STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., *Governor*

CALIFORNIA COASTAL COMMISSION

SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

September 9, 2013

Errin Briggs
County of Santa Barbara
Planning and Development
123 E. Anapamu Street
Santa Barbara, CA 93101

Subject: Draft Negative Declaration, Beach Club Drive Family Trust Lot Split, New Residence and Gabion Wall (Case Nos. 12TPM-00000-00006, 11CDH-00000-00006, 11CDH-00000-00054)

Dear Mr. Briggs:

Commission staff has reviewed the Draft Negative Declaration (Draft ND) for proposed development located at 2825 Padaro Lane (APN 005-260-018). The proposed project includes subdivision of the existing 10.25 acre parcel into two parcels of 3.02 acres (Proposed Parcel A) and 7.23 acres (Proposed Parcel B) and a proposal to allow (1) as-built grading, (2) modifications to a previously approved biological resources restoration plan, (3-6) demolition and removal of existing structures, (7) abandonment of an existing well, (8) grading for sensitive resource capping, and (9) installation of a split-rail safety fence. The proposed project also includes construction of a new 5,576 sq. ft. 16 ft. high single-family residence with a 500 sq. ft. basement and a 750 sq. ft. attached garage. Commission staff conducted a site visit with the applicant's representatives and County of Santa Barbara staff on September 27, 2011. Our comments below are based on the information provided in the Draft ND regarding the new proposed project and are intended to be preliminary, as staff has not evaluated full-size project plans or complete revised restoration plans. We offer the following comments for your consideration:

Project Description

1.) The Draft ND indicates that development envelopes "would be identified on each of the resultant parcels to contain all future structural development." It is unclear where the development envelope for proposed Parcel B will be located and whether the development envelope is proposed to be included as part of the proposed project. Please clarify. Additionally, please provide a site plan depicting both development envelopes on each parcel (if proposed) and depict setbacks from all resource areas. All development should be clustered in the appropriate location to the maximum extent feasible in order to avoid potential impacts to coastal resources. Each residential development envelope should be located at least 100 ft. from the edge of the riparian canopy (measured using the baseline as the riparian canopy prior to the unpermitted thinning and removal).

Development should also be located outside of the known archeological site identified as CA-SBA-1566.

2.) Please provide a more detailed project description that includes a list of all structures that are proposed to be approved (both new proposed or as-built structures) within the 100 ft. creek buffer (measured using the baseline as the riparian canopy prior to the unpermitted thinning and removal). What is the distance of each of the structures from the edge of the riparian canopy (prior to unpermitted removal) and to the top of bank? Please be sure to include a description of any drainage devices or devices constructed within the creek or within the 100 ft. creek buffer. Have all the existing drainage devices and erosion control devices been previously approved and/or which drainage or erosion control devices are proposed for after-the-fact approval, if any? For example, boulders were observed toward the creek mouth at the 2011 site visit.

Additionally, a retaining wall was observed in the riparian corridor. The Draft ND is unclear regarding whether the retaining wall is proposed for after-the-fact approval.(pg. 20) When was the retaining wall constructed and was it constructed pursuant to an approved CDP? If not previously permitted, the retaining wall should be removed and the area restored, or alternatively, it should be included for after-the-fact approval.

3.) As built-grading: Please provide clarification of the grading amounts for each component of proposed new development and development proposed for after-the-fact approval. The Draft ND indicates that as-built grading occurred primarily along the existing driveway, and to the north and west of the lower bioswale. (pg. 18) Please describe the "lower bioswale." Where is the bioswale located exactly (within the creek)? When was it constructed and was it permitted or is this development proposed for after-the-fact approval?

4.) Restoration Plan:

Plan Addendum: Commission staff would appreciate the opportunity to review the proposed "Plan Addendum" by Hunt & Associates that the Draft ND indicates is on file with P&D.

Gabion wall: What is the setback of the as-built gabion wall from the edge of the riparian canopy (measured using the baseline as the riparian canopy prior to unpermitted thinning and removal)? What are the grading amounts for as-built gabion wall? The Draft ND indicates that the wall would allow restoration plantings "to anchor into stabilized soil and reduce sedimentation at the mouth of Toro Canyon Creek." Fill soil is proposed to be packed into the rocks and the wall is proposed to be planted. How is the soil proposed to remain stabilized on the stacked gabion wall?

Boulders for slope stabilization: The proposed project includes placement of 6-inch and 24-inch diameter rocks for slope stabilization, with grading for placement of boulders and tree wells along the western slope of the stream terrace. Why is slope stabilization necessary in this location? What alternatives are available to avoid or minimize the use of hard structures in the creek buffer? How far are the boulders set back from the creek? Are any hard armoring devices proposed to be placed within the creek itself? The Draft ND is unclear exactly where boulders were placed (or are proposed to be placed). (pg. 19) Please clarify exactly where boulders are proposed for after-the-fact approval or removal. Please also quantify disturbed vegetation as a result of boulder placement and quantify grading amounts for each location.

Stream terrace plantings: The proposed project would revise the planting plan to remove some of the existing additional plantings of *Carex pragracilis* and intersperse the existing plantings with three other species "to give the restoration a more natural appearance." (p.2) During the site visit, this area of stream terrace, although it may have been planted with native species, was observed by Coastal Commission staff to function as a lawn for use of the residents and not as restored riparian ESHA. This lawn should be removed and replanted with species appropriate for riparian ESHA in this watershed. The goal of the restoration of this riparian corridor, which will rectify previously unpermitted removal of ESHA, is to restore the habitat value and not to create "a more natural appearance" of an area functioning as a lawn. The Draft ND indicates that if approved, the subject permit would "allow revisions to the previously approved restoration plan to reflect its current, as-built condition." However, based on the site visit, it appears that changes are required to be made to on-the-ground conditions, especially along the bank of Toro Canyon Creek as noted above.

Coastal Strand Restoration. Please provide a more detailed description of what coastal strand habitat was previously disturbed, when it was disturbed, the extent of disturbance, and what restoration is proposed.

Visual Resources

1.) The Visual Resources section should be revised to address public views of new residential development looking from the beach and ocean to the property. How far is the residence proposed to be setback from the bluff? Will the proposed residence be visible from the beach below?

2.) How far is the proposed development envelope on proposed Parcel B from the bluff edge? What is the potential for future residential development on proposed Parcel B to impact public views? For example, what is the anticipated maximum height of the future residence and/or accessory structures?

Cultural Resources

1.) The project includes adding a top tier to the currently unpermitted gabion wall. How will this impact CA-SBA-1566 given the existing wall given that work in this area directly impacted the existing deposit?

2.) The Draft ND indicates that the "new residence and associated infrastructure, including utility lines and drywells, are located outside of the significant portion of CA-SBA-1566." What is meant by the "significant portion" of CA-SBA-1566? Will the proposed residence and associated infrastructure be located within any portion CA-SBA-1566? If so, what are the alternatives to locate this development outside of this resource area?

Alternatives

1.) Please provide an analysis of alternatives to the proposed as-built gabion wall and proposed wall addition.

2.) Please evaluate alternatives to the placement of hard structures or boulders within the creek.

3.) Please evaluate alternatives to locate the proposed building envelope and associated development for each proposed parcel outside of the 100 ft. creek buffer (as measured from the riparian canopy as it existed prior to unpermitted vegetation removal) and outside of the identified cultural resource areas.

Thank you for the opportunity to provide comments on this project. Please contact me if you have questions or would like to set up a meeting regarding the proposed project. We look forward to providing more detailed comments upon review of the site plans, revised restoration plans, and additional project details.

Sincerely,

A. Amber Geraghty

A. Amber Geraghty
Coastal Program Analyst

Cc: Steve Hudson, District Manager
Shana Gray, Supervisor, Planning and Regulation

Reeve Woolpert
P.O. Box 312
Summerland, CA 93067

RECEIVED
SEP 09 2013
S.B. COUNTY
PLANNING & DEVELOPMENT

Errin Briggs
Santa Barbara County Planning and Development
123 East Anapamu Street
Santa Barbara, CA 93101

September 8, 2013

RE: Beach Club Drive Family Trust Lot Split, 13NGD-00000-00012

Dear Mr. Briggs,

Clearly, many of the special aspects of the subject property have been abused and corrupted by previous owners. Attacks have not been limited to the disruption of significant cultural resources, the ecology of riparian and stream mouth areas and the face of the bluff along the beach, though.

TORO CREEK TRAIL

For example, the public has lost a key route to the beach from Padaro Lane at Toro Creek that once provided a superlative shortcut to the cobbled bend in our coast where stream and ocean meet. This trail was stunning, a respite from heavily developed beach accesses to the west, a truly educational experience and of low impact to its surroundings, including adjoining properties.

Importantly, it provided access to the shoreline at and down coast of Toro Creek, unlimited by restraints on lateral access via the beach. High tides, on the notoriously narrow, ephemeral ribbon of sand between the creek and the Loon Point trail, are becoming nearly a daily impediment to shore line walks with beach flooding and blockage worsening with sea level rise. Here, up coast of the creek, very dangerous, and at times dramatically failing buffs, and the seasonal erosion of the sandy beach into dilapidated fields of large and small boulders severely hamper year round, safe access to Padaro Lane's two coveted "private" beaches east of Toro Creek.

The Loon Point trail does not allow long walks down coast much of the year. Decades ago, this was noted by Summerland citizens who worked hard to protect the Toro Creek trail and envisioned that by adding it to our Community Plan (via Summerland's PRT map), the community, county and public would one day see our lovely path along the creek made permanent.

There has been a long history of public use of lower Toro Creek for access—much by surfers. For years, though, that access has been thwarted by various actions of property owners and the County's indifference. It seems the County is obligated to finally protect this access as stated in LCP Policy 7-1 and our Coastal Act Section 320211. It's time to find the necessary time and money to secure this delightful trail—a trail that protects private property and the environment is possible.

Please note that although the Loon Point parking lot may be approximately ¼ mile to the west of the old Toro Creek access, the beach trail from Loon Point heads further west, creating even more separation between vertical accesses along Summerland's notably unstable and dangerous eastern shoreline. Also, the Loon Point trail easement, as well as the sandy beach where it ends, is burdened with a lopsided legal agreement between the County and the owner of the private land it crosses. This easement relies too much on the land owner's good will. Area residents know of more than one occasion when the present owners have threatened closure.

It would be an insult to Summerland if the County used its DIMF fee from the Toro Creek project elsewhere. Every effort, every step forward, no matter how small, should be toward one day opening and improving this historic, needed route.

BEACH ACQUISTION
Please note the County's Comprehensive General Plan, section 3.7.4 policies as applied to the Summerland area. In particular, the following Implementing Action:

b. The County shall acquire all dry sandy beach area seaward of the toe of the bluff from the Baka property (APN 5-250-1) to Loon Point.

Again, with this project, the County seems to be skirting this obligation as well.

PUBLIC VIEWS
Staff's assessment of the public views in the area is incorrect and insensitive to the cumulative impact of significant past losses of prime public views along western Padaro Lane. Views into the site and to the ocean and channel are NOT prevented by plants growing on the southern shoulder of Padaro Lane. Indeed, present views may be limited, nevertheless the filtered southern light, tones and maritime colors of the property and seascape beyond are enjoyed through the thin hedge and definitively announce the ocean's presence and significantly contribute to the feeling of being seaside in a near pastoral setting when on this stretch of Padaro.

Along Padaro Lane west of Toro Creek , Summerland, the public and the County have lost an incredible—again—an INCREDIBLE, rambling scenic view of the ocean, islands, channel and sky that was as fine as any on the south coast. In recent years, this precious view was squandered, stolen and privatized. What a shame. Please protect the bits that remains near Toro Creek along the north side of this project.

