rise should be considered, as this was identified as a primary driver of bluff erosion at the site. Furthermore, we recommend considering a planning horizon of greater than 50 years so that adaptation planning of the site can be appropriately described.

References

Ashton, A.D., Walkden, M.J.A, and Dickson, M.E., 2011, Equilibrium responses of cliffed coasts to changes in the rate of sea level rise, *Marine Geology*, 284, pp. 217-229.

Barnard, P.L., Erikson, L.H., Foxgrover, A.C., Limber, P.L., O'Neill, A.C., and Vitousek, S., 2018, Coastal Storm Modeling System (CoSMoS) for Central California, v3.1 (ver. 1f, May 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P9NUO62B.

Battalio, R.T., Bromirski, P.D., Cayan, D.R., and White, L.A., 2016, *Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps: Technical Methods Manual*, Prepared for California Department of Water Resources and California Ocean Science Trust, Prepared by Environmental Science Associates (ESA), pp. 114.

California Coastal Commission (CCC), 2018, California Coastal Commission Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits, Original Guidance Adopted August 12, 2015, Update Adopted November 7, 2018.

Environmental Science Associates (ESA), 2016, Vallemar Bluffs Coastal Hazards Assessment: Estimate of Accelerated Bluff Erosion due to Sea Level Rise, ESA Ref. #D160715.00, Memorandum prepared for Committee for Green Foothills, October 26, 2016.

GeoSoils, Inc. (GSI), 2019, Third-Party Coastal Bluff Retreat and Slope Stability Evaluation at the Proposed New Residence, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, Assessor's Parcel Number (APN) 037-123-430, Prepared for Carlos Zubieta Architects, July 31, 2019.

Michelucci & Associates, Inc. (MAI), 2016, Geotechnical and Geologic Investigation, Proposed New Residence, Vacant Lot on Arbor Lane, APN # 037-123-430, Moss Beach, San Mateo County, California, Prepared for Carlos Zubieta Architects, July 6, 2016.

Michelucci & Associates, Inc. (MAI), 2017, Geotechnical and Geologic Investigation Update, Proposed New Residence, Vacant Lot on Arbor Lane, APN # 037-123-430, Moss Beach, San Mateo County, California, Prepared for Carlos Zubieta Architects, August 29, 2017.

Morall, J., 2010, *Images of Moss Beach*, Arcadia Publishing, San Francisco, CA, 129 pp.

Ocean Protection Council (OPC), 2018, State of California Sea-Level Rise Guidance 2018 Update, Prepared by the California Natural Resources Agency and the California Ocean Protection Council, March 2018.

Renee Ananda, Coastal Program Analyst
North Central Coast District Office
California Coastal Commission
45 Fremont Street Suite 2000
San Francisco, CA 94105

January 11, 2019

Re: Appeal from coastal permit decision of local government

Dear Ms. Ananda,

Enclosed with the letter is our appeal to the California Coastal Commission regarding a decision made by the County of San Mateo Planning and Building described in a Letter of Decision dated December 24, 2018. The specific decision related to File number PLN 2016-00444, for a proposed development project at 199 Arbor Lane, APN 037-123-430.

This proposed development project is located in a uniquely fragile site that has both Ocean front bluff top and Dean Creek bluff top which require adherence to a number of LCP policies including but not limited to 9.8. This site is also in close proximity to the Fitzgerald Marine Reserve (FMR) as well as within the watershed of FMR which is a treasure of biological and marine biodiversity of the Northern California Coast. The FMR is visited by thousands of people each year and we believe that the decision taken by the County of San Mateo Planning and Building Division had insufficient information, that the project, as proposed in not consistent with LCP policy 9.8 and that approval of the development as approved by the County of San Mateo does not safeguard the interest of the public or biological diversity of this unique location.

We note that you have provided some early stage review of the proposed project in your letter of July 14, 2017 to San Mateo County project planner Ms. Morales. We also note that the applicant, Mr. Zubieta, has been the subject of Coastal Commission enforcement action in December of 2017 due to the illegal installation of a fence within the the 75-foot scenic view corridor, created by the California Coastal Commission, that exists on this development project site. For this reason we have concerns about compliance of the off site developer, Mr. Zubieta, with required mitigation measures that are described in the County approval letter at this time.

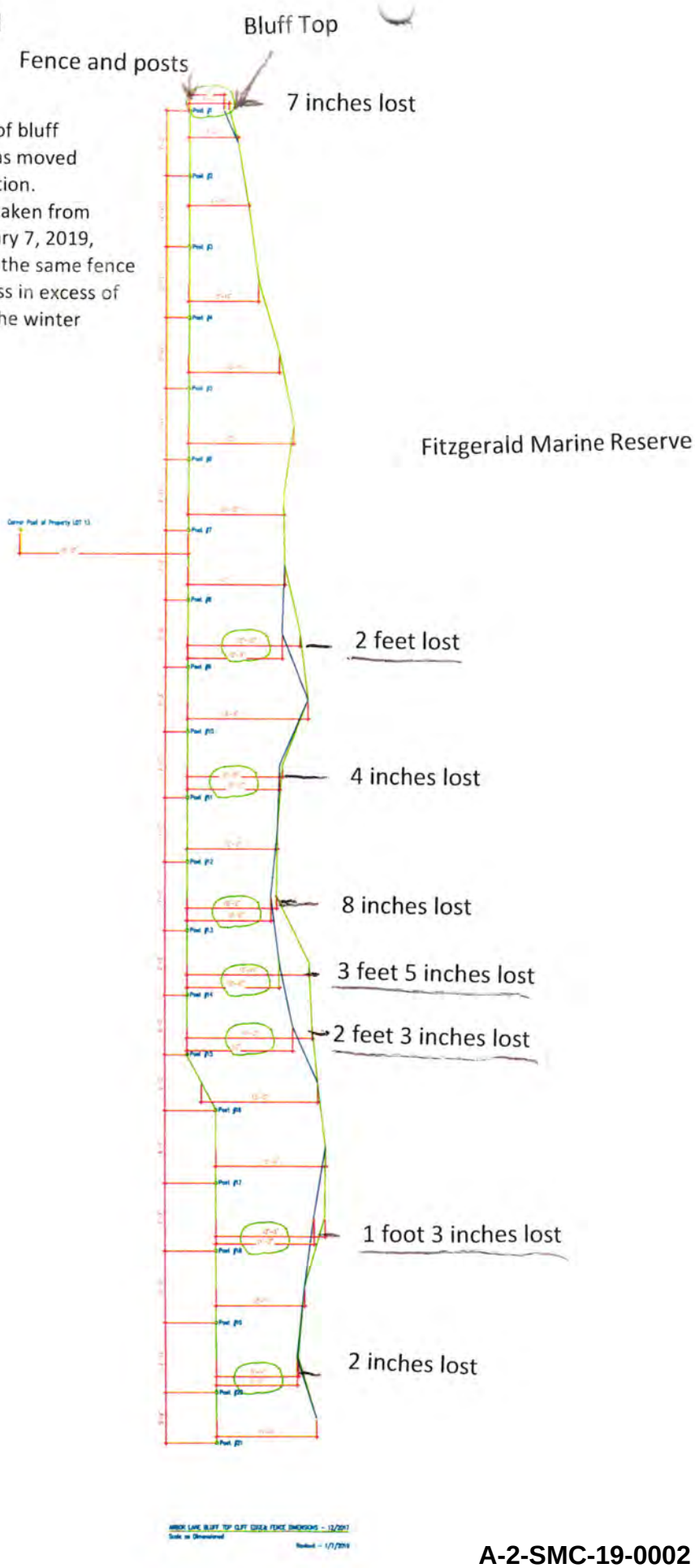
We thank you and the California Coastal Commission staff for taking the time to review this appeal and we believe this appeal and the proposed development should be considered a Substantial Issue by you and your colleagues.

Sincerely,

Steven R. King Ph.D.
Jim Scheinberg
Delivered by hand to 45 Fremont Office, sent via e-mail and overnight mail.

Addendum to Reasons For Appeal

After the loss of 12 feet of bluff on southern end of bluff was lost in 2016/2017 winter season the fence was moved back from bluff edge by Arbor Lane Block Association.
In December 2017 baseline measurements were taken from the fence posts to the edge of Bluff Top. On January 7, 2019, 13 months, later measurements were made from the same fence posts. Bluff loss was noted in 8 locations, some loss in excess of 3 feet as noted. This is an unstable bluff top and the winter rains of 2019 have only just started.

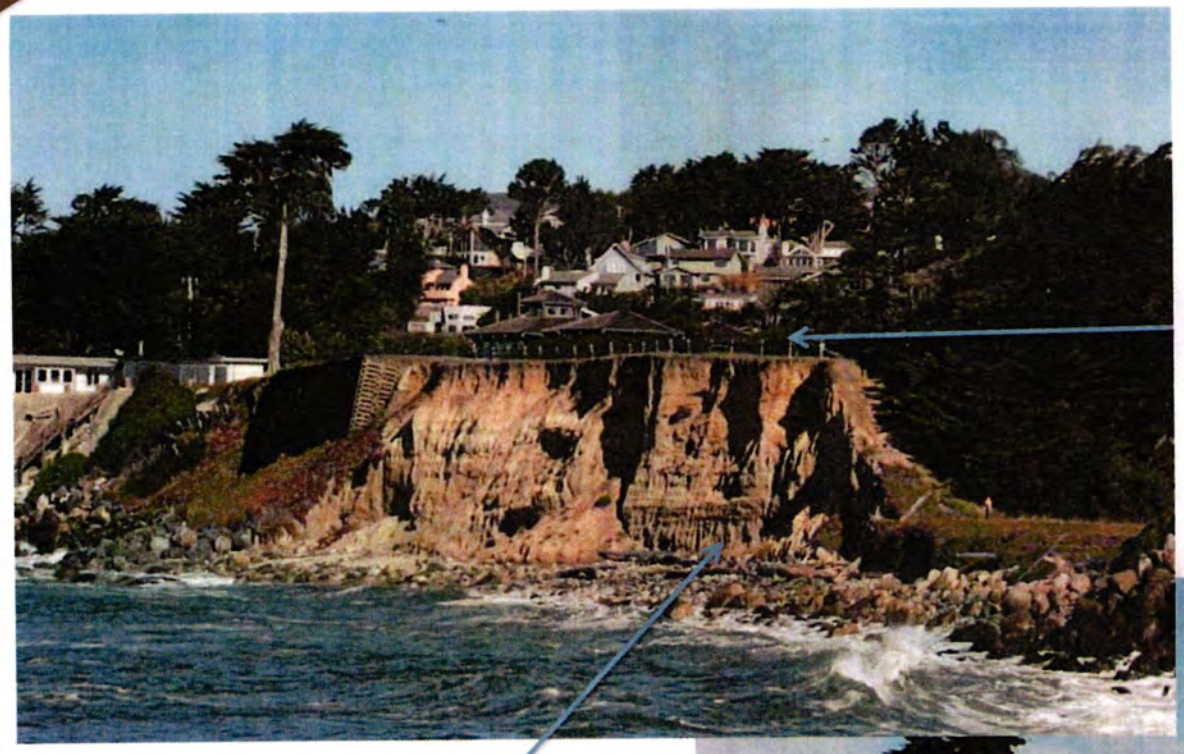


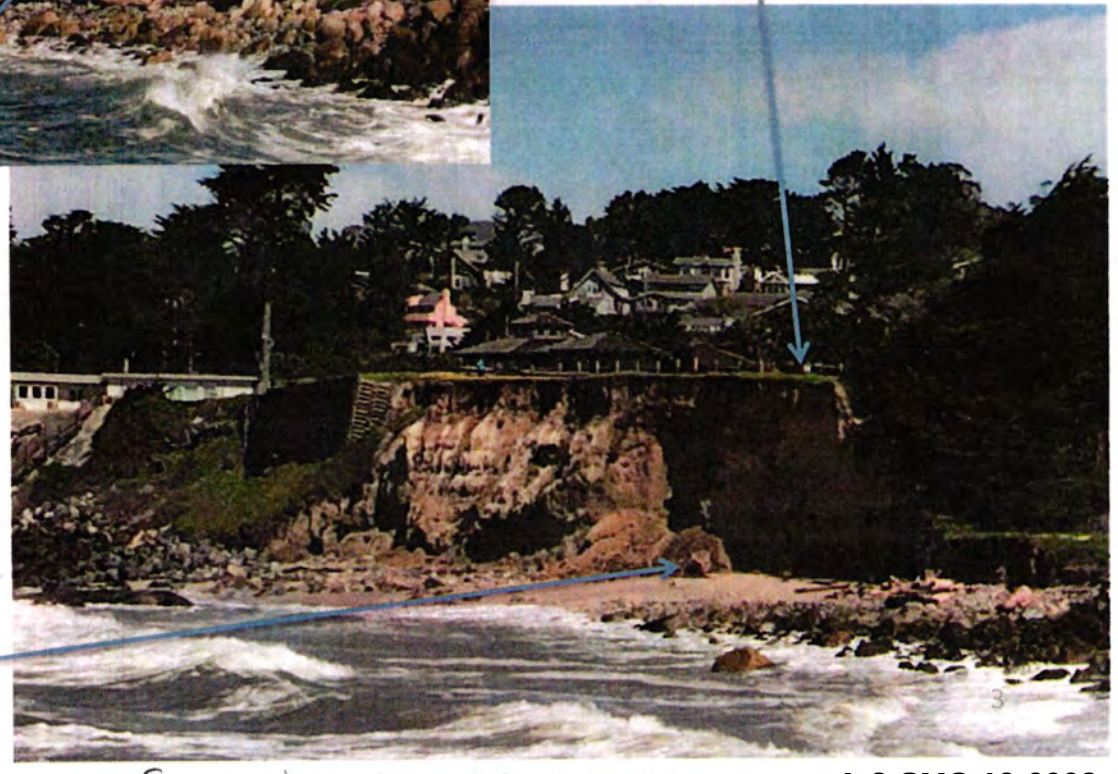
#1

Entry Pole Photo
199 Abalone Lane
View from Marine Reserve

#1

Cliff erosion

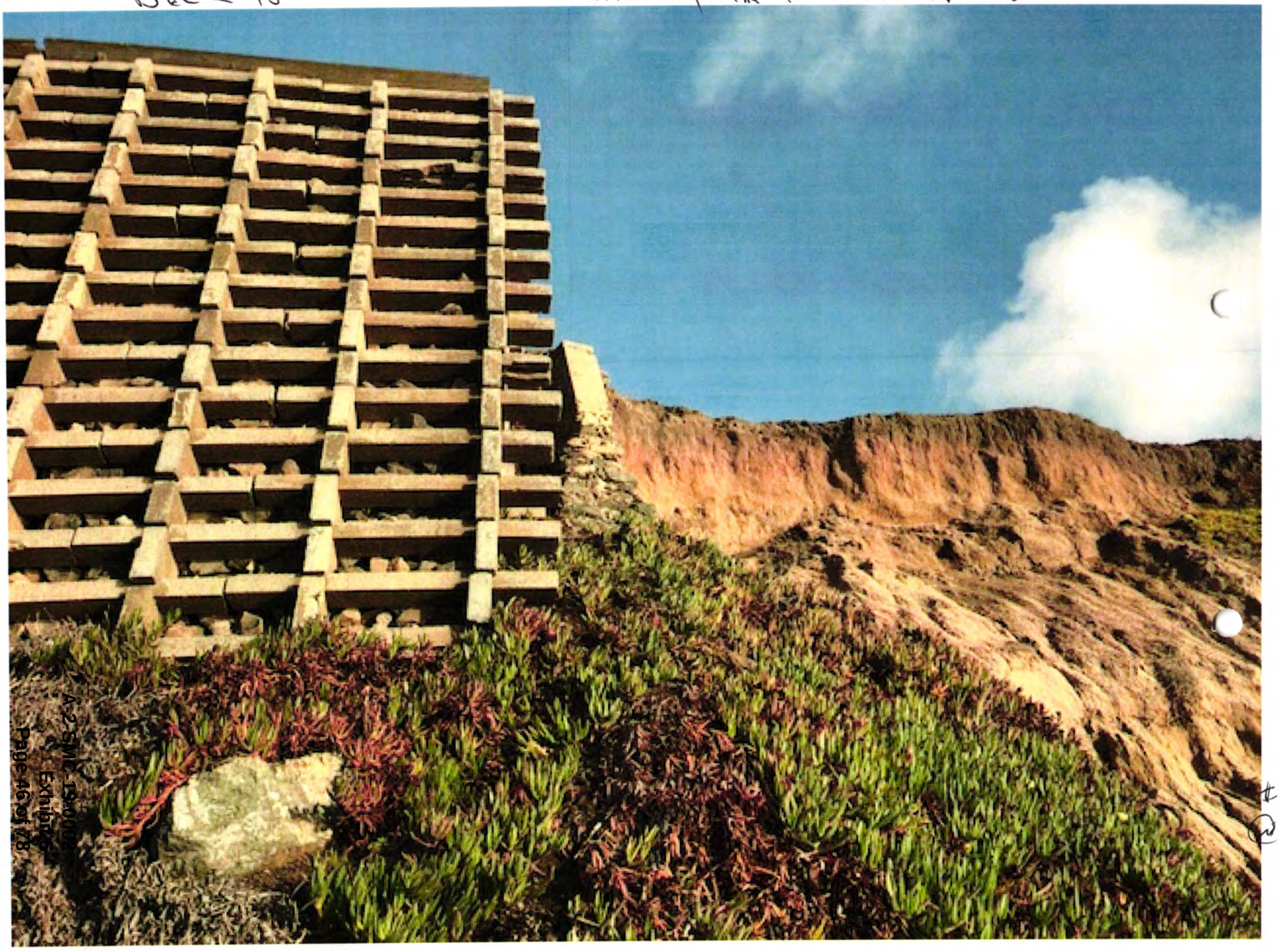




Blufftop is 49 feet above sea level.

