

Project No. M8889
25 May 2005

MR. KEITH RAYBOULD
Monterey Bay Aquarium Research Institute
7700 Sandholt Road
Moss Landing, California 95039

Subject: Horizontal Directional Drilling Option
Proposed 5 inch Directional Drill

Reference: Monterey Bay Aquarium Research Institute
Moss Landing, California

Dear Mr. Raybould:

At your request, we have reviewed the proposed 5 inch directional drilling option to be implemented from the end of Sandholt Road on your vacant lot 4,700 feet to a location just north of the Monterey Bay Canyon edge. The purpose of our review was to determine the feasibility of the project relative to existing geotechnical information and the geologic setting in the immediate area of the horizontal drill borehole project.

The scope of our review included:

1. A working meeting with yourself, Charles Paul and Farley Shane from the Monterey Bay Aquarium Research Institute;
2. Review of plans and summary descriptions of the proposed project. The directional drill plans were prepared by Environmental Crossings of Traverse City, Missouri;
3. Discussions with Greg Horn, project manager for Environmental Crossings, who has evaluated the 5 inch drill pipe borehole project for constructability.
4. A review of geotechnical investigations in the immediate area of the MBARI vacant lot on Sandholt Road in Moss Landing. This included subsurface exploratory borings and the CPT recordings that were developed during the subsurface investigation of the MBARI Research Institute Buildings;
5. A review of deep exploratory borings and CPT recordings our firm conducted on the north side of Moss Landing Harbor as well as at the mouth of the Pajaro River;
6. A review of the geologic maps of the Monterey Bay Canyon;
7. Preparation of this summary letter report.

A review of geologic maps of the Monterey Bay Canyon (Geology of Monterey Bay, McCulloch and Green; 1990 and Geologic Map of Monterey Bay, Green et al. 2002) indicates that the headward portion of the canyon where the pipe drill will be located contains Aromas sands, Purisima Formation sandstone, alluvial deposits, and marine sediments. The location of the target area, 4,700 feet from shore, suggests that it will be located in alluvial deposits and Aromas sands. These materials are penetrable by the proposed drilling process with very little effort. These materials do not fracture when impacted by drilling augers. A review of the aforementioned geotechnical investigations indicate that the nearshore environment consists of at least 120 feet of alluvial deposits consisting of loose to medium dense sands and silts in the top 60 to 80 feet and denser sands and gravelly sands with layers of silt below that depth. These subsurface exploratory borings confirm the geologic mapping of the Monterey Bay Canyon we reviewed. Should Purisima sandstone be encountered Environmental Crossings, Inc. indicate that the drill rig setup will have no problems penetrating the partially to highly cemented sandstone materials. The sandstone materials are located at depth and should the sandstone fracture during drilling operation, it would not negatively influence the overburden alluvial layers acting as a cap.

The preferred route of the directional drill will be west of the San Gregorio fault line. The Monterey Bay Fault that runs through the axis of the canyon is buried below deep deposits (120 feet) of recent alluvial materials acting as a buffer to the cable should seismic activity occur during the life of the project.

The drilling process includes a bentonite slurry (drilling mud) that will maintain the opening of the drill hole to allow the cable to be threaded through the borehole. The bentonite filled borehole will be under approximately 50 to 60 feet of alluvial sands during most of the drill route. Within 30 to 50 feet of the exit point drilling operations will be stopped and the slurry mud will be flushed from the borehole with clean water. The final drilling to the surface of the ocean floor will be done with fresh water. This is a typical subsurface horizontal drilling procedure. The drilling contractor will have control of the bentonite slurry operation.

The location of the vacant lot south of the Harbor Jetty where the drilling pit will be established and the steep angle of entry (20 vertical feet to 100 horizontal feet) will ensure that the borehole will be under the harbor jetty. The drill path will be at approximately 40 feet below sealevel as it crosses under the south harbor jetty.

Based on our review of current geologic information of the Monterey Bay, our review of numerous geotechnical investigations in very close proximity to the shoreline where the directional drilling operation will begin and our discussions with the contractor, Environmental Crossings, Inc., it is our opinion that the

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proposed project has been well thought out, is environmentally safe and geotechnically feasible.

If you have any questions, please call our office.

Very truly yours,

HARO, KASUNICH AND ASSOCIATES, INC.

John E. Kasunich
G.E. 455

JEK/dk

Copies: 4 to Addressee