



California Department of Fish and Wildlife
San Mateo County
San Mateo Coastal Watersheds
Stream Habitat Assessment Reports

Apanolio Creek

Surveyed 2011

Report Completed in 2013



Apanolio Creek

STREAM INVENTORY REPORT

Apanolio Creek

INTRODUCTION

A stream inventory was conducted 6/7/2011 to 8/2/2011 on Apanolio Creek. The survey began at the confluence with Pilarcitos Creek and extended upstream 4 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Apanolio Creek.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Apanolio Creek is located in San Mateo County, California (Map 1). It is a tributary to Pilarcitos Creek, which flows into Half Moon Bay, which flows into Pacific Ocean. Apanolio Creek's legal description at the confluence with Pilarcitos Creek is T05S R05W Sec.28. Its location is 37.476 north latitude and 122.4116 west longitude, LLID number 1224116374760. Apanolio Creek is a first order stream and has approximately 3.6 miles of blue line stream according to the USGS National Hydrology Dataset (NHD). Apanolio Creek drains a watershed of approximately 2.1 square miles. Elevations range from about 105 feet at the mouth of the creek to 1,742 feet in the headwater areas. Evergreen forest and herbaceous grasslands dominates the watershed. The watershed is primarily privately owned, which accounts for 99% of the land area. Ninety-nine percent of the land is considered natural, less than 1% is agricultural, and less than 1% is urban. Vehicle access exists via Hwy 92 heading east out of the town of Half Moon Bay. Further access to the watershed exists via Ox Mountain Landfill Road.

METHODS

The habitat inventory conducted in Apanolio Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Wildlife (CDFW). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are fully measured. All other habitat unit types

Apanolio Creek

encountered for the first time in each reach are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Apanolio Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Apanolio Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Apanolio Creek, embeddedness was

Apanolio Creek

ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Apanolio Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Apanolio Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Apanolio Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Apanolio Creek

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Apanolio Creek. In addition, 1 site was electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Apanolio Creek include:

Apanolio Creek

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of 6/7/2011 to 8/2/2011, was conducted by D. Dela Vega, A. Hernandez, and J. Hanson (WSP). The total length of the stream surveyed was 20,860 feet with no additional feet of side channel.

Multiple stream flow measurement were taken during and after the survey was conducted. Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.638 cfs on July 6, 2011. On July 28, 2011 stream flow was measured at the same location at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.844 cfs.

Apanolio Creek is a F4 channel type for 10,417 feet of the stream surveyed (Reach 1), a NA channel type for 213 feet of the stream surveyed (Reach 2), a F4 channel type for 4,051 feet of the stream surveyed (Reach 3), a G4 channel type for 2,861 feet of the stream surveyed (Reach 4), a A3 channel type for 3,318 feet of the stream surveyed (Reach 5). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width to depth ratios, and gravel-dominant substrates. G4 channels are entrenched 'gully' step-pool channels on moderate gradients with low width to depth ratios, and gravel-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels with depositional soils, and cobble-dominant substrates. NA channels had no access.

Water temperatures taken during the survey period ranged from 52 to 60 degrees Fahrenheit. Air temperatures ranged from 55 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 50% flatwater units, 30% pool units, 18% riffle units, 2% culvert units, 0% not surveyed units (Graph 1). Based on total length of Level II habitat types, there were 83% flatwater units, 9% riffle units, 6% pool units, 1% not surveyed units, 1% culvert units (Graph 2).

Eighteen Level IV habitat types were identified (Table 2). The most frequent habitat types by

Apanolio Creek

percent occurrence were 29% step run units, 12% run units, 11% plunge pool units (Graph 3). Based on percent total length, 64% step run units, 12% run units and 8% glide units.

A total of 109 pools were identified (Table 3). Scour pools were the most frequently encountered at 48% (Graph 4), and comprised 40% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. One of the 109 pools (1%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 109 pool tail-outs measured, 51 had a value of 1 (47%), 37 had a value of 2 (34%), 11 had a value of 3 (10%), 1 had a value of 4 (1%), 9 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 31, flatwater habitat types had a mean shelter rating of 30, and pool habitats had a mean shelter rating of 40 (Table 1). Of the pool types, the backwater pools had a mean shelter rating of 19, main channel pools had a mean shelter rating of 33, scour pools had a mean shelter rating of 51 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover type in Apanolio Creek. Graph 7 describes the pool cover in Apanolio Creek. Small woody debris is the dominant pool cover type, followed by root masses.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel substrate was observed in 40% of pool tail-outs; and sand substrate was observed in 25% of pool tail-outs.

The mean percent canopy density for the surveyed length of Apanolio Creek was 95%. Of the canopy present, the mean percentages of hardwood and coniferous trees were 98% and 2%, respectively. Five percent of the canopy was open. Graph 9 describes the mean percent canopy in Apanolio Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 92%. The mean percent left bank vegetated was 93% (Table 7). The dominant elements composing the structure of the stream banks consisted of 74% sand/silt/clay, 11% bedrock, 10% cobble/gravel and 5% boulder (Graph 10). Brush was the dominant vegetation type observed in 49% of the units surveyed. Additionally, 49% of the units surveyed had deciduous trees as the dominant vegetation type, and 2% had grass as the dominant vegetation type (Graph 11).

Apanolio Creek

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at 1 site for species composition and distribution in Apanolio Creek on June 23, 2011. Water temperatures taken during the electrofishing period of 1211 to 1332 ranged from 50 to 52 degrees Fahrenheit. Air temperatures ranged from 67 to 61 degrees Fahrenheit. The sites were sampled by D. Acomb, D. Resnik, (CDFW), and A. Hernandez (WSP).

In reach 1, which comprised the first 731 feet of stream, 1 site was sampled. The reach sites yielded 0 young-of-the-year steelhead/rainbow trout (SH/RT), 2 age 1+ SH/RT, 1 age 2+ SH/RT, and 1 California Red-Legged Frog.

The following chart displays the information yielded from these sites:
2011 Apanolio Creek electrofishing observations.