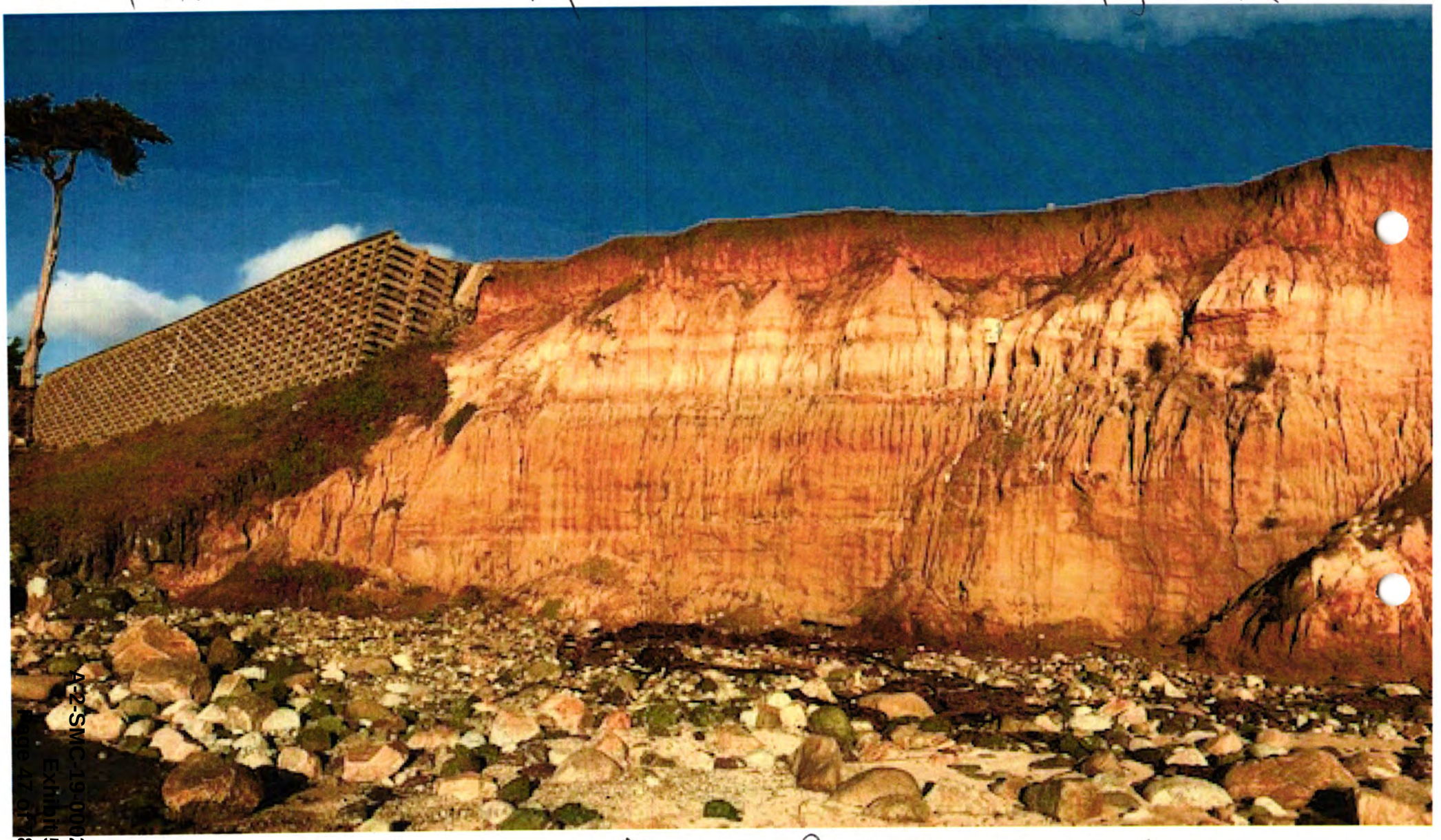
Source Mid Coast Community Council Aug 23, 2017

Dec 2018 Bluff top in front of 199 ↓ W #



Dec 1, 2018

Bluff top unstable cliff in front of project site



↑ Fitzgerald Marine Reserve ↑

Dec. 2018

#5

#5

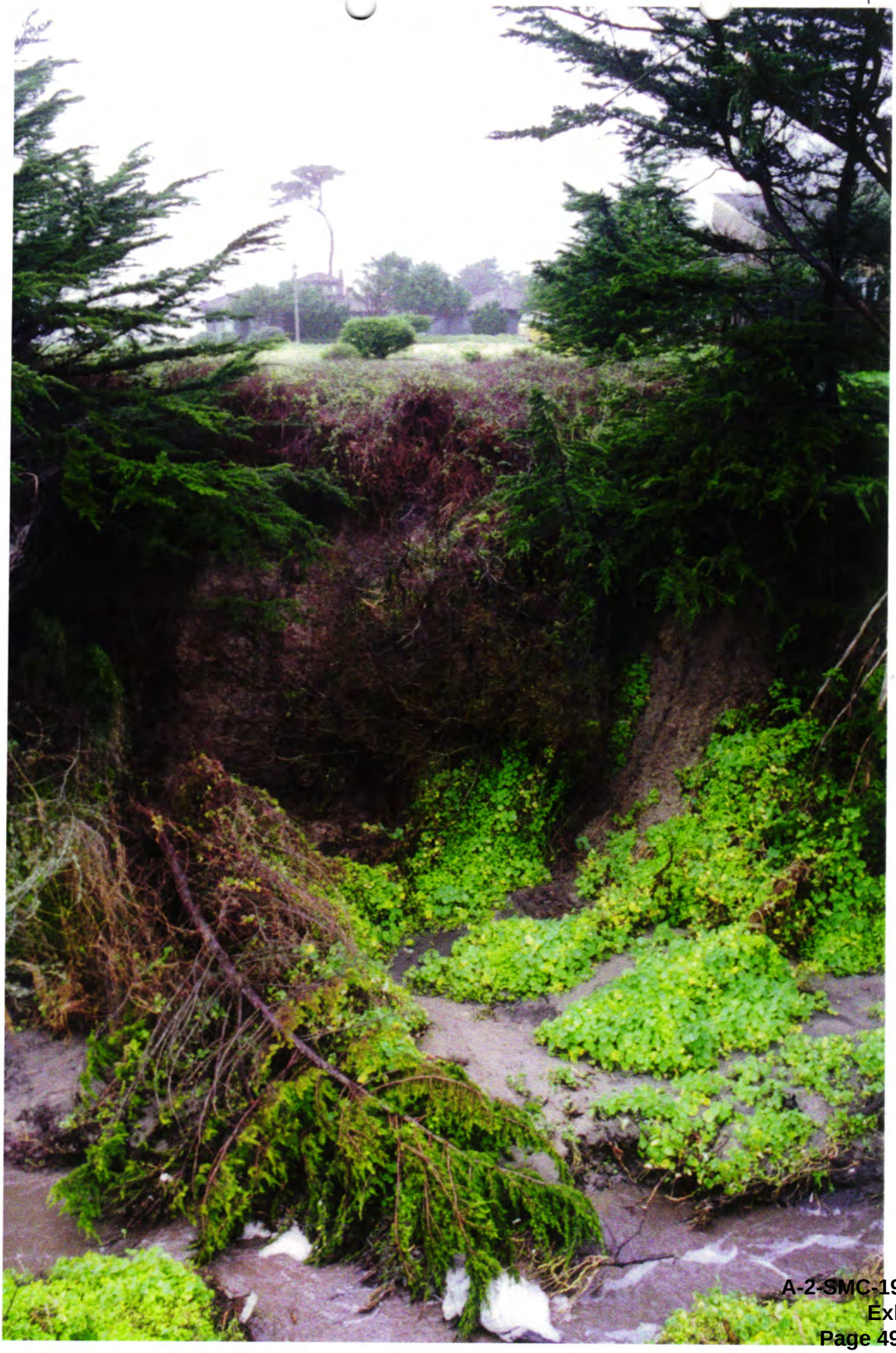
60ft or less from proposed project
January 2019

↓ FMR

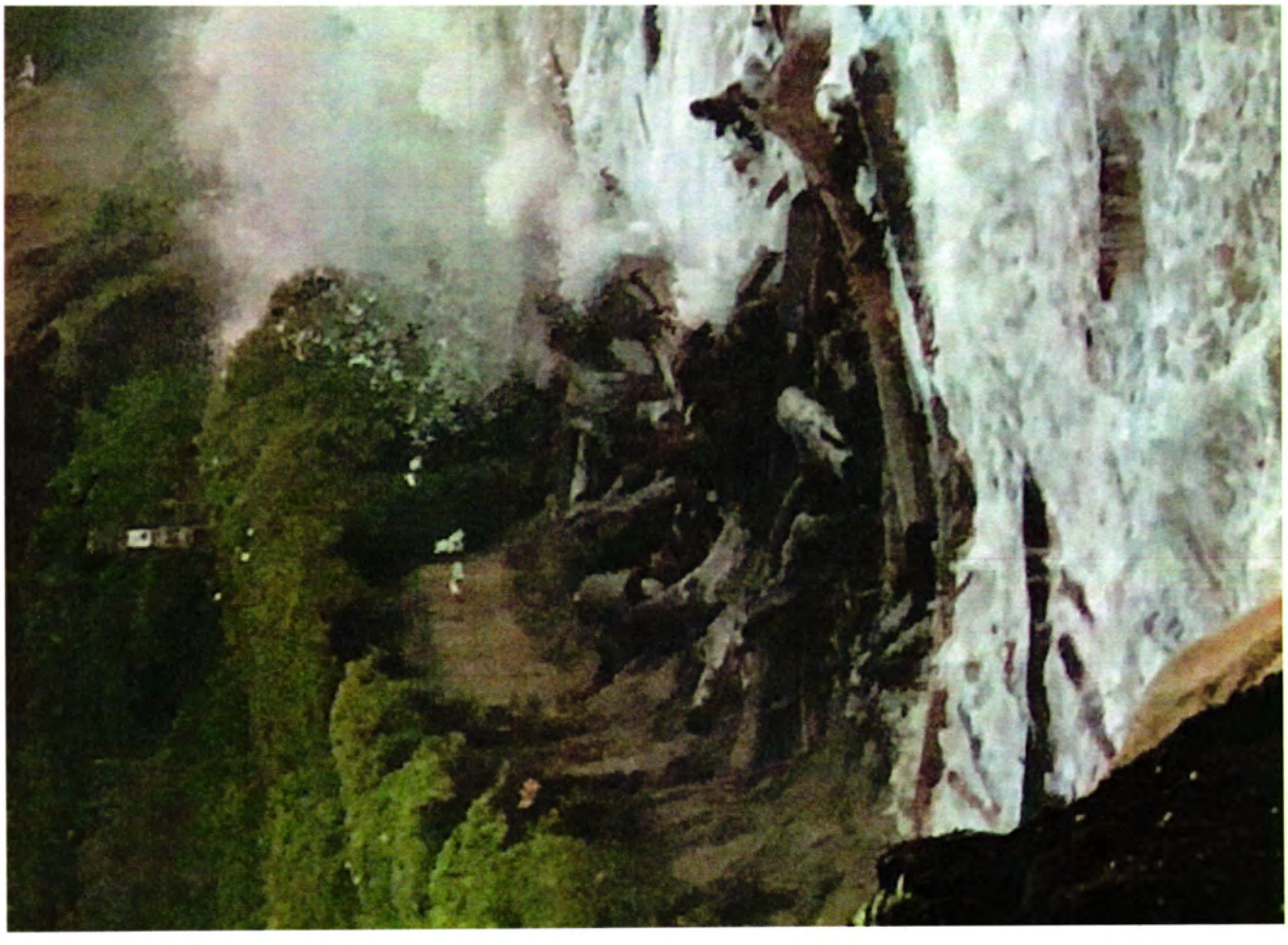
↑ FMR

#6

Dec 1997 Dean Creek Bluff Top 199 Acton Lane



#7

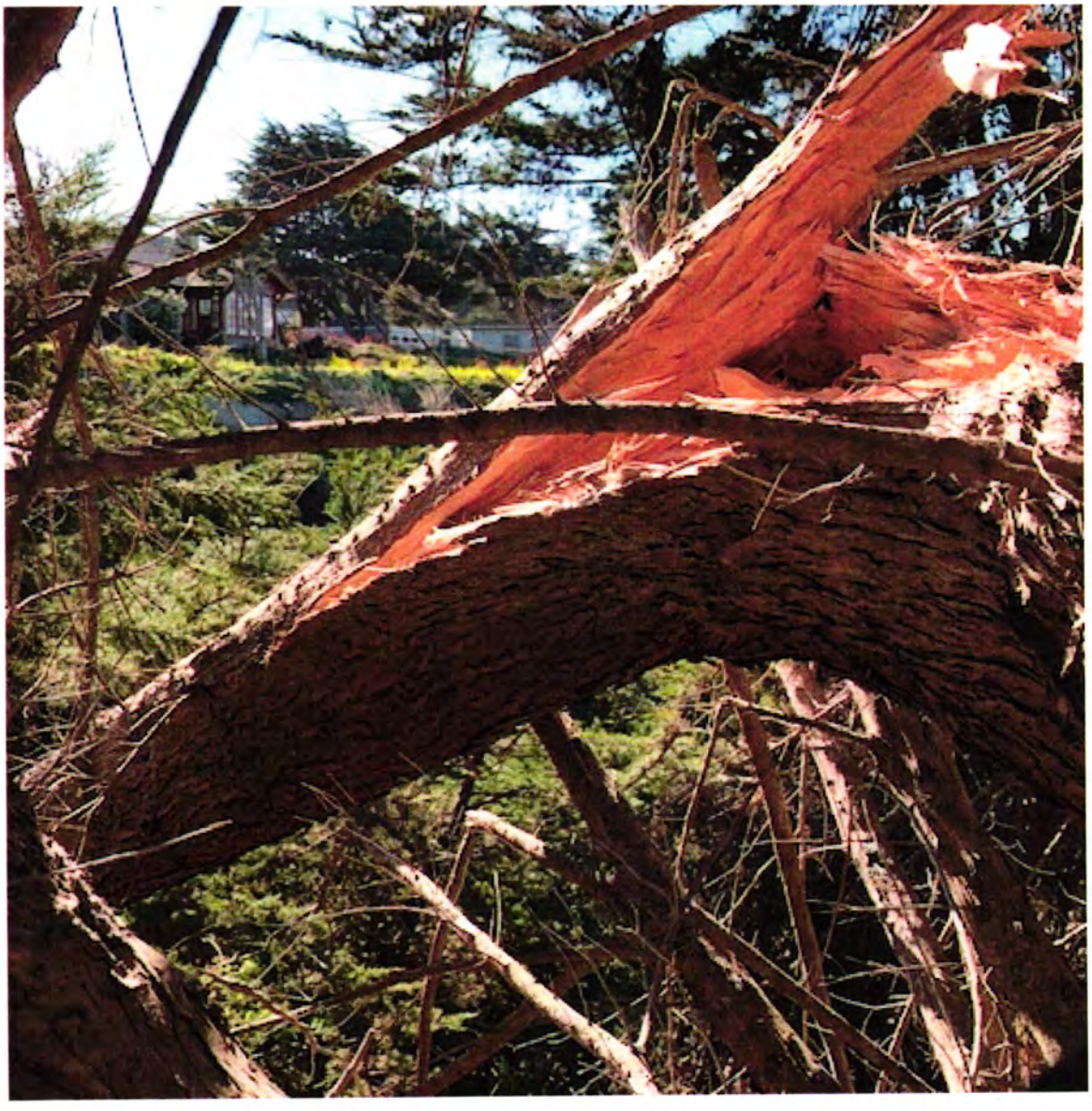


Mouth of Arana Creek December 2018

#8

#8

Storm tree damage December 2018
Edge of Deer Creek Bluff near
Entrance of 199 Arbor Lane

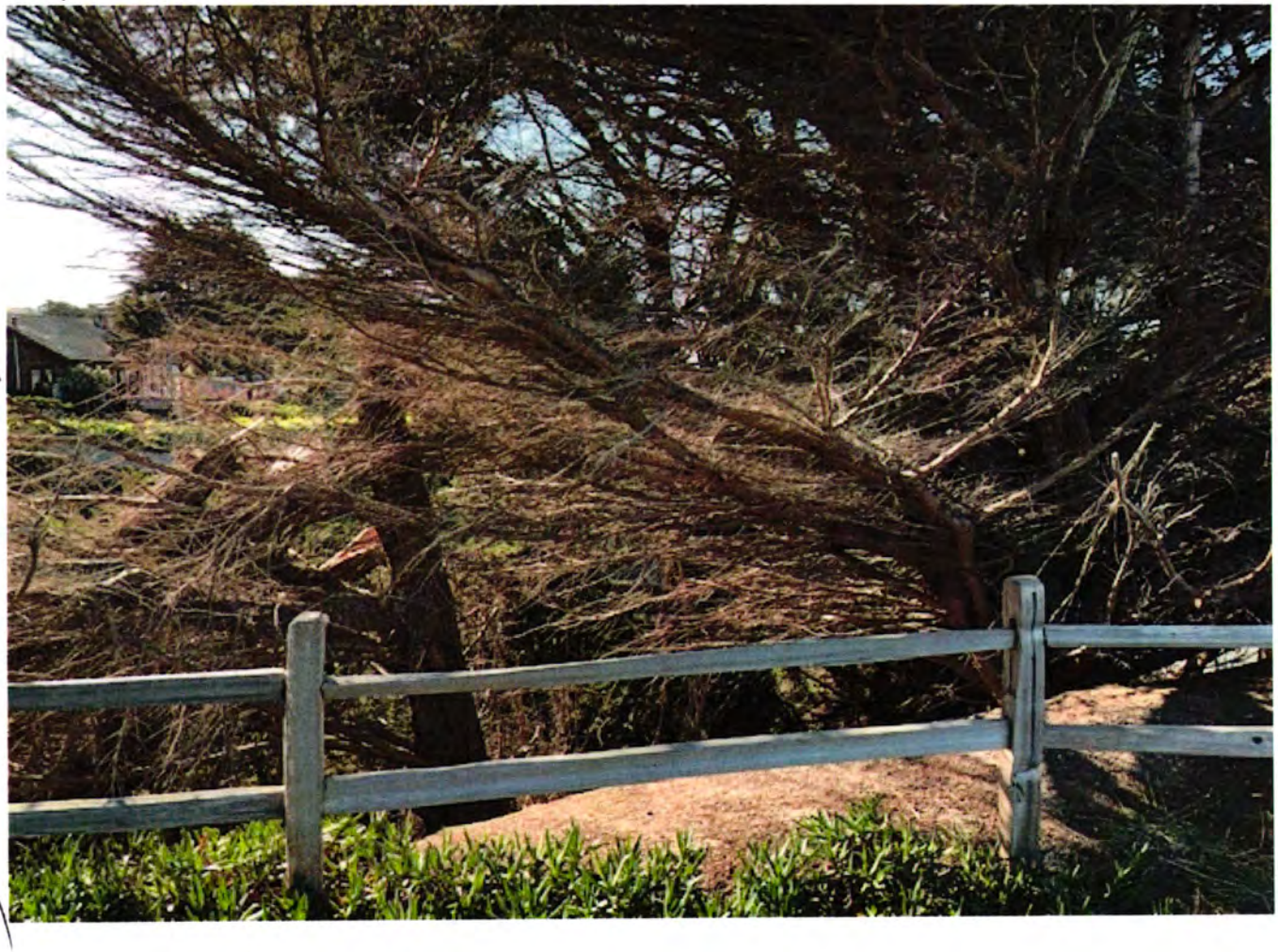


(#9)

(#9)

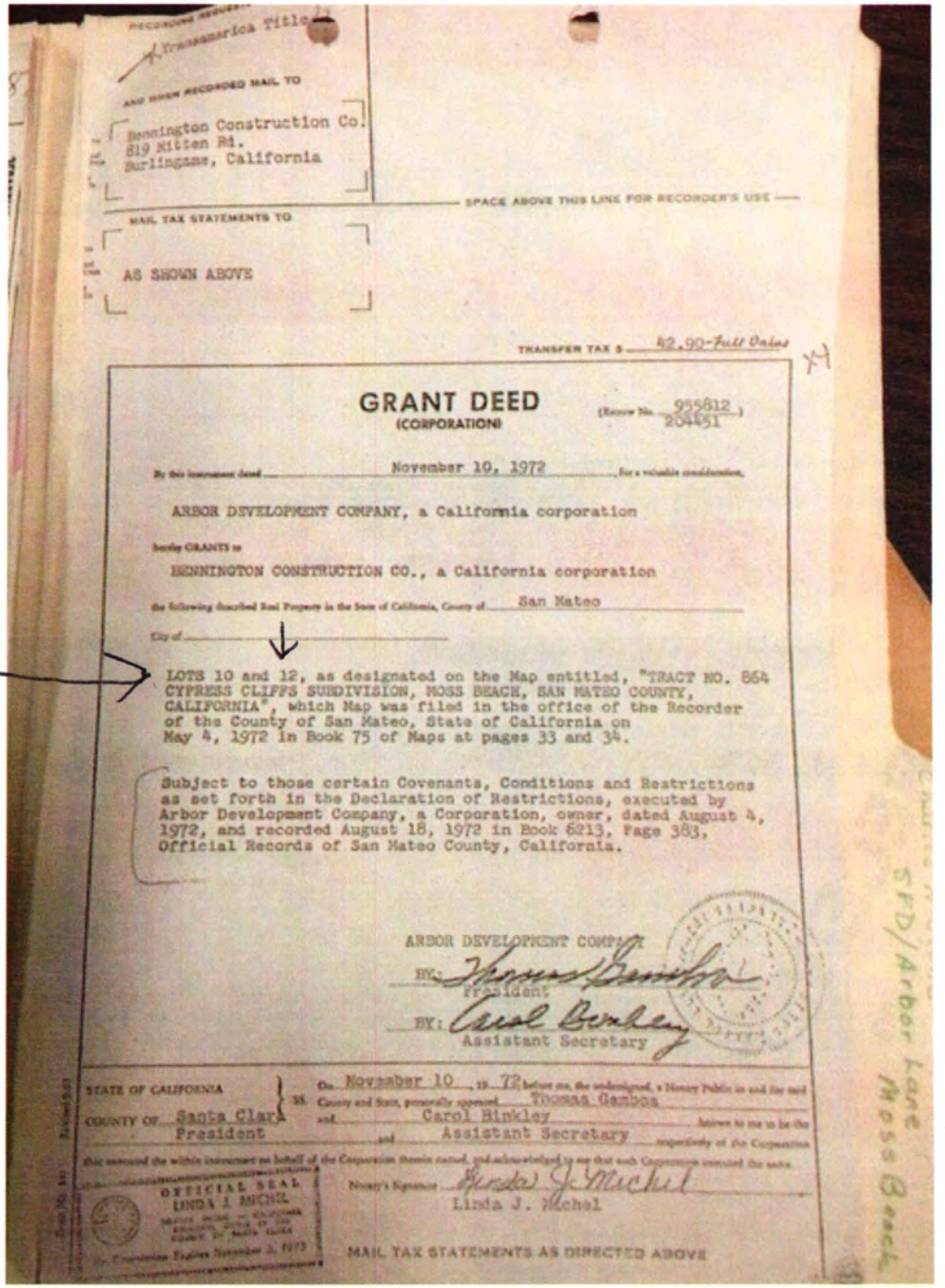
Storm tree damage near footprint of proposed development

December 2018



top of Ocean bluff term used by applicant on plans.