Sincerely,
REEVE WOOLPERT
Reeve Woolpert

STATE OF CALIFORNIA Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Boulevard
West Sacramento, CA 95691
(916) 373-3715
(916) 373-5471 – FAX
e-mail: ds_nahc@pacbell.net

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S.B. COUNTY
PLANNING & DEVELOPMENT

August 23, 2013

Mr. Erin Briggs, Planner
County of Santa Barbara Planning and Building
123 Anapamu Street
Santa Barbara, CA 93101

RE: SCH#2013081025 CEQA Notice of Completion; proposed Negative Declaration for the **"Beach Club Drive Family Trust Lot Split, New Residence and Gabion Wall Project;"** located in the Summerland area; Santa Barbara County, California

Dear Mr. Briggs:

The Native American Heritage Commission (NAHC) has reviewed the CEQA Notice regarding the above referenced project. In the 1985 Appellate Court decision (170 Cal App 3rd 604), the court held that the NAHC has jurisdiction and special expertise, as a state agency, over affected Native American resources impacted by proposed projects, including archaeological places of religious significance to Native Americans, and to Native American burial sites.

The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA guidelines 15064.5(b). To adequately comply with this provision and mitigate project-related impacts on archaeological resources, the Commission recommends the following actions be required:

Contact the appropriate Information Center for a record search to determine :If a part or all of the area of project effect (APE) has been previously surveyed for cultural places(s), The NAHC recommends that known traditional cultural resources recorded on or adjacent to the APE be listed in the draft Environmental Impact Report (DEIR).

If an additional archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey. We suggest that this be coordinated with the NAHC, if possible. This area is known to the NAHC to be very culturally sensitive. The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure pursuant to California Government Code Section 6254.10.

A list of appropriate Native American Contacts for consultation concerning the project site has been provided and is attached to this letter to determine if the proposed active might impinge on any cultural resources. Lack of surface evidence of archeological resources does not preclude their subsurface existence.

Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, pursuant to California Health & Safety Code Section 7050.5 and California Environmental Quality Act (CEQA) §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities. Also, California Public Resources Code Section 21083.2 require documentation and analysis of archaeological items that meet the standard in Section 15064.5 (a)(b)(f). Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans. Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, CEQA §15064.5(e), and Public Resources Code §5097.98 mandates the process to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

Sincerely,

Dave Singleton
Program Analyst

CC: State Clearinghouse

Attachment: Native American Contacts list

Native American Contacts
Santa Barbara County
August 22, 2013

Ernestine DeSoto, Tribal Elder
1311 Salinas Place # 5 — Chumash
Santa Barbara CA 93103
805-636-3963

Patrick Tumamait
992 El Camino Corto — Chumash
Ojai , CA 93023
(805) 640-0481
(805) 216-1253 Cell

Beverly Salazar Folkes
1931 Shadybrook Drive — Chumash, Tataviam, Ferrnandeño
Thousand Oaks, CA 91362
folkes9@msn.com
805 492-7255
(805) 558-1154 - cell
folkes9@msn.com

San Luis Obispo County Chumash Council
Chief Mark Steven Vigil
1030 Ritchie Road — Chumash
Grover Beach CA 93433
(805) 481-2461
(805) 474-4729 - Fax

Santa Ynez Band of Mission Indians
Vincent Armenta, Chairperson
P.O. Box 517 — Chumash
Santa Ynez , CA 93460
varmenta@santaynezchumash.
(805) 688-7997
(805) 686-9578 Fax

John Ruiz
1826 Stanwood Drive — Chumash
Santa Barbara CA 93103
(805) 965-8983

Barbareno/Ventureno Band of Mission Indians
Julie Lynn Tumamait-Stennslie, Chair
365 North Poli Ave — Chumash
Ojai , CA 93023
jtumamait@sbcglobal.net
(805) 646-6214

Gilbert M. Unzueta Jr.
571 Citation Way — Chumash
Thousand Oaks, CA 91320
uhuffle@aol.com
(805) 375-7229

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

his list s only applicable for contacting local Native Americans with regard to cultural resources for the proposed
SCH#2013081025; CEQA Notice of Completion; proposed Negative Declaration for the Beach Club Family Trust Lot Split, New Residence and Gabion Wall Project; located in Summerland; Santa Barbara County, California.

Santa Barbara County Planning & Dev. 9-3-13
123 E Anapamu St
Santa Barbara Calif. 93101

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S.B. COUNTY
PLANNING & DEVELOPMENT

Attn: Errin Briggs

Re: 13NGD-00000-00012 (Beach Trust)

Please accept the following comments re the above mentioned case.

Locating/lowering the proposed residence elevation (current proposed FF = 63) approximately 3' to elevation 60 would result in a better balanced project considering the field elevation of 55± and very highest S.W. property corner elevation of 70. The amount of imported fill material would be reduced significantly and visual impacts lessened. (See Summerland BAR comments)

Colors and materials should be as per Summerland BAR guidelines page 14 (enclosed)

The document characterizes the Hedge along Padaro as "Thick", however, pleasant filtered views of the Ocean are available along its length in contrast to the situation with the new wall immediately to the West. It should be posible to maintain some public views of the Ocean and still respect the privacy of the residences.

Respectfully submitted:
Tom Evans, P.O. Box 622
Summerland CA 93067
969-3050

B. VIEW AND PRIVACY PROTECTION

1. Requirements for Review

Where the County BAR finds that the project has the potential to create significant view or privacy impacts, the Board and applicant should consider the following as possible mitigation for view and privacy protection:

a. Reduction of building height.
b. Excavation of building into site.
c. Hip roofs / direction of roof pitch / break up roof mass.
d. Siting of new structure.
e. Footprint of new structure.
f. Reducing the mass of the second story and adding to the first story.
g. Control of window, deck or balcony placement.
h. View blockage of only "secondary" views (i.e. Bedroom instead of living room).

2. Mitigation of View and Privacy Impacts - Rural Projects

In rural areas, all new development shall be designed to minimize visual and aesthetic impacts utilizing the following:

a. All structures (primary and accessory structures, including residences, garages, guest houses, barns, corrals, sheds, greenhouses, lathhouses, artist's studios, etc.) and private driveways shall be located on slopes of 20% or less;
b. Special attention shall be focused on design of future structures in order to minimize use of large vertical faces. Large understories and exposed retaining walls shall be avoided;
c. All structures, fences, walls, and roofs shall be constructed using medium to dark earthtone colors and construction materials that are compatible with the natural surroundings. All colors shall blend in with the surrounding soils, vegetation and rock outcroppings. Light colors such as white, offwhite, grey, etc. shall be prohibited. Nightlighting shall be low intensity, hooded, and shielded inward from property boundaries;
d. Any necessary retaining walls shall be constructed in earthtones using materials or construction methods which create a textured effect. Where feasible, native groundcovers shall be planted to cover retaining walls from view;
e. All cut and fill slopes shall be revegetated with native drought tolerant groundcover immediately after grading is completed; and

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
South Coast Region
3883 Ruffin Road
San Diego, CA 92123
(858) 467-4201
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

September 6, 2013

Errin Briggs
Santa Barbara County Planning and Development Department
123 East Anapamu Street
Santa Barbara, CA 93101
ebriggs@co.santa-barbara.ca.us

Subject: Draft Mitigated Negative Declaration for the Beach Club Drive Family Trust Lot Split, New Residence and Gabion Wall Project, SCH # 2013081025, Santa Barbara County

Dear Mr. Briggs:

The California Department of Fish and Wildlife (Department), has reviewed the above Draft Mitigated Negative Declaration (DMND) for impacts to biological resources. The project applicant proposes construction of a single family residence, demolition and removal of existing structures, abandonment of an existing well, installation of a split-rail safety fence, and installation of a gabion wall and boulders for bank stabilization of a section of Toro Canyon Creek (Creek). The proposed project site is located on a 10.25 acre property at 2825 Padaro Lane, in the community of Summerland, in Santa Barbara County (County), adjacent to the western bank of the Creek. The Creek is mapped as Environmentally Sensitive Habitat (ESH) in the Summerland Community Plan (1992).

Habitat types with the potential to be impacted by the project include California sycamore-coast live oak riparian woodland. Wildlife with the potential to be impacted by the project include the State Special Concern Species yellow warbler (*Dendroica petechia brewsteri*), two-striped garter snake (*thamnophis hammondii*), Cooper's hawk (*Accipiter cooperi*), and yellow-breasted chat (*Icteria virens*). Measures proposed in the DMND to mitigate impacts to biological resources include pre-construction bird nesting surveys and nesting bird avoidance, implementation of a Habitat Restoration and Revegetation Plan for the Creek, and employment of best management practices for construction activities.

The Department is California's trustee agency for fish and wildlife resources, holding these resources in trust for the People of the State pursuant to various provisions of the California Fish and Game Code. (Fish & G. Code, §§ 711.7, subd. (a); 1802.) The Department submits these comments in that capacity under the California Environmental Quality Act (CEQA). (See generally Pub. Resources Code, §§ 21070; 21080.4.) Given its related permitting authority under the Fish and Game Code section 1600 et seq., the Department also submits these comments likely as a responsible agency for the Project under CEQA. (*Id.*, § 21069.)

California Wildlife Action Plan

The California Wildlife Action Plan, a Department guidance document, identified the following stressors affecting wildlife and habitats within the project area: 1) growth and development; 2) water management conflicts and degradation of aquatic ecosystems; 3) invasive species; 4) altered fire regimes; and 5) recreational pressures. The Department looks forward to working with the County to minimize impacts to fish and wildlife resources with a focus on these stressors.

Impacts to Jurisdictional Drainages

The Department has regulatory authority with regard to activities occurring in streams and/or lakes that could adversely affect any fish or wildlife resource. For any activity that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream or use material from a streambed, the project applicant (or "entity") must provide written notification to the Department pursuant to Section 1602 of the Fish and Game Code. Based on this notification and other information, the Department then determines whether a Lake and Streambed Alteration (LSA) Agreement is required.

The restoration project proposed for the Creek includes impacts to streambeds within Department jurisdiction. Notification to the Department under Section 1600 et seq., therefore will be required. You may call our San Diego office at (858) 636-3160 to initiate the 1600 process. You may also obtain a notification package online by visiting the Department's website at http://www.dfg.ca.gov/1600/1600.html.

Thank you for this opportunity to provide comment. Questions regarding this letter and further coordination on these issues should be directed to Mr. Martin Potter, Staff Environmental Scientist at (805) 640-3677.

Sincerely,

Betty J Courtney

Betty Courtney
Environnemental Program Manager
South Coast Region

ec: Ali Aghili, CDFW, Los Alamitos
Martin Potter, CDFW, Ojai
Natasha Lohmus, CDFW, Carpinteria
Scott Morgan, State Clearinghouse, Sacramento

Santa Barbara County
PUBLIC Health
DEPARTMENT

Environmental Health Services

225 Camino del Remedio • Santa Barbara, CA 93110
805/681-4900 • FAX 805/681-4901

Takashi M. Wada, MD, MPH *Director/Health Officer*
Anne M. Fearon *Deputy Director*
Suzanne Jacobson, CPA *Chief Financial Officer*
Susan Klein-Rothschild *Deputy Director*
Elizabeth Snyder, MHA *Deputy Director*
Peter Hasler, MD *Medical Director*

2125 S. Centerpointe Pkwy. #333 • Santa Maria, CA 93455-1340
805/346-8460 • FAX 805/346-8485

Lawrence D. Fay, Jr. *Director of Environmental Health*

TO: Errin Briggs, Planner
Planning & Development Department
Development Review Division

FROM: Paul E. Jenzen
Environmental Health Services

DATE: August 21, 2013

SUBJECT: 13NGD-00000-00012, Case No. 12TPM-00000-00006

Environmental Health Services has reviewed the subject environmental document and has no comments to submit concerning it. Thank you for the opportunity to review and comment on this document.

