GeoScience, Inc.

September 1, 2011

Mr. Brian Wilson
US Army Corps of Engineers
via email: brian.j.wilson@usace.army.mil

RE: ADDITIONAL INFORMATION, LUKENS PROJECT, NWP-2011-141

Dear Mr. Wilson:

Per the recent request by NMFS regarding the proposed Lukens bank protection project, I am providing the following additional information and comments.

The 8/6/2011 letter from NMFS to Kevin Moynahan states:

> "Based on the information provided by the Corps, NMFS does not concur with the finding that the proposed project will not adversely affect OC coho salmon for the following reasons: (1) installation of riprap will create a sterile environment reducing habitat complexity and the available sheltering and feeding habitats for juvenile coho salmon; (2) primary constituent elements (PCEs) of critical habitat including forage and natural cover will be permanently degraded from the placement of riprap; (3) elevated concentrations of suspended sediments are reasonably certain to adversely affect juvenile OC coho salmon; and (4) the proposed action will adversely affect the water quality PCE of OC coho salmon critical habitat..."

In the context of the proposed project, the observations and facts on the ground are not consistent with this assessment. In this area, the "natural" bank between mean high and low tide consists of clay-cemented dune sands, which have been designated "Marine Terrace Deposits" (MTDs) for purposes of the previous report and this letter.

It is in fact the MTDs rather than rip rap which are "sterile" at this particular location. The attached site photos were taken along the currently partially rip-rapped bank extending north from the Lukens property. The issue with the MTDs is that the clay cement of the surface layer of the deposits breaks down over time in the changing salinity caused by inundation by saline water during high tide, while fresh water runs over the bank during low tide. As the cement breaks down, the surface layer of sand grains is removed relatively rapidly, exposing the next layer. This constant ablation of the surface layer does not provide a stable substrate for sessile marine organisms. Therefore, the uncovered areas of natural MTDs are devoid of most organisms. Some areas are vegetated by thin layers of algae and iron-bacteria. Other areas are completely devoid of flora and fauna.

Exhibit L

By contrast, the rip rap at the same site provides the only stable substrate for sessile organisms including barnacles, several species of kelp, mussels, and other marine invertebrates. As a result, the rip rap, which is approximately 15 years old, is densely populated with these organisms. Given the demonstrated abundant presence of marine life along the rip-rapped stretch of Sea Watch Estates, while noting the lack of such potential food sources for juvenile coho in areas not so protected, it is difficult to support the conclusion that the rip rap is sterile and does not provide feeding habitat.

In addition, based on dive records from nearby sites, the MTDs extend to the bottom of the channel approximately 28 to 30 feet below low tide level, and the bank is essentially barren in this zone, probably due to the same process of surface ablation which affects the intertidal zone. In this area, the channel is reported to be floored mostly by sand. As a result, juvenile fish, including OC coho salmon, and benthic fauna such as crabs have essentially no cover from predators or piscivorous birds. In this environment, the voids between rip rap and the cover provided by kelp can be beneficial, which is consistent with the observations of numerous crabs living in the rip rap.

With respect to suspended sediment, the proposed project is designed specifically to stop the contribution of fine sand and silt from the bank to the river. Under the current situation, during periods of high groundwater discharge following significant precipitation events, large amounts of sand and silt are entering the river constantly, completely smothering sessile marine life which might otherwise be present. Without the proposed protection, the bank will continue to erode and contribute large amounts of suspended sediment and sand to the near-shore environment. As has been noted in the adjacent, currently rip-rapped areas, the areas where the such sediment is in transport across the inter-tidal zone are usually almost devoid of sessile benthic organisms, which is because these sediments tend to bury and choke the mussels and other fauna. The proposed project is specifically designed to retain fine sand and silt on the bank, while allowing groundwater to drain.

Given the site access and space constraints, the addition of large woody debris with root wads attached was considered but found to be impossible to implement without unacceptable impacts to the performance of the sediment retention system. No means of anchoring large woody debris are apparent. The logs cannot be "buried" in the MTD without causing significant disruption and weakening of the bank. The logs also cannot be incorporated into the filter fabric "burrito" designed to retain the finer-grained un-cemented dune deposits on top of the MTDs. The machinery which can access the area proposed to be protected is not sufficiently large to transport rip rap of the size which would be required to securely anchor large woody debris.

