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Subject: Conceptual Plan and Cost estimate for Removal of Fish Passage Barrier at Torino Road, Arroyo Burro Creek, Santa Barbara, CA.

## **INTRODUCTION**

This letter report presents the results of our analysis of the existing conditions for the creek crossing of Arroyo Burro Creek at Torino Road and includes preliminary design recommendations and a conceptual plan and cost estimate for improvement of the fish passage barrier at this site. The report is based on background information in our files from our previous work in the City of Santa Barbara, a site visit, and preliminary engineering analysis.

The Crossing is owned by City of Santa Barbara, and some coordination has occurred with the City has occurred in preparation of this conceptual design. Additional coordination with the City, the County, and the Santa Barbara County Flood Control district will be needed as the project moves forward in planning and design.

## **SITE LOCATION**

The Torino Road site is located in Hidden Valley Park, in the City of Santa Barbara, California (**Figure 1**). The Torino Road crossing is between Calle de Los Amigos and Barcelona Dr, 1.8 miles from where the creek enters the Pacific Ocean near the Arroyo Burro Beach County Park.

## **WATERSHED**

Arroyo Burro Creek begins in the Santa Ynez Mountains and flows south until it empties into Arroyo Burro Beach (Hendry's Beach). The watershed encompasses about 6,217 acres, and it extends about seven miles from the ocean to the ridge of the Santa Ynez Mountains at 3800 feet elevation. Major tributaries to Arroyo Burro Creek consist of Las Positas Creek, Barger Canyon, and San Roque Creek near Northridge Road where two minor tributaries empty into Arroyo Burro. A small lagoon is present at the end of the creek at Arroyo Burro Beach. The lagoon has regular tidal influence. The upper portions of the creek traverse rural estates and orchards, while the middle portions of the creek pass through residential and commercial development between Foothill Road and Highway 101. Downstream of Highway 101, the creek traverses a mixture of residential areas and open space.

Erosion and bedload transport are reportedly high in the upper portion of the watershed, however, reach inspection shows little sign of heavy bed mobility, with smaller gravel to small cobble size classes in the project reach.

## **FISH PASSAGE DATABASE**

The September 2006 Passage Assessment Database lists this site (**Barrier ID: 706563**) priority as a High. From the Pacific Ocean to the upstream natural limit of anadromy, 11 barriers exist on Arroyo Burro Creek, three of which are complete barriers, while the remaining are partial or temporal barriers. Removal of this barrier would extend access to 2,302 feet of creek habitat to the next complete barrier (Barrier ID 706568) for a total of 11,855 feet or 2.2 miles. Two downstream barrier projects are planned or in progress, along with other wetland and habitat restoration projects. The immediately downstream barrier is owned by Caltrans and repair of this barrier, a rock grade control structure, should be coordinated with repair of the Torino Road barrier.

## **EXISTING CONDITIONS AND FISH PASSAGE BARRIER CONSTRAINTS**

The Torino Road crossing of Arroyo Burro Creek consists of an existing, large concrete double box culvert roadway. The public roadway surface is located about 25 feet above the creek bed. This is a public road maintained by the City of Santa Barbara. Concrete wing walls and vegetated stream banks with an approximate 3:1 slope surround the outlet. The two box culverts have approximate dimensions of 8 x 10 feet each. The inlet of the culvert is at grade and aligned with the streambed. The smooth and flat concrete culvert interior was observed to be clean of sediment and having less than a %1 slope. The outlet of the culvert consists of a 2 to 3 foot vertical drop onto a sloping concrete apron, followed by a sloped, grouted rip rap grade control.

The project reach investigated is approximately 1000 feet long. It is apparent that Arroyo Burro Creek has incised several feet (4-5 feet or more) downstream in this vicinity. The channel incision has head cut up to the grouted rock grade control below the box culvert, effectively prevented further head cutting. The steep grouted rock, concrete apron, approximate 3 foot outfall, and smooth flat culvert interior present significant leap and velocity barriers to steelhead migration further upstream. The creek channel below the culvert is vegetated with native and exotic shrubs, trees, and reeds.

According to FEMA floodplain maps, the 100-year floodplain is about 100 feet wide in the vicinity of Torino Rd along the creekway. Areas along Torinia Drive, Palermo Drive and Barcelona Drive, to the North and East are also within the 100 year floodplain. The existing FEMA mapping is currently being revised by the City of Santa Barbara in cooperation with the Santa Barbara Flood Control District.