Date	Site #	Reference Point	Distance From Reference Point (ft.)	Steelhead/Rainbow Trout			Non Salmonids Name species
				0+	1+	2+	
06/23/2011	1	Staff Plate near end of Road	0	0	2	1	1 California Red-legged Frog

DISCUSSION

Apanolio Creek is a F4 channel type for 10,417 feet of the stream surveyed, a NA channel type for 213 feet of the stream surveyed, a G4 channel type for 4,051 feet of the stream surveyed, a A3 channel type for 2,861 feet of the stream surveyed, a A3 channel type for 3,318 feet of the stream surveyed. The suitability of F4, NA, G4, and A3 channel types for fish habitat improvement structures is/are as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; NA channel types were not surveyed and suitability cannot be assessed; G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover; and A3 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days 6/7/2011 to 8/2/2011 ranged from 52 to 60 degrees Fahrenheit. Air temperatures ranged from 55 to 69 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Apanolio Creek

Flatwater habitat types comprised 83% of the total length of this survey, riffles 9%, and pools 6%. The pools are relatively shallow, with 1 of the 109 (1%) pools having a maximum residual depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Eighty-eight of the 109 pool tail-outs measured had embeddedness ratings of 1 or 2. Twelve of the pool tail-outs had embeddedness ratings of 3 or 4. Nine of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Apanolio Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Sixty of the 109 pool tail-outs measured had gravel and small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 40. The shelter rating in the flatwater habitats is 30. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by terrestrial vegetation in Apanolio Creek. Small woody debris is the dominant cover type in pools, followed by root masses. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 95%. Reach 1 had a canopy density of 92.6%, Reach 2 had a canopy density of N/A, Reach 3 had a canopy density of 96.7%, Reach 4 had a canopy density of 95.5%, and Reach 5 had a canopy density of 96.4%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 92% and 93%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

GENERAL RECOMMENDATIONS

Apanolio Creek should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to

Apanolio Creek

remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

- 1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Terrestrial Vegetation. Adding high quality complexity with woody cover in the pools is desirable.
- 2) Suitable size spawning substrate on Apanolio Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.
- 3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 4) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 5) Access for migrating salmonids should be assessed at all road crossings and dams. Sites of particular concern include the identified in-stream impoundment structure located upstream of the agricultural plots and greenhouse structures and all access road culverts. All identified dams and old dam sill sites were considered to be fish passage barriers and are located at the top extent of Reach 1 and Reach 3. Multiple temporary man-made dams and a large earthen dam site were identified throughout Reaches 3 and 4 as potential fish barriers. All fish passage assessments should be done according to Part 9 of the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). Where needed, crossings should be replaced or modified to improve fish passage.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position	Habitat Unit #	Memo
0	0001.00	Start of Survey at the Confluence to Pilarcitos Creek. Rip Rap on both banks of creek
14	0002.00	Rip Rap continues up stream into this habitat unit.
181	0007.00	Rip Rap continues on both banks and includes large concrete slabs.

Apanolio Creek

Position	Habitat Unit #	Memo
181	0007.00	Salmonid Young of the year (YOY) observed 230ft up the habitat unit.
539	0008.00	In middle of the habitat unit are 2 PVC pipes in the right bank.
650	0011.00	Several salmonid YOY observed throughout the habitat unit.
886	0015.00	Rip Rap on both banks ends at outlet of culvert.
886	0015.00	Culvert #1 located at HWY 92. Culvert has a height=11', a width=10', and a length =36ft; it is made of intact concrete with a natural bottom. Not likely a possible barrier to juveniles and adult salmonids. Bottom of culvert is natural streambed. WP#3 N37.47837 W122.41342
922	0016.00	75ft into the habitat unit is 1" PVC pipe entering creek. 100ft into the habitat unit is baffle culvert on the left bank contributing runoff into creek. Entire habitat unit has significant amount of trash in it.
1,159	0018.00	Large concrete slabs next to the right bank.
1,229	0021.00	Unidentified 1+ fish observed
1,412	0026.00	Unidentified 2+ fish observed
1,515	0031.00	Lots of tires in streambed. Embedded car on the left bank at the top of the habitat unit.
1,815	0032.00	Large piece of concrete creating riffle
1,843	0033.00	At top of the habitat unit is old chimney top and refrigerator on the left bank.
2,181	0039.00	200 ft into the habitat unit is 1.5' diameter pipe exposed on the right bank. Concrete blocks placed on right bank are stabilizing the entire right bank of the habitat unit.
2,425	0040.00	Unidentified 1+ fish observed
2,478	0042.00	Unidentified YOY observed.
2,670	0053.00	Concrete slabs holding up on the right bank, some have fallen into the stream channel.
2,686	0054.00	Concrete slabs continue on the right bank
2,735	0056.00	At top of the habitat unit is a 3.5' vertical plunge created by LWD.
2,812	0058.00	Cement retaining wall on the right bank is slumping into creek channel. 270ft into the habitat unit is a large pipe contributing a significant amount of water to the stream.

Apanolio Creek

Position	Habitat Unit #	Memo
2,812	0058.00	Unidentified 1+ fish observed
3,119	0059.00	Salmonid YOY observed
3,127	0060.00	Rip rap and retaining wall occur sporadically on the right bank throughout the habitat unit.
3,372	0061.00	One foot diameter pipe at top of the habitat unit spans across the channel.
3,372	0061.00	Bridge #1 is a temporary access bridge, made of wood and metal I-beams and has a width=14', a height=5', and a length=14'. Not a possible barrier to juvenile or adults salmonids.
3,643	0065.00	Lots of trash in stream channel and both banks along the entire habitat unit. 600 ft into the habitat unit is a cracked water pipe which spans the creek and contributes water to stream. Cracked water pipe is creating source of erosion on right bank.
4,431	0069.00	Within the first 100ft of the habitat unit is a series of SWD potentially from old landslide.
4,631	0070.00	LWD#001 has a height=4', a width=13', and a length=12' with 3 large wood pieces. Water flows through the LWD but has no visible gaps. It is a potential barrier for adult fish during high flows and has no stored sediment. Calibration WP#009 N37.48558 W122.41955
5,068	0078.00	Large old redwood water tank slumping onto creek channel from the left bank; 100ft into the habitat unit is buried 2' diameter pipe in the left bank. 135ft into the habitat unit is old cement retaining wall w/rebar reinforcement slumping into creek channel from the right bank.
5,244	0079.00	Lots of trash in the left bank slumping into stream channel.
5,311	0080.00	At top of the habitat unit is old car embedded in the left bank; above car is 1' diameter pipe sticking out of the left bank. Calibration WP #010 N37.48751 W122.41988
5,611	0081.00	Several salmonid YOY observed 100ft into the habitat unit. 400ft into the habitat unit is 2" PVC pipe on the right bank. 500ft into the habitat unit is large 9" diameter PVC pipe spanning stream channel and continues into next habitat unit to a cement box water catch system. Whole structure is creating a cascade.

