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To: To the individuals listed on the last page, from Sierra Railway Company, Mendocino Railway, Fort Bragg City Staff and Council, Sherwood Valley Band of Pomo Indians, Department of Toxic Substances and Control, California Coastal Commission Staff, Division of Safety of Dams, California Department of Fish and Wildlife, and Water Control Board

Subject: Adding a "Third Pathway" for Mill Pond clean-up on the Fort Bragg Headlands

This letter is towards the mission of a robust Fort Bragg economy via smart growth on the Headlands. Smart growth requires smart decisions. In practice it means maximizing the economic, aesthetic, recreational, and ecological opportunities of the Fort Bragg Headlands while yielding a sizable profit for the investors. It is the proverbial win-win scenario.

As of the latest public notification in August 2024 of the draft plan for studying the clean-up of the old Mill Pond (Pond 8),¹ there are essentially two proposed pathways.

One pathway is to truck the entire sediment load to Kettleman City in the Central Valley, then remove the dam, berm, and rock rip rap. The beach, lowland, and estuary could then return to its natural state, which would be great for the economy. But this is very costly, and an ethical grey-zone.

The other pathway has 7 alternatives within it, and is to leave the pond infrastructure in place, in one form or another. Leaving in place is costly, risky in the long run with sea level rise, storm waves, and earthquakes; and makes the public access options of the sliver of an ugly beach and rock rip-rap barrier quite underwhelming (See Figure 1). Some of the alternatives do not allow for any public

¹ The 2019 Draft Feasibility Study is here: https://www.envirostor.dtsc.ca.gov/public/final_documents2?global_id=23240008&doc_id=60416830, and the August 2024 Draft Addendum has a table with the latest proposed alternatives to study: https://www.envirostor.dtsc.ca.gov/public/deliverable_documents/6596363663/24_corr-out_OUE%20FS%20Add_Draft%20Alt%20List_20240830.pdf



access due to safety concerns. This on its own seems untenable and a violation of the Coastal Act and the California Coastal Commission mandate, but that debate is beyond the scope of this letter.



Figure 1. Picture of the area in question from above Soldier Bay. The old Mill Pond (Pond 8) is on the right, held in place by the dam and the earthen berm. Pond 7 is the most toxic but cannot be excavated without compromising the berm. The rock rip-rap armours Pond 7 and the berm from storm waves. The proposed alternative herein would remove all of this infrastructure and allow for a natural restoration of the beach and lowlands.

Leaving the infrastructure in place misses huge opportunities for increasing property values via improved recreational and public access, and, given new information, it appears to have a lower return on investment (ROI) than the third, not yet studied, pathway.

This Third Pathway is a hybrid between the two existing pathways. **It is to move the entire Mill Pond, and the infrastructure, and the lowland ponds, but only truck a very small percentage of the contents to Kettleman City (e.g. less than 10%, and ideally ~1%), not all the contents.** Details of how this could be possible are below.



Removal of the dam, berm, and rock rip-rap constraining the beach would in turn allow for the removal of the sediments from the most hazardous remaining pond, Pond 7, that is below the berm and hence cannot be fully removed currently.

All this would allow for a clean slate, allowing for a much larger beach, a natural estuary, and a great place for people to go!

This place being so close to Downtown and the proposed development of the rest of the Headlands will dramatically increase the property values and draw of the whole city, and especially the Headlands developments. It will make the Headlands truly world class and have a cascade of beneficial impacts. And of course it is better for us all and the ecosystem in the long run. Further, there are many federal and state funding streams that could fund this pathway.

Yes, there are unknowns that need to be resolved, but that is the point of a feasibility study; to examine the unknowns and to get some dollar figures to the required actions. Hence, please add this pathway to the list of alternatives in the Draft Feasibility Study Addendum now before the April 3 deadline for the revised addendum. This would be via one, two, or three alternatives detailed below.

Introduction

For those of you that do not know me, and hence the context of this letter, here is an introduction. I grew up here on the Coast, left for college, started my career, went to graduate school, then to a post-doc on the other side of the world. In 2013 I got a career job where I could work remotely. At this point, with options galore, my wife and I chose to move here to the Mendocino Coast to raise our family. Hence, I love this place and am vested in its long term sustainability. As such, I co-founded and am Chair of the Fort Bragg Headlands Consortium (FBHC), a science-based group of organizations and individuals leveraging its technical expertise to promote informed and engaged communication within the community about the redevelopment of the Fort Bragg Headlands. Among other contributions, we have made this [map gallery](#)², including the map of OU-E with elevation levels and sea level rise indications. I am also Senior Conservation Scientist at Conservation Biology Institute, the organization that created the mapping platform for the above gallery. In a nutshell, we provide data-driven land-use solutions for meeting the needs of society and the environment at the same time. My CV is

² <https://databasin.org/galleries/e3cfe7329ba04dbfb7434618daa919ab>



linked from my [staff page](#)³. In short, I strive to be a jack of all trades, master of some, and so I can help with the initial vision and research of this pathway, below.