LU-5184

PRICE, POSTEL & PARMA LLP

J. TERRY SCHWARTZ
DAVID W. VAN HORNE
PETER D. SLAUGHTER
DOUGLAS D. ROSSI
CRAIG A. PARTON
CLYDE E. WULLBRANDT
CHRISTOPHER E. HASKELL
TIMOTHY E. METZINGER
TODD A. AMSPOKER
MARK S. MANION
MELISSA J. FASSETT
IAN M. FISHER
SHEREEF MOHARRAM
SAM ZODEH
KRISTEN M. R. BLABEY
S. VICTORIA KAHN
LAUREN B. WIDEMAN

COUNSELLORS AT LAW

200 EAST CARRILLO STREET, SUITE 400
SANTA BARBARA, CALIFORNIA
93101-2190

MAILING ADDRESS P.O. BOX 99
SANTA BARBARA, CA 93102-0099
WWW.PPPLAW.COM

TELEPHONE (805) 962-0011
FAX (805) 965-3978

E-MAIL: CEW@PPPLAW.COM

OF COUNSEL

ARTHUR R. GAUDI
JAMES H. HURLEY, JR.
ERIC P. HVOLBØLL
KENNETH J. PONTIFEX
SUSAN M. BASHAM
STEVEN K. MCGUIRE

RETIRED PARTNERS

GERALD S. THEDE
DAVID K. HUGHES

OUR FILE NUMBER

21889-1

September 9, 2013

HAND DELIVERY

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S.B. COUNTY
PLANNING & DEVELOPMENT

Errin Briggs
Santa Barbara County
Planning and Development Department
123 East Anapamu Street
Santa Barbara, CA 93101

Re: Beach Club Drive Family New Residence: 11CDH-00000-00054

Dear Errin:

We have reviewed the Draft Mitigated Negative Declaration (MND) (13NGD-00000-00012) for the Beach Club Drive Family Trust subdivision, new residence and gabion wall project. We are concerned that portions of the new residence are located within the 75-year coastal bluff retreat setback required by both the County of Santa Barbara and the California Coastal Commission.

As discussed in the January 16, 2003 California Coastal Commission memorandum entitled "Establishing Development Setbacks for Coastal Bluffs" (a copy of which is attached), the 75-year bluff setback is derived using the Coastal Commission's guidelines by combining the effective slope stability setback and the calculated long-term bluff retreat rate. The analysis of the bluff setback included in the MND appears to be based entirely upon Adam Simmons' 2006 report. GeoDynamics, Inc., acting on behalf of the County, determined that the Simmons report was incorrect and incomplete as it did not follow the Coastal Commission guidelines.

In response to GeoDynamics' review, the applicant had Earth Systems prepare its June 18, 2013 report, which seems to correctly utilize the Coastal Commission guidelines and then establishes a setback of "about 71 feet." It appears, however, that this number may be based on "post construction" conditions, and also incorrectly speculates that development with "cantilevers" is permissible beyond the setback. Neither of these are correct.

Our expert geologist, Bob Hollingsworth (who is very familiar with Coastal Commission methodologies), has plotted the setback line (see attached diagram and Hollingsworth letter) based on the 2013 Earth Systems report. His plot shows the Factor of Safety distances are 56 feet from the top of bluff at Section A and 43 feet at Section B. Adding the expected bluff retreat of 31 feet then results in a structural bluff setback of 87 feet from top of bluff at Section A and 74 feet at Section B. As the plot clearly shows, a significant portion of the proposed structure (more than 23 feet), as well as retaining walls and patios (in excess of 30 feet), are located within the setback. There is an attempt to justify this encroachment into the established setback with the use of "cantilevered foundations," though the MND incorrectly identifies the extent of the encroachment.

The analysis in the MND further states that the June 18, 2013 Earth Systems report identifies an "additive factor of safety setback" which "acts to supplement" the bluff retreat rate to ensure any structure is still located safely outside the 75-year bluff retreat setback. This interpretation is incorrect. The "factor of safety" identified in the Earth Systems report does not act to supplement the bluff retreat line; it establishes the bluff retreat line. Once this single setback line has been established, the only encroachments allowed within it are specified in LCP Policy 3-5, which states:

> *Within the required bluff top setback, drought-tolerant vegetation shall be maintained. Grading, as may be required to establish proper drainage or to install landscaping,* ***and minor improvements, i.e., patios and fences that do not impact bluff stability, may be permitted****. Surface water shall be directed away from the top of the bluff or be handled in a manner satisfactory to prevent damage to the bluff by surface and percolating water (Emphasis added).*

Given the Coastal Commission's guidance on establishing a 75-year bluff retreat setback and the concise direction of LCP Policy 3-5, all portions of the proposed new residence (including patios and other flatwork, unless expressly demonstrated not to impact bluff stability) must be set behind the setback line. Development as proposed represents a potentially significant environmental impact and is clearly inconsistent with applicable LCP policy.

Thank you very much for the opportunity to provide comment on this project. Should you have any questions please don't hesitate to contact me.

Very truly yours,

C.E. Chip Wullbrandt
for PRICE, POSTEL & PARMA LLP

Enclosures:
California Coastal Commission Memorandum, dated January 16, 2003
Letter and map by Robert A. Hollingsworth dated August 1, 2013
Map by Robert Hollingsworth showing extent of encroachments

cc: Daniel Grigsby, Esq.
Robert Hollingsworth, E.G./G.E.

STATE OF CALIFORNIA—THE RESOURCES AGENCY GRAY DAVIS, GOVERNOR

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

W11.5

MEMORANDUM

Date: 16 January 2003

To: Commissioners and Interested Parties

From: Mark Johnsson, Staff Geologist

Subject: **Establishing development setbacks from coastal bluffs**

STAFF NOTE

Consistency with section 30253 of the Coastal Act requires that:

> New development shall:
>
> (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
>
> (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.
>
> ...

This section requires that new development be located such that it will not be subject to erosion or stability hazard over the course of its design life. Further, the last clause requires the finding that no seawall, revetment, jetty, groin, retaining wall, or other shoreline protective structure, inasmuch as such a structure would substantially alter natural landforms along bluffs and cliffs, will be needed to protect the development over the course of its design life. The Commission has found on many occasions that siting new development away from eroding bluffs is the preferred means of assuring consistency with this section, and the establishment of bluff-top setbacks for new development is an integral part of most local coastal programs. Further, the State's draft Policy on Coastal Erosion Planning and Response states that avoidance of geologic hazards, such as eroding coastal bluffs, should be the primary means of safeguarding new development.

Accordingly, the determination of what constitutes an adequate setback is a critical component of the analysis of proposals for new development.

Because coastal bluffs are dynamic, evolving landforms, establishing appropriate development setbacks from coastal bluffs is far more challenging than it is for manufactured or natural slopes not subject to erosion at the base of the slope. The mechanisms of coastal bluff retreat are complex, but can be grouped into two broad categories. Bluff retreat may occur suddenly and catastrophically through slope failure involving the entire bluff, or more gradually through grain-by-grain erosion by marine, subaerial, and ground water processes. For both processes, the setback must be adequate to assure safety over the design life of the development.

In an effort to clarify the analytical procedures undertaken by Coastal Commission staff in evaluating proposed development setbacks, the Commission's staff geologist made two presentations at the *California and the World Ocean '02* conference held in Santa Barbara in October 2002. These presentations were combined into a single manuscript to be published in the proceedings volume for that Conference, which is attached to this staff report.

In order to bring these procedures before the Commission, and to further the exposure of them to the public, the staff geologist will brief the Commission on this methodology at the February 2003 hearing. This methodology does not represent a formal policy or position of the Coastal Commission. In fact, there may be other appropriate methodologies to establish development setbacks, and the Commission has the discretion to base a decision on any method that it finds technically and legally valid. Further, as new techniques and information become available, these methodologies may change. Nevertheless, the type of analysis outlined here represents the current analytical process carried out by Coastal Commission staff in evaluating proposals for new development on the California coast, and in recommending action upon those proposals to the Commission. The Commission then makes its decisions on a case-by-case basis, based upon the site-specific evidence related to the particular development proposal.

Attachment: Preprint of manuscript entitled "Establishing development setbacks from coastal bluffs," by Mark J. Johnsson, to appear in *Proceedings, California and the World Ocean, '02*, Orville Magoon, ed., 21 p.

Johnsson, Mark J., *In press*, Establishing Development Setbacks from Coastal Bluffs, *In* Magoon, Orville (ed.) *Proceedings, California and the World Ocean '02.*

Establishing Development Setbacks from Coastal Bluffs

Mark J. Johnsson[1]

Abstract

Responsible development, and California law, requires that coastal development be sited a sufficient distance landward of coastal bluffs that it will neither be endangered by erosion nor lead to the construction of protective coastal armoring. In order to assure that this is the case, a development setback line must be established that places the proposed structures a sufficient distance from unstable or marginally stable bluffs to assure their safety, and that takes into account bluff retreat over the life of the structures, thus assuring the stability of the structures over their design life. The goal is to assure that by the time the bluff retreats sufficiently to threaten the development, the structures themselves are obsolete. Replacement development can then be appropriately sited behind a new setback line. Uncertainty in the analysis should be considered, as should potential changes in the rate of bluff retreat and in slope stability. The deterministic approach presented here is based on established geologic and engineering principals, and similar approaches have been used to establish development setbacks from slope edges throughout the world for some time. Alternative approaches based on probabilistic methods may allow, however, for better quantification of uncertainties in the analysis. Although probabilistic coastal hazard assessment is in its infancy and data needs are large, the approach shows great promise. Developing probabilistic methods for establishing development setbacks should be a goal for future coastal zone management in California.

Introduction

In an era of sea-level rise such as has persisted on Earth for the past ~20,000 years (Curray 1965; Emery and Garrison 1967; Milliman and Emery 1968), the landward recession of coastal bluffs is an inevitable natural process wherever tectonic or isostatic uplift rates are lower than the rate of sea-level rise. New structures should be sited a sufficient distance landward of coastal bluffs that they will neither be endangered by erosion nor require the construction of coastal armoring to protect them from erosion over their design life. Because coastal bluffs are dynamic, evolving landforms, establishing responsible development setbacks from coastal bluffs is far more challenging than it is for manufactured or natural slopes not subject to erosion at the base of slope. Although internationally agreed-upon methods for establishing setbacks from static slopes have been developed, and codified in the International Building Code, no such consensus has emerged with respect to setbacks from dynamic slopes such as coastal bluffs. This paper presents a methodology for establishing such setbacks given the types of data generally available through relatively inexpensive geologic studies.

Relatively little work has been undertaken towards developing rational methodologies for establishing development setbacks from bluffs and cliffs. Coastal development setbacks have generally focused primarily on beach erosion, rather than on coastal bluff recession (*e.g.*, Healy 2002). Generally, the approach has been to simply

[1] Staff Geologist, California Coastal Commission, 45 Fremont Street, Suite 2000, San Francisco, CA 94105. Email: mjohnsson@coastal.ca.gov. The opinions expressed herein are those of the author and do not reflect a formal position of the California Coastal Commission.

extrapolate historic long-term erosion rates into the future, and establish setbacks at a particular predicted future shoreline position. This approach does not work well for shorelines with coastal bluffs, where the setback also must consider the possibility of bluff collapse (see Priest 1999 for a discussion of these issues). Komar and others (2002) presented a methodology for establishing setbacks for use on coasts where the principal hazards are wave runup and storm surge. They showed how their method could be extended to use on coasts with sea cliffs by determining the average number of hours that a sea cliff would be subject to wave attack. Their method does not, however, include a quantitative assessment of bluff stability. Given the significance of the coastal erosion threat in California, where public safety, financial investments, and environmental resources are at stake, and given the call for action urged by such recent national studies as the Heinz Center's FEMA-sponsored studies (The Heinz Center 2000a; 2000b), it is critical that a rational method be established for establishing development setbacks on coastal bluff tops.

The California Coastal Act (California Public Resource Code Sections 30000 *et seq.*) regulates coastal development in California. Section 30253 states, in part, that:

> New development shall:
>
> (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
>
> (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.
>
> ...

This law requires that new development be sited in such a way that it will not be subject to erosion or stability hazard over the course of its design life. Further, the last clause requires the finding that no seawall, revetment, jetty, groin, retaining wall, or other shoreline protective structure will be needed to protect the development over the course of its design life.

The principal challenge in meeting these requirements is predicting the amount and timing of coastal erosion to be expected at a particular site. The landward retreat of coastal bluffs is far from uniform in space or time (Komar 2000). Marine erosion tends to be concentrated at points and headlands due to wave refraction, occurs more quickly in weak rocks, and may vary along a coastline as these and other factors vary (Honeycutt et al. 2002). Further, coastal bluff retreat tends to be temporally episodic due to a variety of external and internal factors.