Apanolio Creek

Position	Habitat Unit #	Memo
6,111	0082.00	Cascade is created by structure described in previous habitat unit. Cascade has 3 vertical drops: first downstream plunge= 3' second downstream plunge= 4' and the third downstream plunge=4.5'. Entire structure is a potentially fish barrier. At top of the habitat unit, upstream of cement box water catch, is a dam pool created by structure.
6,136	0083.00	Dam pool is created by structure which occurs and is described in previous habitat unit. Both banks are covered in cement and a 1" PVC pipe spans stream channel. Large 9" metal pipe runs through across habitat unit, diverting water to property on the left bank. 60ft into the habitat unit are 3 large trees catching SWD.
6,212	0084.00	At bottom of the habitat unit, sandy substrate is so fine that it's creating a sinking/ liquefaction effect.
6,268	0085.00	Old metal pipe is rusted and unused; it runs through the first 10ft of the habitat unit and started about 40ft into habitat unit #083.
6,355	0086.00	Plunge is created by downcutting of water from collapsing Culvert #002 just upstream. Old rusted 2" pipe extends across plunge pool from under culvert in next the habitat unit. 3" PVC pipe spans stream channel above culvert outlet; this pipe is diverting water to agricultural field on the right bank.
6,361	0087.00	Road above culvert is eroding into stream and culvert is collapsing into itself.
6,361	0087.00	Culvert #002 is made of CMP, and has a height=4', a width=3', and a length=20'. It's severely degraded and collapsing. The down cutting is a height=2ft and has created a 1.5ft pool in outlet. Potential fish barrier.
6,381	0088.00	Unidentified frog observed
6,885	0097.00	Sixty five feet into the habitat unit on the right bank are spoil piles from newly developed agricultural space.
7,353	0102.00	At end of the habitat unit is 2" diameter metal pipe on the left bank entering the stream channel.
7,517	0103.00	At bottom of the habitat unit is old rusted metal oven in stream channel.
7,681	0108.00	First 30ft of the habitat unit is eroding.

Apanolio Creek

Position	Habitat Unit #	Memo
7,723	0109.00	16ft into the habitat unit is 1" metal pipe spanning creek channel. Two metal culverts on the left bank are unused and embedded into bank. Bottom culvert clogged with dirt. Both culverts have a length = 40' and are 5ft in Diameter.
7,931	0111.00	Unidentified young fish observed. Fish was dark in color.
8,002	0113.00	Bottom of the habitat unit on the right bank is erosion site with a height = 30', a length = 20', and a width=30'.
8,030	0116.00	200ft into the habitat unit is rusted metal equipment/machine in stream channel.
8,759	0127.00	Substrate in left bank tributary #001 was mostly sand and mud. Tributary is likely fed by a spring.
8,759	0127.00	Left bank Tributary #001 is wet for the first 45' and has a slope of 3% with an estimated flow= .001cfs (contributing approximately 2% of flow to receiving stream). It is accessible to fish for the first 100' with a water temperature = 57F. No fish were observed in the tributary.
9,068	0133.00	Right bank erosion site has a height = 100' and a width=40'
9,215	0136.00	TV in stream channel.
9,444	0142.00	Old Dam- not in use. Dam #001 has a height = 7' (along the Right bank wall), and width= n/a. Dam is creating down cutting with a height = 0.7'; this could be a potential barrier for juvenile fish. Water is running over the top of the sill.
9,460	0143.00	Flashboards 10' into habitat unit
9,594	0147.00	Old rusted car in the right bank extends into the upstream habitat unit.
9,673	0151.00	22ft into the habitat unit is 1" PVC pipe in stream channel and the right bank. At end of the habitat unit is man-made dam, made of small long logs and sand bags, (about 20ft long) next to old large eucalyptus root mass which eroded into creek from the left bank.
9,854	0152.00	High gradient riffle is created by large concrete slabs and rip-rap, which are slumping into channel from the right bank.
9,881	0153.00	1" PVC pipe falling into stream channel extends into the right bank where a small landslide area is

Apanolio Creek

Position	Habitat Unit #	Memo
		occurring. Old over-grown landslide is 20'x20'x3'. 310 ft into the habitat unit is old degraded 1" diameter pipe spanning across stream channel. 425 ft into the habitat unit are old degraded metal pipes scattered in channel.
9,881	0153.00	2 unidentified YOY and several salmonid YOY observed throughout the habitat unit. Rough-skinned Newt observed.
10,311	0154.00	Unidentified 1+fish observed
10,357	0155.00	Water flowing through culvert is turbid. On other side of culvert is inaccessible duck pond. There is an unused plastic culvert on the right side of culvert #003.
10,357	0155.00	Culvert #003 is located below access road. Two culverts with one active and one unusable culvert. Made of plastic and in good condition with a height=3', a width=3', and a length = 60'. Slope of culvert is 3-6% with an outlet pool depth = 0.7ft. It is a Potential Barrier to juveniles and adult salmonids
10,417	0156.00	Man-made duck pond is inaccessible.
10,630	0157.00	Bottom of the habitat unit is flagged and marked on GPS (WP#022 N37.49773 W122.42062.) Survey continues and access continues past WP; Crew started at the upstream end of no access zone/ duck pond. Looks like end of developed agricultural areas.
11,097	0168.00	130 ft into the habitat unit is old unused 2" diameter pipe protruding from the left bank into the channel.
11,520	0176.00	2 unidentified YOY observed
11,882	0179.00	Old rusted culvert in stream channel creating plunge and bedrock ledge shelter.
11,894	0180.00	Right bank tributary #002 is over-grown with vegetation and has sandy and silty substrate. Calibration WP#025 N37.50038 W122.41925 (was taken in middle of the habitat unit).
11,894	0180.00	Right bank tributary #002 is wetted and has a discharge =0.01 cfs, and contributes 1-3% flow to the receiving stream. The slope of the tributary stream channel= 5-7%, with a water temp= 58 F. No fish were observed in the tributary. 40ft into tributary is culvert contributing water; at confluence are old degraded car parts.

Apanolio Creek

Position	Habitat Unit #	Memo
11,894	0180.00	Erosion site on the right bank in middle of the habitat unit is 20'x15'x4ft.
11,920	0181.00	Substrate in stream is dominantly cobbles and gravel.
11,948	0182.00	2 old unused 3" diameter pipes are sticking out of the left bank.
11,993	0183.00	45ft into the habitat unit are old rusty 5" diameter metal pipes strung in channel.
12,187	0185.00	100ft into the habitat unit is 3" diameter metal pipe spanning channel from the left bank.
12,535	0193.00	Unidentified fish observed
12,553	0194.00	1" plastic pipe at top of the right bank adjacent the creek.
12,589	0195.00	2 pipes in creek; unsure if they are active.
12,589	0195.00	Unidentified fish observed
12,725	0199.00	Old refrigerator at bottom of the habitat unit.
12,900	0201.00	Boulders are from rip-rap- old erosion control project.
12,949	0202.00	Bridge #002 is a residential access road, made of concrete, with width=27', a height=13', and a length = 22 ft. Rip rap under the bridge continues downstream to create downstream habitat unit. Corrugated pipes under bridge on the right bank are not being used.
13,079	0207.00	130ft into the habitat unit is concrete rip rap (40'x10') held by metal rebar. 170ft into the habitat unit are two pipes off the left bank. 230ft into the habitat unit pipe runs along top of the left bank. 358ft into the habitat unit is a decaying footbridge spanning the channel; severely decaying and not usable.
13,079	0207.00	Unidentified fish observed
13,794	0212.00	2 salmonid YOY observed
13,845	0213.00	2+ salmonid observed
13,856	0214.00	Unidentified fish observed
14,068	0215.00	2+ salmonid observed
14,116	0217.00	salmonid YOY observed
14,134	0218.00	At the bottom of the habitat unit are two 2" diameter pipes spanning across channel.
14,149	0219.00	In the middle of the habitat unit is a stream gauge.
14,160	0220.00	At the bottom of the habitat unit is remnants of old