See file



Transamerica Title

AND WHEN RECORDED MAIL TO

Bennington Construction Co.
819 Mitten Rd.
Burlingame, California

SPACE ABOVE THIS LINE FOR RECORDER'S USE

MAIL TAX STATEMENTS TO

AS SHOWN ABOVE

TRANSFER TAX $ 42.90-Full Value

GRANT DEED
(CORPORATION)

(Escrow No. 955812 204451)

For a valuable consideration, receipt of which is hereby acknowledged, November 10, 1972

ARBOR DEVELOPMENT COMPANY, a California corporation

hereby GRANTS to

BENNINGTON CONSTRUCTION CO., a California corporation

the following described Real Property in the State of California, County of San Mateo

City of

LOTS 10 and 12, as designated on the Map entitled, "TRACT NO. 864 CYPRESS CLIFFS SUBDIVISION, MOSS BEACH, SAN MATEO COUNTY, CALIFORNIA", which Map was filed in the office of the Recorder of the County of San Mateo, State of California on May 4, 1972 in Book 75 of Maps at pages 33 and 34.

Subject to those certain Covenants, Conditions and Restrictions as set forth in the Declaration of Restrictions, executed by Arbor Development Company, a Corporation, owner, dated August 4, 1972, and recorded August 18, 1972 in Book 6213, Page 383, Official Records of San Mateo County, California.

ARBOR DEVELOPMENT COMPANY

BY: Thomas Gamboa
President

BY: Carol Binkley
Assistant Secretary

STATE OF CALIFORNIA
COUNTY OF Santa Clara } ss.

On November 10, 19 72 before me, the undersigned, a Notary Public in and for said County and State, personally appeared Thomas Gamboa
President
and Carol Binkley
and Assistant Secretary
known to me to be the respectively of the Corporation that executed the within instrument on behalf of the Corporation therein named, and acknowledged to me that such Corporation executed the same.

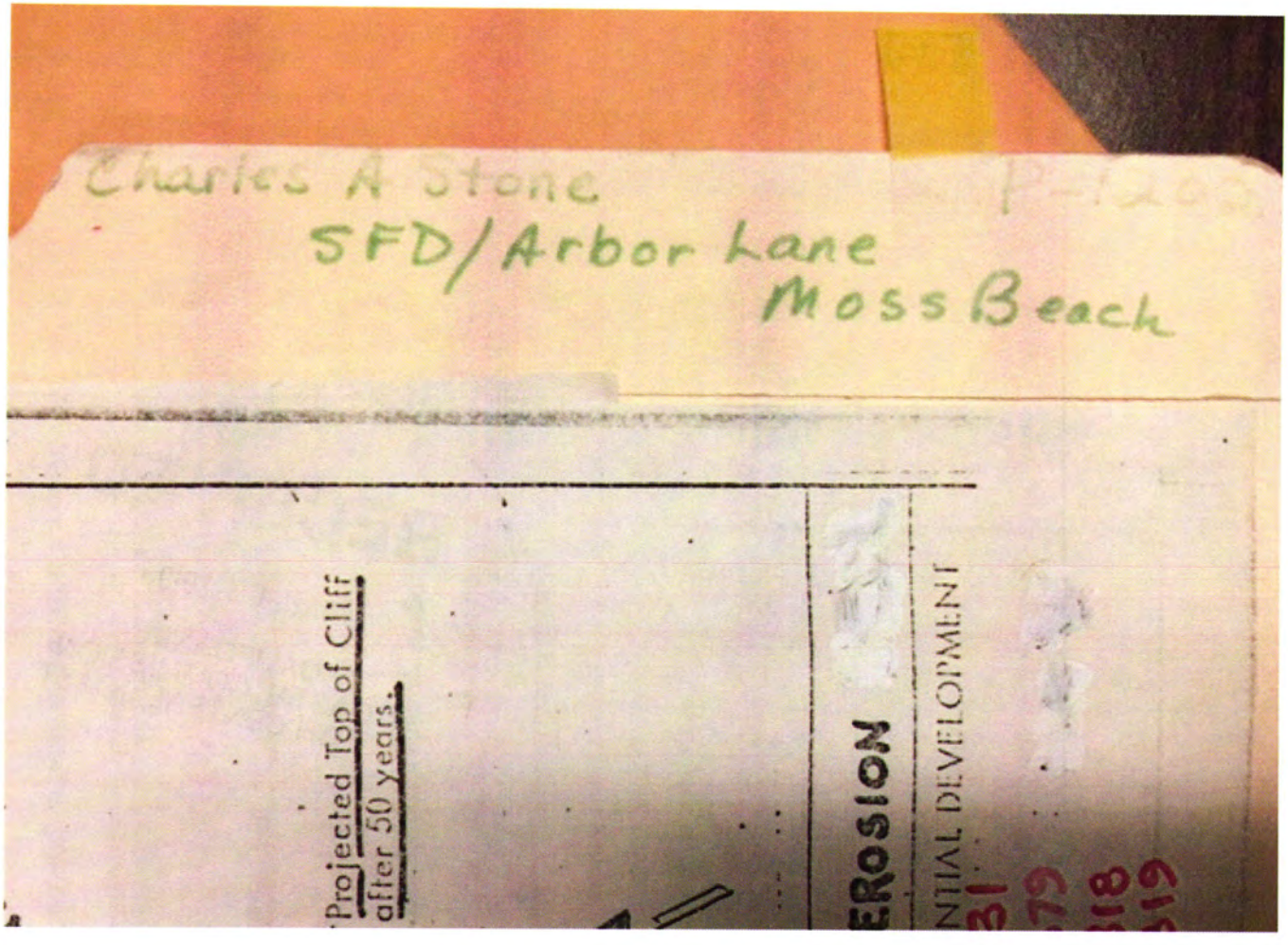
OFFICIAL SEAL
LINDA J. MICHEL
NOTARY PUBLIC — CALIFORNIA
PRINCIPAL OFFICE IN SAN MATEO COUNTY
My Commission Expires November 3, 1973

Notary's Signature Linda J. Michel
Linda J. Michel

MAIL TAX STATEMENTS AS DIRECTED ABOVE

SFD/Arbor Lane Moss Beach

(2) ccc file


Charles A Stone
SFD/Arbor Lane
Moss Beach
Projected Top of Cliff
after 50 years.
EROSION
NTIAL DEVELOPMENT

(2) Retention of trees and provisions of landscaping as provided for in staff reports shall be observed, and

(3) Granting of said permits shall be subject to the statements and plans ed by applicant.

BE IT FURTHER RESOLVED that the Central Coast Regional Commission does hereby he following permits subject to these additional conditions:

P-1172, W. R. KOERTING: In the event of the formation of an underground utility district, the applicant shall be required to connect to the assessment district. Power poles would be removed at that time.

P-1202, CHARLES STONE: Applicant shall record the permit for this development, which will state that the parcel known as lot 10, Cypress Cliffs, is subject to the forces of wave-cut and surface-saturation erosion.

P-1186, ROY HORN: One on-site parking space shall be provided and final plot plan showing the location shall be submitted to staff for approval.

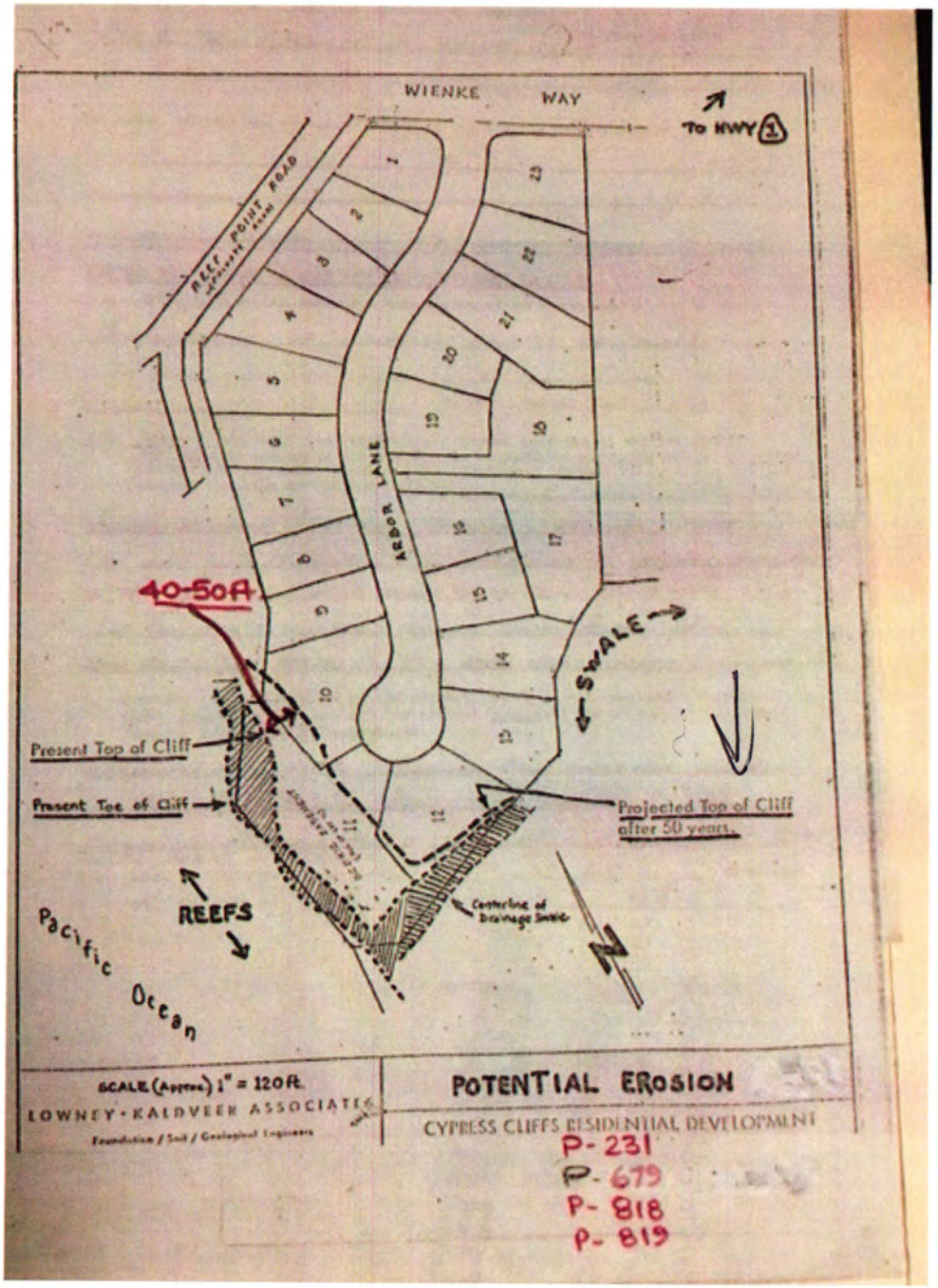
P-1201, MILTON MACKEN: No trees shall be removed. No construction activity shall take place within 20 ft. of the stream bank.

P-1183, DANFORD WILKINSON; P-1184, THOMAS UCHYTIL; P-1189, M. E. NORMAN; P-1192, IRADGE FARRAHI; and P-1193, JAYANT S. KARMARKAR: Standard small ic tank conditions for Santa Cruz County.

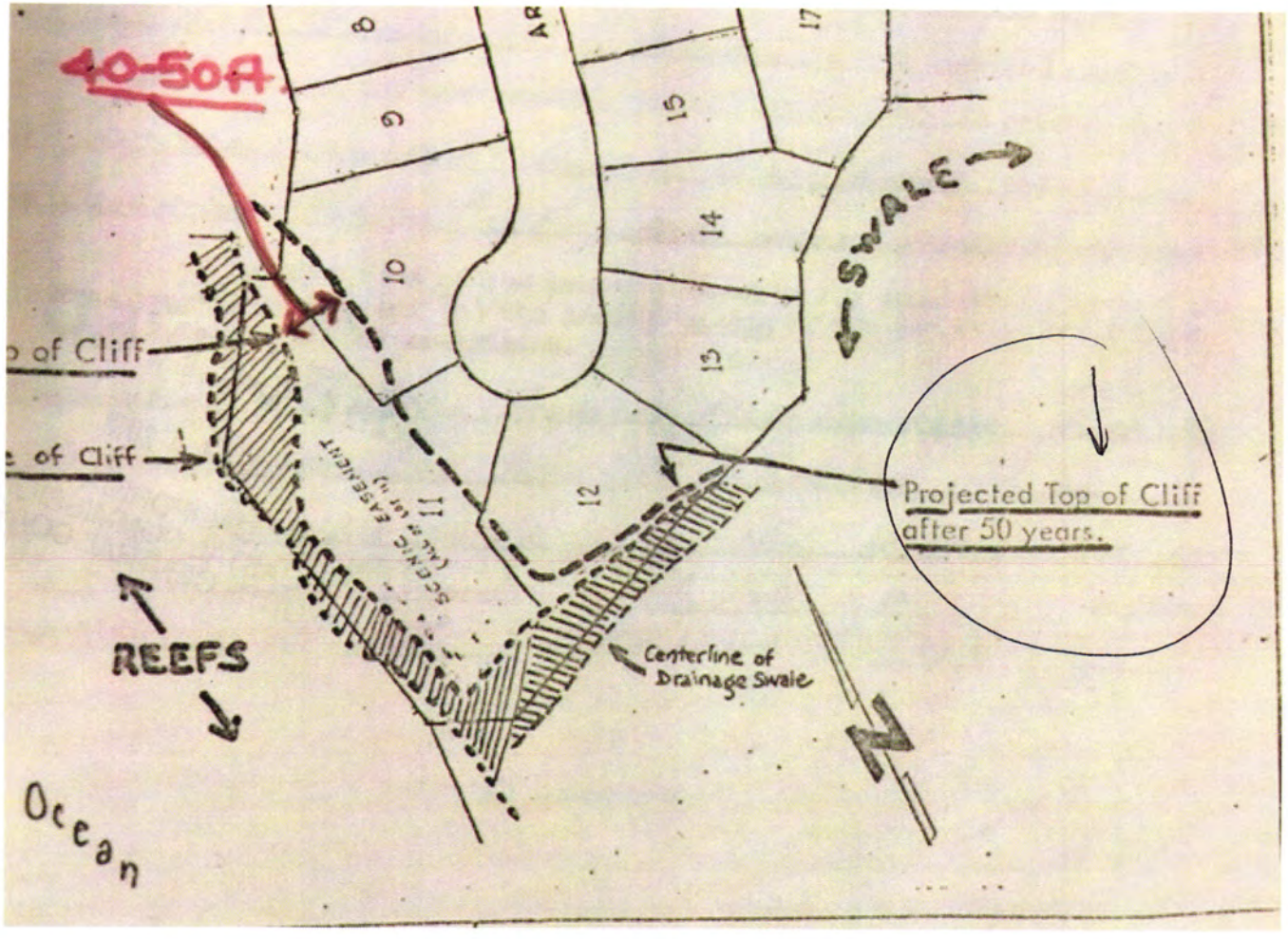
1. Septic tank shall have a 24-hour effluent holding capacity.

CCC file

(H)


WIENKE WAY
To HWY 1
REEF POINT ROAD
ARBOR LANE
40-50ft
SWALE
Present Top of Cliff
Present Toe of Cliff
Projected Top of Cliff after 50 years.
REEFS
Pacific Ocean
Centerline of Drainage Swale
SCALE (Approx.) 1" = 120ft.
LOWNEY · KALDVEER ASSOCIATES
Foundation / Soil / Geological Engineers
POTENTIAL EROSION
CYPRESS CLIFFS RESIDENTIAL DEVELOPMENT
P-231
P-679
P-818
P-819

(5) CCA 6/19


40-50A
8
9
10
11
12
13
14
15
17
SWALE
of Cliff
of Cliff
SCENIC EASEMENT
Projected Top of Cliff
after 50 years.
REEFS
Centerline of
Drainage Swale
Ocean

Appendix 1

Environmental Services Agency

Planning and Building Division

County of San Mateo

Mail Drop PLN122 - 590 Hamilton Street - 2nd Floor - Redwood City
California 94063 - Telephone 415/363-4161 - Fax 415/363-4849

June 4, 1997

Jim Wilkinson
Wilkinson Enterprises, Inc.
P.O. Box 3218
Half Moon Bay, CA 94019

Dear Mr. Wilkinson:

SUBJECT: Clarification of Locational Requirements for Domestic Well Placement on APN 037-123-430; File No. CDP 96-0045

As you know, the Zoning Hearing Officer's February 6, 1997 approval of CDP 96-0045 to drill a domestic well at the above cited parcel included a condition (Condition No. 1 of the decision letter dated February 10, 1997) that restricted the well location to within a prescribed envelope. In addition to those constraints, however, the Zoning Hearing Officer (ZHO) stated at the hearing that the well must be set back an additional distance from the creek bluff top edge, in order to comply with attached Local Coastal Program (LCP) Policy 9.7 *(Regulation of Development on Coastal Bluff Tops)*. That discussion acknowledged past erosion problems in that area of the creek bluff top and the subject LCP policy that required that the well be set back an additional distance than what was initially proposed by the applicant. Wells are considered development and the ZHO indicated that it was subject to the same LCP policy criteria as any development would be relative to an ocean bluff top, due to its proximity to and contributive erosion impacts by the ocean.

Essentially, either the well must be located at least 50 feet away from the creek bluff top edge, or a geotechnical report must be completed and submitted for review and approval in order to assess the integrity of the earth material within that 50-foot setback before a well could be located in that area.

While the property owner may not have expected that a geotechnical report would be required prior to submittal of a building permit for the residence, it is the only mechanism by which Planning is able to assess the integrity of that 50-foot area in order to comply with the applicable LCP policy if you choose to locate the well in that area. The geotechnical report

could also assess the entire site for the future development of the residence as well. If you choose to proceed on that track, you should contact Jay Mazzetta, in our Geotechnical Section at 363-1838, to discuss this issue.

I apologize that the letter of decision was not specific to this point, but the ZHO's directives and admonitions must be adhered to and supersedes the narrower dictates of Condition No. 1 as previously mentioned. Also, remember that the Environmental Health Division needs to have the sewer lateral that serves the adjacent property (owned by Steven King) shown on your submitted survey.

If you have any further questions, please contact me at 415/363-1837.

Sincerely,

David Holbrook
Project Planner

DH:fc - DJHH0834.6FH

Attachment

cc: Mr. William Rozar, Development Review Manager
Mr. Eugene Barhar
Ms. Elizabeth Vesprimi
Mr. Steven King

Initial analysis of Inaccurate or inadequate Information re: SLR Core Issues Not Addressed in Geo Soils Report (July 31, 2019)

"Third Party Coastal Bluff Retreat and Slope Stability Evaluation At the Proposed New Residence 199 Arbor Lane, Moss Beach CA Assessor's Parcel # (APN 037-123-430)"

1. There is no mention or analysis of the impact of the armoring on the adjacent bluffs immediately to the North of the subject property that the consultants have suggested will be intact for the "lifetime" of the project (see photos pages 4-6). It appears that the authors of the Geo Soils Report may not have actually visited the site, as they are in a remote location from the proposed development. It appears that the consultants may have based all of their analysis on low resolution remote sensing, internet images and/or literature. In any event, the impact of the armoring of the adjacent bluffs and resultant reflected wave energy, that has been documented to cause accelerated erosion in other locations on the California Coast, should be analyzed consistent with the Coastal Commission's decision on Appeal A-2-SMC -11-044 (Gerardo-Lietz, 263 Nevada Ave., Moss Beach) This is even more critical given that the Coastal Bluff Tops are directly above the fragile Fitzgerald Marine Reserve which is a public access treasure of marine and shoreline biological diversity.

2. There is no analysis of the 80-foot set back required by the CCC on a nearby site with similar soil and exposure profile of shoreline and bluffs as the subject property. In the attached photograph page 4 the199 Arbor lane proposed development site is at the top of the photograph, with a yellow area where the proposed development will be situated. The 263 Nevada site in second lower site where the CCC **Senor Geologists recommended an 80 ft. set back from the Coastal Bluff Top in 2012. (12/12/2012)** The general guidelines for Coastal Bluff Top related developments **B.5 Determining Bluff Setback Line state that:**

"The analysis shall assume that any current shoreline protective device does not exist, such that the site would erode in a manner similar to unarmored sites in the same vicinity with similar geologic attributes.

No such analysis was done or provided in the initial submission by the Applicants consultants.