As observed a few hundred feet north of the site, a few old stumps remain on the top of the MTDs in the position in which they were buried there several thousand years ago by the advancing Florence Dune Sheet. Although this debris is within the intertidal zone, it supports very little sessile marine organisms. This is likely due to the same issues which preclude the MTDs from being successfully populated. The other layers of wood slough off over time, removing any attached organisms. This degradation and decay of the wood over time also results in relatively rapid removal of smaller roots.

As a result, the sheltering function of root wads attached to large woody debris is lost within a relatively short time period. The voids in the rip rap, onthe other hand, clearly remain viable for a significantamount of time, provided high quality rock is utilized. It has been noted at other, nearby sites (i.e. near Shelter Cove, about 0.75 miles downstream) that Tyee Formation sandstone which was used as rip rap along the old channel boundary a significant time ago has not vegetated. This likely due to the fact that the sandstone is subject to the same surficial erosion and ablation processes as the MTDs. For this project, igneous rock fragments will be imported from either the Mapleton or Hale Valley quarries. Based on the observations at the site, these rocks are not subject to surficial degradation over the time frame of interest (tens of years), and, therefore, provide a stable substrate for sessile organisms which can, in turn,serve to provide shelter and food sources for juvenile fish which are adjusting to the saline environment in this area during their migration to the ocean.

Per the NMFS question, the total expected linear distance of rip rap is 200 feet. As presented in GeoScience's previous report, this length was developed from 2H : 1V slope angles extending to the river from the ends of the sheet-pile seawall in front the Lukens home. The 2H : 1V angle is the empirically derived stable slope angle for dune sand in the Florence area.

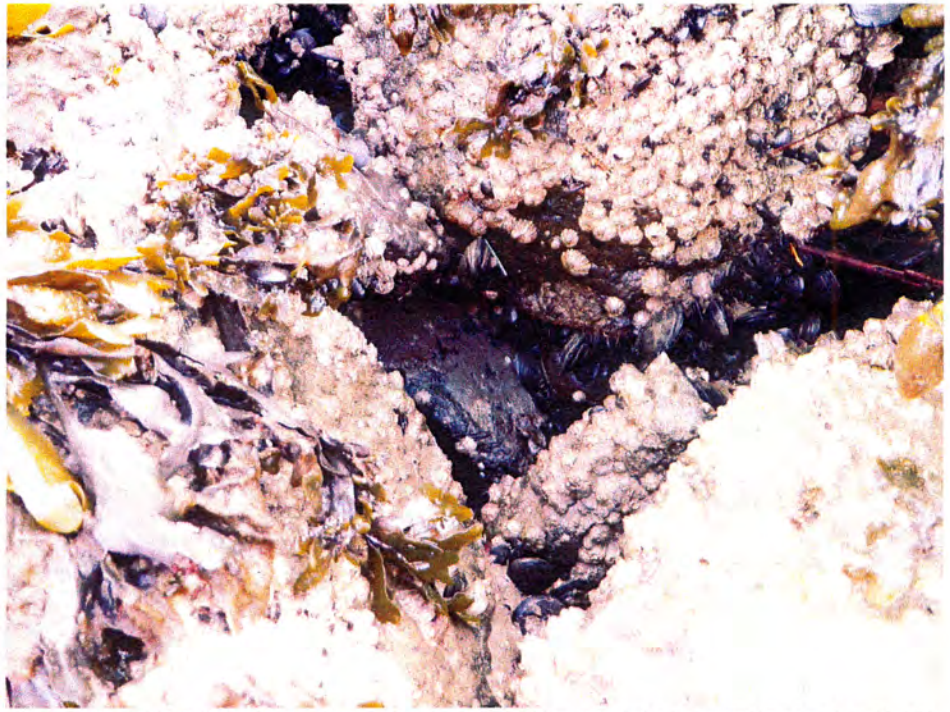
A diagram showing the elevations of mean high and low tides with respect to theproposed project is attached. The approximate Mean High Tide is 6.17' and the approximate Mean Low Tide is 0.97'. The project extends approximately 1 to 2 feet below Mean Low Tide, depending on the location of the lower "shelf" of the MTDs.

If it was deemed helpful to resolving these issues in a timely manner, GeoScience would be more than willingto meet a representative of NMFS at the site. If this is possible and desired, or if there are further questions we might be able to answer, please contact me at (541) 729-4271 (cell phone).