Apanolio Creek

Position	Habitat Unit #	Memo
		electrical lines spanning across channel. 20ft into the habitat unit is 2" metal pipe spanning creek (about 30ft high). WP#030 N37.50527 W122.41760
14,274	0222.00	Plunge pool is created by Dam #002
14,283	0223.00	Dam #002 has a length=8', a height=6', and a width =14ft. Bank to bank is a length = 17ft. No flashboards are installed. The height of the waters' edge to the sill = 3.5ft, which is creating down cutting of 1.5ft. The dam retains gravel and is a potential barrier to both juvenile and adult salmonids. There is a water gauge on the left bank of the dam wall. The dam is extremely vegetated.
14,681	0235.00	Unidentified YOY observed
14,719	0237.00	292ft into the habitat unit is right bank tributary#003; it is wet with no flow. The slope in the tributary channel= 2-4%. The survey crew checked up 200ft but no fish were observed, although it is potentially accessible to fish during high flows. The tributary has a wide channel with gravel and small cobble substrate, and is draining from the mountain side.
15,101	0239.00	Unidentified fish observed
15,668	0251.00	Unidentified YOY observed
16,043	0261.00	Two unidentified YOY observed
16,161	0264.00	Left bank tributary #004 is wet with an estimated discharge =0.20 cfs, and is contributing 15-20% of flow to receiving stream. The crew checked 65ft into the tributary. It is accessible to fish but no fish were observed. The water temperature = 53 F and the slope = 2%. 40ft into the tributary is a plunge created by a tarp and LWD. The channel is densely vegetated with a substrate of silt and gravel.
16,187	0267.00	129ft into the unit is an old tarp strung across channel.160ft into the unit is another tarp spanning channel.
16,535	0275.00	Salmonid YOY observed at top the habitat unit.
16,663	0279.00	100ft into the habitat unit a 1+salmonid observed
16,939	0280.00	A plunge pool appears to be created by man made cobble and tarp dam. It is a potential fish barrier with a plunge height = 3.2ft. On the left bank are two springs feeding into the channel. WP#039 N38.50967 W122.41560

Apanolio Creek

Position	Habitat Unit #	Memo
16,954	0281.00	Streambed made of concrete sand bags.
16,972	0282.00	At the bottom of the habitat unit on the left bank are metal stakes. 40ft into the habitat unit are metal stakes on both banks, holding up tarp across channel.
17,986	0299.00	Unidentified YOY observed
18,381	0305.00	6 ft into the habitat unit is right bank tributary#005. The tributary is wet with discharge = 0.1cfs, and contributes 4% of flow to the receiving stream. The water temperature = 53 F. The survey crew checked 175ft into the tributary. The estimated slope is 7-12%. No fish were observed. The substrate is mostly sand, gravel, and some boulders.
18,702	0313.00	The plunge pool has a 3.5ft vertical plunge.
19,112	0325.00	3 Salmonid YOY observed
19,125	0326.00	45ft into the habitat unit is right bank tributary #006, which is wet with discharge = 0.15 cfs, and is contributing 1-5% flow to the receiving stream. The channel slope= 2-4% and has a water temperature = 56 F. The survey crew checked the first 175 ft into the tributary and found it was not accessible to fish beyond this point. No fish were observed. The tributary is overgrown.
19,178	0327.00	1.5ft diameter pipe is creating plunge. The earthen dam is a major artificial barrier. The next habitat unit shows signs of small recently carved trails and tarps draped over a structure. The stream water seems to be diverted under the structure through a 30ft culvert exposed in habitat unit #326. WP#045 was taken at the right bank tributary #006 which is 15' downstream of structure.
19,184	0328.00	Dam #003 has a length = 32ft. with no flashboards installed. The dam is creating down cutting of 1.2 ft. and is a barrier to juvenile and adult salmonids. The earthen dam is diverting creek water through 30ft pipe. It is made of concrete sand bags, dirt, and is covered with a tarp.
19,216	0329.00	Halfway into the habitat unit are several rebar pieces in the creek from the right bank, which are diverting flow and catching small wood.
19,244	0330.00	Unidentified fish observed
19,601	0334.00	19ft into the habitat unit is left bank tributary #007, which is wet with discharge = 0.2 cfs, and is

Apanolio Creek

Position	Habitat Unit #	Memo
		contributing 10% of flow to the receiving stream. The survey checked 40ft into the tributary and found it was accessible to fish. After this there is a 5 ft. plunge. The channel slope = 4-6% and the water temperature = 58 F.
19,734	0339.00	Right bank tributary #008 is wet with discharge =0.001 cfs and is contributing < 1% of flow to the receiving stream. The water temperature = 63 F, and the channel has a slope >10%. It is not accessible to fish and there is a sulphur-like smell from the tributary.
19,820	0340.00	10ft height increase over the unit. The slope is approximately 47 %.This is a potential fish barrier.
19,856	0342.00	There is a 6ft height increase over the unit. The slope is approximately 54%.This is a potential fish barrier.
20,018	0347.00	The habitat unit is created by concrete slabs, tarp, and rebar; looks like potential dam remains. PVC piping on the left bank. N37.51664 W122.41542
20,041	0349.00	At the confluence of tributary #009 and Apanolio creek is a 3ft plunge created by a tarp covering pipes in the banks. In the first 30ft the streambed is made of concrete sand bags, with the bank-full width =5ft and wetted width = 3ft.Gravel and cobble are the dominant substrate past the first 30ft.
20,041	0349.00	At the top of the habitat unit is left bank tributary #009, which is wet with discharge = 0.4 cfs, and is contributing 20-25% of flow to the receiving stream. The survey crew checked 170ft into the tributary, and found the water temperature = 55 F and the slope = 3-6%. The tributary is accessible to fish in high flows, but no fish were observed.
20,676	0363.00	10ft into the habitat unit is right bank tributary #010, which is wet with discharge = 0.01 cfs, and is contributing <1% of flow to the receiving stream. The survey crew checked 100ft into the tributary, and found the slope = 10-20%, the water temperature = 55 F. The tributary is not accessible to fish. The dominant substrate is bedrock and the banks are silty and highly erodible.
20,860	0367.00	End of survey due to multiple potential fish barriers in the downstream habitat units. The last observed fish were below steep bedrock sheets. The channel is