The existing crossing represents a complete barrier to juvenile and adult salmonid passage to upstream reaches of Arroyo Burro Creek. There are two main reasons to

consider modifying the existing grouted rock grade control, concrete apron, and culvert bed:

- 1) The grouted rip rap, sloped apron, and approximate 3' entry leap represent an impassable migration barrier.
- 2) The culvert's flat and wide interior surface could create a depth and velocity barrier to any fish that manages to navigate the rip rap, apron, and entry leap.

## **HYDRAULIC ANALYSIS**

A detailed hydraulic analysis (HEC-RAS) has been completed for this creek by the City of Santa Barbara as part of a FEMA floodplain mapping revision, although the model has not yet been publicly released. The model shows high velocities through the culvert. The model can be used during the final design of the barrier project.

As previously indicated, Arroyo Burro Creek has apparently incised some 3 to 5 or more feet in the vicinity of the Torino Road crossing, and channel headcutting has apparently worked its way upstream to the grouted rock apron below the Torino Road crossing, where this structure has arrested further localized upstream movement of channel incision. Lower Arroyo Burro Creek is unstable due to a combination of unstable geologic formations along the creek, and active channel incision, which has been partially arrested by the installation of grade control structures. Modification of the creek channel for improved fish passage must therefore carefully consider potential effects on channel stability, including the deep seated bank failures and land sliding that occur downstream. This will involve completion of detailed geotechnical analysis, in addition to hydraulic analysis, to insure that any modifications to drop structures do not further exacerbate channel incision. It may be possible to incorporate fish passage improvements into a larger, reach-wide plan to stabilize and enhance lower Arroyo Burro Creek that was discussed in the draft Arroyo Burro Existing Conditions study completed for the City by Questa in 2004.

## **CONCEPTUAL PASSAGE DESIGN**

The preliminary conceptual passage design Was based on file information and a site visit, as well as existing channel topography. The final design will need to be based on high and low design flows for the swimming and leaping abilities of fish as described in Culvert Criteria for Fish Passage, CDFG, May 2002. This will require completion of a detailed hydraulic analysis.

The majority of all fish passage restoration projects entail perched or failed concrete structures that have not adjusted over-time with the fluvial system in which they occur. As a result, two general options are available to improve fish passage: 1) removal of the barrier or 2) creation of a passable slope below the barrier. As valuable infrastructure is often involved, slope creation is often the most viable option. Within the realm of slope creation, there are generally three basic approaches to create and redistribute slope for

fish passage: step pool, riffle-pool, and roughened channel designs. Culvert modifications, such as installing low flow walls, and offset baffles or weirs may also serve to address velocity and depth issues within the culvert itself, but only when replacement is not an option.

The conceptual design for this project involves a roughening of channel within the box culvert to address depth and velocity barrier, with a combination of steep pool and riffle-pool design downstream to reduce the steep approach and leap barriers at the culvert outlet. The proposed preliminary design plan is shown in **Figures 2-4**.

All of these requirements considerably reduce the expense of the passage design and construction compared to replacing the crossing. The actual hydraulic modifications within the culvert will need to be calculated using the previously mentioned HEC-RAS data for the structure, along with foreseeable considerations for passage of watershed products to verify that they do not adversely impact channel capacity and flooding in this area.

## **CONSTRUCTION IMPACTS**

Since the project may require road and creek access, possible removal of existing grouted rock and concrete, and installation of new structures, localized noise and traffic disturbance will occur.

### **Noise Impact**

Noise due to construction averages at 50 dBA. There are 8 to 10 residential buildings within 600 feet of the site so the impact of noise would be minimal.

### **Traffic Impact Considerations**

The western portion of the Hidden Valley is a neighborhood with two access routes. The project location is at the southern access route. This provides two options for traffic control during construction hours. Option 1 would be to close Torino Road at the project location, shifting neighborhood access to the northern crossing, Calle de Los Amigos. Option 2 would be to close one of two lanes to provide room for construction equipment and materials. Either option would likely have minimal impact on traffic and safety.

## **CONSTRUCTION COST ESTIMATE AND DISCUSSION OF FEASIBILITY**

The cost for building a new step pool structure and modifying the existing structure is estimated to be in excess of \$206,000. When final design, environmental review, permitting, construction observation and mitigation are considered, and a 25% contingency is added, costs may exceed \$360,000. A planning level construction cost estimate is shown in **Table 1**.

Should you have any questions on this, please do not hesitate to contact me at (510) 236-6114 Ext. 206.

Questa Engineering Corporation

Jeff Peters,  
Principal

Attachments

JP/skc

Ref. 270020 Cecchetti Rd. Report



Figure 1.  
 (Adapted from City of Santa Barbara Creek Restoration Watershed Division 2003)