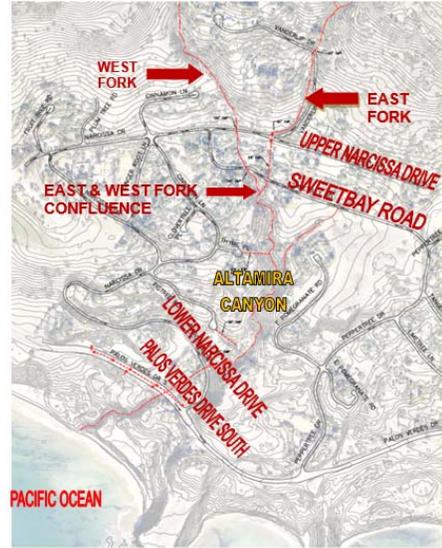


# PROJECT STUDY REPORT ALTAMIRA CANYON DRAINAGE / EROSION CONTROL PROJECT



**PREPARED FOR:**  
**CITY OF RANCHO PALOS VERDES**  
**PUBLIC WORKS DEPARTMENT**

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## I. EXECUTIVE SUMMARY

### **Introduction:**

Harris & Associates (Harris) was retained by the City of Rancho Palos Verdes (RPV) to define the drainage deficiencies in the Altamira Canyon, identify alternative solutions to remedy these deficiencies and present the findings in a Project Study Report (PSR). The PSR is intended to evaluate and present information regarding at least four (4) alternative solutions and to aid in identifying specific environmental, geotechnical, right-of-way easements and other construction related considerations. Information presented in the PSR represents planning level construction concepts and estimates and includes soft costs, which will help in programming the required future implementation budget for the selected design alternative. Furthermore, information presented in the PSR will assist the stakeholders involved in determining how to proceed with programming, phasing and engineering design decisions required to manage the runoff that flows through the canyon, minimize erosion and reduce the amount of surface waters from infiltrating into the existing canyon fractures and fissures.

### **Background:**

Except for the very uppermost tributary area, Altamira Canyon is a mostly natural drainage course that conveys stormwater runoff generated within the canyon and the upstream tributary watershed, which consists of a total area of approximately 855 acres. Within the focused study area, the runoff is conveyed through the natural canyon and roadway culvert crossings in the private Altamira Canyon Gated Community, which then outlets into the Pacific Ocean in Abalone Cove Shoreline Park. These stormwater flows have been observed by residents as high volume flood waters that are fast moving and have caused erosive damage along the edges of the canyon along the adjacent private properties. There are also considerable sediment transport issues primarily due to the unstable canyon slopes, which laden the flood waters with a range of silts, cobbles and boulders. Stormwater runoff has also been observed to dissipate into the ground as it proceeds downstream often times completely disappearing prior to reaching the ocean outfall. This stormwater infiltration is believed to contribute to the movement of the landslide.

A solution to this continuing erosion and water infiltration has been long studied (see Recommendations and Analysis for Drainage Improvements, Robert Stone & Associates, 1983; Abalone Cove Landslide Stabilization Project, Environmental Impact Report, Envirosphere Company, 1989; Altamira Canyon Pre-Design Report, Charles Abbott Associates, Inc., 1993) and local residents are looking for an actionable plan. The question this PSR is seeking to answer is which solution, or solutions, will best serve residents, and the City of Rancho Palos Verdes (RPV) going forward and the related construction costs.

### **Alternatives:**

The scope of the Project Study Report (PSR) assignment required Harris to investigate at least four (4) alternative designs and make assessments on a number of criteria including effectiveness of the design concept, constructability, geological feasibility, environmental impacts and related mitigation, schedule, cost and other factors. Five (5) hydraulic alternatives were investigated, but then refined down to the three most feasible, bringing the total number of alternatives to four (4) when a “No Project” option is included, which would leave the canyon in an “as-is” condition. A potential sub-alternative or “interim” solution was also studied to divert spring-fed low flows from the east fork of Altamira Canyon to an adjacent canyon to minimize water intrusion into the Abalone Cove Landslide. The PSR details each of these alternatives.

**Recommended Alternative 4 – Canyon lining, extension of the Palos Verdes Drive South Culvert upstream and protection of the existing canyon drainage improvements:**

The recommended Alternative 4 consists of the construction of 9.5-foot diameter welded steel pipe (lined and coated) storm drain to extend the existing CMP pipeline just upstream and north of Lower Narcissa Drive. The existing culvert crossings under Palos Verdes Drive South, Lower Narcissa Drive, Upper Narcissa Drive and Sweetbay Road would all be slip-lined with the same size 9.5-foot diameter welded steel pipe (lined but not coated since the annular space will be grout filled between the pipes). The remainder of the upper canyon, from approximately 400 feet north of Upper Narcissa Drive to the new storm drain pipe and lower canyon south of Palos Verdes Drive South to within approximately 100 feet north of the beach would be lined with an ungrouted riprap trapezoidal channel (with an impermeable barrier and sub-drain system). The existing drainage improvements south of Sweetbay Road and between Sweetbay Road and Upper Narcissa Drive would remain and the proposed trapezoidal channel half-section would be constructed alongside these improvements. These existing drainage improvements consist of wood and gabion walls and would remain if they are determined to be structurally sound during the PS&E phase. The east fork of Altamira Canyon would be the same ungrouted riprap trapezoidal channel (with an impermeable barrier and sub-drain system), from the confluence with the west fork downstream of Sweetbay Road to Sweetbay Road, with a short portion being a half-section due to an existing gabion wall constructed just downstream of Sweetbay Road. The upper terminus of the east fork creek lining improvement will connect to the 54” CMP culvert crossing under Sweetbay Road, with the remainder of the existing underground pipe system being protected in place all the way upstream past Upper Narcissa Drive.

The engineer’s opinion of total cost (construction plus soft costs) of this Preferred Alternative is estimated to be \$8.3 million.