Apanolio Creek

Position	Habitat Unit #	Memo
		becoming more enclosed, and the water has stopped flowing. The survey ended just before a 4ft plunge bedrock sheet. WP#054 N37.51871 W122.41569

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. *Catena*, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

Apanolio Creek

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to marsh	(MAR)	[9.1]	

Apanolio Creek 2011

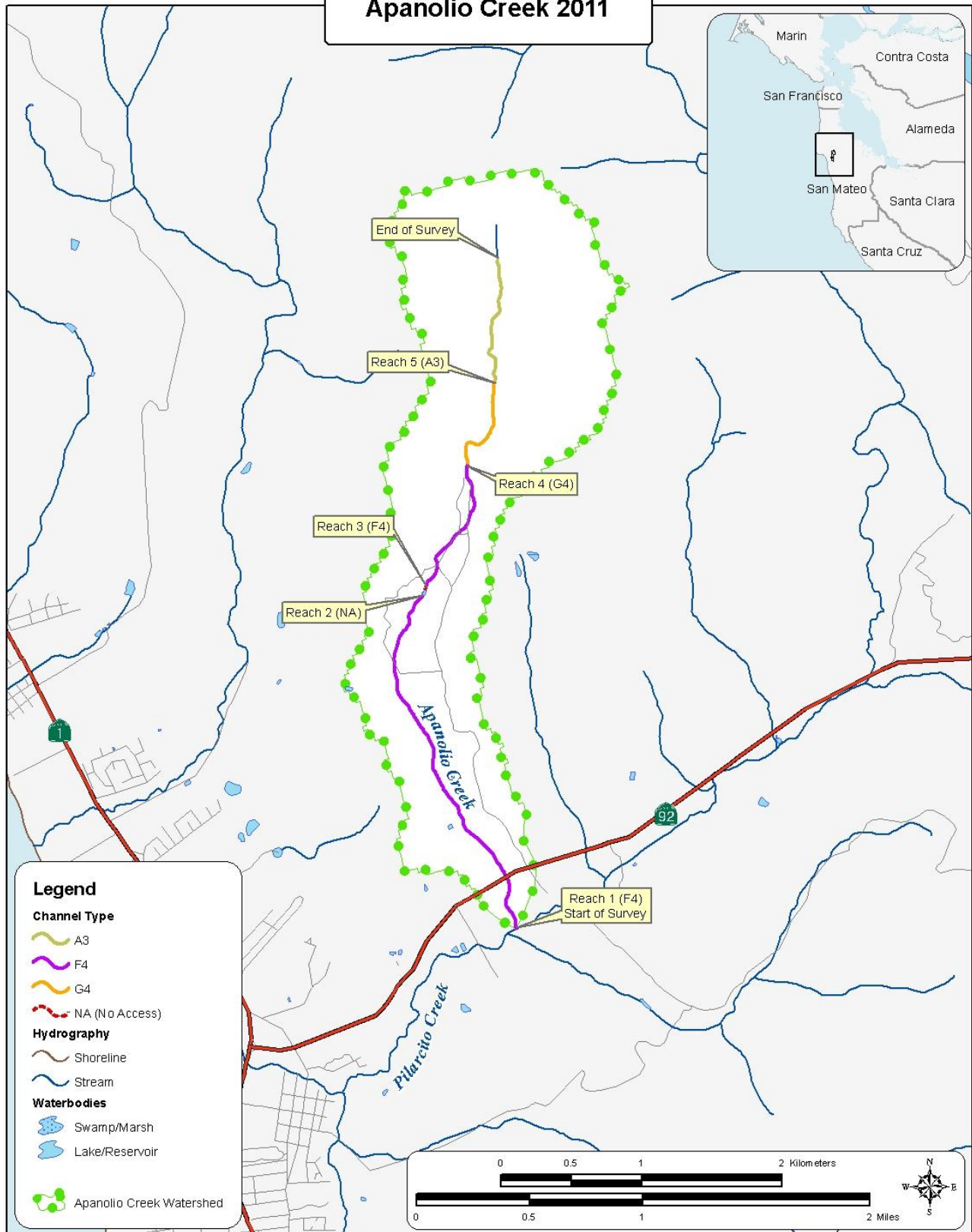


Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN

Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
8	0	CULVERT	2.2	26	208	1.0									
182	31	FLATWATER	49.6	95	17241	82.7	4.6	0.4	0.7	216	39352	95	17211		30
1	0	NOSURVEY	0.3	213	213	1.0									
109	109	POOL	29.7	12	1304	6.3	5.9	0.6	1.1	70	7653	69	7540	52	40
67	24	RIFFLE	18.3	28	1894	9.1	5.5	0.4	0.8	154	10303	70	4697		31
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
367	164				20860						57309		29449		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN

Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
38	11	LGR	10.4	32	1219	5.8	6.0	0.4	1.1	195	7417	82	3129		26	94
12	5	HGR	3.3	29	352	1.7	6.0	0.5	1.1	124	1494	60	717		26	94
9	4	CAS	2.5	23	206	1.0	8.0	0.6	1.2	196	1767	104	936		63	97
8	4	BRS	2.2	15	117	0.6	2.0	0.4	1.3	34	272	15	123		18	97
31	9	GLD	8.4	51	1591	7.6	5.0	0.4	1.0	147	4567	64	1994		25	94
45	11	RUN	12.3	53	2400	11.5	4.0	0.4	0.9	157	7083	65	2909		26	94
106	11	SRN	28.9	125	13250	63.5	5.0	0.4	1.2	331	35131	149	15818		37	94
37	37	MCP	10.1	10	388	1.9	6.0	0.6	1.6	58	2153	48	1762	33	31	95
10	10	STP	2.7	26	256	1.2	6.0	0.6	1.6	130	1303	111	1107	82	39	98
3	3	CRP	0.8	9	27	0.1	4.0	0.6	1.1	34	103	30	90	21	42	96
5	5	LSL	1.4	15	77	0.4	6.0	0.5	1.2	95	475	73	364	48	69	98
3	3	LSR	0.8	10	29	0.1	6.0	0.6	1.5	59	178	52	156	37	92	97
1	1	LSBo	0.3	9	9	0.0	5.0	0.8	1.6	27	27	27	27	22	30	90
40	40	PLP	10.9	9	374	1.8	6.0	0.7	2.0	60	2419	59	2353	42	47	94
1	1	BPR	0.3	5	5	0.0	6.0	0.4	0.7	30	30	24	24	12	10	100
9	9	DPL	2.5	15	139	0.7	6.0	0.7	2.8	107	966	184	1658	172	19	94
8	0	CUL	2.2	26	208	1.0										
1	0	NS	0.3	213	213	1.0										
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)				
367	164				20860					65384		33168				