California Coastal Commission staff report, 12/13/2012, p. 18,
http://documents.coastal.ca.gov/reports/2012/12/Th12b-12-2012.pdf

https://documents.coastal.ca.gov/assets/climate/slr/vulnerability/residential/RevisedDraftResidentialAdaptationGuidance.pdf
See page 61, B5 "Determining Bluff Setback Line"

(see page 7 photograph of current Cliff Bluff Top Erosion at 263 Nevada, Moss Beach)

3. The information on page 17 of GS report regarding the "CoSMoS program not covering

San Mateo County" is incorrect at this time. The Geo Soils report states that "The CoSMos Method does not include cliff retreat for San Mateo outer coast and is not valid for this site". In fact, the CoSMos v3.1 is for the outer coast and does include the site 199 Arbor as part of the outer San Mateo coast. The current Sea Level Rise information that is now being provided is 250 – 300 cm revised from 125 – 175 cm previously. This would add another 3-4 ft. to the SLR factor utilized in the 263 Nevada setback recommended by CCC geologist which would be 83-84 ft. setback if all other calculations from 2012 conditions still apply. The current CoSMos data v3.1 can be viewed on the website of "Our Coast Our Future".

4. The data provided on final two pages of the Geo Soils Report in not accurate. The distance presented in Geological Cross Section B-B" from "**Top of Bluff" is between 4ft and 13 ft. and not 35** ft. as depicted B-B' graphic (photographs pages 9 & 10) and it is continuing to erode onto the Marine Reserve each year as measured and depicted in the Addendum for Reasons for Appeal graphic (page 13).

The distance presented in Geologic Cross Section A-A' **from "Top of Bluff" is actually 5ft 5 inches and not 15 feet as depicted** in the graphic A-A' (photograph page 12)

5. The GS report does not address the requirement specifics of how the proposed development design will facilitate its removal from this fragile site when the Cliff Bluff Top erosion does threaten the proposed single family residence. At the San Mateo Planning Commission hearing on this project where this proposed development was narrowly approved by a 3-2 vote, at least 20 minutes of the meeting was focused on the demolition phase of the structure and what would be required of the owner of record at the time of demolition. This is required as per below:

"**B.2 Removal Plan Conditions for New Development in Hazardous Areas**

For development subject to coastal hazards, **require structures to be designed so that they can be removed without significantly damaging the site or surrounding land,** and impose a permit condition requiring preparation and execution of a Removal and Restoration Plan at such time as the development meets any of the removal criteria in ***Model Policy D.1 – Removal Conditions/Development Duration***, and indicating that it will be the property owner's responsibility to remove the structure(s) and restore the site at the owner's expense in a way that best protects the public trust and coastal resources. The plan shall specify that in the event that portions of the development fall to the bluffs, beach or ocean before they are removed/relocated, the landowner will remove all recoverable debris associated with the development from the bluffs, beach or ocean and lawfully dispose of the material in an approved disposal site. The plan shall also specify that such removal requires a coastal development" (LR Note: You should include the source of this cited "B.2. Removal Plan Conditions for New Development in Hazardous Areas".

https://documents.coastal.ca.gov/assets/climate/slr/vulnerability/residential/RevisedDraftResidentialAdaptationGuidance.pdf
See page 60, B2 "**Removal Plan Conditions for New Development in Hazardous Areas**"

6. There is no mention or analysis provided on Sea Level Rise, frequent winter storms, King Tides and large tree trunks (1 or more tons) or telephone poles battering and eroding the bluffs of the subject property with inevitable loss of beach, a critical feature of the Fitzgerald Marine Reserve. (photograph on page 14).

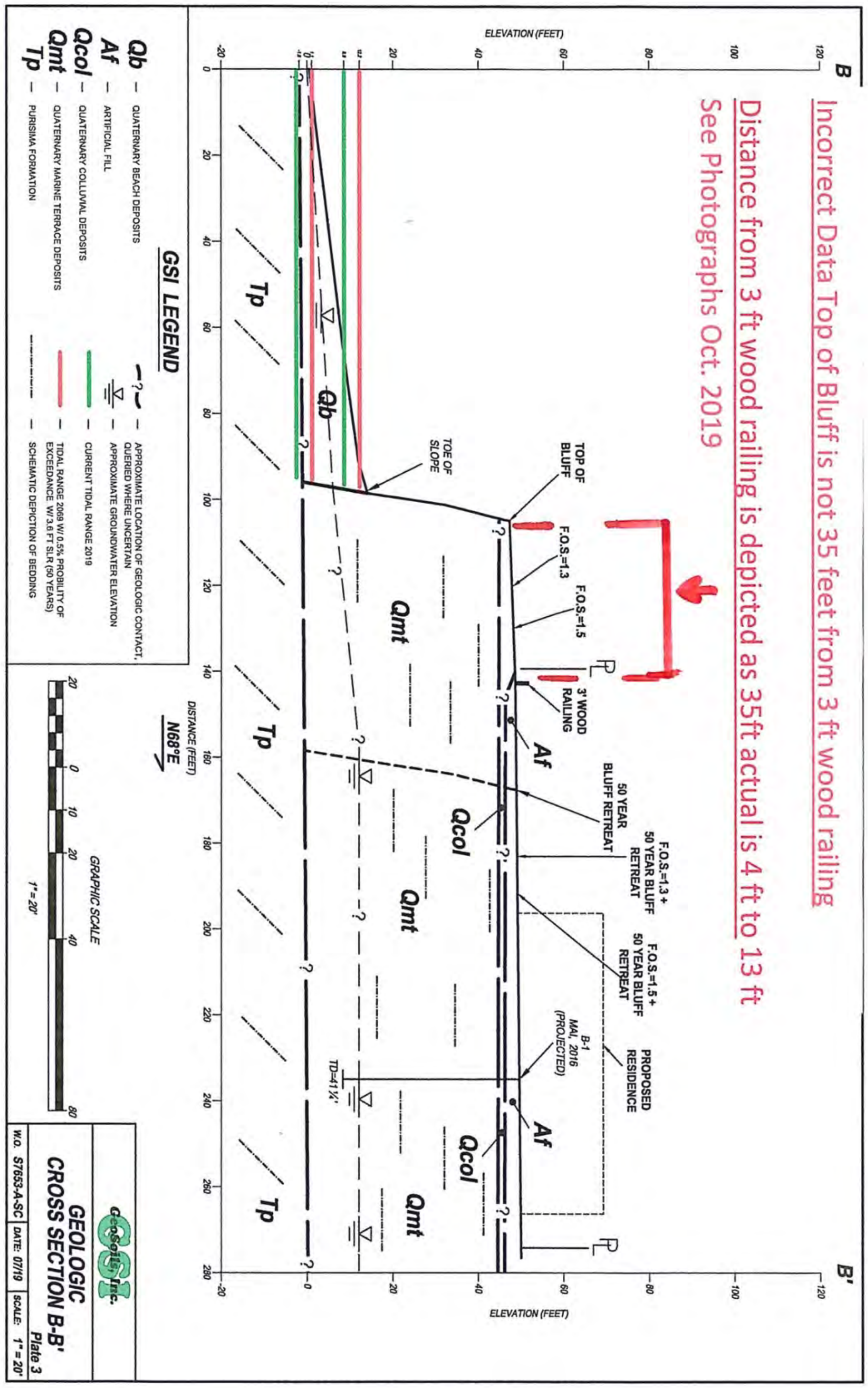
7. The overall foundation of the GS report is flawed because the authors presentation on Climate Change and Sea Level Rise (pages 7-13) does not comport with the vast majority of international scientific research findings on rates and impacts of Climate Change and Sea Level Rise. The totality of the scientific data and viewpoint on Climate Change and Sea Level Rise represented in the final attached 43 references provide an accurate picture of Global Climate Change and Sea Level Rise that is in stark contrast to the civil engineer and geologist hired by the developer to attempt to minimize the scope, scale, impact of Climate Change on Sea Level Rise on California Coastal landscapes, including the proposed 199 Arbor lane proposed development.

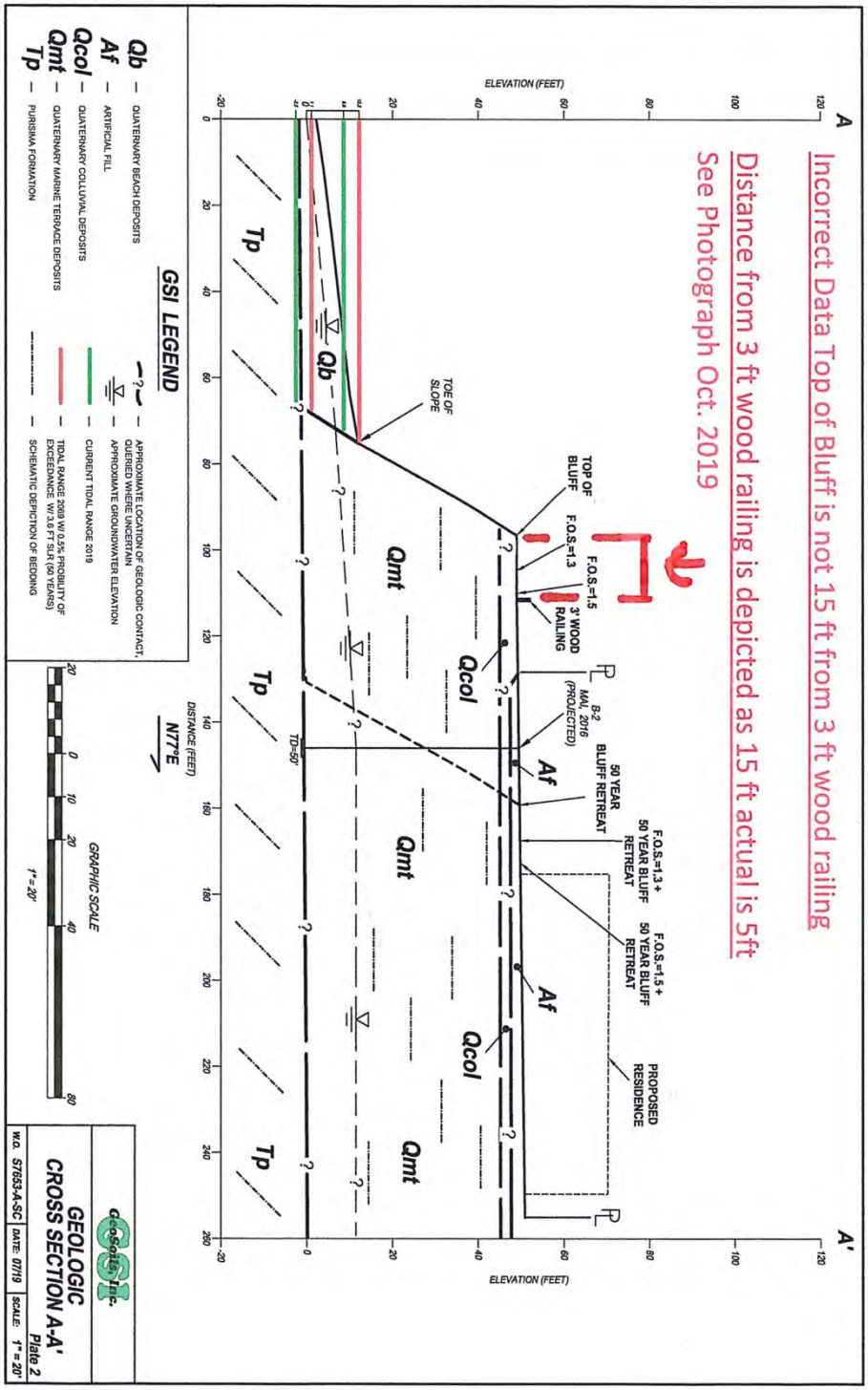
Sincerely,

Steven R. King Ph.D.

30 consecutive years of observation on site at 199 Arbor Lane, Moss Beach California.

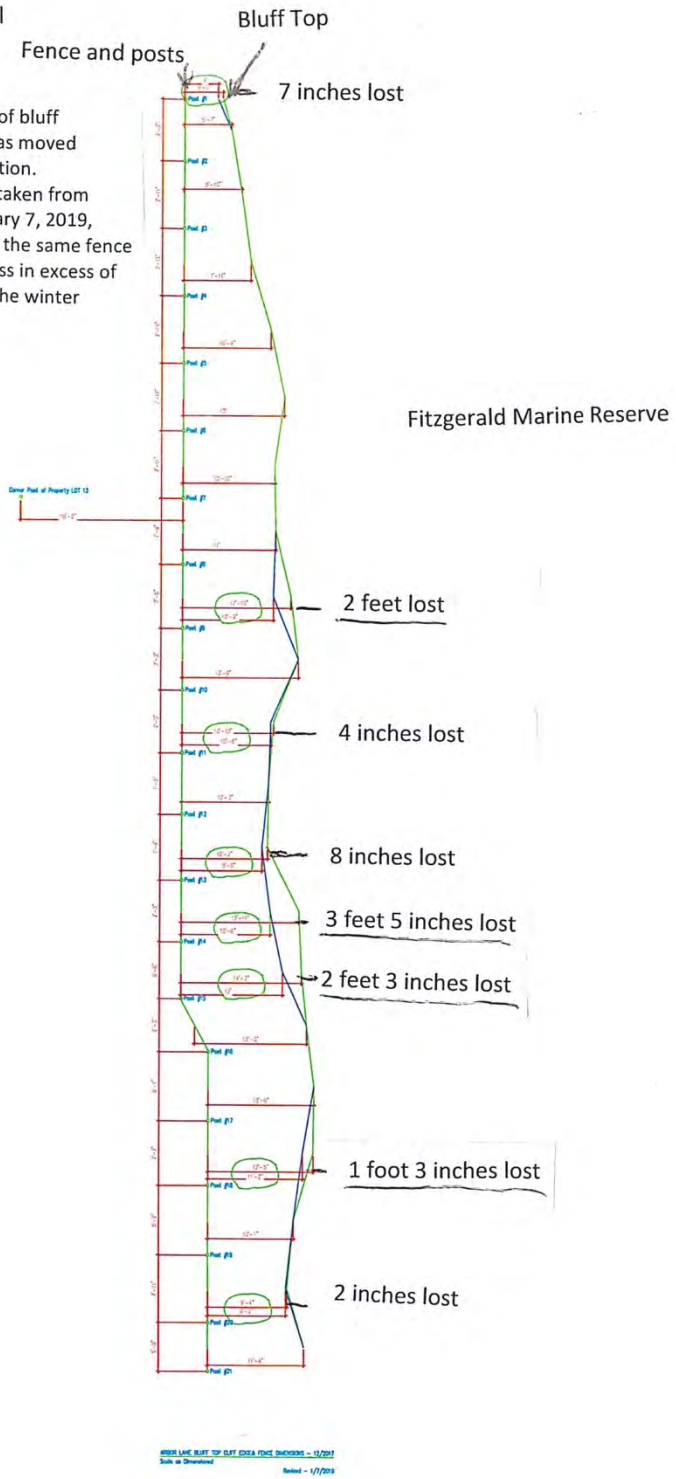

Google
Imagery ©2019 Google, Map data ©2019

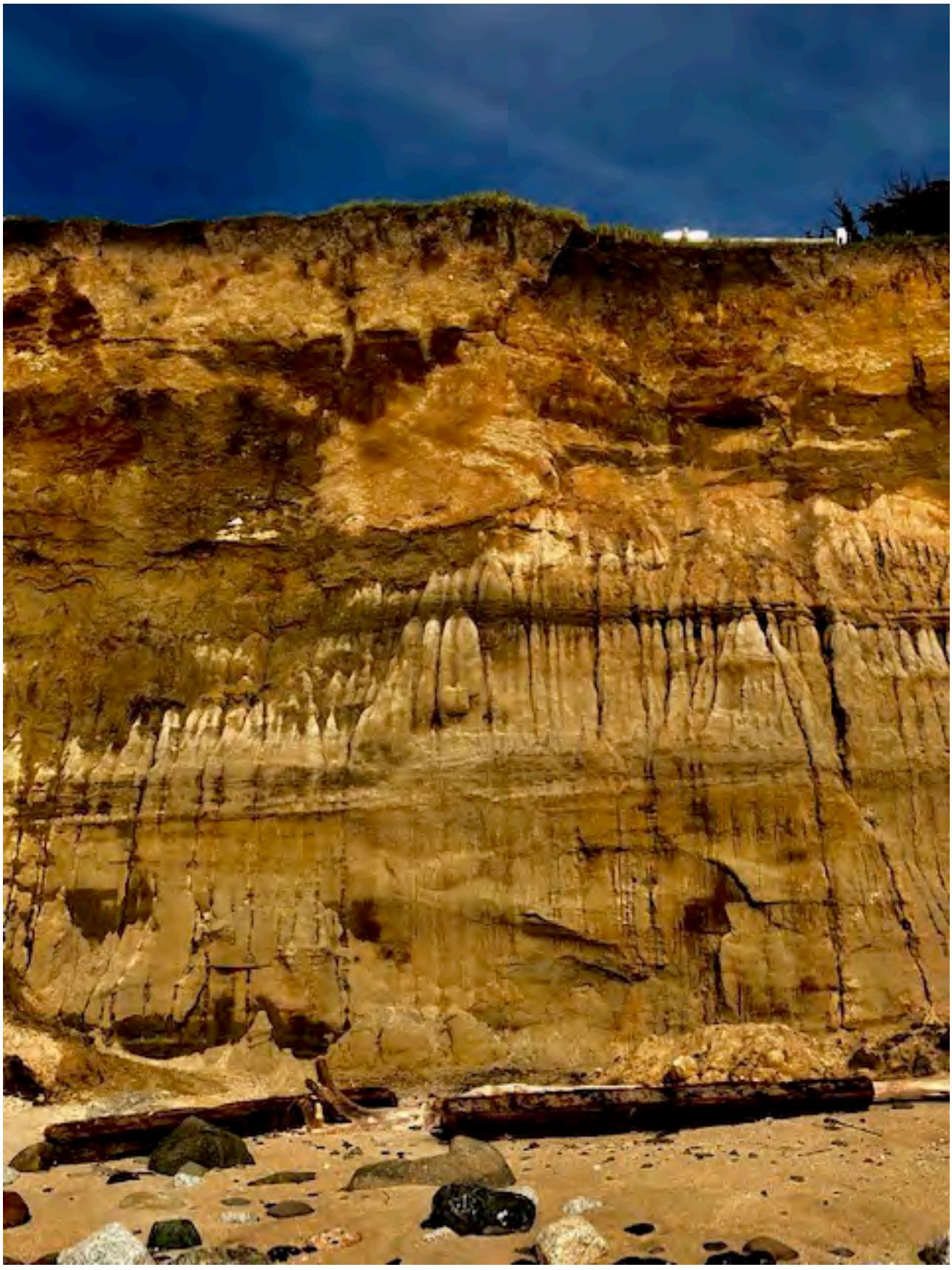

Incorrect Data Top of Bluff is not 35 feet from 3 ft wood railing
Distance from 3 ft wood railing is depicted as 35ft actual is 4 ft to 13 ft
See Photographs Oct. 2019
B
B'
ELEVATION (FEET)
DISTANCE (FEET)
N68°E
TOP OF BLUFF
TOE OF SLOPE
F.O.S.=1.3
F.O.S.=1.5
3' WOOD RAILING
50 YEAR BLUFF RETREAT
F.O.S.=1.3 + 50 YEAR BLUFF RETREAT
F.O.S.=1.5 + 50 YEAR BLUFF RETREAT
PROPOSED RESIDENCE
B-1 MAL 2016 (PROJECTED)
TD=41½'
Tp
Qb
Qmt
Qcol
Af
GSI LEGEND
Qb – QUATERNARY BEACH DEPOSITS
Af – ARTIFICIAL FILL
Qcol – QUATERNARY COLLUVIAL DEPOSITS
Qmt – QUATERNARY MARINE TERRACE DEPOSITS
Tp – PURISIMA FORMATION
APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
APPROXIMATE GROUNDWATER ELEVATION
CURRENT TIDAL RANGE 2019
TIDAL RANGE 2069 W/ 0.5% PROBILITY OF EXCEEDANCE W/ 3.6 FT SLR (50 YEARS)
SCHEMATIC DEPICTION OF BEDDING
GRAPHIC SCALE
1" = 20'
GeoSoils, Inc.
GEOLOGIC CROSS SECTION B-B'
Plate 3
W.O. S7653-A-SC
DATE: 07/19
SCALE: 1" = 20'


Incorrect Data Top of Bluff is not 15 ft from 3 ft wood railing
Distance from 3 ft wood railing is depicted as 15 ft actual is 5ft
See Photograph Oct. 2019
A
A'
ELEVATION (FEET)
DISTANCE (FEET)
N77°E
TOP OF BLUFF
F.O.S.=1.3
F.O.S.=1.5
3' WOOD RAILING
TOE OF SLOPE
B-2 MAI, 2016 (PROJECTED)
50 YEAR BLUFF RETREAT
F.O.S.=1.3+ 50 YEAR BLUFF RETREAT
F.O.S.=1.5+ 50 YEAR BLUFF RETREAT
PROPOSED RESIDENCE
TD=50'
Qb
Af
Qcol
Qmt
Tp
GSI LEGEND
QUATERNARY BEACH DEPOSITS
ARTIFICIAL FILL
QUATERNARY COLLUVIAL DEPOSITS
QUATERNARY MARINE TERRACE DEPOSITS
PURISIMA FORMATION
APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
APPROXIMATE GROUNDWATER ELEVATION
CURRENT TIDAL RANGE 2019
TIDAL RANGE 2069 W/ 0.3% PROBILITY OF EXCEEDANCE W/ 3.6 FT SLR (50 YEARS)
SCHEMATIC DEPICTION OF BEDDING
GRAPHIC SCALE
1" = 20'
geologic inc.
GEOLOGIC CROSS SECTION A-A'
Plate 2
W.O. S7553-A-SC
DATE: 07/19
SCALE: 1" = 20'

Addendum to Reasons For Appeal

After the loss of 12 feet of bluff on southern end of bluff was lost in 2016/2017 winter season the fence was moved back from bluff edge by Arbor Lane Block Association.
In December 2017 baseline measurements were taken from the fence posts to the edge of Bluff Top. On January 7, 2019, 13 months, later measurements were made from the same fence posts. Bluff loss was noted in 8 locations, some loss in excess of 3 feet as noted. This is an unstable bluff top and the winter rains of 2019 have only just started.