Sincerely,
GeoScience, Inc.

Gunnar Schlieder, Ph.D., CEG

Rip Rap Provides Stable Substrate for Sessile Marine Invertebrates and Kelp, MTD does not (Lower Right Corner)

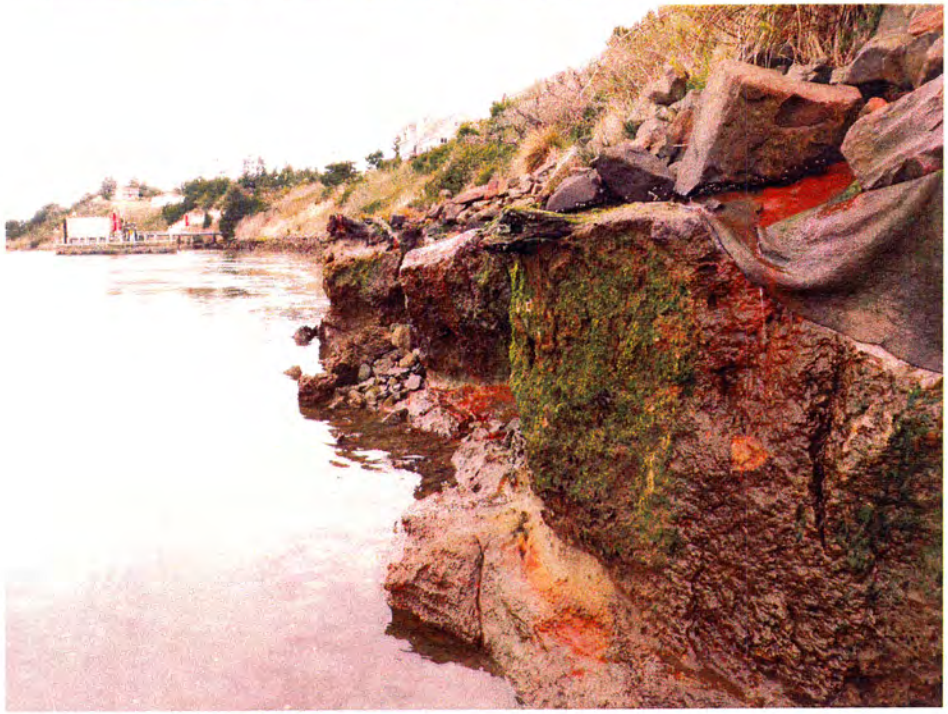


Dense Populations of Sessile Marine Organisms Except in Central Area Subject to Inundation by Sand in Transport from Areas Above High Tide

Barnacles Dominate in Zone Located Approximately 1 to 2 feet Below Mean High Tide. Kelp Dominates in Next Zone.

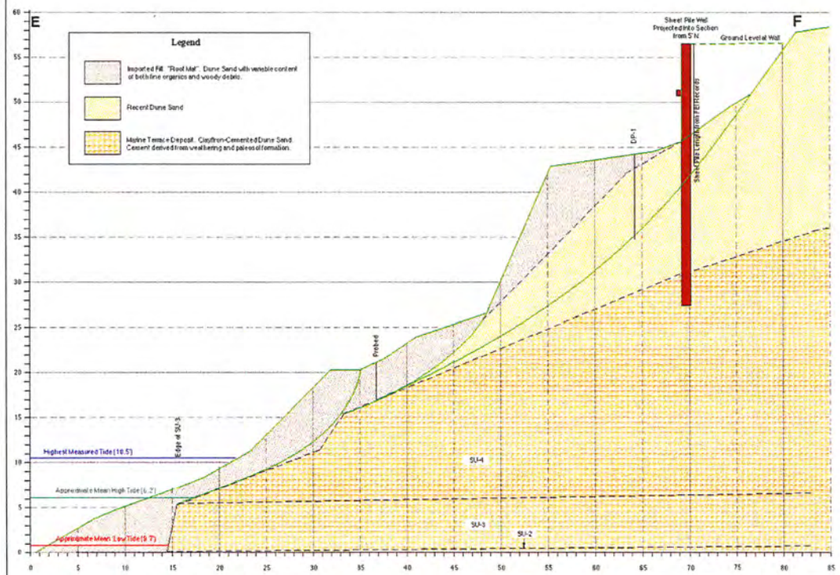
Mussels and Barnacles Populate the Zone Around and Below Mean Low Tide.