**Conclusion:**

Altamira Canyon **Alternative 4** is being recommended. The advantages of this alternative, combined with the disadvantages associated with other alternatives, make this the recommended project solution. This alternative has been estimated to be the least impactful to private property, lowest cost, feasible solution and has fewer administrative, environmental and uncertainty issues associated with it than the other alternatives. This recommendation is also supported by the following reasons:

1. It diminishes the erosion and undercutting in the canyon, thereby protecting existing residential improvements and minimizing debris transport to allow “clear water” flows
2. It substantially reduces the amount of flow being infiltrated in the existing canyon fissures.
3. It provides a design that will accommodate continuous inflow from the side slopes within the canyon, which a buried pipe would not.
4. It provides a design that will restore and protect the existing streambed.
5. It provides a “natural” looking ungrouted riprap rock invert that can “self-heal”, and remain functioning during storm conditions, if there should be any land movement unlike a buried pipe solution.
6. Restoring the streambed and protection of existing drainage (wall) improvements will require less administrative issues in regards to environmental concerns and resident approval.
7. The protection of existing improvements will be received with less opposition from residents.
8. The uncertainty of the improvements being damaged during some differential movements is of less concern as the riprap is able to ‘self-heal’. If a storm even were to

occur immediately after said land movement the riprap could still retain its flood protection properties.

Alternative 4 is also rated number 1 in the objective “Risk Chart” (see page 21 of this PSR) while the “No Project” alternative rated last. Although the “No Project” alternative would cost nothing today, it could potentially be most expensive long-term solution. Further, doing nothing to improve conditions could compromise the homes of the residents of the Altamira Canyon community.



Note a sub-alternative was also developed for a low flow diversion along the Upper Narcissa Drive east fork canyon where a natural spring flows year round. This was studied as a potential solution as part of the PSR with the intent to reduce the amount of flows infiltrating into the Abalone Cove landslide. However, it is not being recommended as part of the preferred Alternative 4 solution due to prohibitive costs and the redundant solution it provides given the impermeable liner proposed along the canyon (which will also eliminate infiltration) and due to other potentially negative factors associated with diverting flows from their historic flood path and infiltrating water into the adjacent dormant ancient landslide “edge-scarp”, possibly reactivating movement there over time.

## II. INTRODUCTION

**Harris & Associates** (Harris) was retained by the City of Rancho Palos Verdes (RPV) to provide a comprehensive Project Study Report (PSR), including preliminary concept design alternatives to minimize erosion, reduce water infiltration and convey the 100-year storm flows within the Altamira Canyon. The PSR effort also identified a separate low flow diversion project concept, which would serve as a measure to reduce water infiltration into the Altamira Canyon possibly as an interim solution, before funding can be secured for the ultimate final design and construction. The PSR also included an investigation of the project site for existing conditions including hydrological, geological, environmental and topographical. Harris sub-contracted the following services to the following companies to capitalize upon their expertise:

**KOA Corporation** – Community Outreach Facilitation

**KDM Meridian** – Aerial Mapping / Survey / Right-of-Way / for Base Sheets Plans (**Appendix A**)

**Ninyo & Moore Geotechnical** – Geotechnical Requirements (**Appendix C**)

**LSA Consulting** – Environmental Assessment Requirements (**Appendix D**)

**CWE** – Hydraulics Engineering (**Appendix F**)



Figure 1 - EXISTING LOCATION MAP

## A. Project Limits

The subject Altamira Canyon Drainage System falls within of the jurisdictions of the City of Rancho Palos Verdes (RPV) and is generally bounded by:

### Hydrology Boundary Edge: Defining Feature

- **West:** Catalina View Gardens, Jack's Hat Trail / Open Space
- **South:** Pacific Ocean
- **East:** Portuguese Bend Reserve, Peppertree Drive
- **North:** Crest Road, Northbay Road, Scottwood Road and Ocean Terrace Drive

## B. Purpose & Need

The primary goals of this PSR is to review, evaluate and present solutions to convey the 100-year design storm, mitigate erosion problems experienced in the Altamira Canyon, along with reducing the amount of stormwater flows that infiltrate into existing rock fractures and fissures. These problems affect the residents of the private Altamira Canyon Gated Community and the stability of the still active Abalone Cove landslide.

The periodic flooding associated with certain storm events is exacerbated by the unstable canyon walls that provide a continuous source for new sediment, rock and cobbles to the creek bed, which in turn is transported downstream.

Concern and support for a solution in the local community has been building for years and of late has been growing rapidly as expressed at several community meetings specifically held to discuss the issue. The public is concerned that the present conditions threaten their property from flooding and debris flows.

**Water Quality:** Although a significant amount of the tributary flow is from natural canyon runoff there are also residential developments and roadways that are tributary from the uppermost portions of the watershed. Presently the “first flush” flows from the streets above are absorbed into the pervious natural canyon invert, which essentially serves as a natural bio-swale and eliminates the need for expensive and maintenance-prone water quality treatment systems otherwise required to prevent the first flush runoff from reaching to the ocean.

**Dewatering:** There are approximately 20 active dewatering wells which are discharged through a system of 2 to 4-inch diameter PVC pipes down the canyon to the ocean per an existing MS4 Permit. It was previously noted that although dewatering will continue to be a solution for the canyon, dewatering will not be a focus item in the study scope since there is no geotechnical boring sampling in the scope that could help make significant recommendations for placement of additional wells. There are also significant permitting issues and a specific Abalone Cove Landslide Abatement District (a geological hazard abatement district formed in 1980) that already oversees the dewatering system for the geologic hazard abatement of the vicinity. Thus the primary focus in this report is “solutions in the canyon”.

## C. Objectives

This PSR details the existing conditions and known history of the existing geology, drainage and erosion problems. It defines the hydrologic conditions and hydraulics of the existing Altamira Canyon. It includes the analysis and evaluation of impacts and the feasibility of several

alternative solutions (including establishing a list of associated pros and cons, required outside agency approvals, potential easement needs and costs, geotechnical constraints, environmental impacts and related mitigation costs, and potential implementation schedules associated with each alternative). The alternatives considered have also been detailed via preliminary concept design plans.

Further, for reference purposes, various exhibits within the report depict the following:

- Existing Facilities Exhibit – this map shows existing Altamira Canyon storm drain facilities beginning at Upper Narcissa Road (**see Appendix B**)
- Hydrology map and calculations for the 100-year storm event peak discharge ( $Q_{100}$ ) for the drainage area tributary to the Altamira Canyon (**see Appendix E**)
- Preliminary Conceptual Altamira Canyon Improvement Plan Sheets for the three “refined” alternatives, including typical sections (**see Appendix G**)
- Detailed opinion of construction cost estimates for each proposed alternative solution (**see Appendix H**)

### III. SETTING

Altamira Canyon is a relatively natural drainage channel that trends north-south and consists of moderate to steep sloping terrain that yields fast flowing stormwater runoff. This runoff collects within the natural canyon creeks/channels and it is conveyed through the PSR study area in a drainage system consisting of a natural canyon and existing pipe culverts for an approximate length of 4,700 lineal feet.