Initial List of References That Refute Geo Soils information Presented on pages 7-13 of Geo Soils Report Regarding Climate Change and Sea Level Rise

Arrhenius, S., "On the Influence of Carbonic Acid in the Air Upon the Temperature of the Ground", *Philosophical Magazine, 41* (1896)

California Department of Water Resources, *California Water Plan Update*, 2013, available at https://water.ca.gov/Programs/California-Water-Plan/Water-Plan-Updates

Church, J. A., et al., "Revisiting the Earth's Sea-Level and Energy Budgets from 1961 to 2008", *Geophysical Research Letters, 38* (18), L18601 (2011)

Church, J. A., et al., "Sea Level Change", *Climate Change 2013: The Physical Science Basis*, Chap. 13

Church, J., White, N., "Sea Level Rise from the Late 19th to Early 21st Century", *Surveys in Geophysics*, *32*, (2011)

Collins, M., et al., Chap. 12: "Long-term Climate Change: Projections, Commitments and Irreversibility", C*limate Change 2013*: *The Physical Science Basis* (2013)

County of San Mateo Sea Level Rise Vulnerability Assessment (2018), available at https://seachangesmc.org/wp-content/uploads/2018/03/2018-03-12_SLR_VA_Report_2.2018_WEB_FINAL.pdf

DeConto, R. & Pollard, D., "Contribution of Antarctica to Past and Future Sea-Level Rise", *Nature, 518* (7596), (2016)

DeJong, B., et al., "Pleistocene Relative Sea Levels in the Chesapeake Bay Region and Their Implications for the Next Century", *GSA Today*, *25*(8), (201

Deschamps, P., et al., "Ice-sheet Collapse and Sea-Level Rise at the Bølling Warming 14,600 Years Ago", *Nature*, *483*, *(2012)*

Ekwurzel, B, et al., "The Rise in Global Atmospheric CO2, Surface Temperature, and Sea Level from Emissions Traced to Major Carbon Producers *Climate Change, 144*, (2017)

Foote, E., "Circumstances Affecting the Heat of the Sun's Rays", *The American Journal of Science and Arts,* 46 (1856)

Fourier, J., "General Remarks on the Temperature of the Earth and Outer Space", *American Journal of Science, 32*, (1824), Translation by Ebeneser Burgess

Fourth National Climate Assessment, 2018, Vol. I, Chap. 12: "Sea Level Rise", available at https://science2017.globalchange.gov/chapter/12

Fourth National Climate Assessment, 2018, Vol. II, Summary Findings, available at https://nca2018.globalchange.gov/#sf-12

Frumhoff, P., et al., The Climate Responsibilities of Industrial Carbon Producers, *Climatic Change*, *132*, (2015)

Griggs, G, et al. (2017), "Rising Seas in California: An Update on Sea-Level Rise Science", *California Ocean Science Trust*, available at http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf

Hawkins, E., et al. (2017), "Estimating Changes in Global Temperature Since the Preindustrial Period", *Bulletin of the American Meteorological Society*, *98*(9),

International Energy Agency, "Global Energy and CO2 Status Report", available at https://www.iea.org/geco/emissions/

Intergovernmental Panel on Climate Change, "Summary for Policymakers", *Global Warming of 1.5C* (2018)

Jones, C., et al., "Twenty-First-Century Compatible CO2 Emissions and Airborne Fraction Simulated by CMIP5 Earth System Models Under Four Representative Concentration Pathways", *Journal of Climate*, *26,* (2013)

Kopp, R. E., et al., "Probabilistic 21st and 22nd Century Sea-Level Projections at a Global Network of Tide-Gauge Sites", *Earth's Future*, *2*, (2014)

Le Quéré, C., et al. (2018), "Global Carbon Budget 2017", *Earth System Science Data*, *10*

Le Quéré, C., et al., "Global Carbon Budget 2018", *Earth System Science Data*, *10* (2018)

Leifert, H., "Sea Level Rise Added $2 Billion to Sandy's Toll in New York City", *Eos*, *96* (2015)

Levermann, A., et al., "The Multimillennial Sea-level Commitment of Global Warming", *Proceedings of the National Academy of Sciences*, *110*(34), (2013)

Lourantou, A., et al., "Changes in Atmospheric CO_2 and Its Carbon Isotopic Ratio During the Penultimate Deglaciation", Q*uaternary Science Reviews*, *29*, (2010)

Masson-Delmotte, V., et al., Chap. 5: "Information from Paleoclimate Archives", *Climate Change 2013*: *The Physical Science Basis* (2013)

Mitrovica, J. X., et al., "On the Robustness of Predictions of Sea Level Fingerprints", *Geophysical Journal International*, *187*(2), (2011)

Nerem, R. S., et al., "Climate-Change-Driven Accelerated Sea-Level Rise Detected in the Altimeter Era", *Proceedings of the National Academy of Sciences of the United States of America*, *115*(9), (2018)

Nienhuis, J. H., et al., "A new Subsidence Map for Coastal Louisiana", *GSA Today*, *27* (2017)

Nuccitelli, D., et al., "Comment On Ocean Heat Content and Earth's Radiation Imbalance, II - Relation to Climate Shifts", *Physics Letters A*, *376*(45), (2012)

Pacific Institute, The Impacts of Sea Level Rise on the San Francisco Bay, (2012), available at http://www.energy.ca.gov/2012publications/CEC-500-2012-014/CEC-500-2012-014.pdf

Rasmussen, D. J., et al., "Extreme Sea Level Implications of 1.5°C, 2.0°C, and 2.5°C Temperature Stabilization Targets in the 21st and 22nd Centuries", *Environmental Research Letters*, *13*, 034040 (2018)

Rogelj, J., et al., "Paris Agreement Climate Proposals Need a Boost to Keep Warming Well Below 2 C", *Nature 534*(7609) (2016)

Schneider, S. (1989), "The Greenhouse Effect: Science and Policy", *Science*, *243*

Shepherd, A., et al., "Mass Balance of the Antarctic Ice Sheet From 1992 to 2017, *Nature, 556*, (2018)

Solomon, S., et al. (2010), "Contributions of Stratospheric Water Vapor to Decadal Changes in the Rate of Global Warming", *Science*, *327*

Stocker., et al., "Technical Summary", *Climate Change 2013: The Physical Science Basis* (2013)

Sweet, W.V., R. Horton, R.E. Kopp, A.N. LeGrande, and A. Romanou, 2017: "Sea Level Rise", *Climate Science Special Report, Fourth National Climate Assessment, Volume I* [Wuebbles, D.J., D.W. Fahey, K.A. Hubbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)], U.S. Global Change Research Program, Washington, DC, USA

Tyndall, J., "On the Absorption and Radiation of Heat By Gases and Vapours, and On the Physical Connexion of Radiation, Absorption, and Conduction"**,** *Philosophical Magazine, 22,* (1861)

UN Paris Agreement, available at https://unfccc.int/process- and-meetings/the-paris-agreement/the-paris-agreement

U.S. Army Corps of Engineers, "North Atlantic Coast Comprehensive Study Report" (2014), available at http://www.nad.usace, army.mil/CompStudy/

CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE (415) 904-5200
FAX (415) 904-5400

July 22, 2020

GEOTECHNICAL REVIEW MEMORANDUM

To: Erik Martinez, Coastal Program Analyst

From: Joseph Street, Ph.D. P.G., Staff Geologist *Joseph Street*

Re: 199 Arbor Lane, Moss Beach (Carlos Zubieta), Appeal No. A-2-SMC-19-0002

Summary

Based on a review of the applicant's geotechnical reports and other relevant information, I evaluate the total setback needed to protect new development at the site from slope instability and bluff erosion over the next 50 years, without reliance on shoreline protection. The chief short-term geologic hazards at the site include: (a) rapid episodic bluff erosion and retreat during winter storms; and (b) bluff instability. Based on the applicant's slope stability analysis, a 1.5 factor of safety against bluff failure is achieved 13.5 to 25 feet inland of the bluff edge, depending on the cross-section analyzed. A short-term hazard setback in these amounts would protect against both episodic bluff retreat and bluff instability in the present-day. Future bluff retreat at the site over the next 50 years could range from approximately 82 – 114 feet under the high projections of future sea level rise recommended for use by the 2018 State Guidance, based on projections using the simplified SCAPE model. The range in these projections reflects different assumptions about how rates of bluff retreat will be affected by rising sea level. In this case, due in part to the presence of a broad bedrock shore platform fronting the bluff at this site, 82 feet of future bluff retreat is deemed the more likely estimate, though greater retreat remains a possibility. The total bluff top setback necessary to assure the stability of new development over 50 years, consistent with the San Mateo County LCP, ranges from 95.5 ft (13.5 ft + 82 ft) across the northern part of the site to 107 ft (25 ft + 82 ft) across the southern part of the site.

Introduction

In connection with the above-referenced appeal, I have reviewed the following documents directly related to the subject property:

1) Michelucci & Associates, Inc. (MAI), 2016. "Geotechnical and Geologic Investigation, Proposed New Residence, Vacant Lot on Arbor Lane, APN# 037-123-430, Moss Beach, San Mateo County, California", prepared for Carlos Zubieta Architect, signed by J. Petroff, D. F. Hoexter (CEG) and J. Michelucci (GE), July 6, 2016.
2) MAI, 2017a, "Geotechnical and Geologic Investigation Update, Proposed New Residence, Vacant Lot on Arbor Lane, APN# 037-123-430, Moss Beach, San Mateo County, California", prepared for Carlos Zubieta Architect, signed by J. Petroff, D. F. Hoexter (CEG) and J. Michelucci (GE), August 29, 2017.
3) MAI, 2017b, "Response to Steven R. King, Ph.D. October 22, 2017 Memo, Proposed New Residence, Vacant Lot on Arbor Lane, APN# 037-123-430, Moss Beach, San Mateo

County, California", prepared for Carlos Zubieta Architect, signed by D. F. Hoexter (CEG) and J. Michelucci (GE), November 22, 2017.

4) MAI, 2018, "Supplemental Foundation Criteria, Proposed New Residence, Vacant Lot on Arbor Lane, APN# 037-123-430, Moss Beach, San Mateo County, California", prepared for Carlos Zubieta Architect, signed by J. Michelucci (GE), June 7, 2018.
5) King, S. R. and Scheinberg, J., 2019, "Appeal from coastal permit decision of local government", dated January 11, 2019.
6) Committee for Green Foothills (CGF), 2019, "Summary of Reason for Appeal", dated January 14, 2019.
7) GeoSoils, Inc. (GSI), 2019, "Third-Party Coastal Bluff Retreat and Slope Stability Evaluation at the Proposed New Residence, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, APN 037-123-430", prepared for Carlos Zubieta Architect, signed by J. P. Franklin (CEG) and D. W. Skelly (RCE), July 31, 2019.
8) King, S. R., undated. "Initial analysis of Inaccurate or inadequate Information re: SLR Core Issues Not Addressed in Geo Soils Report (July 31, 2019)."
9) GSI, 2020a, "Response to California Coastal Commission Review of Third-Party Bluff Retreat and Slope Stability Analysis, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, APN 037-123-430", prepared for Carlos Zubieta Architect, signed by J. P. Franklin (CEG) and D. W. Skelly (RCE), January 6, 2020.
10) GSI, 2020b, "Geotechnical Map (Re-Revised Plate 1)", "Geologic Cross-Section A-A' (Revised Plate 2)", and "Geologic Cross-Section B-B' (Revised Plate 3), plan set dated January 2020, received by Commission staff on February 3, 2020.
11) GSI, 2020c, "Supplemental Analysis of Coastal Bluff Retreat, Proposed New Residence, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, APN 037-123-430", prepared for Carlos Zubieta Architect, signed by J. P. Franklin (CEG) and D. W. Skelly (RCE), April 28, 2020.
12) Environmental Science Associates (ESA), 2020, "Arbor Lane Coastal Bluff Erosion Review and Study", prepared for Committee for Green Foothills, signed by Louis White (PE), May 27, 2020.

I have also consulted numerous other references (listed below), which provide additional geologic context and hazards information. I have visited the project site and observed the beach, bluff and stream gully adjacent to the site on several occasions, most recently on July 17, 2020.

The purpose of this memo is to evaluate geologic hazards at the project site, and to determine the total bluff top setback that would be needed to minimize these hazards to the proposed new development and assure stability and structural integrity, consistent with the County of San Mateo's certified Local Coastal Program (LCP), over a minimum project life of 50 years. The County LCP requires that new bluff and cliff top development be permitted only if design and setback provisions will assure stability and structural integrity for at least 50 years without contributing to erosion or geologic instability of the site or surrounding area (Hazards Policy 9.8a). More specifically, the LCP requires that such design and setback provisions be based on a site evaluation report that considers, among other factors, historic, current and foreseeable cliff erosion (Policy 9.8b(1)), potential landslide conditions (9.8b(4)), wave action and marine erosion (9.8b(5)), ground and surface water conditions (9.8b(6)), seismic forces (9.8b(7)), and the effects of the

proposed development (9.8b(8)). The LCP also prohibits new structures that would rely on a shoreline/bluff protective device (Policy 9.8d).

To meet these requirements, it is necessary to evaluate risks to the project site over the next 50 years from bluff instability, erosion and retreat, and to estimate a total bluff top setback by combining (1) the setback needed, under present conditions, to assure the stability of the proposed development against landslides and bluff failures, and/or a major short-term episodic erosion event; and (2) the expected long-term bluff retreat at the site over the full project life, including consideration of future sea level rise. This memo will provide recommendations for the components of the total setback, such that, in combination, the setback would meet the LCP criteria.

Site Description & Geologic Setting

The proposed project involves the construction of a new residence on an undeveloped bluff top parcel at the southern end of Arbor Ln. in the community of Moss Beach, San Mateo County. The western boundary of the subject property is located approximately 25 – 30 feet inland of the edge of a 35 – 40-ft high, eroding coastal bluff. To the south, the site is bounded by an incised gully formed by the intermittent flow of Dean Creek. A plan view of the site is shown in **Exhibit 2**; photos of the site are provided in **Exhibit 3**. Shoreline armoring, including a riprap revetment, upper bluff retaining walls, and a full-bluff gunnite seawall, protects properties immediately to the north, while several revetments are present on the beach and bluff south of the site, along Nevada Ave.

The top of bluff seaward of the project site occurs at elevations of +47 – 49 feet NAVD88, and the subject property itself is nearly level. MAI (2016) (Ref. 1) indicates that the bluff consists of at least four distinct units of late Pleistocene-aged marine terrace deposits composed primarily of poorly to moderately consolidated, relatively stiff marine, eolian and alluvial sands, interspersed with variable amounts of silt, clay and gravel. The terrace deposits are overlain by 2 – 4 feet of native soil and artificial fill. The terrace deposits extend to approximately 45 – 50 feet below ground level, where they rest unconformably on bedrock consisting of the highly fractured, fossil-rich siltstones, shales and sandstones of the Tertiary-aged Purisima Formation.[1] The exposed bluff face consists entirely of the relatively weak terrace deposits, and, as discussed in greater detail below, is subject to relatively rapid erosion and retreat during periods of intense wave attack. The inclination of the bluff face ranges from about 60˚ to near vertical (Ref. 1), indicative of active marine erosion at the toe of the bluff.

The bluff is fronted by a relatively narrow sand and cobble beach, and a wave cut platform in the Purisima Formation which forms a broad intertidal reef (“Horseshoe Reef”) extending from the beach through the nearshore zone. The reef dissipates wave energy and limits the maximum height of waves that can directly strike the bluff. Nonetheless, the preponderance of rock and cobble at the site indicates that this is a high-energy beach environment; waves regularly reach the bluff toe during high tides and/or high wave conditions (Griggs 2015). A review of historical photographs indicates that the beach width and sand volume have varied over time. At present, the sand volume appears to be relatively low. During a July 17, 2020 site visit, the beach was dominated by boulders, cobble and gravel, with only thin and discontinuous sand cover (**Exhibit 3**).

[1] Previous well borings at the site indicate that Montara Mountain granite/quartz diorite basement rock underlies the Purisima Formation at depths of approximately 145 feet below ground surface. (Ref. 1).

CSA (2016) has argued that beaches in the Moss Beach area have narrowed significantly over the past 40 years.

Geologic Hazards at the Project Site

Episodic Bluff Erosion and Retreat

The sedimentary deposits that make up the bluff at the project site and elsewhere along the central Moss Beach shoreline are highly susceptible to erosion and episodic retreat. Elevated sea levels and high waves associated with winter storms increase the exposure of the bluff to wave attack, leading to erosion of the bluff toe, undercutting of the weak marine terrace deposits which comprise the bluff, and bluff retreat due to small block failures and slumping on the bluff face (Refs. 1, 7; Lajoie and Mathieson 1998, Griggs et al. 2005, HKA 2012).[2] The narrow beach at the project site provides only limited protection from wave attack. At the same time, elevated groundwater levels, saturated soils, and seepage at the cliff face resulting from heavy precipitation likely contribute to upper bluff instability and collapse (Hampton and Dingler 1998). These processes typically manifest as small to moderate slides and block falls, often occurring in quick succession during a single storm event. During winters with frequent or sustained storms, the bluff edge at a given location can retreat by tens of feet as a result of multiple, discrete erosion events.

Major episodes of bluff retreat in the Moss Beach area have often coincided with El Niño events, which along the California coast bring elevated sea levels and more frequent southwesterly winter storms. A series of strong storms and record high water levels during the El Niño winter of 1982-83 caused severe beach and cliff erosion in Moss Beach, destroying a beach access stairway and threatening several houses (Lajoie and Mathieson 1998). Rapid bluff retreat during 1982-83 was the direct impetus for the placement of a rock revetment and upper bluff wall along the bluff north of the project site, at 190 and 198 Arbor Ln., as well the construction of revetments at several locations to the south along Nevada Ave (Griggs et al. 2005). Magnitudes of episodic bluff retreat in Moss Beach during the 1982-83 winter are not reported in the sources I have consulted. However, an analysis of historical aerial photographs conducted by HKA (2012) provides evidence that the locations on the unprotected bluff fronting 263 Nevada Ave. (about 250 yards south of the project site) retreated between 12.5 – 23 feet between 1979 and 1983, and it is likely that a large portion of this retreat occurred during 1982-83. Substantial episodic bluff retreat in the project vicinity also occurred during the winters of 1997-98, 2009-10, 2015-16 and 2016-17 (Refs. 1, 2; Brady/LSA 2002; HKA 2012; CSA 2016). Based on an examination of overhead aerial imagery using Google Earth, I estimate that certain locations on the bluff edge at the project site retreated 11 – 12 feet during the El Niño winter of 2015-16, and that the Nevada Ave. bluff to the south retreated up to 18 – 19 feet near the Beach Street terminus. Both MAI (2017a) (Ref. 2) and the appellants (Refs. 5, 6) have reported an additional 11 – 12 feet of retreat on the northern part of the subject bluff during the winter of 2016-17.

The significant bluff edge retreat occurring during the winter of 2016-17 and during subsequent years post-dated the topographic site survey used in the MAI (2016) geologic investigation. As a result, the bluff edge position depicted in figures in Ref. (1) and the July 2019 coastal hazards report (GSI 2019; Ref. 7) are no longer accurate. Subsequent survey work was completed on the applicant's behalf and an updated geotechnical site map, with a revised position of the bluff edge, was provided to Commission staff as part of Ref. 10. The updated site map and associated bluff cross-sections provide the basis for the analysis and discussion contained in this memo.

[2] MAI (2016) (Ref. 1) describes this process, vividly, as the "peeling" of the bluff face.