The mechanisms of coastal bluff retreat are complex (Emery and Kuhn 1982; Sunamura 1983; Vallejo 2002), but can be grouped into two broad categories. Bluff retreat may occur suddenly and catastrophically through slope failure involving the entire bluff, or more gradually through grain-by-grain erosion by marine, subaerial, and ground water processes. The distinction between the two categories may be blurred in some cases—"grains" may consist of relatively large blocks of rock or shallow slumps, for example. Nevertheless, in establishing structural setbacks it is important to evaluate the susceptibility of the bluff to both catastrophic collapse and to more gradual erosion and retreat.

For both slope stability and long-term bluff retreat by "grain-by-grain" erosion, the setback must be adequate to assure safety over the design life of the development. For this reason, it is necessary to specify the design life of the structure. Many Local Coastal Programs (the implementation of the California Coastal Act at the local government level) specify a particular value, although the Coastal Act itself does not. The most commonly assumed design lives for new development range from 50 to 100 years; the most common value is 75 years. The reasoning behind establishing a setback based on the design life is that by the time the bluff retreats sufficiently to threaten the structure, the structure is obsolete and is ready to be demolished for reasons other than encroaching erosion. Replacement development can then be appropriately sited at a new setback, appropriate for conditions at the time of its construction. This process may be thwarted by limitations imposed by parcel size, and Constitutional takings issues may complicate land use decisions. Nevertheless, the only alternative to an armored coast—with all of its attendant impacts—is to continually site, and reposition, development in harmony with coastal erosion as it inevitably moves the shoreline landward.

What follows is the methodology employed by the staff of the California Coastal Commission in evaluating setbacks for bluff top development. I would suggest that this methodology is useful on other coasts with coastal bluffs, as well. This methodology does not represent a formal policy or position of the Coastal Commission. In fact, there may be other appropriate methodologies to establish development setbacks, and the Commission has the discretion to base a decision on any method that it finds technically and legally valid. Any such alternative methods should, however, be at least as protective of coastal zone resources as those outlined here. Further, as new techniques and information become available, these methodologies may change. Nevertheless, the type of analysis outlined here represents the current analytical process carried out by Coastal Commission staff in evaluating proposals for new development on the California coast, and in recommending action upon those proposals to the Commission. The Commission then makes its decisions on a case-by-case basis, based upon the site-specific evidence related to the particular development proposal.

Definition of "Bluff Edge"

Development setbacks normally are measured from the upper edge of the bluff top. Accordingly, a great deal of effort often is focused on defining that "bluff edge." The bluff edge is simply the line of intersection between the steeply sloping bluff face and the flat or more gently sloping bluff top. Defining this line can be complicated, however, by the presence of irregularities in the bluff edge, a rounded or stepped bluff edge, a sloping bluff top, or previous grading or development near the bluff edge. Accordingly, a set of standards for defining the bluff edge is necessary.

Under the California Coastal Act, the bluff edge is defined as:

> ... the upper termination of a bluff, cliff, or seacliff. In cases where the top edge of the cliff is rounded away from the face of the cliff as a result of erosional processes related to the presence of the steep cliff face, the bluff line or edge shall be defined as that point nearest the cliff beyond which the downward gradient of the surface increases more or less continuously until it reaches the general gradient of the cliff. In a case where there is a steplike feature at the top of the cliff face, the landward edge of the topmost riser shall be taken to be the cliff edge..." (California Code of Regulations, Title 14, §13577 (h) (2).

This definition is largely qualitative, and the interpretation of the topographic profile to yield a bluff edge determination at any given coastal bluff may be subject to various interpretations. Accordingly, it may be useful to use more quantitative means to define "bluff edge." One approach, adopted, for example, by the City of Laguna Beach, is to define the bluff edge as that point at which the coastal bluff attains a certain specified steepness. This steepness is equivalent to the first derivative of the topographic profile. Such a definition may, however, be inconsistent with the legal definition above. Further, ambiguous results may be obtained when the upper portion of the bluff fluctuates around the specified steepness value. Better results may be obtained by finding the point at which the second derivative, the rate of change in steepness, of the topographic profile increases sharply. This approach may be amenable to computer analysis, although such analysis is rarely employed.

The position of the bluff edge may be changed by a variety of processes, natural and anthropogenic. Most obvious is the landward retreat of the bluff edge through coastal erosion. A bluff edge also may move seaward, through tectonic processes, but such movement is rare and usually small on human time scales. More significant is the anthropogenic modification of the bluff edge by grading or the construction of structures. A landward shift of the bluff edge commonly occurs through cutting into and removing natural materials during grading operations or the construction of seawalls. Conversely, placing artificial fill on or near the bluff edge generally does not alter the position of the natural bluff edge: the natural bluff edge still exists, buried beneath fill, and the natural bluff edge is used for purposes of defining development setbacks.

Slope Stability

Once the bluff edge is located, the first aspect to consider in establishing development setbacks from the bluff edge is to determine whether the existing coastal bluff meets minimum requirements for slope stability. If the answer to this question is "yes," then no setback is necessary for slope stability considerations. If the answer is "no," then the distance from the bluff edge to a position where sufficient stability exists to assure safety must be found. In other words, we must determine how far back from the unstable or marginally slope must development be sited to assure its safety.

We are guided in this analysis by the industry-accepted standards for artificial slopes (codified in many local grading ordinances), which require that a particular minimum "factor of safety" against landsliding be attained. A more difficult situation is the case of overhanging or notched coastal bluffs, or bluffs undermined by sea caves.

Landslides. Assessing the stability of slopes against landsliding is undertaken through a quantitative slope stability analysis. In such an analysis, the forces resisting a potential landslide are first determined. These are essentially the strength of the rocks or soils making up the bluff. Next, the forces driving a potential landslide are determined. These forces are the weight of the rocks as projected along a potential slide surface. The resisting forces are divided by the driving forces to determine the "factor of safety." A value below 1.0 is theoretically impossible, as the slope would have failed already. A value of 1.0 indicates that failure is imminent. Factors of safety at increasing values above 1.0 lend increasing confidence in the stability of the slope. The industry-standard for new development is a factor of safety of 1.5, and many local grading ordinances in California and elsewhere (including the County of Los Angeles, and the Cities of Irvine, Malibu, and Saratoga, among others) require that artificial slopes meet this factor of safety.

A slope stability analysis is performed by testing hundreds of potential sliding surfaces. The surface with the minimum factor of safety will be the one on which failure is most likely to occur. Generally, as one moves back from the top edge of a slope, the factor of safety against landsliding increases. Therefore, to establish a safe setback for slope stability from the edge of a coastal bluff, one needs to find the distance from the bluff edge at which the factor of safety is equal to 1.5.

Inherent in the calculation of a slope stability analysis is the shape (topographic profile) and geologic makeup of the coastal bluff. There are many ways to calculate the forces involved in slope stability analyses. All methods must consider such factors as rock or soil strength, variations in rock and soil strength values due to different types of materials making up the slope, anisotropy in these values, and any weak planes or surfaces that may exist in the slope (Abramson et al. 1995). More subtly, other factors that must be considered include: pore water pressure, which produces a buoyant force that reduces the resisting forces, the particular failure mechanism that is most likely (e.g., a block slide mechanism vs a circular failure mechanism), and seismic forces. Seismic forces normally are considered through a separate analysis, in which a force equal to 15% of the force of gravity is added to the driving forces. Because seismic driving forces are of short duration, a factor of safety of 1.1 generally is considered adequate to assure stability during an earthquake. This type of analysis is fairly crude, and other methods for evaluating slope stability based on maximum permanent displacement experienced during earthquakes do exist, but the pseudo-static method represents the current standard of practice for most development in California (Geotechnical Group of the Los Angeles Section of the American Society of Civil Engineers 2002). Guidelines for conducting slope stability analyses for review by the California Coastal Commission are presented in Table 1.

Table 1. Guidelines for performing quantitative slope stability analyses

1) The analyses should demonstrate a factor of safety greater than or equal to 1.5 for the static condition and greater than or equal to 1.1 for the seismic condition. Seismic analyses may be performed by the pseudostatic method or by displacement methods, but in any case should demonstrate a permanent displacement of less than 50 mm.

2) Slope stability analyses should be undertaken through cross-sections modeling worst case geologic and slope gradient conditions. Analyses should include postulated failure surfaces such that both the overall stability of the slope and the stability of the surficial units is examined.

3) The effects of earthquakes on slope stability (seismic stability) may be addressed through pseudostatic slope analyses assuming a horizontal seismic coefficient of 0.15g. Alternative (displacement) methods may be useful, but should be in conformance with the guidelines published by the Geotechnical Group, American Society of Civil Engineers, Los Angeles Section (2002).

4) All slope analyses should ideally be performed using shear strength parameters (friction angle and cohesion), and unit weights determined from relatively undisturbed samples collected at the site. The choice of shear strength parameters should be supported by direct shear tests, triaxial shear test, or literature references, and should be in conformance with the guidelines published by the Geotechnical Group, American Society of Civil Engineers, Los Angeles Section (2002).

5) All slope stability analyses should be undertaken with water table or potentiometric surfaces for the highest potential ground water conditions.

6) If anisotropic conditions are assumed for any geologic unit, strike and dip of weakness planes should be provided, and shear strength parameters for each orientation should be supported by reference to pertinent direct sheer tests, triaxial shear test, or literature references.

7) When planes of weakness are oriented normal to the slope or dip into the slope, or when the strength of materials is considered homogenous, circular failure surfaces should be sought through a search routine to analyze the factor of safety along postulated critical failure surfaces. In general, methods that satisfy both force and moment equilibrium, such as Spencer's (Spencer 1967; 1973), Morgenstern-Price (Morgenstern and Price 1965), and General Limit Equilibrium (Fredlund et al. 1981; Chugh 1986) are preferred. Methods based on moment equilibrium alone, such as Simplified Bishop's Method (Bishop 1955) also are acceptable. In general, methods that solve only for force equilibrium, such as Janbu's method (Janbu 1973) are discouraged due to their sensitivity to the ratio of normal to shear forces between slices (Abramson et al. 1995).

8) If anisotropic conditions are assumed for units containing critical failure surfaces determined above, and when planes of weakness are inclined at angles ranging from nearly parallel to the slope to dipping out of slope, factors of safety for translational failure surfaces should also be calculated. The use of a block failure model should be supported by geologic evidence for anisotropy in rock or soil strength. Shear strength parameters for such weak surfaces should be supported through direct shear tests, triaxial shear test, or literature references.

Establishing a safe setback line. Once the stability of the coastal bluff has been assessed, the development setback line to assure safety from marginally stable slopes is simply the line corresponding to a factor of safety of 1.5 (static) or 1.1 (pseudostatic), whichever is further landward. In establishing this line one can either use a single cross section and specify a single distance from the bluff edge at which the factor of safety rises to 1.5 (or 1.1 for the pseudostatic case), or use several cross sections and contour the factors of safety on the bluff top. Then, by choosing the 1.5 contour (or 1.1 for the pseudostatic case, if it lies further landward), a setback line is established. The latter method generally is necessary for large or complicated sites.