The proposed west fork canyon improvements study area starts approximately 400 feet above Upper Narcissa Drive, where flows are conveyed through a natural canyon. The flows are then conveyed by an existing 10-foot diameter CMP culvert under Upper Narcissa Drive (**See Photos 1 & 2**), then flow through a semi-improved channel (**See Photo 3**), and again pass through an existing 10-foot diameter CMP culvert that crosses under Sweetbay Road (**See Photos 4 & 5**). Downstream from there the flows travel through another section of semi-improved channel (**see Photo 6**) before the flows confluence with the east fork. The semi-improved section of channel (downstream of Upper Narcissa Drive) consists of an existing timber wall retaining wall along the easterly side of the canyon with a grouted riprap invert (**See Photos 2 & 3**). The semi-improved channel downstream of Sweetbay Road has a gabion wall built upon a concrete wall again along the easterly canyon wall (**See Photos 5 & 6**). The tributary area to the west fork is approximately 350 acres before it confluences with the east fork downstream of Sweetbay Road. The flows travel at a high velocity and occur over relatively short durations which erode the banks of the canyon walls. In reaches where the canyon wall does not have some type of slope protection improvement, residents have to backfill the existing canyon in order to restore the distance between the top of canyon wall and the existing dwelling structures and garages (**see Photo 7**).



**Photo 1** – Upper Narcissa Dr. at West Fork 10-foot CMP Culvert U/S Inlet



**Photo 3** – Existing Wood Wall downstream of Upper Narcissa Dr



**Photo 2** – Upper Narcissa Dr. at West Fork 10-foot CMP Culvert D/S Outlet



**Photo 4** – West Fork at Sweetbay Road 10-foot CMP Culvert U/S Inlet

Note: The existing gabion and timber walls were erected only on one side of the canyon. As a result, the canyon on the opposite side has experienced increased erosion.



**Photo 5** – West Fork Sweetbay Rd Culvert D/S Outlet

**Photo 6** – Existing Gabion Wall south of Sweetbay Rd along West Fork



**Photo 7** – Canyon erosion encroaching closer to garage U/S of Upper Narcissa Dr

Although the east fork has a smaller tributary area (**200 acres**), a constant flowing natural spring adds to the amount of flows infiltrated into the Canyon. The east fork is also comprised of a system of natural canyons, culverts and semi-improved channels. The culverts along the east fork are of smaller diameter, ranging from 42” to 54” diameter. Unlike the west fork, the existing culvert is continuous from north of Upper Narcissa Drive to south of Sweetbay Road. The pipe size starts as a 42-inch in diameter (**see Photo 8**) and outlets as a 54-inch diameter pipe (**see Photo 9**). Similar to the west fork, only half of the channel is improved with a gabion wall downstream of Sweetbay Road (**see Photo 9**) rendering the opposite side of the channel more prone to erosion.



**Photo 8** – Upper Narcissa Drive 42-inch culvert U/S inlet (east fork)



**Photo 9** – Sweetbay Road 54-inch diameter culvert D/S outlet (east fork)

**Note: Constant spring-fed low flow is visible.**

The confluence of the east and west fork occurs approximately 300 feet south of Sweetbay Road. This confluence point coincides with the top (buried headscarp) of the Abalone Cove landslide. The confluenced flows then wind through the natural canyon (**see Photo 10**) until they reach the Lower Narcissa Drive / PVDS culvert inlet (**see Photo 11**). This CMP culvert is 10-feet in diameter and lined along the bottom with concrete. This is the last reach of pipe in the Altamira Canyon before outletting into the Pacific Ocean. The culvert has several inlets (**see Photo 12**) that convey flows from PVDS and the properties adjacent to Lower Narcissa Drive.



**Photo 10** – Altamira Canyon south of the East and West Fork confluence



**Photo 11** – Existing Culvert Upstream Inlet at Lower Narcissa / PVDS (looking downstream)



**Photo 12** – A mid-culvert riser inlet just D/S of Lower Narcissa Dr and U/S of PVDS

**Photo 13** – Altamira Canyon D/S Outlet south of PVDS (looking Upstream)



**Photo 14** – Altamira Canyon south of PVDS

The flows then finally wind through the last section of canyon and outlet to the Pacific Ocean

The existing Lower Narcissa Drive / PVDS culvert outlet is of concern to the Altamira Canyon community due to the vandalism experienced from trespassers entering their gated community (**photo 13 is a “before” photo and photo 15 is an “after” photo of the interim grate that has been placed downstream of PVDS**). Further, the City is pursuing a project to construct an energy dissipator/pedestrian barrier at the outlet of the existing 120” CMP culvert in order to deter the vandalism experienced.



**Photo 15** – Interim Grate installed on Altamira Canyon D/S Outlet south of PVDS (looking Upstream)

#### IV. COMMUNITY INVOLVEMENT

The Altamira Canyon Gated Community is the most affected by the ongoing drainage and erosion problems and as such has been influential in procuring and providing valuable firsthand input to this Altamira Canyon drainage study. The City of RPV has been supportive in helping fund this PSR in an effort to help solve these reoccurring flooding problems and provided direction to gather input from the local community prior to developing alternative solutions. Continued community support and involvement will also be a key element in procuring future funding for the project.

In the course of a  development, two community meetings were held to solicit input from the Altamira Community. The first meeting was held on April 7, 2016 primarily to listen to and gather the resident's concerns and ideas (**see Appendix J for meeting presentation slides**). During this meeting the following input was received:

- The storm flows within the canyon should take into account the upper developments that are tributary to Altamira Canyon.
- Flows infiltrate into fissures that contribute to the Abalone Cove landslide.
- Address silt and debris in canyon.
- Extend the study area and proposed improvements to approximately 400 feet above Upper Narcissa Drive (past the houses at the base of the larger natural canyon above).
- Protect the toe of the landslide located at the Altamira Canyon outlet to the Pacific Ocean.
- Address differential movement of proposed underground pipes.
- Improvements should look 'natural'.
- Propose solutions that work around existing erosion control systems.
- Address existing utilities within the canyon.
- Residents have completed work to stabilize the side of the canyon that is within their property which in some cases has resulted with increased erosion on the adjacent property.

After the first community meeting, the proposed alternatives were developed to address the concerns expressed by the residents. A second community meeting was held on November 2, 2016 to present the proposed alternatives and specifically detail how we addressed all of the residents' concerns that were expressed in the previous meeting (**see Appendix J for meeting presentation slides**). Many of the previously expressed concerns were repeated at this second meeting, but some additional new input was also received (and incorporated into this PSR as appropriate) as follows:

- Consider extending a pipe continuously to the confluence of the east and west fork.
- Perform periodic inspections of proposed improvements.
- Perform measurements of rain storm to verify hydrology calculations.