Table 3 - Summary of Pool Habitat Types

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN

Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid. Vol (cu.ft.)	Mean Shelter Rating
47	47	MAIN	43	14	644	49	5.6	0.6	74	3456	43	2041	33
52	52	SCOUR	48	10	516	40	6.2	0.6	62	3202	41	2120	51
10	10	BACKWATER	9	14	144	11	5.7	0.7	100	996	156	1558	19
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
109	109				1304					7653		5720	

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN

Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
37	MCP	34	10	27	27	73	0	0	0	0	0	0
10	STP	9	1	10	9	90	0	0	0	0	0	0
3	CRP	3	2	67	1	33	0	0	0	0	0	0
5	LSL	5	1	20	4	80	0	0	0	0	0	0
3	LSR	3	2	67	1	33	0	0	0	0	0	0
1	LSBo	1	0	0	1	100	0	0	0	0	0	0
40	PLP	37	6	15	33	83	1	3	0	0	0	0
1	BPR	1	1	100	0	0	0	0	0	0	0	0
9	DPL	8	4	44	4	44	1	11	0	0	0	0
Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1 < 2 Feet Max Resid. Depth	Total 1 < 2 Feet % Occurrence	Total 2 < 3 Feet Max Resid. Depth	Total 2 < 3 Feet % Occurrence	Total 3 < 4 Feet Max Resid. Depth	Total 3 < 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
109			27	25	80	73	2	2	0	0	0	0
Mean Maximum Residual Pool Depth (ft.):			1									

Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name: Apanolio Creek

Dry Units:

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN

Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
38	11	LGR	6	25	4	4	28	0	5	13	15
12	5	HGR	4	16	0	4	29	0	19	28	0
9	4	CAS	10	20	8	10	3	0	25	18	8
8	4	BRS	0	28	0	18	18	0	0	8	5
67	24	TOTAL RIFFLE	5	23	3	7	22	0	11	16	9
31	9	GLD	11	6	0	18	43	0	0	0	11
45	11	RUN	18	10	2	8	56	0	0	4	2
106	11	SRN	15	10	3	15	40	0	2	15	2
182	31	TOTAL FLAT	15	9	2	13	47	0	1	6	5
37	37	MCP	16	21	8	17	25	0	2	10	1
10	10	STP	17	22	3	17	7	0	13	21	2
3	3	CRP	48	0	0	42	10	0	0	0	0
5	5	LSL	11	22	36	11	4	0	16	0	0
3	3	LSR	0	20	13	53	0	0	7	7	0
1	1	LSBo	0	0	0	0	0	0	100	0	0
40	39	PLP	15	14	8	15	12	1	26	3	5
1	1	BPR	30	0	0	70	0	0	0	0	0
9	9	DPL	11	31	19	5	24	0	0	0	10
109	108	TOTAL POOL	16	19	9	17	16	0	13	6	3
8	0	CUL									
1	0	NS									
367	163	TOTAL	14	17	7	15	23	0	10	8	4

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Apanolio Creek

Dry Units:

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: Quad: MONTARA MOUNTAIN **Legal Description:** T000R000S00 **Latitude:** 37:28:34.0N **Longitude:** 122:24:42.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
38	11	LGR	0	45	36	18	0	0	0
12	5	HGR	0	40	20	0	20	20	0
9	4	CAS	0	25	50	0	0	25	0
8	4	BRS	0	0	0	0	0	0	100
31	9	GLD	0	89	11	0	0	0	0
45	11	RUN	9	64	18	0	9	0	0
106	11	SRN	0	55	45	0	0	0	0
37	37	MCP	8	78	14	0	0	0	0
10	10	STP	0	30	50	0	0	20	0
3	3	CRP	0	100	0	0	0	0	0
5	5	LSL	20	80	0	0	0	0	0
3	3	LSR	0	67	0	33	0	0	0
1	1	LSBo	0	100	0	0	0	0	0
40	40	PLP	5	80	10	3	0	0	3
1	1	BPR	100	0	0	0	0	0	0
9	9	DPL	11	78	11	0	0	0	0
8	0	CUL	0	0	0	0	0	0	0
1	0	NS	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: **Quad:** MONTARA MOUNTAIN **Legal Description:** T000R000S00 **Latitude:** 37:28:34.0N **Longitude:** 122:24:42.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
95	2	98	0	92	93

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Apanolio Creek LLID: 1224116374760 Drainage: San Mateo Coastal
 Survey Dates: 6/7/2011 to 8/2/2011 Survey Length (ft.): 20860 Main Channel (ft.): 20860 Side Channel (ft.): 0
 Confluence Location: Quad: MONTARA Legal Description: T000R000S00 Latitude: 37:28:34.0N Longitude: 122:24:42.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 92.6	Pools by Stream Length (%): 4.6
Reach Length (ft.): 10417	Coniferous Component (%): 2.0	Pool Frequency (%): 25.8
Riffle/Flatwater Mean Width (ft.): 5.1	Hardwood Component (%): 98.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 97.5
Range (ft.): 5.00 to 8.00	Vegetative Cover (%): 92.5	2 to 2.9 Feet Deep: 2.5
Mean (ft.): 6.87	Dominant Shelter: Terrestrial Veg.	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.80	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0.638	Occurrence of LWD (%): 9.7	Mean Max Residual Pool Depth (ft.): 1.21
Water (F): 54 - 60 Air (F): 55 - 65	LWD per 100 ft.:	Mean Pool Shelter Rating: 47
Dry Channel (ft.): 0	Riffles: 2	
	Pools: 4	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 5.0 Sand: 52.5 Gravel: 42.5 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 80.0 2. 10.0 3. 7.5 4. 0.0 5. 2.5		

STREAM REACH: 2

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 213	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): 6.00 to 6.00	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.): 6.00	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.: 0.00	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs): 0.638	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 54 - 54 Air (F): 61 - 61	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