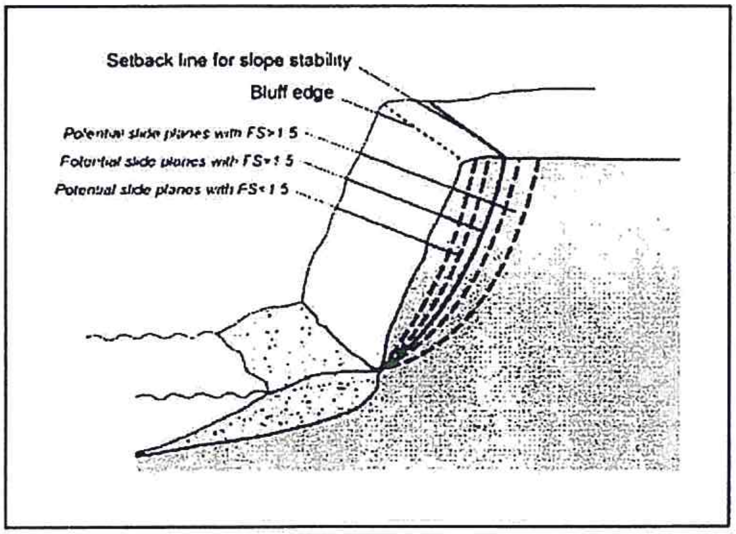

Figure 1. Establishing a development setback for slope stability. The potential slide plane possessing a defined minimum standard of stability is identified, and its intersection with the bluff edge is taken as a minimum development setback. The minimum standard for stability is usually defined as a factor of safety (FS) against sliding of 1.5 for the static case, or 1.1 for a pseudostatic (seismic) case, whichever is further landward.

Block failure of overhanging bluffs and sea caves. Assessing the factor of safety against block failure for overhanging or notched coastal bluffs, or bluffs undermined by sea caves, is far more difficult than conducting a slope stability analysis against landsliding. This is due to several factors, the most important of which are: 1) uncertainty as to the presence of local heterogeneities or planes of weakness, hidden in the bluff, that commonly control block failures, 2) difficulty in assigning shear strength values to such heterogeneities even if they can be identified, and 3) greater complexity in modeling the stress field within a bluff in terms of heterogeneities or planes of weakness as compared to a modeling a homogenous slope. The current state of the science does not allow for the calculation of a factor of safety against block failure for such overhanging or notched coastal bluffs, or bluffs undermined by sea caves, and even makes any form of quantitative assessment of the risk of failure extremely difficult. Promise is shown in mathematical models such as that of Belov and others (1999), but translating such process-oriented models into setback methodologies has not yet been attempted.

Accordingly, establishing appropriate setbacks from overhanging or undermined coastal bluffs is problematic at best. An appropriate conservative approach is to project a vertical plane upward from the rear wall of the overhang, notch, or sea cave, and establish this as the minimum setback line. This approach has been adopted by the City of San Diego. and codified in the City's Local Coastal Program. Although it is certainly possible that failure could occur along a line inclined either seaward or landward from the rear wall of the overhang, notch, or sea cave, a vertical plane would seem to be a good default configuration to assume in the absence of more compelling evidence for another configuration. Further, vertical, bluff-parallel fractures—perhaps related to stress-relief at the free face represented by the bluff face—are a common feature of otherwise homogenous coastal bluffs. In many cases, such a plane will intersect the sloping bluff face seaward of the bluff edge, and no setback from the bluff edge would be necessary to assure stability from block collapse. In cases where the plane intersects the bluff top seaward of a setback line established for landsliding, as discussed above, no additional setback would be necessary to assure stability from block collapse. In the rather rare case, however, in which the plane intersects the bluff top landward of both the bluff edge and any setback line for landsliding, the line of intersection of the plane and the bluff top would be an appropriate setback line for slope stability considerations.

Long Term Bluff Retreat

The second aspect to be considered in the establishment of a development setback line from the edge of a coastal bluff is the issue of more gradual, or "grain by grain" erosion. In order to develop appropriate setbacks for bluff top development, we need to predict the position of the bluff edge into the future. In other words, at what distance from the bluff edge will bluff top development be safe from long-term coastal erosion?

The long-term bluff retreat rate can be defined as the average value of bluff retreat as measured over a sufficient time interval that increasing the time interval has negligible effect on the average value (a statistical basis could be applied to the term "negligible," but this is rarely done). This definition implies that the long-term bluff retreat rate is linear, an assumption that certainly is not valid over time scales of more than a few centuries, or in periods of rapid sea-level change such as the late Pleistocene/early Holocene (Curray 1965; Emery and Garrison 1967; Milliman and Emery 1968). There is some overlap between slope stability issues and long-term bluff retreat issues, in that the "grains" may be fairly large rocks, and in that shallow slumping is a common mechanism for gradual bluff retreat. In addition even gradual bluff retreat tends to be highly episodic due to a host of internal and external factors.

The rate at which gradual bluff retreat occurs generally is measured by examining historic data. This is somewhat problematic in that the historic bluff retreat rate may not accurately predict the future bluff retreat rate (Watson 2002). This is a particularly issue in light of the likelihood of an acceleration in the rate of sea level rise as a result of global warming (Intergovernmental Panel on Climate Change 2001) and the resulting likely increase in bluff retreat rate (Bray and Hooke 1997; Watson 2002).

Nevertheless, historic data currently are our best indicators of future erosion at any given site. Such data may include surveys that identify the bluff edge, in which case the criteria used to identify the bluff edge must be the same in the surveys that are compared. Sufficiently detailed surveys are rare, however, and vertical aerial photography is more commonly used to assess changes in bluff position through time. The best data are those compiled photogrammetrically, whereby distortions inherent to aerial photography (due, for example, to tilting of the camera, variations in the distance from the camera to various parts of the photograph, and differences in elevation across the photograph) are corrected (see, for example, Moore 2000). Sometimes such data have been gathered as parts of specific studies of coastal bluff retreat, but more commonly they are collected as part of other work, and must be sought out for coastal erosion studies.

Coastal bluff retreat tends to be temporally episodic due to a variety of external and internal factors. External factors include tides, episodic wave events (spurred by either local or distant storms), episodic rainfall events (Kuhn 2000), El Niño-Southern Oscillation events (Griggs and Johnson 1983; Griggs 1998; Griggs and Brown 1998; Lajoie and Mathieson 1998; Storlazzi and Griggs 2000), major earthquakes (Plant and Griggs 1990; Griggs and Scholar 1997) and long-term climate change on a multidecadal to century scale (Inman and Jenkins 1999). Internal factors include the autocyclicity inherent to many bluff failure mechanisms (Leighton and Associates Inc. 1979; Hampton and Dingler 1998) and bluff response to continued toe erosion (Sunamura 1992).

Despite the episodic nature of coastal bluff retreat, it is necessary to identify the future long-term bluff retreat rate in order to establish appropriate development setbacks. The episodic nature of bluff retreat makes any calculated rate highly dependent on sampling interval. To illustrate the dependence of calculated long-term bluff retreat rates on sampling interval, it is useful to perform a sensitivity analysis from real data. Unfortunately, there are insufficient data to perform a meaningful analysis for any one site in California. Accordingly, a synthetic data set was created as part of this study.

A Synthetic Data Set. Creating and examining a synthetic data set allows for testing the effects of sampling on the determination of long-term bluff retreat rates. The long-term retreat rate is, by definition, known for the synthetic data set. Further, a synthetic data set can be created that is both longer and more complete than any such data set available from nature. The data set considered here (available upon request from the author) was created for a hypothetical 200-year period, assigned the dates 1800-2000. Figure 2 is a graphical representation of the data set, and charts the progressive retreat of the hypothetical bluff edge through that time period. Although the data are fictitious, they roughly correlate with well-known periods of episodic erosion in coastal California, at least for the second half of the data set.

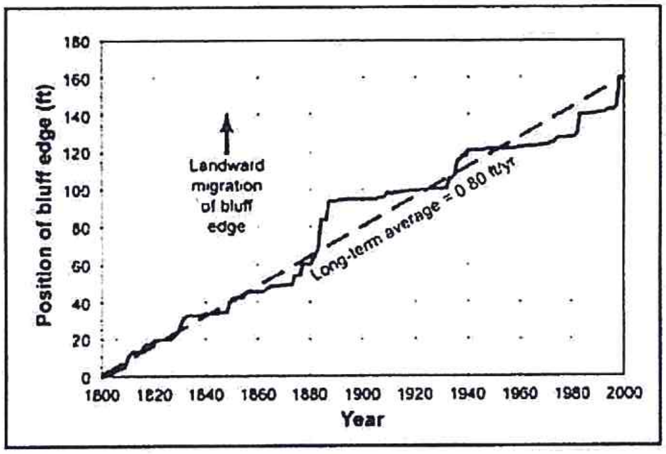

Figure 2. Plot of the position of the top edge of a hypothetical coastal bluff over time. These data represent a synthetic data set that is meant to roughly mimic typical episodic bluff retreat. Although fictitious, the data correlate well with what is know of temporal variations in erosion rate for a typical California bluff experiencing moderate erosion. The data set is far more complete than actual data available at any given site, however, making possible a sensitivity analysis of sampling interval on the calculation of the long-term bluff retreat rate.

Moving averages. A standard statistical method to smooth spikes in data is to average the data over a window of some width, while moving that window through the data set. Figure 3 shows the effect of applying this technique to the synthetic data set, using averaging windows of various widths. The first derivative of the curve representing bluff edge position through time (Figure 2) is the "instantaneous" bluff-retreat rate, and varies from 0 to 15 ft/yr for the synthetic data set (Figure 3). As the averaging window increases in width, the maximum retreat rate values decrease and the minimum values increase, effectively smoothing and broadening the "peaks" representing episodic erosion events. Depending on how the window is centered on the point representing the window average, peaks may be offset in time as well. With the widest sampling windows, peaks are essentially eliminated, and the retreat rate calculated approaches the average long-term retreat rate for the entire data set (0.80

ft/yr). Note that it is only when the window width approaches (and exceeds) 50 years in width that the calculated bluff retreat rate approaches the long-term average rate.

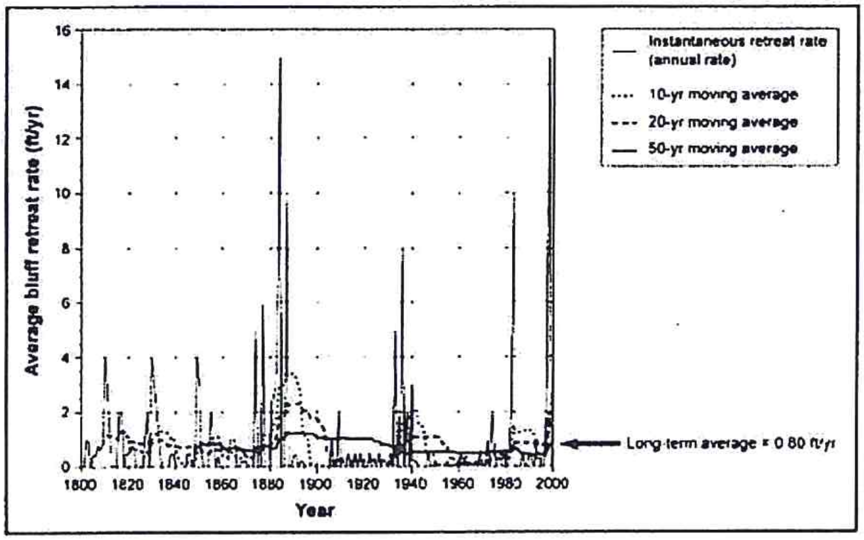

Figure 3. Average annual bluff retreat rate calculated from the synthetic data set using moving averages with various averaging window sizes. Only when data are averaged over ~50 years or more does the calculated annual bluff retreat rate approach the known long-term average for the data set.

Data gathered at intervals. Data regarding bluff edge position are almost always gathered at widely spaced intervals, corresponding to the dates of surveys or photographs. This precludes the use of a moving average technique, which depends on continuous data. Figure 4 shows the calculated bluff retreat rates at regularly spaced intervals of 10, 20, and 50 years. A wide range of values for the bluff retreat rate are obtained at the shorter sampling intervals. Although short sampling intervals give the most information on the variability of bluff retreat, the best estimate of the long-term bluff retreat rate is provided by sampling at long time intervals. Even at these long time intervals, if a statistically greater- or lesser-than-average number of "episodic events" are included in the sample, then the bluff retreat rate calculated for that interval will seriously over- or underestimate actual the long-term average bluff retreat rate.