How would the Sediments be treated?

The soils and sediments could be treated via a workflow that could be determined during the revised feasibility study. Step 1 would be the initial, onsite treatment of the materials utilizing new technologies and discoveries that are in process compared to those around in the 2000s when this was last discussed. Ideally the cost, feasibility, and efficacy of each is determined. It may be that a combination or sequence of treatments is recommended and/or treating sediment and soil differently.

These potential treatments include:

- a. new technology like
 - i. ecospears (ecospears.com),
 - ii. HALT (aquagga.com/ourtech),
 - iii. Plasma (onvector.us/technology),
 - iv. and others,
- b. [bacterial remediation](#)⁴, and
- c. [fungal remediation](#)⁵

See the webpages, footnotes and the Addendum (“Can fungal and bacterial approaches address dioxins and furans?”) for more on this.

Step 2 would be the distribution of the treated materials to a variety of locations, depending on how many types of materials the load could be separated into. If three groupings, then the most hazardous remains could be shipped to Kettleman City, the less hazardous remains could be put in a Consolidation Fill on site, and the safe materials could be deposited in an alternate location nearby that is permitted such as an existing or new landfill in Mendocino County. Further, the cleanest group of the soils/sediment, if it meets adequate standards and gets the required permits,

³ <https://consbio.org/people/john-gallo/>

⁴ A starting point: Use of immobilized bacteria for environmental bioremediation: A review. <https://www.sciencedirect.com/science/article/abs/pii/S2213343721008976>

⁵ A starting point: Fungal bioremediation: An overview of the mechanisms, applications and future perspectives <https://www.sciencedirect.com/science/article/pii/S2590182624000237>



could be deposited in the ocean.⁶ The number of groups and the percentages of each waste type could be estimated during the Feasibility Study.

It is worth noting that the current sediments and soil load, untreated, are not hazardous waste. Hence the draft feasibility study says the load would need to go to a “non-hazardous waste disposal facility” if disposed of. It is estimated that the nearest facility that is guaranteed to accept this sediment is 400 miles away, which is the distance to the Kettleman City, which has a hazardous waste facility.

It is either unknown or unstated if one or more northern California, possibly Mendocino County landfills would accept this “non-hazardous” soil, especially in knowing how good it would be for the county economy. *This should be addressed in the feasibility study of this option, namely, knowing the characteristics of the soil/sediment that would be accepted by the various local, northwestern CA landfills*, and estimating what percentage of the soil/sediment load would meet that/those standards. It may be that only a small percentage of the load would be required to go to Kettleman city unless treated. If this is the case, the costs and the greenhouse gas emission estimates of the “truck to kettleman city” alternative could be updated accordingly.

Some of you may remember that we tried a Consolidation Fill for the ash from OU-A. But that failed. It did not fail in principle, but in engineering. It was engineered incorrectly and started gathering water so needed to be trucked away. This incarnation of the onsite Consolidation Fill can be engineered properly to allow adequate drainage. It could be on one of the higher locations on the property, well away from the threats of sea level rise.

Some of you may also remember that GP studied the possibility of fungal remediation sometime around 2010. The fungi studied were not able to solve the problems of dioxin and furans, but that does not mean this whole line of thinking should be off the table. Maybe the right fungus or approach was not studied. Maybe there is much better science on this in the last 15 years. Maybe the fungi can treat the other contaminants like the PCBs. See the above linked studies which are more current and comprehensive, and see the appendices. Regarding the new technologies, it could be that some have the option of consolidating the toxins, such as the indication that the plasma approach can treat the soil but results in dioxin

⁶ Waste introduced to the ocean is allowed to be settleable material as long as it meets standards, such as being tested and not being over any of the thresholds for degrading benthic communities or other aquatic life. My initial inquiries with the Water Board indicate you would want to talk with Mona Dougherty who is in charge of the NPDES permitting unit, Craig Hunt who is the case manager for the RWB for the cleanup site and to Gil Falcone CWA section 401 permitting lead. Email addresses available upon request. Details are in the CALIFORNIA OCEAN PLAN Revised 2019. https://www.waterboards.ca.gov/water_issues/programs/ocean/docs/oceanplan2019.pdf



and furan byproducts. If these could be contained and separated safely then that could be a promising workflow.