## V. EXISTING UTILITIES

In February 2016, a letter of request for utility atlas maps was sent to all utility companies identified through an Underground Service Alert (USA) search and above ground utilities (poles, covers, etc.) were identified during field visits and via surveys.

Identification of the existing utilities within the limits of the project and coordination with the utility companies is an essential element to almost all drainage projects. This is an essential step to making utility companies aware of an upcoming project that may affect their facilities. However, the majority of the utilities that cross our existing/proposed drainage system alignments are in the roadways and given that we will be simply lining the existing culverts there results in a reduced risk of utility conflicts and relocation issues. Still there are a handful of utility issues that were identified as follows:

During the project site visit, it was noted that there were existing utility pipes that were exposed where they crossed the canyon (**see Photos 16, 17 & 18**) and a power pole/guy anchor and two SCE manholes in the bed of the canyon (**see Photo 17-19**). In order to facilitate the construction of the proposed improvements, coordination and relocation of said conflicts with the utility owners will need to occur during the PS&E phase of the project.



**Photo 16 – Water utility pipe crossing east fork creek downstream of Sweetbay Rd**



**Photo 17 & 18 - Water utility pipe crossings downstream of east and west fork confluence point**



**Photo 19 & 20 Power Pole and Guy Anchor in creek section upstream of east / west fork confluence point**



**Photo 21 Side by side SCE Manholes upstream of Lower Narcissa Dr culvert**

## VI. PROPOSED STORM DRAIN STANDARDS AND DESIGN CRITERIA

### A. Storm Drain Hydrology and Sediment Production

As part of this PSR a detailed confirmation of the tributary drainage boundaries was performed for the Altamira Canyon. The Modified Rational Method hydrology criteria used for this study are outlined in the latest Los Angeles County Public Works Hydrology Manual, dated January 2006. The program Watershed Modeling System (WMS) software package<sup>1</sup> was utilized to perform the detailed hydrology analysis. The site is located within Los Angeles County Debris Potential Area (DPA) Zone 6 and soil type numbers 2 and 4. These parameters establish that **the natural Altamira Canyon is capable of generating 13,305 cubic yards of debris**. This potential debris volume would have to be addressed if a debris basin design was being contemplated (which it is not, see Section XI Other Alternatives for additional discussion).

1. MODRAT Interface by the Environmental Modeling Research Laboratory at Brigham Young University, Version 10.1.10 (64-bit), build date June 3, 2016, copyright 2016, serial WMS-00915.

Peak flow rates were calculated for the 100-year storm level reoccurrence. The 100-year storm level hydrology resulted in a **Q<sub>100</sub> = 1,460 cfs** at the ocean outlet point. Although the design storm event being recommended in this PSR is Q<sub>100</sub>, (for added security and

consistency with the recent adjacent McCarrell Canyon and San Ramon Canyon studies), Los Angeles County only requires that the proposed drainage improvements be designed to convey a “Capital Flood” (which is a 50-year storm event peak discharge,  $Q_{50}$ ) Note: For Altamira Canyon the calculated  $Q_{50} = 1,210$  CFS.

## B. Canyon and Culvert Hydraulics

All canyon valley and pipe culvert hydraulic modeling was performed utilizing Hydraulic Engineering Center River Analysis Software (HEC-RAS)<sup>2</sup>. The HEC-RAS program computes and plots uniform and non-uniform steady flow water surface profiles and pressure gradients in open channel or closed conduits with regular or irregular cross sections. Using the HEC-RAS program, each of the alternatives were studied to analyze the resulting flooding width, depth and velocity of the canyon flows and are detailed in the hydraulics report (see **Appendix F**).

2. US Army Corp of Engineers, Institute for Water Resources, Hydrologic Engineering Center, 609 Second Street, Davis, CA 95616, Software Version 5.0, February 2016

## VII. ENVIRONMENTAL REQUIREMENTS

### A. Environmental Clearance Jurisdictional Agencies

Per LSA Associates’ identification of environmental scope that will be required to go to construction for any of the three (3) primary Alternatives 3, 4 & 5 discussed herein (see **Appendix D**), an *Initial Study / Mitigated Negative Declaration (IS/MND)* is needed to clear the project under CEQA and if federal funds are used for the project, an Environmental Assessment / Finding of No Significant Impact (EA/FONSI) is needed to clear the project under the National Environmental Policy Act (NEPA). The Altamira Canyon is under the jurisdiction of the Army Corp of Engineers (ACOE) as part of the River and Harbors Act. It is also under the jurisdiction of the California Department of Fish and Game (CDFG) and the Los Angeles Regional Water Quality Control Board (LARWQCB). Since all improvements alternatives proposed to stop riprap placement 100 feet north of the beach it will come under the jurisdiction of the ACOE (again as part of the River and Harbors Act) and the LARWQCB. Permits from these agencies will likely be required for impacts to jurisdictional waters. Impacts to biological species and habitat will be mitigated through the Natural Community Conservation Plan (NCCP) as discussed below. To avoid reproducing all of the environmental findings and recommendations the referenced report is considered an integral part of this PSR.

### B. Natural Community Conservation Plan (NCCP)

RPV anticipated the need to repair or improve drainage systems in several canyon areas throughout the City and realized that these drainage projects would necessitate work in potentially sensitive habitat areas. Thus they drafted a citywide Natural Community Conservation Plan (NCCP). This plan identified biological resource areas and established habitat preserves, such as the Palos Verdes Shoreline Park / Open Space site (south of 25<sup>th</sup> Street / PVDS and west of San Pedro / CLA). During the PS&E phase, LSA will discuss with the resource agencies (U.S. Fish and Wildlife Service and California Department of Fish and Wildlife) all proposed mitigation for the Altamira Canyon project impacts to coastal sage

shrub and non-native grassland habitat areas to make sure that the NCCP mitigation is acceptable. This is particularly necessary given the draft NCCP has not been formally adopted by the agencies and no implementation agreement is in place.