Episodic erosion during coastal storms will continue to drive future bluff retreat at the project site. In the local context, LCP policies requiring development setbacks sufficient to assure stability for at least 50 years, without requiring bluff protection, must account for not only a single slope failure or landslide event (see discussion below) but also episodic bluff retreat, consisting of multiple smaller cliff failures, occurring within short timeframes. Based on observations of past episodic retreat occurring at the project site and near vicinity during severe winter storm seasons, I estimate that a minimum development setback on the order of 10 - 20 feet would be necessary, maintained over the full project life, to protect against short-term episodic erosion.

Landslides and Bluff Instability

In many geologic settings, deep-seated landslides and other large slope failures are a primary mode of coastal bluff erosion and retreat. In the Moss Beach area, CSA (2016) has identified a large, dormant deep landslide complex and several smaller active landslides on the high (>400 ft) Pillar Point bluffs, approximately 1 mile south of the project site. A portion of the Seal Cove neighborhood of southern Moss Beach is located on a known, active deep-seated landslide (Griggs et al 2005; Griggs 2015). However, landslides and large slope failure events are not known to have occurred along the lower bluffs in the immediate project area. In a qualitative assessment, MAI 2016 (Ref. 1) found no evidence for past or existing landslides or rotational failures along the subject bluff. Rather, the primary slope instability hazards at the project site appear to be from the small to moderate block failures and slumps associated with marine erosion, and, as discussed below, ground-shaking during an earthquake.

GSI (2019) (Ref. 7) performed a quantitative slope stability analysis[3] along two site cross-sections to determine whether the bluff is grossly stable against failure and whether it meets minimum stability standards. One common standard, which the Commission has consistently applied for many years in evaluating coastal bluff stability, is a factor-of-safety against sliding of 1.5 for static conditions and 1.1 for pseudostatic conditions, assuming strong ground-shaking during an earthquake. If the entire bluff does not possess a factor of safety of 1.5 or 1.1 (seismic), the position on the bluff face or bluff top at which this factor is attained must be determined in order to establish a safe setback. The GSI analysis determined that a 1.5 factor-of-safety was achieved along a modeled failure plane daylighting approximately 13.5 feet inland of the bluff edge on the northern part of the site (Section A-A'), and 25 feet inland of the bluff edge along the southern part of the site (Section B-B') (*see* **Exhibit 2).** For the pseudostatic condition (assuming a groundshaking coefficient of k = 0.15 g), a 1.1 factor of safety was achieved at slightly more seaward locations on the two bluff cross-sections. Based on this analysis, and following the Commission's customary approach, a minimum bluff edge setback of 13.5 feet along the northern portion of the project site, and increasing to 25 feet along the southern portion of the site, would assure the stability of the proposed new development in the present day.

GSI (Refs. 7 and 11) has argued that the Commission's reliance on the 1.5 factor of safety as an indicator of bluff stability is overly conservative, and that slopes do not typically fail until the factor

[3] There are a variety of different methods for evaluating slope stability, and calculating factors of safety, that are appropriate for the analysis of bluffs with different geological and structural characteristics. In coastal settings, geologists and geotechnical engineers often use one of several limit equilibrium analysis, which, in general terms compares the forces, moments, and/or stresses *resisting* mass movement to those that promote motion and instability. Previous Commission guidance recommends the use of methods such as Spencer's, Morgenstern-Price, General Limit Equilibrium, or Simplified Bishop's (Johnsson 2005). Ref. (7) used Spencer's method.

of safety drops closer to 1.0. GSI notes that bluff stabilization structures are warranted to protect development when the factor of safety is less than 1.2 or 1.3, and argues that the 1.3 factor of safety would, in conjunction with a setback for long-term bluff erosion (see below), provide a sufficiently protective threshold for assuring the stability of the proposed new development at 199 Arbor Ln. Arguments of this nature have been presented to the Commission previously, and the Commission in its decisions has consistently upheld the 1.5/1.1 factor of safety as its preferred indicator of bluff stability. The reasons for this are myriad. The reliability of quantitative slope stability analyses is limited by how accurately and precisely the key features of a slope or bluff can be characterized, and how well the strength characteristics of the bluff materials are understood. Even in a detailed model, many structural features of the bluff (e.g., faults, fractures, bedding planes, etc.) or variations in the shear strengths of the bluff materials are either not included or remain unknown. Use of a conservative stability indicator like the 1.5 factor of safety provides a greater margin of error against such unknowns. Additionally, most slope stability analyses reviewed by the Commission, including the analysis in Ref. (7), consider only "fair weather" conditions, and do not examine a scenario in which upper bluff soils had been saturated by heavy rainfall, which would both increase the loading on the bluff and reduce the cohesion of bluff sediments, increasing the potential for instability. Use of the 1.5 factor of safety as a stability indicator provides a greater safety buffer against such changing environmental conditions. Furthermore, the Commission is typically evaluating new development against Coastal Act and LCP policies which require not only that hazards be *minimized* and that safety and stability be *assured* over project lives of 50 to 100 years, but also that such new development not require shoreline protective devices in the future. If the 1.3 factor of safety were used to determine the slope stability setback, there is a greater chance that the development could end up being threatened by erosion and bluff instability in the future, increasing the potential demand for a shoreline protection device that could harm coastal resources.

In summary, based the above considerations, I conclude that the 13.5-foot (Section A-A') and 25-foot (Section B-B') setbacks arising from the GSI (2019) analysis are necessary to assure the stability of the proposed new development in the present day. These setback distances are similar to the magnitudes of previously observed, large, short-term episodic bluff retreat events in the immediate project area and would provide adequate present-day protection this hazard. As will be discussed below, an additional setback accounting for future long-term bluff erosion will also be necessary to assure stability over the full 50-year project life.

Long-term Bluff Retreat

Where reliable historical information (e.g., photographs, topographic maps, etc.) is available, bluff edge positions at different points in time can be compared to calculate long-term bluff retreat rates. If such estimates capture multiple cycles of episodic cliff retreat, they can be useful for safely siting bluff top development.

MAI (2016) (Ref. 1) provides several estimates of long-term bluff retreat for the project site, based on several sources of historical shoreline information (maps, aerial photographs) along with modern maps and imagery. As described in Ref. (1), MAI measured historic bluff retreat at a few discrete locations (cross-shore transects) along the subject bluff for each set of historical sources consulted. It is unclear how these locations were chosen, or if the measured bluff retreat at these locations represents the full range retreat that occurred across the project site. Nonetheless, for the longest time interval examined (1866 U.S. Coast and Geodetic Survey Maps vs. 2016 Google Earth image), MAI measured bluff retreat amounts of 144 ft, 133 ft and 51 ft, corresponding to

average retreat rates of 0.96, 0.89 and 0.34 feet/year over the 150-year period. Calculated retreat rates based on sources spanning shorter time intervals (1866 – 2005, 1946 – 2012, 1997 -2016) ranged from 0.21 – 0.78 ft/yr. Independent estimates of long-term bluff retreat in the area include values of 1.25 ft/yr at or near the project site (1866 -1971, Lajoie and Mathieson 1985; Griggs et al. 2005), 0.96 ft/yr at 263 Nevada Ave., just south of the project site (1908-2012, HKA 2012), 1.5 ft/yr at Fitzgerald Marine Reserve (Brady/LSA 2002) and 0.55 – 3.1 ft/yr for the shoreline segment between Dean Creek and Reef Point, spanning the project site (1930s – 1998, Hapke et al. 2007).

MAI (2016) (Ref. 1) recommended a long-term bluff retreat rate of 0.78 ft/yr (representing a rough average of their measurements) for use in determining development setbacks at the site. In my judgement, however, the maximum historical bluff edge retreat rate of 0.96 ft/yr provides a more reasonable and protective basis for evaluating future bluff retreat at the project site, as it captures the full range of bluff retreat that has occurred on the site over the past 150 years. This retreat rate is also more comparable to other, often higher retreat rates that have been observed for unprotected terrace deposit bluffs in the immediate project vicinity. This historical retreat rate must next be adjusted to account for potential future acceleration of bluff retreat related to sea level rise.

Future Bluff Retreat

Previous sections evaluated the present-day risk of slope failures and episodic bluff retreat, and concluded that a slope stability setback (based on the position of the 1.5 factor of safety failure surface on the bluff top) ranging from 13.5 feet (Section A-A') to 25 feet (Section B-B') would be needed to protect against instability and short-term bluff retreat. However, in order to evaluate whether the proposed development would be protected against such short-term hazards over its full design life, and whether the development would require shoreline protection, it is also necessary to evaluate how much bluff retreat could be expected to occur over the next 50 years as a result of natural erosional processes. In previous years, the Commission may have deemed sufficient a future bluff retreat analysis which relied on conservative estimates of the historical erosion rate. However, as collective knowledge of the effects of climate change has increased, it has become necessary to account for the potential effects of significant sea level rise (SLR) on bluff erosion rates (NRC 2012, CCC 2018).

Accounting for Future Sea Level Rise

Rising sea level is expected to cause significant changes to the California coast. For example, a recent study estimates that between 31% and 67% of the beaches in southern California could be lost by 2100 (Vitousek et al. 2017). The loss or narrowing of beaches is likely to lead to increased wave attack at the base of coastal bluffs and increased cliff erosion. More generally, sea level rise (SLR) shrinks the distance between the wave breaking point and bluff positions, results in deeper water and reduced wave attenuation, and increases the frequency and effectiveness of wave attack, increasing bluff erosion. A recent modeling study projects that future bluff retreat rates in southern California could increase more than two-fold relative to historical means under higher sea level rise scenarios (Limber et al. 2018). Other effects of climate change, such as possible changes in storm tracks, wave climate and the frequency of large El Niño events (e.g., NRC 2012; Wang et al. 2017), will also influence rates of bluff retreat. As the available science develops, bluff retreat rates derived from historical information need to be modified to address these concerns.

At present, the Commission recognizes two recent reports from the California Ocean Protection Council (OPC) as providing the best available sea level rise science for California (CCC 2018). The first report, *Rising Seas in California: An Update on Sea-Level Rise Science* (Griggs et al.

2017) synthesizes recent evolving research on sea level rise and provides California-specific projections of future SLR, under several greenhouse gas emissions scenarios, within a quasi-probabilistic framework.[4] For example, under a high emissions pathway (RPC 8.5), the report estimates that SLR in the San Francisco area (including Moss Beach) could exceed 2.5 feet under the 50% probability scenario (median model result), 4.4 feet under the 5% probability scenario (95th percentile model result), and 6.9 feet under the 0.5% probability result (>99th percentile result), by 2100. The projections also include an extreme SLR scenario ("H++") of 10+ feet by 2100 based on recent studies suggesting the potential for rapid, high magnitude ice sheet loss, for which no probability was estimated.[5] For 2070 (corresponding to the minimum 50-year project life under the San Mateo County LCP), the OPC high emissions SLR projections range from 1.4 feet (median projection) to 3.5 feet (0.5% probability projection) to 5.2 feet (H++ projection).

The second report, the *State of California Sea-Level Rise Guidance 2018 Update* (OPC 2018, "State Guidance"), builds on the science report and provides recommendations for how to plan for and address sea level rise impacts. The State Guidance recommends specific sea level rise projections for use in different types of planning and policy decisions, depending on the appropriate level of "risk aversion" that applies to a decision. Most pertinently, the State Guidance recommends that the 1-in-200 chance (0.5% simulated probability) projections be used for "medium-high risk aversion" decisions, including the siting of residential development, for which the consequences of being wrong are higher, potentially risking life and property, and the range of adaptation options is more limited. The recommendations contained in the 2018 State Guidance are deliberately precautionary, in large part because the OPC and other state agencies that contributed to the reports recognized the high degree of uncertainty associated with the course of future sea level rise. Future sea level will be determined both by societal choices (influencing future emissions pathways) and by the physical responses and feedbacks of the earth system to rising temperatures and greenhouse gas concentrations, which remain only partially understood. It is important to recall that the future sea level rise "probabilities" provided in the State Guidance reports are simulated probabilities, reflecting only the percentile outcomes of the modeling exercise, and are subject to the same assumptions and limitations as the climate and sea level rise models themselves.

Future Bluff Retreat at 199 Arbor Lane

MAI (2016) (Ref. 1) estimated future bluff retreat at the project site based on an average historical retreat rate of 0.78 ft/yr, stating that the bluff edge would not reach the footprint of the residence (as planned at the time) for 99 years. MAI also considered a bluff retreat rate of 1.25 feet/year, which would reduce this interval to 62 years. However, MAI's analysis did not account for

[4] Following the method of Kopp et al. (2014), the "probabilistic" projections provided in the *Rising Seas* and State Guidance reports reflect the probability that a given amount of SLR was predicted by the ensemble of climate models used to estimate future SLR (from processes such as thermal expansion, glacier and ice sheet mass balance, oceanographic conditions, etc.). These simulated probability distributions will be updated in future updates to the State guidance documents as climate science continues to evolve and models are updated.

[5] New SLR projections produced as part of California's Fourth Climate Change Assessment attempt to include such ice sheet processes within the probabilistic framework of the State Guidance (Pierce et al. 2018). These projections significantly exceed the OPC (2018) projections in the latter part of the 21st century. For example, the median (50th percentile) and 95th percentile (5% probability) SLR projections in 2100 (RCP 8.5) in the new study are almost twice as large as those provided by OPC (2018). The "0.5 probability" (>99th percentile) SLR projections recommended for use by OPC (2018) would fall in the 86% percentile in the Pierce et al. (2018) study.

significant recent bluff retreat (since 2016) or, crucially, the potential effects of SLR on bluff retreat rates. These deficiencies were noted by both the appellants and Commission staff. A more detailed bluff retreat analysis was later provided by GSI (2019) (Ref. 7) that addressed the potential effects of future sea level rise on bluff retreat at the site.

Simplified SCAPE Equation

GSI applied a simple equation estimating the future bluff retreat rate (R_2) as a function of the historical bluff retreat rate (R_1), historical SLR rate (S_1), and future SLR rate (S_2):

$$R_2 = R_1 (S_2 / S_1)^m \qquad \textbf{(Equation 1)}$$

Equation (1) is a "best fit" equation derived from the results of a more complex, process-based numerical model (Soft Cliff and Platform Erosion model, SCAPE) developed to simulate the equilibrium response of a shoreline profile to changes in sea level over timescales of decades to centuries (Walkden and Hall 2005; Walkden and Dickson 2008). The simplified form of the model, Equation (1), was found to apply to shorelines consisting of soft-rock (poorly consolidated) cliffs of uniform composition, in cases where cliff-fronting beaches were absent or of low volume, and where sediments derived from cliff erosion or alongshore transport do not significantly influence cliff retreat rates. The exponent term (*m*) of the best-fit equation was found to be 0.5. The authors indicated that this value was likely to be widely applicable, but Ashton et al. (2011) discusses how *m* could be adjusted to fit a variety of coastal cliff/bluff systems. A value of $m < 1$ describes a "damped" cliff retreat response to increased rates of SLR. In the SCAPE model, this damped response arises from changes in the geometry of the shore profile over time in response to SLR-driven erosion.

GSI (Ref. 7) used a historical bluff retreat rate (R_1) of 0.78 ft/year, based on Ref. (1), and a historical sea level rise rate (S_1) of about 2 mm/yr as observed at the nearby San Francisco tide gauge (NOAA Stn. No. 9414290). GSI used a value of $m = 0.33$ (rather than 0.5), which assumes a relatively strong "damped" response to SLR at the site; they indicated that this is appropriate because the beach at the site will attenuate wave energy prior to impacting the coastal bluff. GSI assigned the future SLR rate (S_2) to be the *average* rate over the next 50 years, assuming 3.6 feet of SLR by 2070 (similar to the OPC 0.5% probability projection) (3.6 ft/50 yr = 0.072 ft/yr, or ~22 mm/yr). GSI then calculated a future bluff retreat rate (R_2) of 1.72 ft/yr in 2069 using the Equation 1. In order to calculate the total amount of bluff retreat over 50 years (2019 – 2069), GSI appears to have estimated that about 1/3 of the total increase in bluff retreat rate would occur between 2019 – 2055, and thus applied a retreat rate of 1.09 ft/yr to this 37 year period. The full future SLR rate (R_2) was then applied to the 13-year period between 2056 – 2069. In total, GSI projected that approximately 63 feet of bluff retreat would occur at the site by 2069.

Any simple modeling approach to projecting future bluff retreat has limitations, and the simplified SCAPE equation is no exception. However, the physical conditions at project site, including a bluff composed of poorly lithified, easily eroded sedimentary deposits, and the absence of a wide protective beach, are a reasonably good fit for the initial assumptions of the equation. Additionally, it is worth noting that Equation (1) projects the *equilibrium* response of the bluff retreat rate to an increase in the rate of sea level rise – in other words, the bluff retreat rate after a single, step-wise acceleration in sea level rise – and does not account for the extended periods of time that could be required (possibly decades or more) for the bluff system to reach a new, stable retreat rate. Thus, bluff retreat projections using Equation (1) for a given future date are likely to be precautionary.

This equation is an acceptable tool for evaluating future bluff retreat at the project site, but as discussed below, it is important to carefully consider the input values used in the equation.

The 50-year bluff top setback calculated by GSI (2019) would provide a measure of protection for the proposed residence. However, in several instances, the GSI analysis uses less precautionary assumptions that may or may not be warranted in this case. First, as noted previously, the future SLR rate (S_2) of 0.072 ft/yr (22 mm/yr) used by GSI is actually an *average* SLR rate over the full 2019 – 2069 period, assuming future SLR of 3.6 ft by 2069. This future SLR rate is significantly lower than the future SLR rate that would be operative in 2069 under the OPC (2018) "medium-high risk aversion" (0.5% probability scenario), which is projected to be 0.092 ft/yr (28 mm/yr). In the OPC (2018) framework, the future SLR (R_2) rate used by GSI would correspond to a lower risk aversion (higher probability) scenario, and results in a lower projection of the future bluff retreat rate and a smaller recommended bluff top setback.

GSI's less precautionary approach is also evident in the selection of m = 0.33 (rather than m = 0.5 as suggested by Walkden and Dickson 2008) as the erosion response term in the simplified SCAPE equation. GSI argues that the beach at the project site is large enough to partially protect the bluff from waves, slowing the bluff retreat response to SLR. Such a situation is not directly addressed by Equation (1), but GSI argued that the net effect of the protective beach would be like that of reducing the value of m. This makes intuitive sense, and is discussed by Ashton et al. (2011), but it remains highly speculative that the narrow, low sand volume beach at the project site would provide a substantial buffer against wave-driven erosion. The beach appears to provide only very limited protection against storm waves at present, and this situation would not improve with higher sea levels. GSI justified the specific value of m = 0.33 based on a comparison of different models of bluff responses to SLR at a beach in San Diego County (Young et al. 2014); it is not established that this beach is a close analog for the beach fronting 199 Arbor Ln., nor that the chosen m value is a reasonable "bootstrapping" of the simplified SCAPE equation to fit conditions at the project site.

However, as discussed at length by Ashton et al. (2011) and correctly noted by GSI (2019), the value of m for a given shoreline system is dependent on the feedbacks between the shore profile geometry and erosion driven by SLR. A value of $m < 1$ denotes a negative feedback, or a non-linear, damped bluff retreat response to further increases in the rate of sea level rise. Increased sediment delivery to the beach from bluff erosion could drive one such feedback, but whether this feedback functions at the project site is very speculative. Less equivocal is the observation that the shore profile at the project site is composed of two highly distinct geologic units – the weak, erodible marine terrace deposits comprising the bluff, and the much more resistant, lithified Purisima Formation comprising the shore platform and offshore reef. In Walkden and Dickson (2008), the modeled shore profiles consisted of a single, uniform rock unit, and the value of m = 0.5 in the best-fit, simplified SCAPE equation emerged from the fact that the horizontal retreat of the bluff in response to SLR proceeded more quickly than the vertical (downward) erosion of the shore platform, resulting in a general elongation of the shore profile (Ashton et al. 2011). At the project site, where the bluff material is much more erosive than the Purisima bedrock comprising the shore platform, it is reasonable to expect a greater disparity between the horizontal and vertical profile responses to SLR, a general lengthening of the shore platform/offshore reef, and thus a longer path of travel, in shallow water, for waves approaching the bluff. While it is difficult to estimate how significantly the local geologic conditions could affect the site-specific value of m, in

my judgement there is reason to believe that a value of *m* lower than 0.5 may be applicable, and that GSI's value of 0.33 may be the better estimate.