Principal observations from the synthetic data set. A few simple generalities can be made from this limited analysis. First, instantaneous bluff retreat rates can exceed the long term average rate by a factor of many times. This is also true for data collected at short (= ~10 years for the synthetic data set) time intervals. Second, data collected at relatively short time intervals give useful information on the episodic nature of bluff retreat, but do not provide accurate estimates of long-term average bluff retreat rates. Third, the best estimate of long-term average bluff retreat rate is obtained by sampling over long (= ~50 years for the synthetic data set) time intervals. Finally, in order to accurately estimate the long-term bluff retreat rate, a stochastically appropriate number of episodic events must be included in the sampling interval. These observations, as well as similar observations from real data, lead to the general guidelines for estimating the long-term average bluff retreat rate at a site that are presented in Table 2.

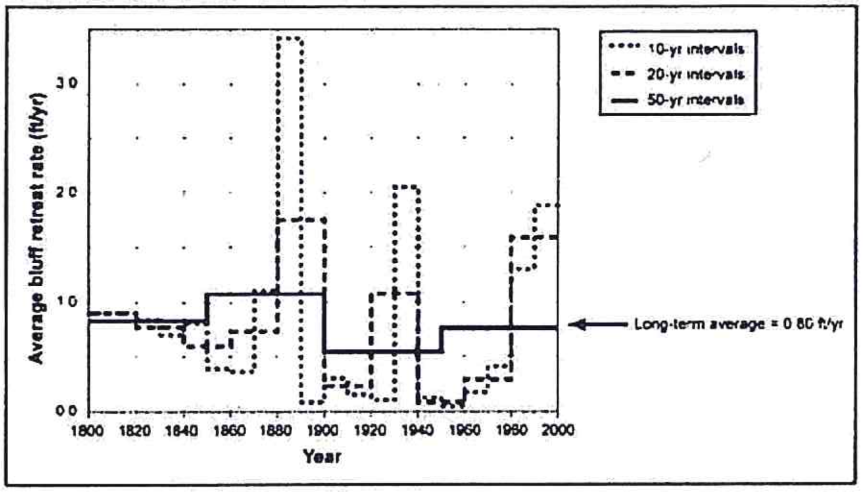

Figure 4. Average annual bluff retreat rate calculated from the synthetic data set using discrete sampling intervals of various sizes. Only when data are sampled at intervals of ~50 years or more does the calculated annual bluff retreat rate approach the known long-term average for the data set.

Establishing setbacks for long-term bluff retreat. Once an historic long-term bluff retreat rate has been estimated, establishing a setback for long-term bluff retreat rate is a simple matter of multiplying that rate, B, by the design life of the development, t. This is equivalent to predicting the position of the coastal bluff edge at the end of the design life of the structure (Figure 5).

Although this is the usual method of establishing setbacks for long-term bluff retreat in California, inherent assumptions and difficulties must be born in mind. Foremost among these is the necessity of defining the design life of the development. Because the landward retreat of an unarmored shoreline is inevitable and ongoing during a period of relative sea level rise, it is impossible to assure the safety of development from coastal erosion unless a time frame is assigned at the onset. But assigning a design life is difficult, and there is nothing in land use law that requires the abandonment of development at the end of its assigned design life.

Other problems associated with this type of analysis revolve around its inherently historic approach. There is no *a priori* reason to believe that bluff retreat rates are, or will continue to be, linear. This is especially relevant in light of expected acceleration of the historic rate of sea level rise as a result of global warming (Intergovernmental Panel on Climate Change 2001). Further, there is good evidence that erosion rates can be highly variable through time (Jones and Rogers 2002). For all of these reasons it is important to adopt a conservative approach to estimating long-term bluff retreat rates.

Table 2. Guidelines for establishing long-term bluff retreat rates

1) Determine bluff edge positions at as many times as possible, but covering a minimum of about 50 years and extending to the present. Common data sets include vertical aerial photographs, surveys that identify the bluff edge, and detailed topographic maps. These sources must be of sufficient scale or precision to locate accurately the position of the bluff edge to within a few feet.

2) If aerial photographs are used, the best results are obtained through photogrammetric methods, whereby distortions inherent to aerial photography are corrected (orthorectified). Even if photogrammetric methods are not used, the scale of the photographs must be carefully determined by comparison of the image size of known features to their actual size.

3) When comparing bluff edge positions on aerial photographs or unanchored surveys, a "shoreline reference feature" must be identified that has been static through time and is identifiable in each data set. Bluff positions throughout the area of reference can be measured relative to this feature. Common shoreline reference features are road centerlines, structures, large rock outcrops, or trees.

4) When comparing bluff edge positions on surveys, it is critical that the same criteria for the identification of the bluff edge was used in each survey. The Coastal Act definition of a bluff edge can be found in California Code of Regulations, Title 14, § 13577 (h) (2).

5) Although the short-term erosion rate for each time interval between data points provides valuable information regarding the nature of bluff retreat at the site, the long-term erosion rate should be determined from the extreme end-points of the time series examined. This time series should exceed 50 years in length, and should include both relatively quiet periods, such as the 1950's-1960's; and the more erosive subsequent time periods (especially the 1982-1983 and 1997-1998 El Niño winters).

6) In larger study areas, the bluff retreat rate should be determined at intervals along the bluff edge, paying special attention to potential differences in retreat rate between headlands and coves, and amongst areas underlain by differing geologic materials.

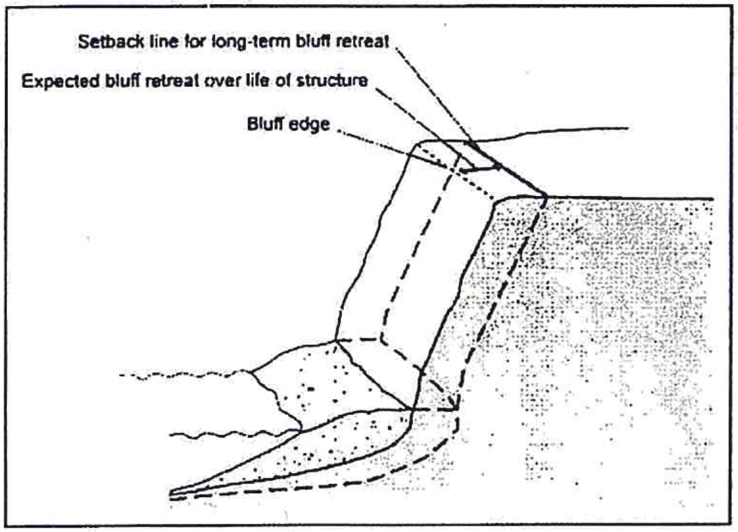

Figure 5. Establishing a development setback for long term bluff retreat. The expected bluff position at the end of the development's useful life is found by multiplying the average annual bluff retreat rate by the design life of the development; this line is taken to represent the minimum setback for long-term bluff retreat.

Uncertainty

There is a great deal of uncertainty in many parts of the analysis discussed above. The deterministic approach outlined here does not deal well with such uncertainty. Various methods have been used to build in some margin for error in establishing safe building setbacks. One approach, commonly used by geologists working in northern California, is to multiply the long-term bluff retreat rate by a factor of safety (used in a different sense than for slope stability), generally ranging from 1.5 to 4.0. More commonly, a simple "buffer" is added to the setback generated by multiplying the long-term bluff retreat rate by the design life of the structure. This buffer, generally on the order of ten feet, serves several functions: 1) it allows for uncertainty in all aspects of the analysis; 2) it allows for any future increase in bluff retreat rate due, for example, to an increase in the rate of sea level rise (Bray and Hooke 1997; Watson 2002); 3) it assures that at the end of the design life of the structure the foundations are not actually being undermined (if that were to be the case the structure would actually be imperiled well before the end of its design life); and 4) it allows access so that remedial measures, such as relocation of the structure, can be taken as erosion approaches the foundations. If a slope stability setback is required (*i.e.*, if the bluff does not meet minimum slope stability standards), that setback can do double duty as this buffer.

Summary: Defining the Total Setbacks for Bluff-Top Development

To define the total development setback, one must combine the two aspects of the setback considered above: the setback to assure safety from landsliding or block failure, and the setback for long-term bluff retreat. The resulting setback assures that minimal slope stability standards are maintained for the design life of the structure.

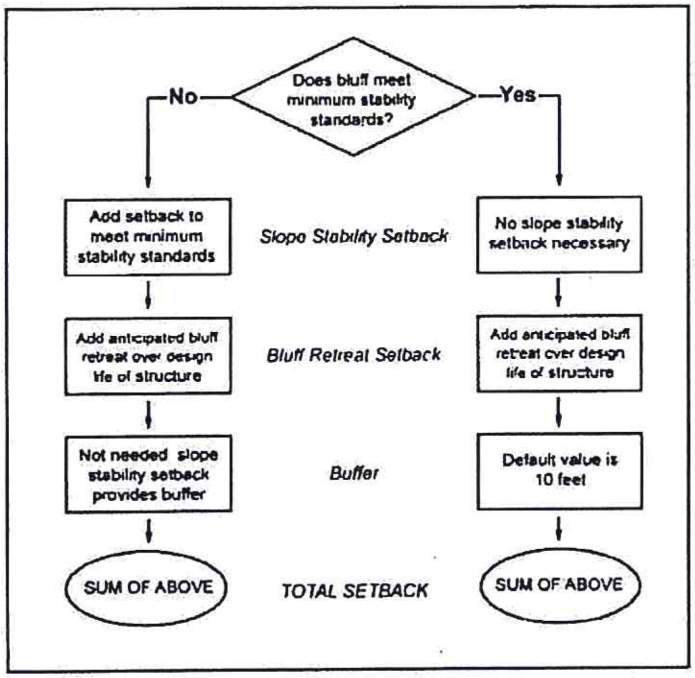

Figure 6. Flowchart for establishing bluff edge setback for development, taking into account stability of the bluff, long-term bluff retreat, and uncertainty in the analysis.

A methodology for combining these setbacks is outlined in Figure 6. First, it must be determined whether the coastal bluff meets minimum slope stability standards. Normally, this will be a factor of safety of 1.5 (static) or 1.1 (pseudostatic). If the answer to this question is "yes," then no setback is necessary to assure slope stability. If the answer is "no," then it is necessary to determine the position on the bluff top where the minimum slope stability standards are attained. This position, as measured relative to the bluff edge, is the setback necessary for slope stability determined as described above. In the case of block failure of an overhanging bluff or collapse of a sea cave, the setback necessary to assure stability from this type of collapse is equivalent to the slope stability setback. Although the current state of the science makes it impossible to quantitatively assess stability relative to this type of failure, a conservative, yet realistic, setback line is the projection of a vertical plane from the rear wall of the overhang or sea cave on the bluff top. If the plane does not intersect the bluff top (*i.e.*, intersects the inclined bluff face seaward of the bluff edge), then no setback for this type of collapse is necessary.

The next step is to determine the expected bluff retreat over the design life of the structure, as described above. This setback is added to the slope stability setback, if any.

Finally, a buffer, generally a minimum of 10 feet, should be added to address uncertainty in the analysis, to allow for any future increase in the long-term bluff retreat rate, to assures that the foundation elements aren't actually undermined at the end of the design life of the development, and to allow access for remedial measures. A buffer is not necessary if the slope stability setback equals or exceeds about ten feet, as it can do "double duty" as both a setback to assure slope stability and a buffer for the purposes listed above.

The total setback is meant to assure that minimum slope stability standards are maintained for the design life of the development. Inherent in this analysis is the assumption that factors affecting slope stability (steepness and shape of the slope, ground water conditions, geometry of rock types exposed in the bluff) will remain constant through the design life of the development, that the future bluff-retreat rate will be linear and of comparable magnitude to the historic rate, and that the nature of erosion processes at the site will remain unchanged. All of these assumptions are potentially flawed, but in the absence of convincing evidence to the contrary, are a means of establishing reasonable development setbacks.