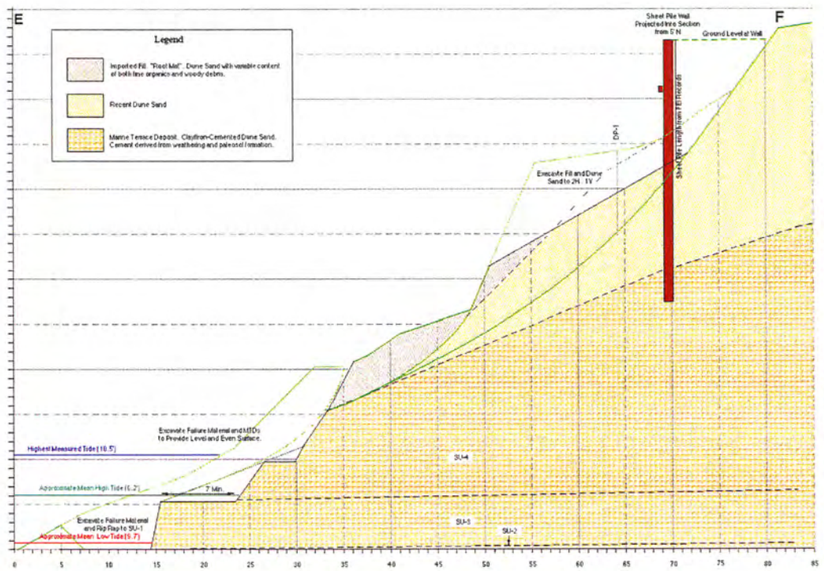
GeoScience, Inc.	Lukens, NWP-2011-141, Additional Information for NMFS,
	Marine Organisms on Rip Rap, Sea Watch Estates
	Generated from GeoScience Site Photos 3/23/11

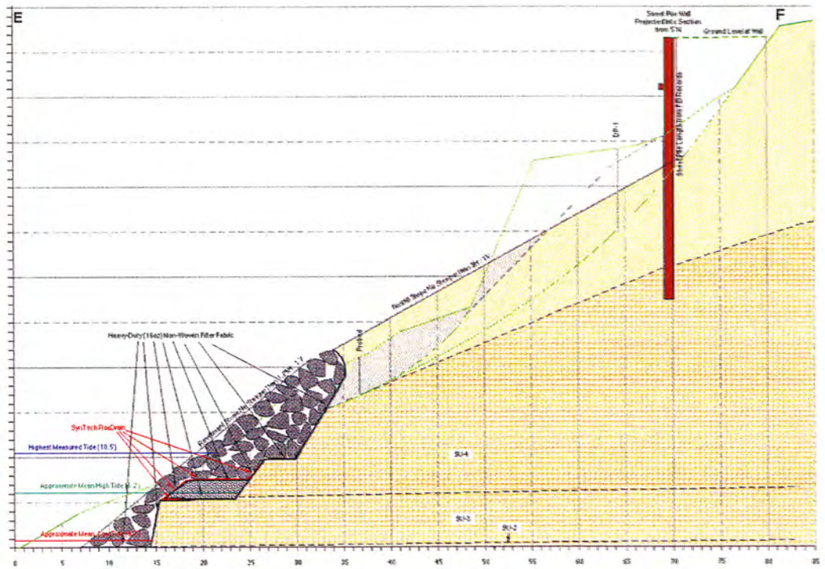


Note Absence of Barnacles/Kelp on Intertidal Marine Terrace Deposits Exposed in Unprotected Bank

GeoScience, Inc.	Lukens, NWP-2011-141, Additional Information for NMFS,
	"Natural" Bank Configuration, Sea Watch Esates
	Generated from GeoScience Site Photos 3/23/11







Note: Section measured using datum steel and 2004 Bengkon tape. This represents only one of numerous possible interpretations of the data. It is based on very limited subsurface information and is subject to change as additional data is developed.

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16 Seawatch Ct., Florence, Bank Failure Mitigation Assessment

Figure 9: Cross Section E-F, Proposed Mitigation

Scale as Shown (1" = 5')