What about Stormwater Polishing?

Removing the Old Mill Pond means that we will need to adjust to the new stormwater polishing requirements the same way that all the other coastal California cities that do not have a Mill Pond adjust. many are constructing ponds and/or bioswales for stormwater polishing. In this proposed pathway, we'll likely need to make at least one pond and/or a bioswale in the eastern portion of OU-E. Again, federal and state grants are available for this, and the long term benefits of this proposed pathway greatly outweigh this additional task.

How does this affect the vision for Creek Daylighting?

Creek Daylighting can occur for all three pathways discussed above. In the case of this proposed Third Pathway, there should be two alternatives studied (one with creek daylighting and one without), and ideally three alternatives. The best but most expensive version would be a pond and/or bioswale at the headwaters of Alder Creek on the site, near Alder Street, and a pond and/or bioswale at the headwaters of Maple Creek on the site, near Maple Street. This would yield the most length of cleaned up daylighted creek. The intermediate version could have one pond/bioswale that is lower in elevation and treats both creeks at once. In either case, the daylighted creek(s) downstream of the stormwater polishing station(s), would be much much longer and more aesthetically pleasing than the one very small creek downstream of the eastern edge of the pond in one of the alternatives in the "keep in place" pathway.

Summary of Benefits of the Proposed Pathway:

1. The proposed pathway will allow for removal of the dam/spillway, the earthen berm/dam that also holds the pond, and the beach rock berm that protects the lowlands below the pond.
2. This will allow for the removal of Pond 7, the most hazardous of all ponds, and one that could not be fully mitigated because it is under the earthen berm/dam.
3. This will allow for the public access to the lowland open space which will re-emerge
 - a. the ocean and tides will reclaim and shape the area.
 - i. it may or may not be a beach versus an estuary/beach hybrid.



4. This will be a much larger and easier to manage area of open space compared to the alternatives that include retaining some or all of the Mill Pond 8 (e.g., won't require continued monitoring and armoring in perpetuity).
5. This will be great for the local economy, ecology, quality of life, etc., and better in all these aspects than if even half the pond is still present and the lowlands need to be heavily managed and/or fortified.
6. For the funding sources that all alternatives are eligible for, this alternative is most ecologically and community beneficial and will be much more competitive and likely to get awarded than the other alternatives which involve continuation of a problematic structure. There are a variety of funding sources only available to this alternative.
 - a. These grants, which are for both feasibility studies and on-the-ground implementation, can dramatically offset the costs, making this alternative as expensive or less expensive for the city and Mendocino Railway than the alternatives, especially when looking at the long term.

In conclusion, all of this links back to the original premise of maximizing the economic, aesthetic, recreational, and ecological opportunities of the Headlands while yielding a sizable profit for the investors. This is the only alternative that does this.

I'd like to stress that I feel like this alternative appears to be the only one that would be a win for the landowner as well as a win for the government agencies, a win for the local economy, a win for public quality of life, and a win for the ecosystem.

Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "John A. Gallo", written in a cursive style.

John A. Gallo

ADDENDUM:

Can fungal and bacterial approaches address dioxins and furans?

My understanding is that the core challenge of this proposal is going to be to remove the dioxins and the furans. As a second round of exploration beyond the above letter, I had a conversation with Chat GPT to produce the below. As such, the statements are mostly accurate but not necessarily 100% so would need to be verified by the consultant. This is just a start.



PART I: “Hey Chat GPT: Are there proven fungal or bacterial approaches to removing dioxins or furans from the soil?”

Yes, there are several **fungal and bacterial bioremediation approaches** that have shown promise in breaking down dioxins and furans in soil. These compounds are highly persistent, but some microorganisms have demonstrated the ability to degrade them or enhance their breakdown under the right conditions.

Fungal Approaches

1. **White-Rot Fungi (e.g., *Phanerochaete chrysosporium*, *Trametes versicolor*)**
 - These fungi produce extracellular enzymes like **lignin peroxidase, manganese peroxidase, and laccase**, which can oxidize and break down dioxins and furans.
 - White-rot fungi have been shown to degrade polychlorinated dioxins (PCDDs) and furans (PCDFs) by **oxidation and cometabolism** with lignin.
2. **Ascomycetes Fungi (e.g., *Aspergillus niger*, *Penicillium sp.*)**
 - Some filamentous fungi can help in breaking down chlorinated hydrocarbons through enzyme-mediated pathways.