Towards Probabilistic Coastal Erosion Hazard Assessment

The deterministic approach presented above is based on established geologic and engineering principals, and similar approaches have been used to establish development setbacks from slope edges throughout the world for some time. However, the approach suffers from its limited ability to consider uncertainties in the analysis. Probabilistic approaches, on the other hand, inherently consider analytical uncertainties, and allow for a better definition of risk. This type of risk assessment has been routine for decades in the field of hydrology, where design basis and land use priorities are based on the magnitude of the "100-year flood," for example. Probabilistic coastal hazard assessment similarly can be used to quantify the likelihood that the bluff edge will erode to any particular point on a bluff top in a given time. Then, by establishing an acceptable level of risk (for example, a probability of <5% that the bluff edge will reach a certain point over the design life of the development) a setback line can be established that inherently includes uncertainties in the analysis. Just as the seismological community has moved away from deterministic methods towards probabilistic ones, such an approach allows for better consideration of the uncertainties in estimating future coastal erosion.

Probabilistic coastal hazard assessment is in its infancy, and no standardized methods have won acceptance—or even much discussion. The failure of coastal bluffs along Lake Michigan through landsliding has been assessed probabilistically by Chapman and others (2002), through the use of probabilistic slope stability analyses. Lee and others (2001) applied a variety of probabilistic methods to questions of coastal bluff retreat in England. Methods that they evaluated include the simulation of recession of episodically eroding cliffs through Monte Carlo techniques, the use of historical records and statistical experiments to model the behavior of cliffs affected by episodic landslide events, event-tree approaches, and the evaluation of the likelihood of the reactivation of ancient landslides. All of these techniques show promise, but the authors restricted themselves to specific cases. What is needed is the development of probabilistic methods that will work in more general cases, and combine both slope stability and long-term bluff retreat considerations. One way to approach this problem is to consider separately the two aspects of defining a development setback as outlined above.

Probabilistic slope stability analyses already are routine (Mostyn and Li 1993: Yang et al. 1993). In addition to quantifying the probability of slope failure (something not done in a deterministic slope stability analysis, which only establishes whether or not failure will occur), probabilistic slope stability analysis allows for consideration of variability or uncertainty in soil or rock strength parameters (Lumb 1970). Uncertainties in these input parameters are quantified by the standard deviation of each parameter. Then, using Monte Carlo techniques, a probability distribution for the factor of safety associated with any given failure plane is produced. From this, the probability of failure along the chosen potential failure plane can be calculated. The probability of failure is the probability that the factor of safety will be less than 1.0, and can be calculated for any given potential failure surface. By performing such analyses on a variety of potential failure surfaces intersecting different portions of the bluff top, a probability could be assigned to any position on the bluff top quantifying the likelihood that a failure will occur landward of that point.

Although not routine, several possibilities present themselves for developing probabilistic models for gradual, episodic, bluff retreat. Perhaps the simplest method of quantifying uncertainty is the application of a confidence interval to the estimate of the long-term average bluff retreat rate. Each time interval examined in estimating this rate is one sample of the mean value. For normally distributed data (or data that can be transformed to a normal distribution by, for example, a log transform), the sample standard deviation is a traditional estimate of uncertainty. There is a ~68.26% probability that the true mean value will lie within ±1 standard deviation of the sample mean. Different probabilities apply to different multiples of the standard deviation. Thus, uncertainties in the product ($B \times t$), above, can be quantified and contoured on the bluff top. For populations that cannot be shown to be normally distributed (likely the case with the small sample sizes available for bluff retreat rates), a better estimate of uncertainty may be a confidence interval based on Student's t distribution, or on nonparametric statistics.

A second approach to probabilistic assessment of coastal bluff recession is to treat annual bluff retreat in a manner analogous to river floods. Thus, the recurrence interval of a particular amount of annual bluff retreat can be calculated by the formula

$$R = \frac{N+1}{M}$$

where R is the recurrence interval, N is the number of years of record, and M is the rank of the annual bluff retreat in the total data set. For the synthetic data set considered above, there are many duplicate values due to the limited precision with which bluff retreat data are generally reported. Eliminating duplicates, and ranking the annual bluff retreat rates, recurrence intervals can be calculated. These data can be graphed in order to arrive at the expected amount of bluff retreat for any particular recurrence interval (Figure 7). The inverse of the recurrence interval is the annual probability that a given amount of bluff retreat will be exceeded. Such data may be especially valuable in assessing the risk of occurrence of an episodic event sufficient to threaten an existing structure.

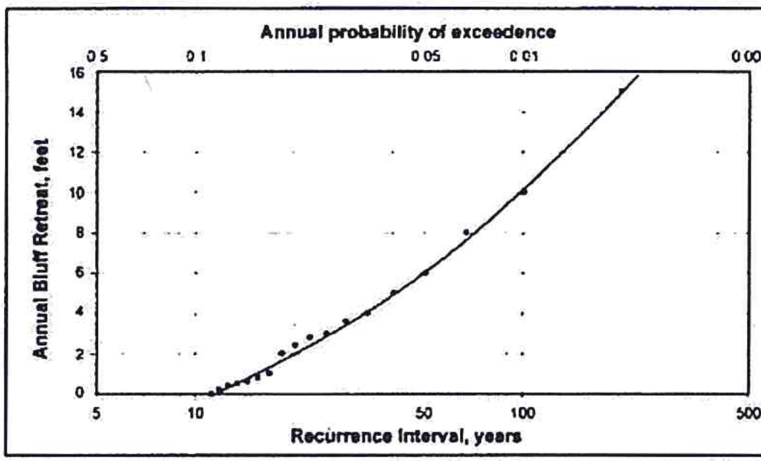

Figure 7. Recurrence interval for annual bluff retreat, calculated for the synthetic data set. The recurrence interval, calculated in a manner analogous to flood recurrence interval, gives the average time between years with a given amount of bluff retreat. The inverse of the recurrence interval is the statistical probability that a given amount of bluff retreat will occur (or be exceeded) in any given year.

The total risk to bluff-top development, which includes both long-term bluff retreat and slope failure, can be calculated by multiplying the probability of slope failure at a given position by the probability that bluff retreat will reach that point by a given time. The geotechnical and planning communities will need to establish what is an acceptable probability, or risk, that the bluff will reach a given point in order to develop setback criteria. Once that probability is established, the setback line can be defined as the locus of points on the bluff top at that probability.

A prime difficulty in applying probabilistic methods to assessing coastal erosion risk will be the difficulty in acquiring sufficiently rich data sets with which to work. More effort is needed at acquiring long, precise data sets on coastal erosion in a variety of geologic conditions throughout the state.

Acknowledgements

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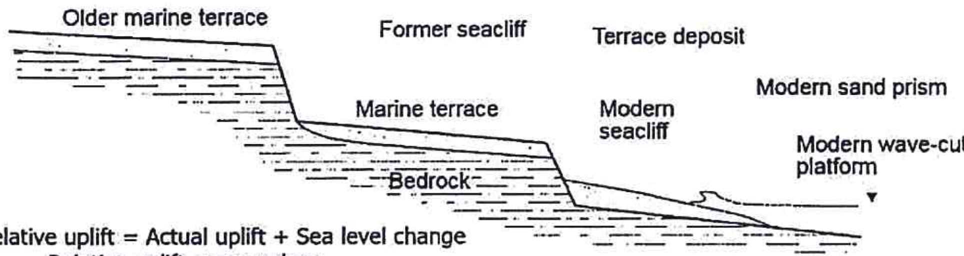
A Primer on Coastal Bluff Erosion

Mark J. Johnsson, Staff Geologist, California Coastal Commission

Seacliffs and coastal bluffs are formed by a rapid uplift of the shore relative to sea level. When the relative uplift of the shore is slow or zero, a wave-cut terrace is formed



Relative uplift = Actual uplift + Sea level change

Relative uplift occurs when:

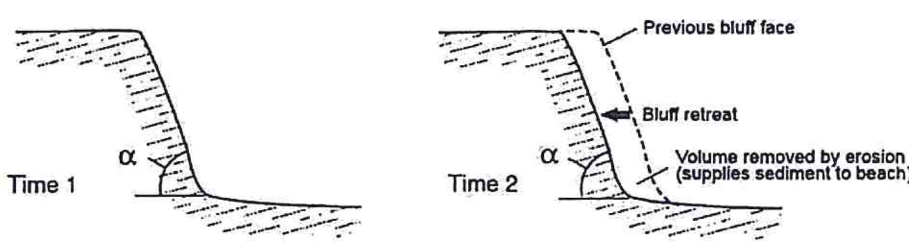
1) Shore rises; sea level falls, is stable or rises at a lower rate than shore; or
2) Shore is stable; sea level falls; or
3) Shore falls; sea level falls at a faster rate

Relative uplift is zero when shore and sea level rise or fall at the same rate (which may be zero)

The term "coastal bluff" refers to the entire slope between a marine terrace or upland area and the sea. The word "seacliff" refers to the lower, near vertical portion of a coastal bluff. Erosion of the entire seacliff-bluff system must be considered together.

Coastal Bluff Retreat

The question of how slopes erode is one of the oldest problems in geomorphology. Much argument has revolved around models calling on parallel slope retreat, versus slope erosion by flattening - the answer may lie somewhere between the two extremes. In any case, steep bluffs tend to erode parallel to the bluff face at an equilibrium stability angle, α. In unconsolidated materials this angle is known as the "angle of repose." α is a function of material strength. A bluff will erode through various mechanisms to establish and maintain the characteristic slope angle for the material of which it is composed.



If a bluff becomes oversteepened (slope angle greater than α) through non-equilibrium erosion (such as marine erosion at the toe of a seacliff), it will be unstable and will tend to erode back to α - perhaps through sudden collapse (landslide, rock fall)

If the rate of erosion as well as α are different for the different materials making up the bluff, then the bluff will develop a bench (if erosion is faster in the upper unit) or overhang (if erosion is faster in the lower unit)

Because material is removed most rapidly from bluff tops and tends to accumulate at the base of bluffs, the overall steepness of the slope appears to decrease through time; but the active part of the slope retreats at the long-term equilibrium stability angle, α, despite short-term departures from this angle.

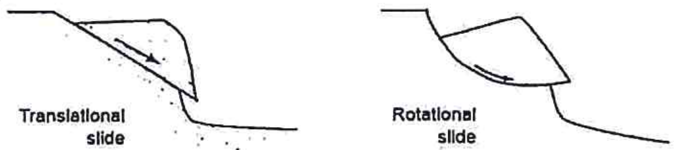
Mechanisms of Bluff Erosion

Sheetwash: Material loosened and carried down bluff by water flowing over its face as a film or sheet

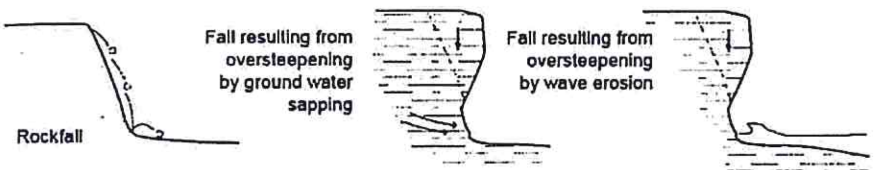
Gullying and rilling: Organization of water flowing over bluff into distinct drainage systems or gullies; concentrates flow energy in narrow portion of bluff, increasing its erosive capacity

Creep: On shallow slopes consisting of poorly consolidated material, sediment may move downslope slowly as a coherent mass

Sudden bluff collapses may take several forms:



Falls: Vertical (or nearly so) movement of coherent masses of material



Erosional Agents Involved in Bluff Erosion

Surface runoff: Promotes sheetwash, rilling and gullying
Ground water: Promotes creep, facilitates slumps and slides
Marine erosion (wave attack): Oversteepens cliffs (above equilibrium stability angle), facilitating slumps, landslides and falls. Exacerbated by wave-driven projectiles (logs, cobbles, etc.)
Wind erosion: Usually less important, but may erode cohesionless sands
Other agents may be important in some situations: e.g., slaking through alternate wetting/drying; wedging by salt crystals, etc.