It is important to acknowledge, however, that this judgement could be wrong, the negative feedback producing an *m* value less than 0.5 may not be operative at the project or could be overwhelmed by other factors, and that bluff retreat could proceed more quickly than anticipated in this analysis. ESA (2020) (Ref. 12) argues, plausibly, that SLR will increase wave exposure at the bluff toe by increasing the water depth across the offshore reef, allowing larger waves to penetrate farther landward prior to breaking, and increasing the total wave energy absorbed by the bluff. Such effects are precisely why sea level rise is expected to increase bluff erosion. A key unknown is the degree to which this increased wave attack will be counterbalanced by a widening of the cross-shore profile at this site. ESA also notes that the USGS CoSMoS Cliff Retreat tool (Barnard et al. 2018) provides more pessimistic projections of bluff retreat in the project area, with the bluff edge regressing well inland of the project parcel with 1 – 1.25 m (3.3 – 4.1 feet) of SLR. These CoSMoS projections are likely to be overestimates of bluff retreat at the site through 2070 for several reasons: (a) historical erosion rates (2.1 – 2.9 feet per year) used in the CoSMoS modeling for the transects nearest the project site are substantially higher than have been observed at the site in other studies, and may be inaccurate due to the high uncertainties associated with the USGS historical cliff retreat dataset (Hapke and Reid 2007); and (b) the CoSMoS cliff retreat projections for the 1 m and 1.25 m SLR scenarios show retreat through 2100, an additional 30 years beyond the 2070 time horizon evaluated here. Nonetheless, the points raised by ESA (2020) highlight the uncertainties associated with future bluff retreat projections at the site.

For purposes of comparison, I have used Equation (1) to generate projections of bluff retreat at the site in 50 years, using both m = 0.33 and m = 0.5, and, in contrast to GSI (2019), using future SLR rates (S_2) taken directly from the OPC (2018) projections for the San Francisco tide gauge.[6] Specifically, for the 50-year (2070) projection, I used a future SLR rate of 0.092 ft/yr (28 mm/yr), which corresponds to the "medium high risk aversion scenario" (0.5% probability of exceedance) for the 2060 – 2080 period under high emissions. Once future bluff retreat rate (R_2) values were calculated using Equation (1), I averaged these rates with a historical retreat rate (R_1) of 0.96 ft/yr to arrive at an average bluff retreat rate for the 2020-2070 period (see **Table 1**). Based on these calculations, the total bluff retreat at the site by 2070 could reach 81 to 114 feet, depending on the value of *m* (the "erosion response scenario") chosen.

Table 1: Projected Bluff Retreat, No Shore Protection Scenario, using **Equation (1)**

Sea Level Rise Scenario (OPC 2018)	**Timeframe**	**Average retreat rate**, ft/yr (m = 0.33)	**Average retreat rate**, ft/yr (m = 0.5)	**Future bluff retreat,** ft (m =0.33)	**Future bluff retreat,** ft (m =0.5)
"Med High Risk Aversion" (0.5% probability) 3.5 ft in 2070	2020 – 2070 50-yr	1.63	2.28	**81**	114
"1-in-20" (5% probability) 2.4 ft in 2070	2020 – 2070 50-yr	1.45	1.88	73	94

[6] The historical SLR rate (S_1) used was 2 mm/yr (0.00656 ft/yr), following the historical sea level trend for the San Francisco tide gauge of 1.99 ± 0.18 mm/yr, reported at https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=9414290.

Following several discussions among the applicant, GSI, and Commission staff, GSI provided a revised bluff retreat analysis (GSI 2020c, Ref. 10) that includes the updated bluff edge position accounting for recent erosion and which largely follows the SLR and future bluff retreat analysis described in the previous paragraph and presented in Table 1. GSI's updated analysis projects a future bluff retreat amount of **82.2 feet** by 2070 under the OPC "medium high risk aversion" (0.5% probability) scenario and assuming m = 0.33.

Conclusion – Bluff Retreat and Total Bluff Setback

In summary, the total future bluff retreat that can be expected over a project life of 50 years, under future high sea level rise conditions, ranges from approximately 81 to 114 feet, using the simplified SCAPE equation as a projection tool. This range reflects the substantial difference between the projections using the "default" erosion response term of m = 0.5 (Walkden and Dickson 2008), and assuming a more highly damped erosion response represented by m = 0.33. In my judgement, the less precautionary approach suggested by GSI (Refs. 7, 11) is appropriate in this particular case because of the somewhat unique geologic conditions at the site, where a coastal bluff composed of highly erodible terrace deposits sits unconformably on more resistant Purisima Formation bedrock. As future bluff erosion proceeds, it can be expected that the bluff toe will retreat more quickly than the shore platform will experience downcutting, resulting in a broader platform and, even with SLR, maintaining some of the wave attenuation that currently occurs across the offshore reef. Some additional protection of the bluff toe may possibly be provided by sand eroded from the bluff. For these reasons, I recommend an 82-foot setback (per GSI 2020c, Ref. 11) to account for future bluff retreat at the project site. This future bluff retreat setback should be added to the previously discussed short-term retreat/slope stability setback (13.5 ft at Sec. A-A'; 25 ft at Sec. B-B') needed to assure the stability of the proposed development over the full project life. A total geologic setback of **95.5 feet** (on the northern portion of the site) to **107 feet** (on the southern portion of the site) would provide reasonable assurance of stability and structural integrity for the next 50 years, in accordance with the LCP and accounting for future sea level rise. The total setback line is depicted in **Exhibit 2**.

As discussed above, the arguments presented by ESA (2020) on behalf of the appellants highlight the possibility that the proposed development could be at risk from bluff retreat and instability within 50 years, even with the large setbacks recommended here. For these reasons, I would suggest that additional permit conditions be considered to assure compliance with LCP hazards policies and to protect coastal resources. Such conditions may include a requirement that the residence be removed or relocated in the event it becomes threatened, and a prohibition on the construction of future shoreline protection devices to protect the residence.

Stream Bank Erosion & Setback

Although the bulk of this memo has been devoted to addressing potential hazards associated ocean-facing bluff west of the project site, the subject parcel is also bounded on the south by a relatively steep, 25- to 30-foot high gully formed by Dean Creek, an ephemeral stream. The appellants (Refs. 5, 6) have suggested that erosion and bank instability along this gully pose potential hazards, and that the proposed building setback from the top of the creek bank (≥ 20 feet) is inadequate. MAI (2016) (Ref. 1) provided a brief evaluation of the creek bank slope, noting minor sloughing of soil in places, but no evidence of landsliding or discernable retreat in aerial photographs spanning a 75-year period. MAI (2017a & b) (Refs. 2, 3), evaluated the

creek bank slope following the winter of 2016-17, and, in contrast to Ref. (5), found no new undercutting, erosion, or significant instability. In response to Commission staff queries, GSI (2020a) (Ref. 9) provided a quantitative slope stability analysis along a stream bank cross-section (Section C-C'). This analysis found that the slope had factors of safety of 1.87 (static) and 1.21 (pseudostatic) within about 6 feet of the edge of the bank; GSI also interpolated the position of the 1.5 factor of safety surface as being about 5 feet landward of the slope edge. During my July 17, 2020 site visit, I observed no signs of significant erosion or instability on the stream bank, although much of the slope was obscured by vegetation. The presence of a large of amount of mature vegetation is a strong indicator that this slope has not suffered significant erosion or landsliding in many years. Based on the available evidence, I conclude that the minimum building setback of 20 feet from the top of the creek bank (as shown in available project plans) will be adequate to the proposed development from present-day instability and future erosion and retreat slope over a 50-year project life.

References

Ashton, AD, Walkden, MJA, and Dickson, ME, 2011. Equilibrium responses of cliffed coasts to changes in the rate of sea level rise. *Marine Geology* 284: 217-229.

Barnard, PL, van Ormondt, M, Erikson, LH, Eshleman, J, Hapke, C, Ruggiero, P, Adams, PN, and Foxgrover, AC, 2014. Development of the Coastal Storm Modeling System (CoSMoS) for predicting the impact of storms on high-energy, active-margin coasts. *Natural Hazards*, 31 p., doi: 10.1007/s11069-014-1236-y

Barnard, PL, Erikson, LH, Foxgrover, AC, Limber, PL, O'Neill, AC, and Vitousek, S, 2018, Coastal Storm Modeling System (CoSMoS) for Central California, v3.1 (ver. 1f, May 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P9NUO62B.

Brady/LSA, 2002. *Fitzgerald Marine Reserve Master Plan*, prepared for San Mateo County Parks and Recreation Division, May 2002.

California Coastal Commission, 2018. *Sea Level Rise Policy Guidance: Interpretive Guidance for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits*. Adopted August 12, 2015; updated November 7, 2018.

California Ocean Protection Council (OPC), 2018. *State of California Sea-Level Rise Guidance, 2018 Update*.

Cotton, Shires & Associates, Inc. (CSA), 2016. "Geotechnical Hazard Assessment Re: Pillar Point Bluffs and California Coastal Trail, County of San Mateo, California", technical report prepared for San Mateo County Parks Department, June 23, 2016.

Griggs, G, Weber, J, Lajoie, KR, Mathieson, S, 2005. "San Francisco to Año Nuevo", in Griggs, G, Patsch, K, Savoy, L (eds.), *Living with the Changing California Coast*. University of California Press, pp. 228-269.

Griggs, G.B., 2015. Lost neighborhoods of the California coast. *Journal of Coastal Research* 31(1): 129–147.

Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group), 2017. *Rising Seas in California: An Update on Sea-Level Rise Science*. California Ocean Science Trust, April 2017.

Hapke, CJ, and Reid, D, 2007. *National Assessment of Shoreline Change, Part 4: Historical Coastal Cliff Retreat along the California Coast.* U. S. Geological Survey Open-File Report 2007-1133

Hapke, CJ, Reid, D, and Borrelli, M, 2007. *The National Assessment of Shoreline Change: A GIS Compilation of Vector Cliff Edges and Associated Cliff Erosion Data for the California Coast,* U.S. Geological Survey Open-File Report 2007-1112.

Haro, Kasunich & Associates, Inc. (HKA), 2012. Coastal Bluff Recession Study, 263 Nevada Ave., Moss Beach, California", June 12, 2012.

Kopp RE, Horton RM, Little CM, Mitrovica JX, Oppenheimer M, Rasmussen DJ, Strauss, BH, Tebaldi, C, 2014. Probabilistic 21st and 22nd century sea-level projections at a global network of tide gauge sites. *Earth's Future* 2: 383–406, doi:10.1002/2014EF000239.

Lajoie, KR and Mathieson, SA, 1985. "San Francisco to Año Nuevo", in Griggs, G, and Savoy, L (eds.), *Living with the California Coast*. National Audubon Society, Duke University Press, pp. 140-177.

Lajoie, KR, and Mathieson, SA, 1998. *1982-83 El Niño coastal erosion, San Mateo County, California*. U.S. Geological Survey Open File Report. 98-41. Web archive at: https://archive.usgs.gov/archive/sites/walrus.wr.usgs.gov/elnino/SMCO-coast-erosion/introtext.html

Limber, PW, Barnard, PL, Vitousek, S, and Erikson, LH, 2018. A model ensemble for projecting multi-decadal coastal cliff retreat during the 21st century. *Journal of Geophysical Research Earth Surface*, doi: 10.1029/2017JF004401.

National Research Council (NRC), 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington*. Washington, D.C.: National Academies Press. 2012.

Pierce, DW, Kalansky, JF, and Cayan, DR, 2018. *Climate, Drought, and Sea Level Rise Scenarios for the Fourth California Climate Assessment*. California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CNRA-CEC-2018-006.

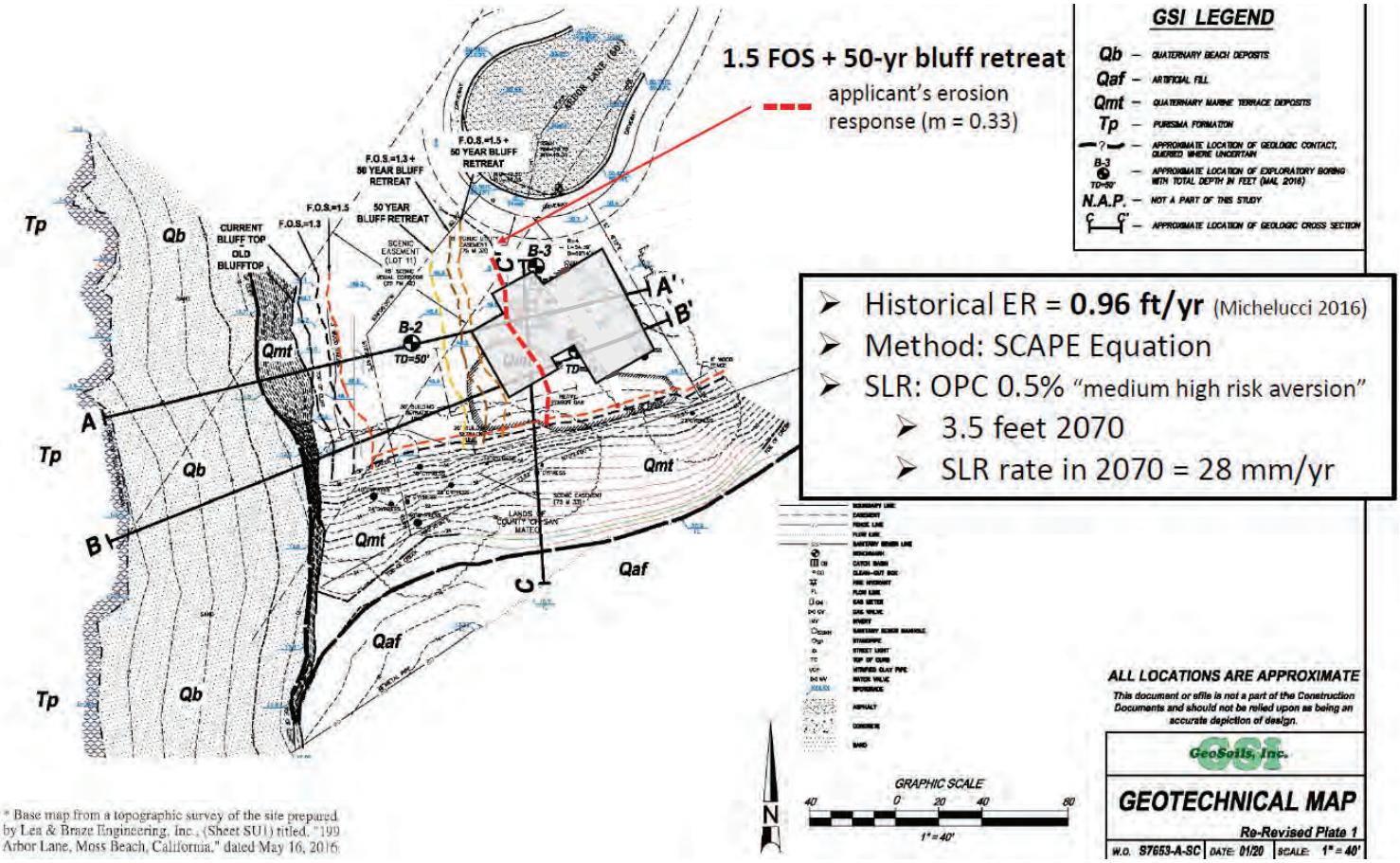
Vitousek, S, Barnard, PL, Limber, P, Erikson, LH and Cole, B, 2017. A model integrating longshore and cross-shore processes for predicting long-term shoreline response to climate change. *Journal of Geophysical Research-Earth Surface*, doi: 10.1002/2016JF004065.

Walkden, MJA, and Hall, JW, 2005. A predictive mesoscale model of the erosion and profile development of soft rock shores. *Coastal Engineering* 52(6): 535-563.

Walkden, M, and Dickson, M, 2008. Equilibrium erosion of soft rock shores with a shallow or absent beach under increased sea level rise. *Marine Geology* 251: 75-84.

Wang, G, Cai, W, Gan, B, Wu, L, Santoso, A, Lin, X, Chen, Z, and McPhaden, MJ, 2017. Continued increase of extreme El Niño frequency long after 1.5 ˚C warming stabilization. *Nature Climate Change* 7: 568-572.

Young, AP, Flick, RE, O'Reilly, WC, Chadwick, DB, Crampton, WC, and Helly, JJ, 2014. Estimating cliff retreat in southern California considering sea level rise using a sand balance model. *Marine Geology* 348: 15-26.



* Base map from a topographic survey of the site prepared by Lea & Braze Engineering, Inc., (Sheet SU1) titled, "199 Arbor Lane, Moss Beach, California," dated May 16, 2016.

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

5741 Palmer Way • Carlsbad, California 92010 • (760) 438-3155 • FAX (760) 931-0915 • www.geosoilsinc.com

April 28, 2020

W.O. 7653-A2-SC

Carlos Zubieta Architects
1745 Abbot Kinney Boulevard
Venice, California 90291

Attention: Mr. Carlos Zubieta

Subject: Supplemental Analysis of Coastal Bluff Retreat, Proposed New Residence, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, APN 037-123-430.

References:

1. "Description of CCC Staff Draft Setback Analysis for 199 Arbor Lane, Moss Beach," dated April 6, 2020, by Joseph Street, Staff Geologist, California Coastal Commission.

2. "Response to California Coastal Commission Review of Third-Party Bluff Retreat and Slope Stability Analysis,199 Arbor Lane, Moss Beach, San Mateo County, California 94038, Assessor's Parcel Number (APN) 037-123-430," W.O. 7653-A1-SC, dated January 6, by GeoSoils, Inc.

3. "Third-Party Coastal Bluff Retreat and Slope Stability Evaluation at the Proposed New Residence, 199 Arbor Lane, Moss Beach, San Mateo County, California 94038, Assessor's Parcel Number (APN) 037-123-430," W.O. 7653-A-SC, dated July 1, 2019, by GeoSoils, Inc.

4. "State of California Sea-Level Rise Guidance," California Ocean Protection Council 2018 Update.

Dear Mr. Zubieta:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) has performed a supplemental analysis of coastal bluff retreat. The purpose of our study was to further evaluate bluff retreat rates at the site, in light of recent comments received from Dr. Joseph Street, geologist for the California Coastal Commission. Briefly, Dr. Street, has settled on a conservative historical retreat rate of 0.96 feet /year for the subject site, has utilized a historical seal level rise rate of 0.0066 ft/yr (see reference No. 3), a future sea level rise rate of 0.092 ft/yr ([28mm] cited by reference No. 4, and is amenable to discussion regarding a 1.3 Factor-of-Safety (FOS), that would ensure that new development would not be in danger from bluff erosion at the end of the 50-year design project life.

As indicated in Reference No. 3, the simplified numerical model ("SCAPE") equation is defined as:

$$R_2 = R_1 (S_2/S_1)^m$$

Where: R_2 = Future retreat rate

R_1 = Historical retreat rate

S_1 = Historical rate of sea level rise

S_2 = Future rate of sea level rise

m =Site-specific response parameter

FUTURE BLUFF RETREAT SUMMARY

The calculated long-term rate of future bluff retreat using the simplified numerical model equation is presented below, based on the two curvilinear sections of GSI (Ref. 3), and:

1. Historical rate 0.96 ft/yr = R_1 (Street).
2. 0.0066 feet/year averaged over an 110-year period (1897 through 2007) for San Francisco = S1 (GSI)
3. Future SLR rate (2019 - 2069), under *medium-high risk aversion scenario* = 3.6 ft/50 yrs = 0.092 ft/yr=S_2 (Street [OPC])
4. m=⅓ (GSI and Street)

At year 2069, under *medium-high risk aversion scenario (0.5% Probability)*,

$R_2 = R_1 (S_2/S_1)^m = (0.96 \text{ ft/yr}) (0.092 \text{ ft/yr}/[\ 0.006595 \text{ ft/yr}\ ])^{⅓} =$
$R_2 = (0.96)\ (13.94)^{⅓} =$
$R_2 = (0.96)(2.41) = 2.31$ ft/yr in the year 2069

0.96 to 2.31 ft/yr, Δ= 1.35 ft/yr from 2019 to 2069; m=⅓

FUTURE BLUFF RETREAT BASED ON SLR CURVE INCREMENTS			
APPLICABLE DATES	BLUFF RETREAT RATE (FT/YR)	DURATION (YEARS)	BLUFF RETREAT (FEET)
2019-2055 (0.96 +⅓ [1.35]= 0.96 + 0.45 = 1.41) SLR rate	1.41	37	52.17
2056-2069 (2.31) increase in SLR rate in 2069	2.31	13	30.03
	Totals	50	82.2

As shown above, the onsite coastal bluff could experience approximately 82 feet of retreat over the 50-year design life of the proposed residential structure.

For simplicity, Reference No. 1 (Street) simply averaged the retreat rate from the historical and future, based on the above SCAPE equation. That resulted in ([0.96 + 2.31]/2) ft/yr= 1.64 ft/yr . This is summarized in the table below:

FUTURE BLUFF RETREAT BASED ON AVERAGE HISTORICAL AND FUTURE RATES			
APPLICABLE DATES	BLUFF RETREAT RATE (FT/YR)	DURATION (YEARS)	BLUFF RETREAT (FEET)
2019-2069/2070 (1.64) SLR rate	1.64	50	82.00
	Totals	**50**	**82.0**

The calcualted retreat rates are in extremely close agreement. Plate 1 shows the effects of SLR on bluff retreat, along with a hypothetical representation of the eroded coastal bluff profile at the end of 50 years or in the year 2069/2070, based on the calculated 82 feet of bluff retreat.