Apanolio Creek

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: F4	Canopy Density (%): 96.7	Pools by Stream Length (%): 9.4
Reach Length (ft.): 4051	Coniferous Component (%): 0.0	Pool Frequency (%): 37.2
Riffle/Flatwater Mean Width (ft.): 5.9	Hardwood Component (%): 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 100.0
Range (ft.): 5.00 to 8.00	Vegetative Cover (%): 90.3	2 to 2.9 Feet Deep: 0.0
Mean (ft.): 6.87	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.99	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0.638	Occurrence of LWD (%): 10.0	Mean Max Residual Pool Depth (ft.): 1.11
Water (F): 52 - 58	Air (F): 57 - 69	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles: 1	Pools: 3
	Pools: 3	Flat: 1
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 3.4	Sand: 13.8	Gravel: 62.1
Embeddedness Values (%):	Sm Cobble: 13.8	Lg Cobble: 0.0
	Boulder: 0.0	Bedrock: 6.9
	1. 48.3	2. 34.5
	3. 6.9	4. 0.0
	5. 10.3	

STREAM REACH: 4

Channel Type: G4	Canopy Density (%): 95.5	Pools by Stream Length (%): 6.6
Reach Length (ft.): 2861	Coniferous Component (%): 3.5	Pool Frequency (%): 35.2
Riffle/Flatwater Mean Width (ft.): 5.6	Hardwood Component (%): 96.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 94.7
Range (ft.): 5.00 to 8.00	Vegetative Cover (%): 95.8	2 to 2.9 Feet Deep: 5.3
Mean (ft.): 6.26	Dominant Shelter: Terrestrial Veg.	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.84	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0.638	Occurrence of LWD (%): 1.7	Mean Max Residual Pool Depth (ft.): 1.08
Water (F): 53 - 57	Air (F): 55 - 59	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles: 0	Pools: 2
	Pools: 2	Flat: 0
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 15.8	Sand: 5.3	Gravel: 36.8
Embeddedness Values (%):	Sm Cobble: 21.1	Lg Cobble: 0.0
	Boulder: 21.1	Bedrock: 0.0
	1. 10.5	2. 63.2
	3. 5.3	4. 0.0
	5. 21.1	

Apanolio Creek

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 5

Channel Type: A3	Canopy Density (%): 96.4	Pools by Stream Length (%): 7.7
Reach Length (ft.): 3318	Coniferous Component (%): 3.4	Pool Frequency (%): 26.6
Riffle/Flatwater Mean Width (ft.): 4.1	Hardwood Component (%): 96.6	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 100.0
Range (ft.): 3.00 to 8.00	Vegetative Cover (%): 93.2	2 to 2.9 Feet Deep: 0.0
Mean (ft.): 5.47	Dominant Shelter: Terrestrial Veg.	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 1.88	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0.638	Occurrence of LWD (%): 1.7	Mean Max Residual Pool Depth (ft.): 0.99
Water (F): 52 - 59	Air (F): 55 - 62	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles: 0	Pools: 2
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 4.8	Sand: 4.8	Gravel: 9.5
Embeddedness Values (%):	1. 14.3	2. 52.4
	3. 23.8	4. 4.8
		5. 4.8
		Sm Cobble: 38.1
		Lg Cobble: 4.8
		Boulder: 33.3
		Bedrock: 4.8

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Apanolio Creek **LLID:** 1224116374760 **Drainage:** San Mateo Coastal
Survey Dates: 6/7/2011 to 8/2/2011
Confluence Location: **Quad:** MONTARA MOUNTAIN **Legal Description:** T000R000S00 **Latitude:** 37:28:34.0N **Longitude:** 122:24:42.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	19	16	10.7
Boulder	12	5	5.2
Cobble/Gravel	15	18	10.1
Sand/Silt/Clay	118	125	74.1

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Grass	2	3	1.5
Brush	87	75	49.4
Hardwood Trees	74	86	48.8
Coniferous Trees	1	0	0.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Apanolio Creek

LLID: 1224116374760

Drainage: San Mateo Coastal

Survey Dates: 6/7/2011 to 8/2/2011

Confluence Location: **Quad:** MONTARA MOUNTAIN

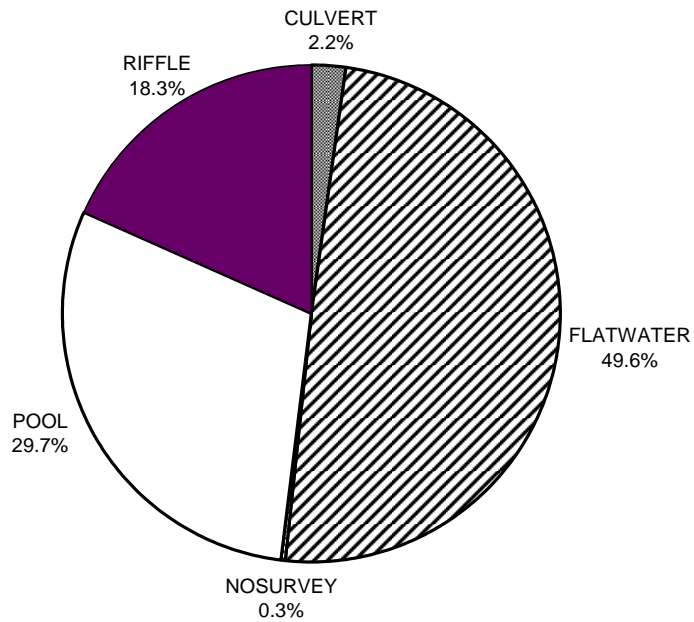
Legal Description: T000R000S00

Latitude: 37:28:34.0N

Longitude: 122:24:42.0W

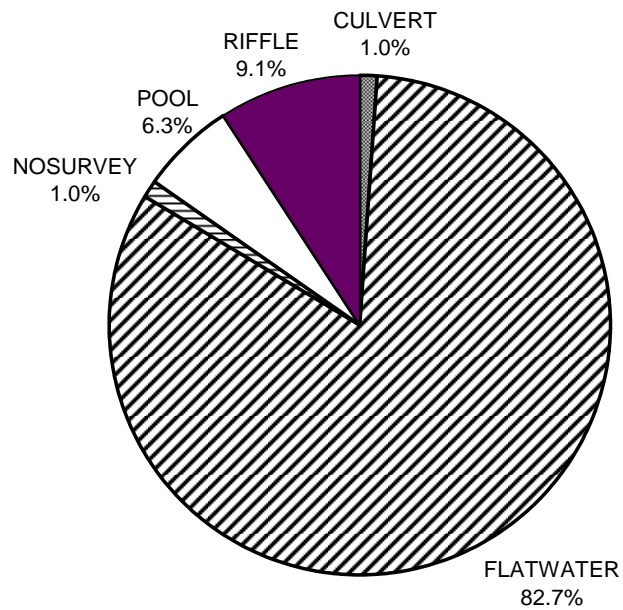
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	5	15	16
SMALL WOODY DEBRIS (%)	23	9	19
LARGE WOODY DEBRIS (%)	3	2	9
ROOT MASS (%)	7	13	17
TERRESTRIAL VEGETATION (%)	22	47	16
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	11	1	13
BOULDERS (%)	16	6	6
BEDROCK LEDGES (%)	9	5	3