Role of the Beach

Affects only marine erosion

Protective beach
Wave energy partly absorbed by beach

No beach
Wave energy delivered to bluff

Offshore bar or reef
Wave energy partly absorbed far offshore

Key issues affecting mechanisms and rate of bluff erosion

- Material strength
  - Rock type
  - Cementation
  - Fractures and orientation
  - Weak planes (e.g., clay seams)
  - Clay content (expandable clays)
- Bluff/beach geometry
- Wave energy
  - Aspect and exposure
  - Local effects (e.g., wave refraction)
  - Protective beach
  - Offshore bars or protective devices
- Surface runoff over bluff
- Presence/absence of ground water

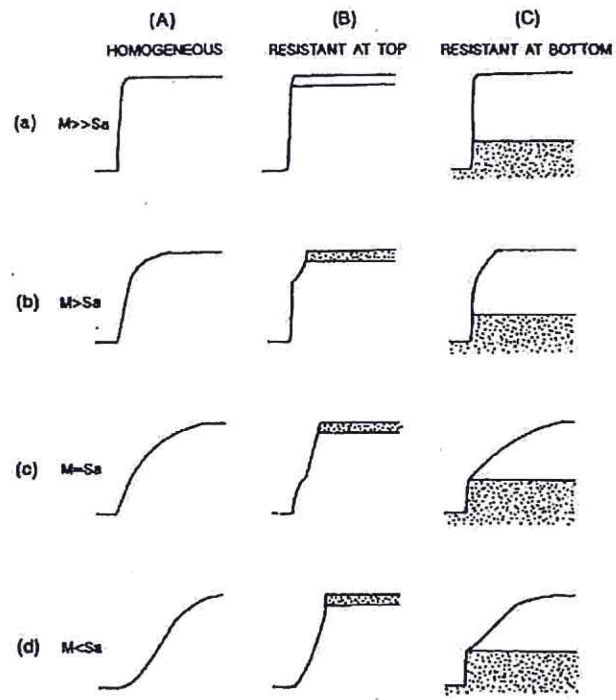
Bluff shape reflects the relative roles of surficial, marine, and ground water erosion acting on the materials making up the bluff

COMPOSITE BLUFFS

Many coastal bluffs in California are composed of more than one type of material; commonly a poorly consolidated marine terrace overlying a better consolidated sedimentary bedrock.

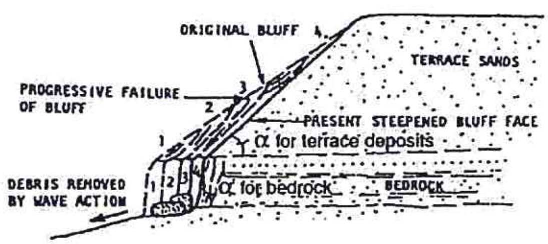
Erosion of seacliffs is through a combination of marine and subaerial processes. The relative importance of each of these processes, together with the relative durability of the various rock layers comprising the bluff, determine the overall geometry of the bluff.

The twelve profiles to the right reflect varying positions of durable units and variable relative importances of marine (M) versus subaerial (Sa) erosion.



(from Emery and Kuhn, 1982)

PAIRED, EPISODIC FAILURES



Composite bluffs commonly fail in paired sets: an initial block failure of a resistant lower unit leaves the weak upper unit unsupported, which will fail as a rotational slide or slump soon thereafter. The process is repeated episodically.

(modified from Leighton and Associates 1979)

POLICY ISSUES AND OPTIONS

Building in areas safe from bluff erosion - establishing setbacks

Bluff retreat rates:

- Represent long-term averages useful over economic lifespan of development; useless over shorter timespans due to episodic nature of bluff retreat
- Should be based on long time series of data, including both relatively quiescent periods in mid-twentieth century, and more active period beginning around 1980 (including El Niño winters of 82-83 and 97-98).
- Data sets: Aerial/satellite photography, topographic surveys, GPS surveys, LIDAR
- Setback = (annual average retreat rate) x (economic lifespan of development) + (buffer)

Slope stability analysis:

- Based on a quantitative model of stability of slope
- Establish likelihood of sudden (catastrophic) failures; currently largely limited to landslide hazards
- Data sets: material strength (cohesion, friction angle) and weight; slope geometry
- Setback = area behind the 1.5 factor of safety line (i.e., forces resisting landslide movement are 1.5 times as great as forces driving landslide)

Remedial measures - alternatives analysis

Control surface runoff:

- Direct runoff away from slope; regrade top of bluff, install berms and swales, extend drainage culverts down face of bluff
- Collect water on bluff face and carry it away through impervious channels/pipes

Control ground water:

- Reduce infiltration: Restrict irrigation, increase hardscape, install clay caps, plug and control rodent burrows
- Lower ground water levels: Install horizontal drains (hydroaugers), pumping wells

Protect base of bluff from marine erosion:

- Establish sand beach, maintain through nourishment
- Offshore structures: groins, submerged artificial reef, breakwaters, etc.
- Seawalls and revetments

Protect overly steep upper bluff:

- Remove and recompact soil; use of geogrid reinforcement
- Upper bluff retaining walls, shotcrete walls, soil nails, tieback anchors, etc.

"Correct" bluff geometry:

- Seacave and notch infills
- Regrade bluff, remove and recompact soil, possibly use of geogrid reinforcement

Negative effects of seawalls and bluff retaining devices

- Fix back of beach; as front of beach moves landward during sea level rise, beach disappears
- Retain sand in coastal bluff which would otherwise have become available to replenish the beach
- Encroach on public beach, reducing area of beach
- May limit vertical and lateral access to beach
- Visual impacts

§30235 of Coastal Act and CEQA require approval of shoreline protective structures only when:

- Required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion
- Designed to eliminate or mitigate adverse impacts on local shoreline sand supply
- The least environmentally damaging alternative available

Some points to bear in mind...

Coastal bluff collapse and retreat are natural erosional processes

Coastal bluff erosion is caused by a combination of processes

Bluff retreat can be stopped or slowed significantly through sufficient engineering

Engineered structures may have negative visual, access, and secondary erosional effects

Grover Hollingsworth and Associates, Inc.

August 1, 2013

Chip Wullbrandt
Price, Postel & Parma LLP
200 East Carrillo Street, Suite 400
Santa Barbara, California 93101

Re: 2825 Padaro Lane
Summerland Area, Santa Barbara County
County of Santa Barbara Project No.: VT-24597-03

Dear Chip:

I have reviewed the reports submitted by Earth Systems Southern California regarding the property located at 2825 Padaro Lane. Based on the data and analyses contained in those reports I have mapped the "1.5 Safety Factor Line" and the "Structure Setback Line" as shown on the attached map. These two lines are separated by the expected 75 year bluff retreat distance discussed by Earth Systems.

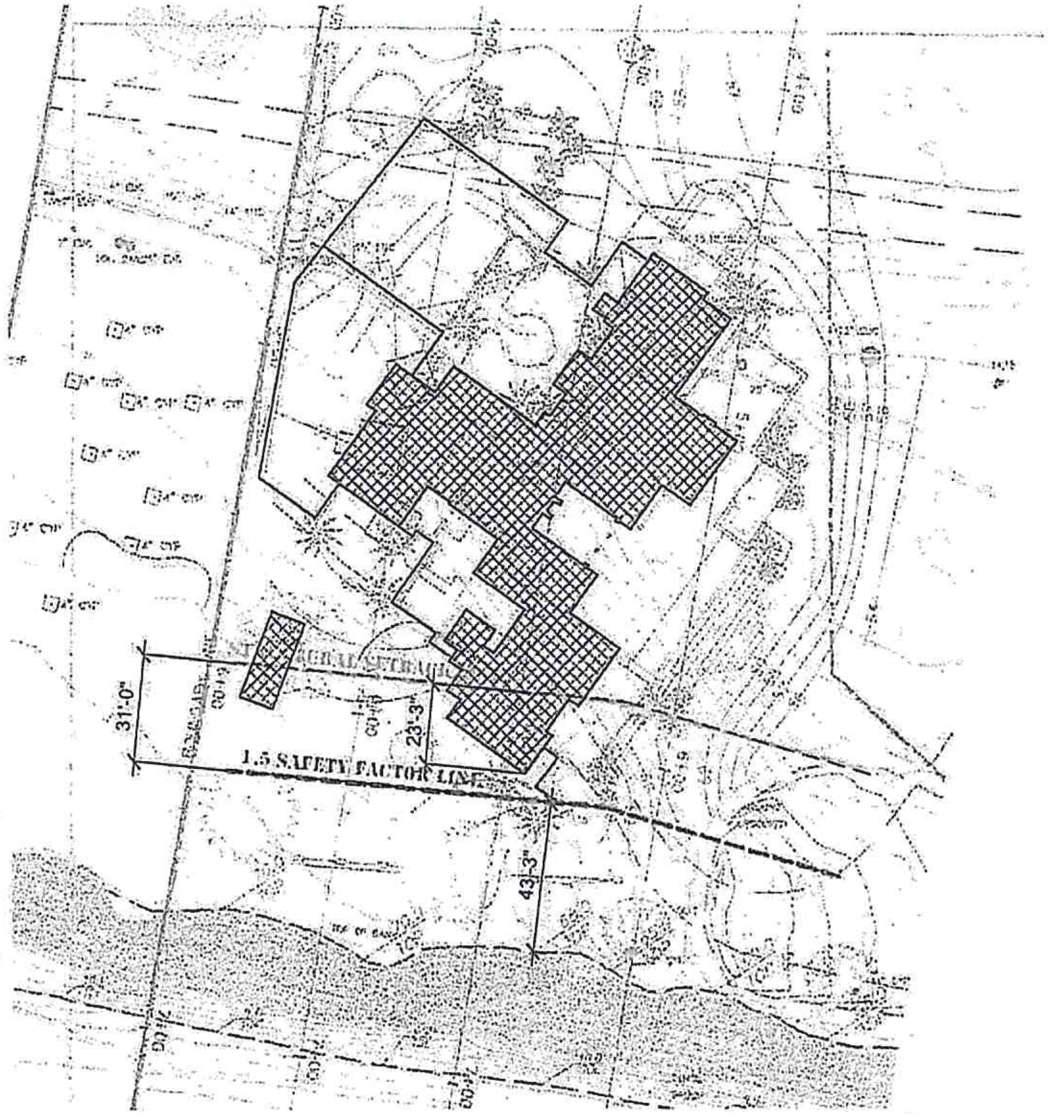
It is my understanding, based on experience throughout the Coastal Zone, that all structural development must be setback beyond the point where the site has a factor of safety of 1.5 with respect to deep seated stability plus the expected bluff retreat over a 75 year period. Based on the information presented by Earth Systems that line is the "Structure Setback Line" shown on the attached map.

If you have any further questions or would like any further explanation, please do not hesitate to call.

Robert A. Hollingsworth
E.G. 1265/G.E. 2022

REGISTERED PROFESSIONAL ENGINEER
ROBERT A. HOLLINGSWORTH
NO. 2022
EXP. 9-30-13
GEOTECHNICAL
STATE OF CALIFORNIA

Grover-Hollingsworth Assoc., Inc.
31129 Via Colinas, Suite 707
Westlake Village, California 91362
bob@ghageo.com
(818) 889 0844



2825 PADARO LANE - SITE PLAN
SCALE: 1/32" = 1'-0" SEPTEMBER 09, 2013

From: Gerber, Joyce
Sent: Wednesday, September 04, 2013 8:35 AM
To: Briggs, Errin
Cc: Almy, Anne
Subject: Public comment for Beach Club DND

Errin,

I received a phone call from Patrick Tumamait [(805) 216-1252]. Mr. Tumamait requested that I provide you with his comments on the Beach Club project (11CDH-00000-00006 & others). I took notes on what he told me, then read them back and received his confirmation that they accurately represented his concerns. His comments are as follows:

- He would like a letter of apology from the owner for grading in the archaeological site.
- He believes that the gabion wall fill (the soil between the rocks) could contain human remains.
- When the deck is removed, he is concerned that laborers will pick up cultural materials. He would like to make sure that the Native American and archaeological monitors will not allow that, and that there is a pre-construction meeting to inform the workers that such activities are not allowed.
- He would like to know what the MLD will deal with any human remains that are identified during work at the site.

Joyce L. Gerber, M.A., RPA
County of Santa Barbara Planning and Development Department
Development Review Division
624 W. Foster Road, Suite C
Santa Maria, CA 93455
(805) 934-6265