### C. Environmental Clearance ~~Obstacles~~

The following are the jurisdictional agencies, along with the permits and requirements of each, for the Altamira Canyon Drainage and Erosion Control Project:

1. **Army Corp of Engineers (ACOE):** Section 404 Individual Permit will be required. This permit is a long lead item and therefor will be the focus of the effort at the beginning of the environmental process. The submittal package will include the construction plans along with details of construction access and staging activities for the proposed project. It is important that the permitting process is initiated as soon as the project design ~~is nearly complete~~ 
2. **California Department of Fish and Game (CDFG):** The proposed improvements ultimately will be altering the Altamira Canyon streambed and therefor a CDFG Section 1602 Streambed Alteration Notification permit will be required to address impacts to the maintained drainage channel. CDGG will request the regional board to review their recommendation and hence issue a 401 permit.
3. **Los Angeles Regional Water Quality Control Board (LARWQCB):** Permanent Best Management Practices (BMP's) will be required for long-term maintenance and water quality purposes. Also a National Pollutant Discharge Elimination System (NPDES) construction document will be required either as part of the LARWQCB requirements or as part of the LAC Municipal Separate Storm Sewer System (MS4) Permit.

### D. Technical Studies:

1. **Air Quality Analysis:** Because the project is within the South Coast Air Quality Management District (SCAQMD) and therefore an air quality impact analysis will be needed to evaluate the impact of the project during construction.
2. **Global Climate Change / Greenhouse Gas Emissions:** In the research perform by LSA, a Climate Action Plan (CAP) for the City of Rancho Palos Verdes was not found. In lieu of preparing a CAP, the greenhouse gas emission associated with construction activities will be calculated and feasible mitigation measures for potential GHG impacts from construction actives will be identified for implementation during construction.
3. **Technical Noise Write up** – An analysis of the potential short-term construction noise and vibration impacts on nearby sensitive receptors will be done and included in the environmental document. A long-term operational noise impact will not be required because no long-term operational noise impacts are expected for the proposed improvements.
4. **Biological Resources Assessment** – A biological assessment will be performed and compared to the City's NCCP Subarea plan (which is in draft format). This assessment will include the following:

- a. Delineation of the existing vegetation, wetlands, nonwetlands, streambeds, and riparian habitat.
  - b. Identify biological resources serves to identify habitats for where endangered species may live, such as the coastal sage brush, which is where the California Gnatcatcher Bird typically lives.
  - c. Focused California Gnatcatcher Bird Survey is performed to identify the existence / absence of this federally threatened species.
  - d. Special-Status Plant Species Survey, which serves to identify endangered plants species as listed by the California Native Plant Society.
5. **Cultural Resources Assessment** – A search for archeological and historical sites through the South Central Coastal Information Center (SCCIC) revealed several Environmentally Sensitive Areas (ESAs) within 0.25 miles of the project footprint of disturbance (Site identified as CA-LAN-141). During the PS&E phase of the project, a field survey will be performed to assess the current status of the prehistoric site and to determine if any other cultural resources are present in the project area.
  6. **Paleontological Resources Assessment** – A search through the Natural History Museum of Los Angeles County (LACM) identified fossil localities near the project site. These fossil localities have produced scientifically important paleontological resources, namely fossils of a variety of vertebrates. As part of the PS&E phase, a field assessment will be performed to note sediments at the surface and to identify the existence / absence of any paleontological resources.
  7. **Water Quality** - Best Management Practices (BMP's) shall be implemented for the project and will be included in the Mitigation Monitoring Program for water quality to ensure compliance with Federal, State and Local NPDES permit requirements. The PS&E construction document preparation phase for the alternative ultimately chosen would also fully detail the construction BMP requirements.

**Environmental Clearance Schedule:** The anticipated length of time required to obtain the environmental clearances identified herein and in Appendix D has been estimated at 3-years. The Section 404 Permit is the critical path for the project schedule and could take up to 3 years. The CEQA process for the IS/MND and, if federal funding is identified, the NEPA process for the EA/FONSI is anticipated to take approximately 1 year. The additional 2 years in the schedule are for the individual Section 404 Permit.

Task No.	Task Name	Duration
1	Project Initiation	1 month
2	Project Management/Meetings	Ongoing
3	Technical Studies	4 months
4	IS/MND	4 months
6	EA/FONSI – concurrent with the IS/MND	4 months
7	CDP is prepared post-CEQA approval	3 months
<b>Permits are prepared and processed concurrently</b>		
5.1	Individual Section 404 Permit – prepared post-NEPA approval	2 to 3 years
5.2	401 RWQCB Water Quality Certification – concurrent with the Section 404 Permit	2 to 3 years
5.3	1602 Streambed Alteration Agreement – post-CEQA/concurrent w/404 & 401	1 year

CDP = Coastal Development Permit

CEQA = California Environmental Quality Act

EA/FONSI = Environmental Assessment/Finding of No Significant Impact

IS/MND = Initial Study/Mitigated Negative Declaration

NEPA = National Environmental Policy Act

RWQCB = Regional Water Quality Control Board

## VIII. GEOTECHNICAL REQUIREMENTS

Per Ninyo & Moore's *Preliminary Geotechnical Study Report* (see **Appendix C**) all of the proposed design alternatives are considered feasible as long as additional subsurface exploration is performed when an alternative is chosen and if the recommendations in the report are followed. Based on the results of Ninyo & Moore's preliminary geotechnical investigation, following conclusions were presented:

1. Design Alternatives 3, 4, 5 and the Low Flow Diversion are considered to be feasible, provided that a detailed subsurface exploration is performed, and the design considerations and recommendations for specific preparation work resulting from the detailed subsurface exploration are followed.
2. For the preferred Alternative 4, the foundations of the existing drainage structures (walls) that are being called to be protected in place should be structurally evaluated for soundness during the design of the project. **(NOTE: It will be important to obtain "As-Built" typical sections, details and photo documentation of the existing retaining wall/drainage improvements to help document and evaluate the existing structures. If said information is not available and/or the City decides not to pursue the recommended structural evaluations, there is an alternate approach that might be considered in order to allow the protection of said existing drainage structures, whereby the affected property owners would be required to sign indemnity agreements to defend, protect and hold harmless any and all entities that might otherwise be named in any and all claims related to their potential failure.)**
3. The site is adjacent to the active Abalone Cove Landslide, which is part of the larger inactive ancient landslide complex that includes the active Portuguese Bend Landslide.
4. The site is underlain by fill soils, alluvium and landslide deposits (**See Figure 2**) See full geotechnical report in Appendix C for additional cross sections and profiles.
5. None of the design alternatives will adversely impact Altamira Canyon.
6. The potential for groundwater during construction should be anticipated.
7. The site will be subject to seismic hazards in the future; however, none of the design alternatives will increase the likelihood or magnitude of these impacts.
8. The final design should consider the earthwork quantities, with respect to balancing the cuts and fills, including the volume of materials that would be displaced by the proposed improvements. Balancing the volume of cut and fill reduces the likelihood of adding any potentially detrimental loading to the still active Abalone Cove Landslide.