Bacterial Approaches

1. **Dehalorespiring Bacteria (e.g., *Dehalococcoides spp.*, *Desulfitobacterium spp.*)**
 - These bacteria use **reductive dechlorination** to remove chlorine atoms from dioxin and furan molecules, making them more susceptible to further degradation.
 - This process works well under **anaerobic** conditions.
2. **Aerobic Bacteria (e.g., *Pseudomonas spp.*, *Sphingomonas spp.*, *Rhodococcus spp.*)**
 - These bacteria can **oxidize** lower-chlorinated dioxins and furans, breaking them down into less toxic byproducts.
 - Some strains have been found to use dioxins as a carbon source under controlled conditions.
3. **Co-Metabolic Degradation (e.g., *Burkholderia*, *Mycobacterium*)**
 - Certain bacteria do not directly use dioxins for growth but can degrade them in the presence of other organic compounds (e.g., phenolics or biphenyls).

Enhanced Bioremediation Strategies

- **Bioaugmentation:** Introducing specific bacterial or fungal strains into contaminated soil to speed up degradation.
- **Biostimulation:** Adding nutrients, electron donors, or oxygen to enhance native microbial activity.
- **Phytoremediation:** Using plant-microbe interactions (e.g., willow trees with rhizosphere bacteria) to degrade dioxins.



- **Composting with Fungi:** Some studies suggest composting with **ligninolytic fungi** enhances dioxin breakdown.

Challenges & Considerations

- Dioxins and furans are **highly hydrophobic** and tend to bind tightly to organic matter, making bioavailability a limiting factor.
- Degradation rates are often **slow** and require optimized environmental conditions.
- Combining **fungal and bacterial approaches** in a **sequential anaerobic-aerobic system** has shown promise in maximizing degradation efficiency.

PART II: Chat GPT: Would you like specific studies or case examples related to these approaches?”

Me: “Yes”

Certainly, here are some notable case studies and research findings demonstrating the application of fungal and bacterial bioremediation techniques for removing dioxins and furans from contaminated soils:

1. Phytoremediation and Fungal Degradation in Vietnam

In Vietnam, soils contaminated with dioxins due to historical military activities have been a significant concern. A study explored the use of **aided phytoremediation**, combining plants with fungal inoculants, to remediate these soils. The research found that this approach effectively reduced dioxin concentrations, leveraging the synergistic actions of plant roots and fungi to degrade the contaminants. This method was highlighted as an eco-friendly and feasible solution for dioxin-contaminated sites. <https://pmc.ncbi.nlm.nih.gov/articles/PMC6920798/>

2. Aerobic Bacterial Degradation in Contaminated Soils

Research has identified specific aerobic bacteria capable of degrading dioxins in contaminated soils. These bacteria utilize oxygen-dependent pathways to break down dioxin molecules, leading to less toxic byproducts. Studies have demonstrated that certain strains can effectively transform and reduce dioxin concentrations under controlled conditions, offering potential for in-situ bioremediation strategies.

<https://bioresourcesbioprocessing.springeropen.com/articles/10.1186/s40643-020-0294-0?>

3. Application of Dehalococcoides in Reductive Dechlorination

The bacterium **Dehalococcoides** has been extensively studied for its unique ability to reductively dechlorinate highly chlorinated dioxins and furans under anaerobic conditions. Field applications have shown that introducing Dehalococcoides-containing cultures into contaminated sites can significantly accelerate the breakdown of these persistent pollutants,



transforming them into less harmful compounds. This approach has been successfully implemented in various remediation projects, highlighting its practical applicability.

<https://en.wikipedia.org/wiki/Dehalococcoides?>

4. Comprehensive Bioremediation Studies by the U.S. Department of Energy

The U.S. Department of Energy conducted extensive studies on bioremediation techniques to address soil contamination, including dioxins and furans, at the Santa Susana Field Laboratory in California. These studies evaluated various biological treatments, such as fungal and bacterial applications, to reduce contaminant levels. The findings indicated that certain bioremediation methods could effectively decrease the concentration of dioxins and furans in soils, offering a potential alternative to traditional excavation and disposal methods. citeturn0search1

These case studies underscore the potential of fungal and bacterial approaches in the bioremediation of dioxin and furan-contaminated soils. While results are promising, the effectiveness of these methods can vary based on site-specific conditions, and further research is ongoing to optimize and validate these bioremediation strategies.

https://www.energy.gov/sites/default/files/2023-09/Bioremediation%20Study%20Final%20Report%20May%2C%202015.pdf?utm_source=chatgpt.com

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