SLOPE STABIILTY AND FACTOR OF SAFETY (FOS) = 1.3

GSI (References No. 2 and 3) previously performed slope stability analyses for the subject site, and the reader is referred to those reports for a more thorough discussion of such, as well as actual calcualtions/cross sections, and printouts. We peviously obtained static and seismic FOS respectively greater than 1.5 and 1.1 for static and seismic conditions for a gross failure through the marine terrace deposits. The criteria for bluff setback used by the CCC in the region is FOS ≥ 1.5, plus the 50-year retreat rate, ostensibly, so that the setback will ensure that new development would not be in danger from bluff erosion at the end of it's design life. However, adding the FOS 1.5 distance to the 50-year retreat rate is actually an overly conservative assumption. In fact, a bluff does not typically fail until the FOS drops closer to 1.0 ((unity, where the driving forces = the resisting forces), and , where the driving forces = the resisting forces, until the resisting forces finally succumb, either by being overwhelmed or diminished, causing failure. Typically bluff stabilization is warranted when the FOS ≤1.3 (usually 1.2; but we will use 1.3 for conservatism). To that end, the FOS ≥1.3 (see reference No. 3), and the cumulative FOS ≥1.3 + the 50-year erosion rate setback is also shown on Plate 1, assuring that bluff stabilization would not be necessary for the property during the life of the structure.

CONCLUSIONS AND RECOMMENDATIONS

Based on our review and geologic, geotechnical, and coastal engineering analysis, it is our opinion that the site appears suitable to receive the proposed residential development, provided our recommendations are properly implemented.

Slope stability analyses indicate that the proposed residential structure with a FOS ≥ 1.3 setback line + bluff retreat rate for 50 years considering SLR, should provide sufficient protection from coastal bluff retreat over the design life of the proposed residential structure. GSI certifies[1] that bluff retreat will not impact the property over the next 50 years and that there is no anticipated need for a shore protection device over the life of the proposed development. There are no recommendations necessary for avoidance or minimization of coastal hazards

Site soils are considered erosive. As such, the proper control of surface drainage is considered essential in minimizing the adverse effects of erosion on the coastal bluff. Surface drainage should be evaluated by a licensed civil engineer.

The proposed project will not directly or indirectly cause, promote, or encourage bluff erosion or failure, either on the site or the adjacent properties. The proposed project will not restrict or reduce public access or beach use.

Provided our recommendations are properly implemented, based on the estimated long-term erosion rates reported herein, the proposed residential structure should be reasonably safe from bluff failure and erosion over its lifetime, without having to propose any additional bluff stabilization to protect the structure in the future, even with a rise in sea level. This assumes regular and periodic maintenance of the property, and prudent control of surface runoff water.

[1] The term "Certify" is used herein as defined in Division 3, Chapter 7, Article 3, § 6735.5 of the California Business and Professions Code (2019).

LIMITATIONS

The materials reviewed on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during earthwork or construction. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

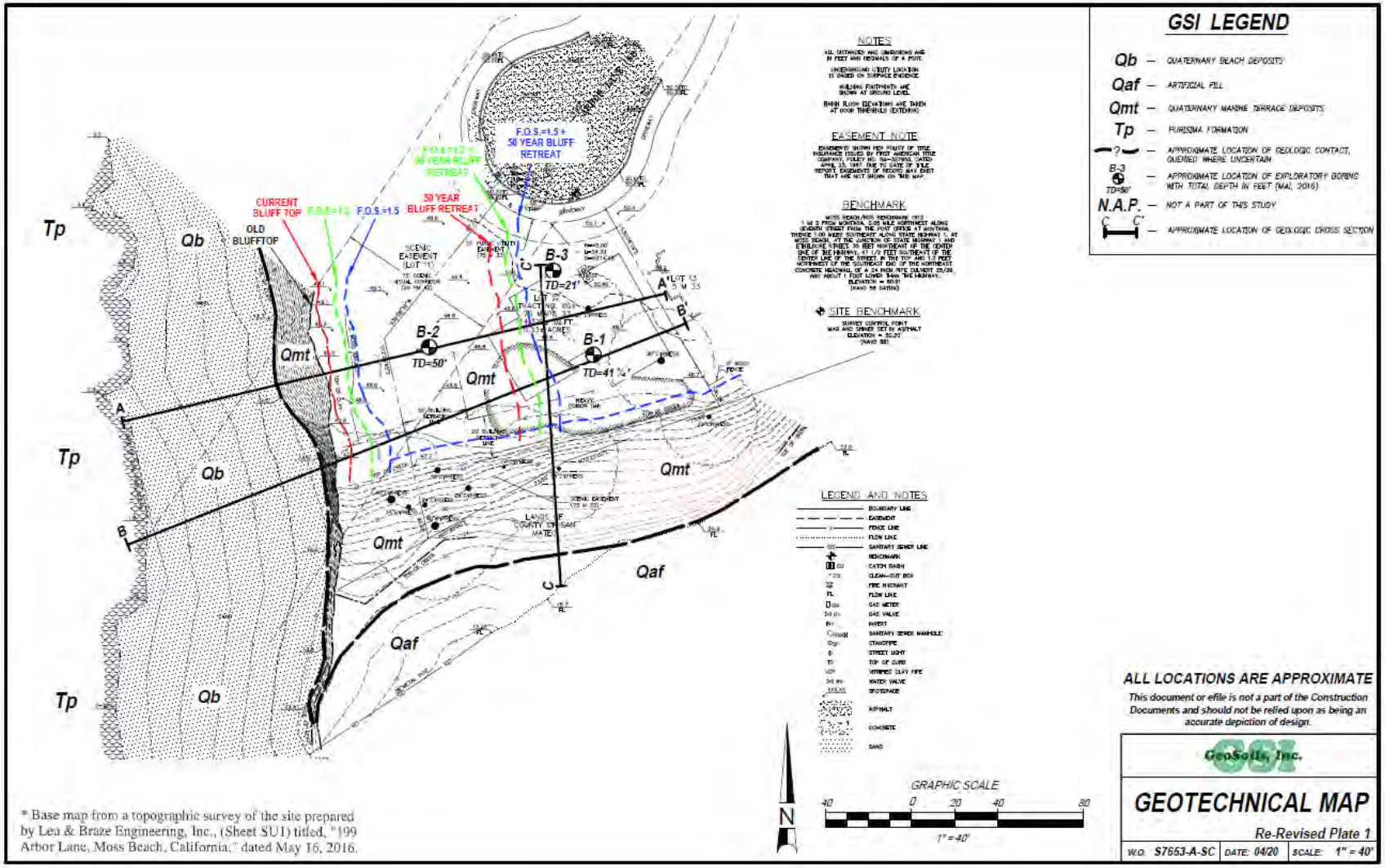
John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

JPF/DWS/mn

Attachment: Re-Revised Plate 1 - Geotechnical Map (with current top of Bluff A1)

Distribution: (3) Addressee (2 wet signed and pdf)


Tp
Qb
Qmt
Qaf
OLD BLUFFTOP
CURRENT BLUFF TOP
F.O.S.=1.2 +
50 YEAR BLUFF RETREAT
F.O.S.=1.5 +
50 YEAR BLUFF RETREAT
50 YEAR BLUFF RETREAT
F.O.S.=1.5
F.O.S.=1.2
SCENIC EASEMENT (LOT 11)
B-1
TD=41 ¼'
B-2
TD=50'
B-3
TD=21'
A
A'
B
B'
C
C'
NOTES
EASEMENT NOTE
BENCHMARK
SITE BENCHMARK
GSI LEGEND
Qb — QUATERNARY BEACH DEPOSITS
Qaf — ARTIFICIAL FILL
Qmt — QUATERNARY MARINE TERRACE DEPOSITS
Tp — PURISIMA FORMATION
— ? — APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
B-3 TD=50' — APPROXIMATE LOCATION OF EXPLORATORY BORING WITH TOTAL DEPTH IN FEET (MA, 2016)
N.A.P. — NOT A PART OF THIS STUDY
C C' — APPROXIMATE LOCATION OF GEOLOGIC CROSS SECTION
LEGEND AND NOTES
BOUNDARY LINE
EASEMENT
FENCE LINE
FLOW LINE
SANITARY SEWER LINE
BENCHMARK
CATCH BASIN
CLEAN-OUT BOX
FIRE HYDRANT
FLOW LINE
GAS METER
GAS VALVE
INVERT
SANITARY SEWER MANHOLE
STANDPIPE
STREET LIGHT
TOP OF CURB
VITRIFIED CLAY PIPE
WATER VALVE
SPOT/GRADE
ASPHALT
CONCRETE
SAND
N
GRAPHIC SCALE
40 0 20 40 80
1" = 40'
* Base map from a topographic survey of the site prepared by Lea & Braze Engineering, Inc., (Sheet SU1) titled, "199 Arbor Lane, Moss Beach, California," dated May 16, 2016.
ALL LOCATIONS ARE APPROXIMATE
This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.
GeoSoils, Inc.
GEOTECHNICAL MAP
Re-Revised Plate 1
W.O. S7653-A-SC
DATE: 04/20
SCALE: 1" = 40'

CALIFORNIA COASTAL COMMISSION
NORTH CENTRAL COAST DISTRICT OFFICE
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105
PHONE: (415) 904-5260
FAX: (415) 904-5400
WEB: WWW.COASTAL.CA.GOV

July 14, 2017

Carmelisa Morales, Project Planner
San Mateo County Planning and Building Department
455 County Center, 2nd Floor
Redwood City, California 94063

Re: San Mateo County Planning Case Number PLN2016-00444 (Zubieta) – 199 Arbor Lane, Moss Beach

Dear Ms. Morales,

Thank you for forwarding the County's Planning Case Number PLN2016-00444 project referral form, dated June 28, 2017, and received in our San Francisco office on June 30, 2017. We also received (on July 11, 2017) a pdf copy of the May 9, 2015 *Biological Resources Assessment* report prepared by Kopitov Environmental. The applicant is requesting Coastside Design Review, a Grading Permit, and Coastal Development Permit for a new 3,542 square-foot single-family dwelling. The proposed project includes 368 cubic yards of grading and the removal of two cypress trees. The parcel is constrained with two recorded scenic easements.

The proposed project site is located on a parcel at 199 Arbor Lane in the Cypress Cliffs Subdivision of Moss Beach, within an area zoned as R-1/S-17/DR/CD. Local Coastal Program (LCP) Section 6300.2 for the S-17 combining district provides regulations applicable to any single-family residential district. We suggest that the proposed residence be evaluated for consistency with the development standards in LCP Section 6300.2. The site plan (Sheet A1.0) you've provided with the referral shows a portion of the proposed concrete pavers and the driveway sited within the scenic corridor. The subdivision map states that the *"Scenic Easement" as shown on lots 11, 12, 13, 14, and 17 shall be kept open and free from buildings or structures of any kind except that sideline fencing may run to top of bank.* Impervious structures, as described in LCP Section 6300.2, include, but are not limited to, non-porous driveways, decks, patios, walkways and swimming pools. The proposed concrete pavers and driveway are structures as described by the LCP and as such are restricted from being located within the easement for the scenic corridor. We recommend that the County require the applicant remove these proposed structures/development from the 75-foot scenic corridor.

We suggest that the County analysis evaluate the proposed project's consistency with the Visual Resources component of the LCP including, but not limited to, LCP Policies 8.4 regarding bluff top development and landscaping and 8.5 for locating development. The proposed project must adhere to the Special Design Guidelines for Coastal Communities as specified in LCP Policy 8.13a for the communities of Montara, Moss Beach, El Granada, and Miramar. The project site is located on a bluff top and should be reviewed for consistency with LCP Policy 9.8 that provides for regulating development on coastal bluff tops, as well.

LCP Policy 7.1 defines intermittent streams as sensitive habitat and specifies sensitive habitat areas as areas that include, but are not limited to, habitat that supports rare, endangered, and unique species. LCP Policy 7.3 prohibits any development or land use that would have a significant adverse impact on sensitive habitat areas and requires that development be sited and designed to prevent impacts that could significantly degrade sensitive habitat. LCP Policy 7.4 limits uses within sensitive habitat areas to resource-dependent uses. Only project activities consistent with those listed in LCP Policy 7.4 shall be allowed in the corresponding sensitive habitat areas. The Biological Assessment report states that the parcel is within the Dean Creek Watershed and identifies Dean Creek, located at the southern boundary of the parcel, as intermittent with potentially suitable habitat for California red-legged frog, San Francisco garter snake, San Francisco dusky-footed woodrat, salt marsh common yellowthroat, and the monarch butterfly to occur or pass through the project area. We urge County staff to evaluate the proposed residence's potential impacts to Dean Creek and the species mentioned above. We suggest that the applicant be required to ensure that the proposed development does not result in negative impacts to Dean Creek, including water quality. The site and adjacent area, which includes the stream, must be protected from erosion and polluted storm water runoff. We recommend that the analysis include an evaluation of the proposed project's consistency with standards contained in LCP Section 6565.20 for the protection of streams and drainages on or adjacent to property proposed for development.

The biology report indicates that "beach strawberry (*Fragaria chiloensis*)" plants occur within the proposed project area and states it is protected by LCP Policy 7.49. LCP Policy 7.49 actually provides for the protection of California wild strawberry (*Fragaria californica*) which is defined in the LCP as a Unique Species. We suggest that the applicant be required to clarify and confirm the occurrence of LCP-protected, strawberry on the parcel. LCP Policy 7.49 requires that any development, within one-half mile of the coast, mitigate the destruction of any California wild strawberry. The proposed project site is located within a half-mile of the coast; therefore we recommend that the County's analysis evaluate the proposed project's consistency with LCP Policy 7.49 and mitigate impacts as specified by this policy. The County should analyze the proposed project for its consistency with the policies in the Sensitive Habitats Component of the LCP for the protection of sensitive habitat, including LCP Policies 7.3, 7.4, and 7.5. The applicant must be required to mitigate impacts to Sensitive Habitat and Sensitive Habitat Areas.

We understand per your e-mail of July 11, 2017, that the biology report will likely be revised before the Initial Study/Mitigated Negative Declaration is prepared (and circulated). Please provide us with a copy of the revised report for our review. Feel free to contact me via e-mail at rananda@coastal.ca.gov or call me at 415-904-5292 if you have questions regarding our comments.

Sincerely,

Renée Ananda

Renée Ananda, Coastal Program Analyst
North Central Coast District

CALIFORNIA COASTAL COMMISSION
NORTH CENTRAL COAST DISTRICT OFFICE
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105
PHONE: (415) 904-5260
FAX: (415) 904-5400
WEB: WWW.COASTAL.CA.GOV

May 22, 2018

Carmelisa Morales, Project Planner
San Mateo County Planning and Building Department
455 County Center, 2nd Floor
Redwood City, California 94063

Re: San Mateo County Planning Case Number PLN2016-00444 (Zubieta) – 199 Arbor Lane, Moss Beach

Dear Ms. Morales,

Thank you for forwarding the Notice of Intent to Adopt Mitigated Negative Declaration dated May 2, 2018, and received in our office on May 3, 2018 for the subject County Planning file referenced above. The proposed project is for the construction of a new 3,338-sq.-ft., two-story, single family residence with an attached 468-sq.-ft., two-car garage on an undeveloped 14,320-sq.-ft. parcel, in Moss Beach. Two significant-sized Monterey cypress trees are proposed for removal. The proposed project also includes 368 cubic yards of grading (186 cubic yards of excavation and 192 cubic yards of fill). A water well is located on the parcel and will be formally abandoned and capped prior to construction. The parcel is constrained by two scenic corridors. We submitted comments to County staff previously in our letter dated July 14, 2017 (a copy of the letter is attached for your convenience).

Project Description
We note that the County's June 28, 2017 project referral described the proposed residence as being 3,542 square feet. The County evaluation must accurately reflect the description for the proposed project. Please clarify size of the proposed residence.

Geology and Soils/Hazards
The proposed project is located on a coastal bluff top and must be reviewed for consistency with Local Coastal Program (LCP) Policy 9.8 which regulates development on coastal bluff tops. LCP Policy 9.8 requires that bluff top development be permitted only if the design and setback provisions are adequate to assure stability and structural integrity for the expected economic life span of the development (at least 50 years) and if the development (including storm runoff, foot traffic, grading, irrigation, and septic tanks) will neither create nor contribute significantly to erosion problems or geologic instability of the site or surrounding area. The County analysis must evaluate the proposed residence's consistency with LCP Policy 9.8.

The applicant's geotechnical consultant firm, Michelucci & Associates, Inc., states in its August 29, 2017 geotechnical report that the primary geologic hazard at the site is coastal bluff retreat. Additionally, the report states that during the winter of 2016-2017 the bluff retreated six feet landward near the current southwest fence corner post and retreated 11 feet further to the north.

The report also notes that the slope failure/bluff erosion during the winter of year 2016-2017 was due to wave action at the beach level undercutting relatively weak, unconsolidated bluff sediments. The applicant's geotechnical report cites a Griggs & Savoy published calculation of average annual bluff retreat near the proposed project site based on an average rate of 1.25 feet per year, which if used to determine bluff retreat for the site, would result in the bluff retreat to the closest point of the proposed residence in 62 years. The applicant uses an erosion rate of 0.78 feet per year and determines that bluff retreat would reach the closest point of the residence in approximately 99 years.

We recommend that annual bluff retreat and the potential for large episodic bluff retreat events, such as what occurred in 2016-2017, be considered in the evaluation of hazards at the project site to determine adequate siting and design for the life of the structure. The setback from the existing bluff top edge should be maximized to sufficiently account for erosion and slope stability including the potential for increased erosion as a result of sea level rise over the required project design life. The proposed development must also not contribute to any increased erosion of the bluff as required by LCP Policy 9.8. Further, LCP Policy 9.8 prohibits new structures that would require the need for shoreline protection. We recommend that future shoreline protection not be allowed for the proposed project and that any approval is conditioned accordingly. The County's analysis should include a discussion of the impact of the proposed project on coastal resources, particularly the drilled piers proposed to support the slab-on-grade foundation, if and when the bluff retreat reaches the proposed residence.

Aesthetics/Scenic Resources
The proposed MND notes that the two significant trees proposed for removal will be replaced with two Monterey cypress trees to be located at the rear of the parcel. The Biological Resources discussion states that the applicant requested an exception to the required 2:1 replacement ratio in order to reduce further impacts to surrounding neighboring properties. We recommend that the County require the applicant provide options for off-site mitigation, since the County has given the applicant an exception to the required 2:1 tree replacement ratio. We suggest that the County analysis evaluate the proposed project's consistency with the Visual Resources component of the LCP including, but not limited to, LCP Policies 8.4 regarding bluff top development and landscaping and 8.5 for locating development. The proposed project must adhere to the Special Design Guidelines for Coastal Communities as specified in LCP Policy 8.13a for the communities of Montara, Moss Beach, El Granada, and Miramar.

Biological Resources/Sensitive Habitats
Dean Creek, an intermittent stream, is located to the south of the proposed project. LCP Policy 7.1 defines intermittent streams as sensitive habitat and specifies sensitive habitat areas as areas that include, but are not limited to, habitat that supports rare, endangered, and unique species. LCP Policy 7.3 prohibits any development or land use that would have a significant adverse impact on sensitive habitat areas and requires that development be sited and designed to prevent impacts that could significantly degrade sensitive habitat. LCP Policy 7.4 limits uses within sensitive habitat areas to resource-dependent uses. Only project activities consistent with those listed in LCP Policy 7.4 shall be allowed in the corresponding sensitive habitat areas. LCP

Policy 7.11 requires that where no riparian vegetation exists along both sides of riparian corridors, buffer zones must extend 30 feet from the midpoint of intermittent streams. We recommend that the County's analysis of the proposed project evaluate its consistency with LCP Policy 7.11; along with the standards contained in LCP Section 6565.20 for the protection of streams and drainages on or adjacent to property proposed for development.

Public Access
LCP Policy 10.1 requires some shoreline access as a condition of granting development permits for any public or private development permits (except as exempted by Policy 10.2) between the sea and the nearest road. The type of provision for shoreline access, the location of the access, and the amount and type of improvements required shall be consistent with the policies of this component. We recommend that the County evaluate the proposed project for its consistency with LCP Policy 10.1, as it does not meet the criteria to be exempt under LCP Policy 10.2.

Feel free to contact me via e-mail at rananda@coastal.ca.gov or call me at 415-904-5292 if you have questions regarding our comments.

Sincerely,

Renée Ananda

Renée Ananda, Coastal Program Analyst
North Central Coast District