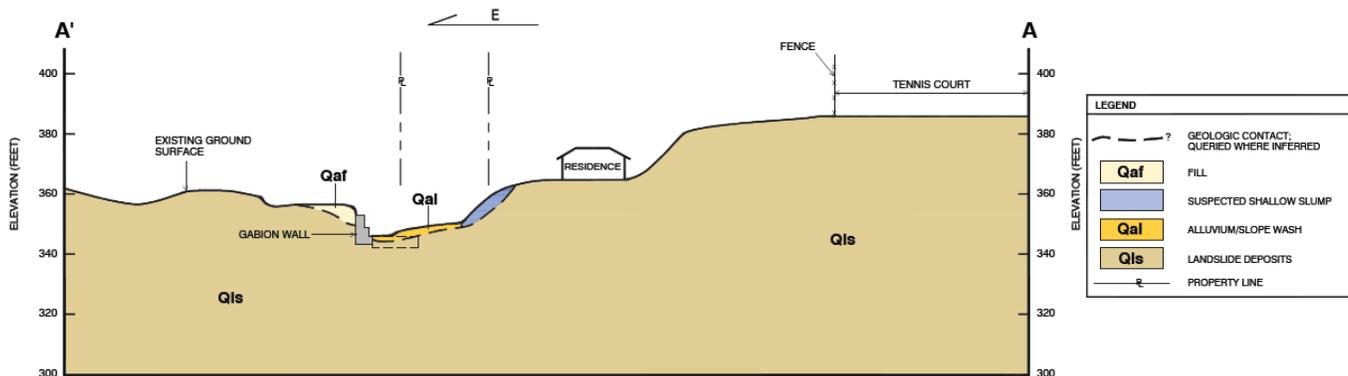


Figure 2 –Cross section taken at existing Gabion Wall (south of Sweetbay Road)

## IX. CANYON DRAINAGE IMPROVEMENTS ALTERNATIVES

The aerial topographic survey specifically obtained for this study was used to layout out and analyze several alternatives for the canyon improvements. The scope of the PSR required Harris to investigate at least four (4) alternative designs and make assessments on a number of criteria including effectiveness of the design concept, constructability, geological feasibility, environmental impacts and related mitigation, schedule, cost and other factors. Five (5) hydraulic alternatives were investigated, but then refined down to the three (3) most feasible alternatives (**Alternatives 3, 4 & 5, see Appendix G and below for additional details**), bringing the total number of alternatives to four (4) when a “No Project” option is included, which would leave the canyon in an “as-is” condition (**“No Project” is Alternative 6**).

A potential sub-alternative or “interim” solution was also studied to divert spring-fed low flows from the east fork of Altamira Canyon to an adjacent canyon to the west to minimize water intrusion into the Abalone Cove Landslide. However, this low flow diversion is not being recommended as part of any alternative solution due to prohibitive costs and the redundant solution it provides given the impermeable liner proposed along the canyon (which will also eliminate infiltration) and due to other potentially negative factors associated with diverting flows from their historic flood path and infiltrating water into the adjacent dormant ancient landslide “edge-scarp”, possibly reactivating movement there over time.

The details of each of these alternatives is as follows:

**A. Alternative 3 – North Extension of existing Palos Verdes Drive South / Lower Narcissa Drive Culvert along Altamira Canyon, with the placement of an ungrouted riprap channel from 100’ north of the beach to approximately 400’ north of Upper Narcissa Drive, slip-lining of all the existing 10-foot CMP culverts and removing the existing private drainage improvements**

Alternative 3 consists of the installation of approximately 480 lineal feet of a 9.5-foot diameter welded steel pipe storm drain to extend the existing CMP pipeline just north of Lower Narcissa Drive. The new pipeline would be generally installed using open trench methods and the top of the pipe is expected to have a minimum cover of approximately 2-feet. The remainder of the canyon, from approximately 400 feet north of Upper Narcissa Drive to the new 9.5-foot storm drain pipe inlet and south from the existing CMP under Palos Verdes Drive South to within approximately 100 feet north of the beach would be lined with a trapezoidal riprap lined channel. Energy dissipaters structures would be constructed at key locations along the canyon in order to reduce the velocity of the storm water flows and the channel width will vary from approximately 10 to 25 feet. The channel would be prepared by removing loose material to firm native soils and placing an impermeable liner along the bottom of the excavation. After placement of the liner, a sub-drain consisting of a 12-inch diameter perforated pipe surrounded by 3/4” gravel wrapped with filter fabric, would be placed near the center of the channel. A second layer of filter fabric will be placed over the sub-drain and covered with 12 inches of 3/4” gravel. This gravel layer will be covered with ungrouted riprap. The sides of the channel would be constructed at a slope of 2:1 (horizontal to vertical) or flatter. The existing channel improvements such as the rock gabion, and timber walls between Upper Narcissa Drive and Sweetbay Road and south of Sweetbay Road would be removed. Existing culvert crossings under Palos Verdes Drive South, Lower Narcissa Drive, Upper Narcissa Drive and Sweetbay Road would remain and be slip-lined with a 9.5-foot welded steel pipe, and the annular space grouted, to maintain the structural integrity of the existing culvert crossings during major storm events.

**Alternative 3 Facts:**

- 9.5-foot diameter welded steel pipe x 480 lineal feet
- Slip-line of existing 10-foot CMP culvert crossings with 9.5-foot diameter welded steel pipe and grout the annular space
- UngROUTED Riprap channel improvements with sub-drain and impermeable sub-grade liner
- Removal of existing drainage improvements previously placed by residents
- Total Cost: **\$9.2 million**

**B. Preferred Alternative 4 – North Extension of existing Palos Verdes Drive South / Lower Narcissa Drive Culvert along Altamira Canyon, with the placement of an ungrouted riprap channel from 100’ north of the beach to approximately 400’ north of Upper Narcissa Drive, slip-lining of all the existing 10-foot CMP culverts and protecting the existing private drainage improvements**

Alternative 4 consists essentially of the same design elements as Alternative 3 with some exceptions. The existing drainage improvements, including the grouted riprap invert/timber walls located between Upper Narcissa Drive and Sweetbay Road and the rock gabion walls located south of Sweetbay Road would be protected in place if they are determined to be structurally sound during the PS&E phase. A proposed grouted riprap half-section trapezoidal channel would be constructed alongside these existing drainage/wall improvements.

**Alternative 4 Facts:**

- 9.5-foot diameter welded steel pipe x 480 lineal feet
- Slip-line of existing 10-foot CMP culvert crossings with 9.5-foot diameter welded steel pipe and grout the annular space
- UngROUTED Riprap channel improvements with sub-drain and impermeable sub-grade liner
- Protect existing drainage improvements previously placed by residents (**see note below**)
- Total Cost: **\$8.3 million**

**NOTE:** For the preferred Alternative 4, the foundations of the existing drainage structures (walls) that are being called to be protected in place should be structurally evaluated for soundness during the PS&E design phase of the project. **(It will be important to obtain “As-Built” typical sections, details and photo documentation of the existing retaining wall/drainage improvements to help document and evaluate the existing structures. If said information is not available and/or the City decides not to pursue the recommended structural evaluations, there is an alternate approach that might be considered in order to allow the protection of said existing drainage structures, whereby the affected property owners would be required to sign indemnity agreements to defend, protect and hold harmless any and all entities that might otherwise be named in any and all claims related to their potential failure.)**

**C. Alternative 5 – Underground Welded Steel Pipe along Altamira Canyon, from Palos Verdes Drive South to approximately 400’ north of Upper Narcissa Drive and the placement of an ungrouted riprap channel from 100’ north of the beach to Palos Verdes Drive South**

Alternative 5 would include the installation of 9.5-foot diameter welded steel pipe along Altamira Canyon from Palos Verdes Drive South to approximately 400’ north of Upper Narcissa Drive. The new pipe would extend from the existing CMP under PVDS through the culvert crossings under Upper Narcissa Drive and Sweetbay Road and approximately 400 feet north of Upper Narcissa Drive. A 4-foot-wide trapezoidal channel and various drainage inlets at key locations would be constructed over the new pipeline to collect local tributary flows to the canyon. Similar to both Alternatives 3 and 4, the existing canyon south of Palos Verdes Drive South to within approximately 100 feet north of the beach would be lined with an ungrouted riprap trapezoidal channel with impermeable liner and sub-drain system.

**Alternative 5 Facts:**

- New Upper-canyon inlet structure
- 9.5-foot diameter welded steel pipe mainline
- Slip-line of existing 10-foot CMP culvert crossings with 9.5-foot diameter welded steel pipe and grout the annular space
- 4-foot trapezoidal channel with impermeable liner along alignment of buried pipeline
- Drainage inlets at key locations along alignment of buried pipeline
- Protect existing improvements previously placed by residents
- Total Cost: **\$9.6 million**

**D. Alternative 6 – “No Project” Alternative / Leave Existing Conditions “As Is”**

Alternative 6 proposes to leave conditions as they presently exist. With this alternative, the Altamira Canyon Gated Community should expect continued water infiltration into Abalone Cove Landslide, sediment transport and cobble deposition and canyon side wall erosion and potential undermining (see **Photo 22**) during moderate rain events. Continued erosion along the canyon and water infiltration could potentially result in the loss of useable property.



**Photo 22 – Existing Canyon Wall Undermining**

This “no project” alternative is NOT to be confused with a “no cost” alternative. It could likely result in costing much more than any of the other alternatives in the long-term if damage to homes should occur due to either erosion or the movement of the Abalone Cove landslide due to continued water infiltration. Such an occurrence would likely require that one of the other alternatives ultimately be constructed in addition to

the cost of repairing whatever damage might occur to private property.

**Alternative 6 Facts:**

- Continued flow infiltration into Canyon fissures
- Continued erosion of the canyon slopes
- High velocity flows carrying sediment, debris & various size rocks and cobbles
- Total Present Cost: Annual maintenance of the canyon slopes
- Total Future Cost: Unlimited maintenance costs and possible of loss of private property

Preliminary level (30% +/- complete) canyon improvement “plan” sheets and typical cross sections have been prepared for the various alternative canyon improvements (**see Appendix G**). Also a separate profile showing the existing Altamira Canyon invert profile along with the proposed riprap channel invert (Alternatives 3 & 4) and proposed 9.5’ storm drain pipe invert (Alternative 5) is also shown in **Appendix G**.

# DECISION/RISK ANALYSIS

Altamira Canyon Drainage and Erosion Study				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Project Cost	Project Schedule	Construct-ability Issues	Availability of Materials	Contractor's Expertise Required	R/W and Easement Requirements	Environmental Impacts	Geotechnical Issues	Flood Protection	Susceptibility to Debris Flow and Land Movement Damage	Aesthetics of Improvements from Residences	Impacts to Water Quality	Impacts to Abalone Cove Beach	Impacts to Private Residents and Adjacent Dwellings	Impacts to Traffic	Impacts to Utilities	Resulting Service Life	Future Maintenance Issues
Weighting Factor				5	3	4	2	2	2	4	5	4	5	5	2	3	4	2	2	3	3
Option No.	Rank	Raw Score	Weighted Score																		
<b>Extending PVDS Culvert to approximately 450 LF north of existing inlet and lining Existing Canyon to just north of upper Narcissa Drive and REMOVING private improvements along Channel</b>																					
<b>3</b>	<b>2</b>	27.5	92.5	1.5	1	1	1.5	1.5	1.5	1.5	2	1.5	2	1.5	1.5	1.5	1	1.5	1.5	2	2
<b>Extending PVDS Culvert to approximately 450 LF north of existing inlet and lining Existing Canyon to just north of upper Narcissa Drive and PROTECTING private improvements along Channel</b>																					
<b>4</b>	<b>1</b>	32	105	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	1.5	1.5
<b>9.5' Diameter steel pipe from PVDS Culvert to upstream of Narcissa Drive</b>																					
<b>5</b>	<b>3</b>	24	76.5	1	1	1	1.5	1.5	1.5	1	1	2	0.5	2	2	2	1	1.5	1.5	1	1
<b>No Project - Leave Conditions "as is" (unlimited maintenance &amp; damage claims)</b>																					
<b>6</b>	<b>4</b>	3	11.5	-0.5	-11.5	-1	1	1	1	1	1	0.5	-1	-1	-1	0	0.5	0.5	-1	0	0

**Raw Score** = Sum of all Raw Scores

**Weighted Score** = Sum of Weighting factor x Raw Score

Scoring Legend		
2	=	Alt. Is best solution among alternatives considered
1.5	=	Alt. Is a very good solution
1	=	Alt. is an acceptable solution
0.5	=	Alt. Is a marginal solution
0	=	Not Acceptable
-1	=	Alt. Is an inferior solution with associated problems

Weighting Factor Legend		
5	=	Most Important / Sensitive Issue
4	=	More Important / Sensitive Issue
3	=	Average Important / Sensitive Issue
2	=	Less Important / Sensitive Issue
1	=	Least Important / Sensitive Issue

## X. RECOMMENDED ALTERNATIVE

**The recommended alignment is Alternative 4.** Its advantages, combined with the disadvantages associated with other Alternatives make this the recommended project solution for the following reasons:

- Rated number 1 in the Decision / Risk Analysis Chart on the previous page.
- It meets all project goal requirements for minimizing erosion within the Altamira Canyon, minimizing groundwater intrusion, and conveyance of a 100-year storm event.
- It Diminishes the erosion and undercutting in the canyon, thereby protecting existing residential improvements and minimizing debris transport to allow “clear water” flows.
- It substantially reduces the amount of flow being infiltrated in the existing canyon fissures with the placement of an impermeable liner and subdrain.
- It provides a design that will accommodate continuous inflow from the side slopes within the canyon, which a buried pipe would not.
- It provides a design that will restore and protect the existing streambed.
- It provides a “natural” looking ungrouted riprap rock invert that can “self-heal”, and remain functioning during storm conditions, if there should be any land movement unlike a buried pipe solution.
- It is the least expensive alternative by up to 10% from the next favorable alternative and provides the targeted flood protection (Q100). Thus it could be argued that it potentially provides the most value (benefit per cost).
- Maintenance of the proposed riprap channel is substantially less than that of an underground pipe.
- The residential investment for the existing canyon drainage (wall) improvements would be protected and will result in impacting less private property than otherwise be needed if these improvements were to be removed.

## XI. OTHER ALTERNATIVES EXPLORED

### A. Low Flow Diversion

There is an existing natural spring along the east fork of the Altamira Canyon with the name of Indian Wells Spring that has a year-round flow (see Photo 23). A sub-alternative of the Upper Narcissa Drive east fork low flow (spring) diversion (see Appendix G), which was studied as part of this PSR with the intent to reduce the amount of flows infiltrating into the Abalone Cove Landslide, is not being recommended as part of any Alternative solution due to its prohibitive cost and redundancy, given the impermeable liner proposed along the canyon as part of the other alternatives and other potentially negative factors associated with diverting flows from their historic flood path and infiltrating water into the dormant ancient landslide “edge-scarp”.



Photo 23: East fork Spring  
U/S of Upper Narcissa Dr

#### Low Flow Diversion = \$3.3 million

A list of “pros” & “cons” associated with this interim solution are as follows:

#### PROS:

- Reduces the potential for infiltrating flows into the Abalone Cove Landslide
- Could be a potential interim solution until the Altamira Canyon can be lined
- During non-rainy periods (and extended drought) it appears that the spring flow volume roughly matched the dewatering outfall flow volume, which in theory suggests that this LFD could help reduce the need for dewatering

#### CONS:

- Prohibitive cost
- Redundancy Given impermeable liner proposed along canyon as part of other alternatives
- Potential negative factors associated with diverting flow from their historic flood path.
- Without the accompaniment of a riprap creek liner, flows continue to infiltrate into the existing Abalone Cove Landslide
- Differential land movement could damage proposed improvements; hence making the maintenance of the low flow diversion cost prohibitive.
- The proposed interim solutions would not reduce the flooding and erosion along the Altamira Canyon.

### B. Diversion Tunnel Alternative

Another alternative considered during the project study was the idea of diverting storm flows that are tributary to Altamira Canyon upstream of the Abalone Cove Landslide and diverting them to the ocean via the most stable bedrock path to the east side of Portuguese Point. This alternative proved to be too costly and have too many environmental impacts and long-term maintenance risks associated with navigating under / adjacent to the ancient complex landslide.

**C. Debris Basin**

A debris basin was another alternative considered during the project study development. The primary purpose of a debris basin is to collect large debris from storm flows for later removal. They should have unobstructed access from a public street and should have maintenance access around the entire perimeter of the facility. In looking at the criteria and the existing conditions, this alternative proved to be too costly, have too many environmental impacts due to the footprint needed, has long-term maintenance risks associated with the natural steep terrain and loading and it could advertently increase loading on the active existing Abalone Cove landslide.

**XII. PERMANENT DRAINAGE EASEMENTS**

An easement is a legal right to use someone else's land for a particular purpose. For the Altamira Canyon Project, that purpose is for drainage improvements and related long-term maintenance. The Altamira Canyon is mostly, if not all within private property and for the purpose of this project, a no-fee drainage easement is recommended for the Altamira Canyon improvements if the proposed improvements are funded and / or maintained by the City.

A preliminary map has been prepared noting the needed easements for the proposed improvements (**see Appendix I**). It was assumed that a 10' wide swath to either side of the edge of the proposed trapezoidal riprap channel segment would be required and a 10' wide swath to either side of the centerline for the 480 LF of pipe segment would be required for a long-term maintenance easement. The following is a table depicting the area needed from each of the parcels for which the improvements cross:

APN	APPROXIMATE EASEMENT AREA (SF)
7572-015-011	400
7572-015-010	8,560
7572-017-034	690
7572-017-002	7,180
7572-017-001	13,530
7572-016-009	9,430
7572-016-020	2,280
7572-016-008	50
7572-016-016	90
7572-016-015	12,580
7572-016-021	6,680
7572-016-014	13,510
7572-016-022	19,690
7572-016-010	17,950
7572-013-019	370

APN	APPROXIMATE EASEMENT AREA (SF)
7572-016-011	690
7572-013-017	620
7572-013-017	7,550
7572-013-015	10,520
7572-013-016	3,980
7572-011-029	230
7572-011-028	7,830
7572-011-030	740
7572-011-027	6,330
7572-011-031	3,950
7572-010-009	4,400
7572-010-009	830
7572-010-020	3,450
7572-002-024	26,800

These easements would primarily be required if the long-term maintenance of the proposed improvements become responsibility of the City. If that is not the case, and the Private Altamira Canyon Gated Community pays for the improvements, then the easements may or may not be required at the discretion of the property owners. Although the easements would be recommended for any joint maintenance agreement that the Private Altamira Canyon Gated Community may put into place, there could also be the option of each fronting property owner taking over the long-term maintenance of their own portion of the creek channel, if that was found to be acceptable by the affected property owners.