**APANOLIO CREEK 2011
HABITAT TYPES BY PERCENT OCCURRENCE**



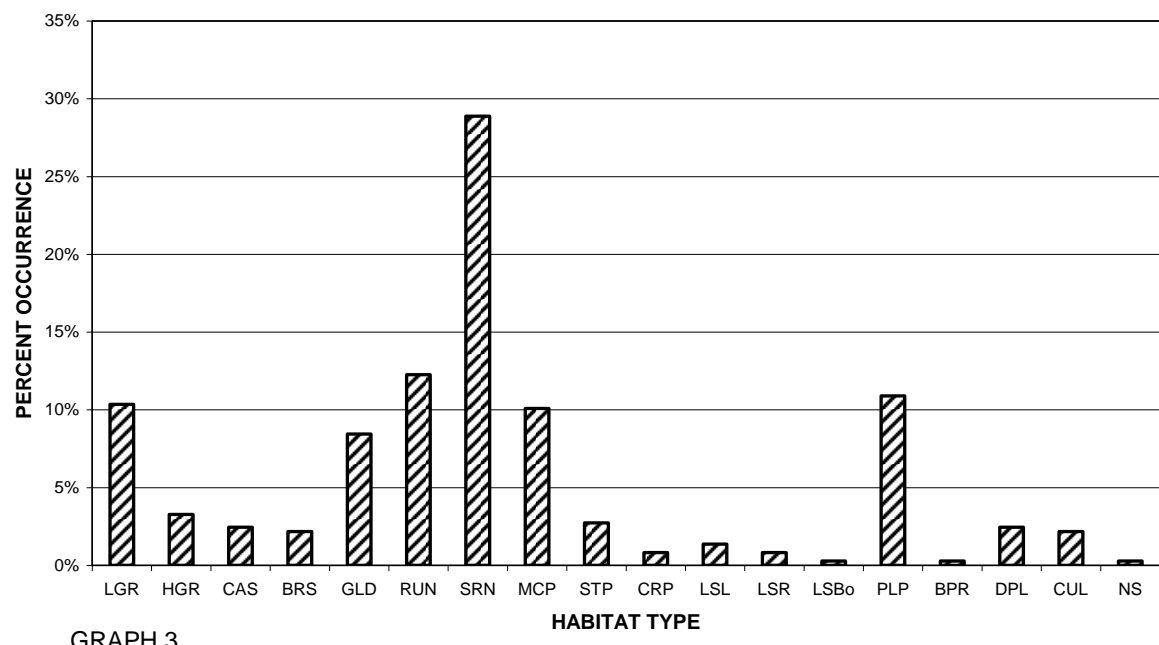
GRAPH 1

**APANOLIO CREEK 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH**



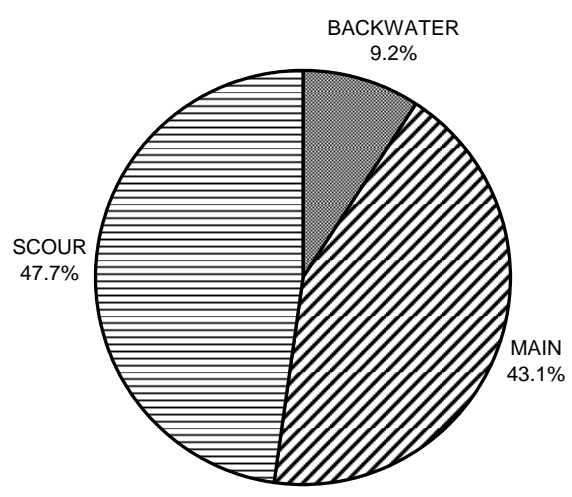
GRAPH 2

**APANOLIO CREEK 2011
HABITAT TYPES BY PERCENT OCCURRENCE**



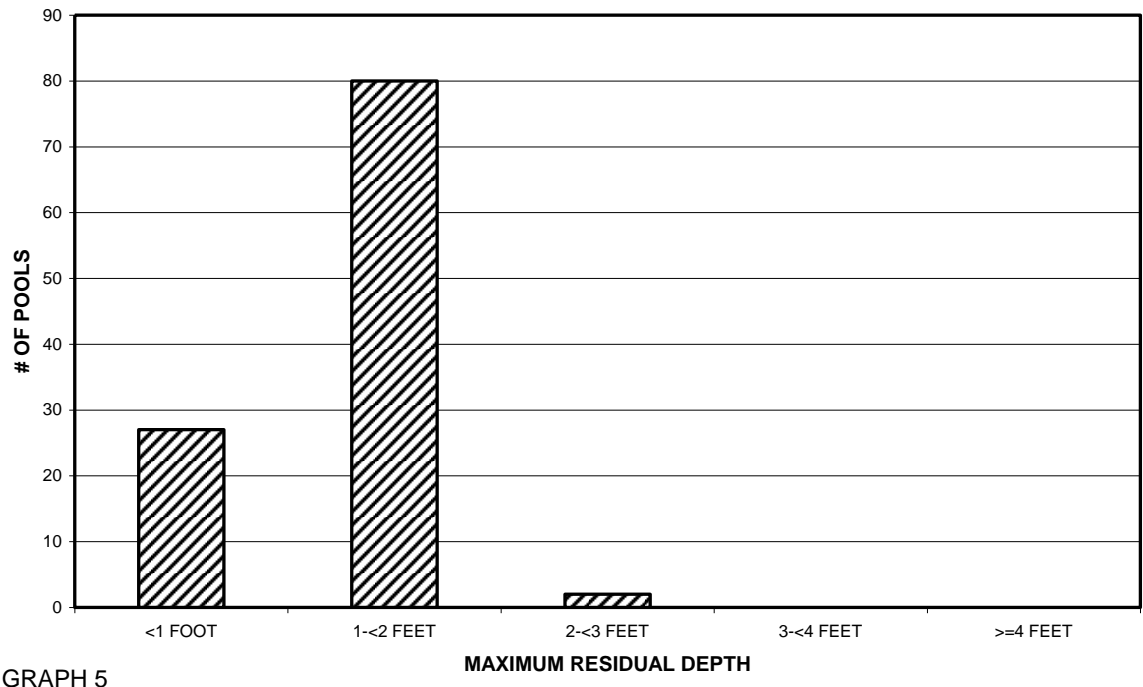
GRAPH 3

**APANOLIO CREEK 2011
POOL TYPES BY PERCENT OCCURRENCE**



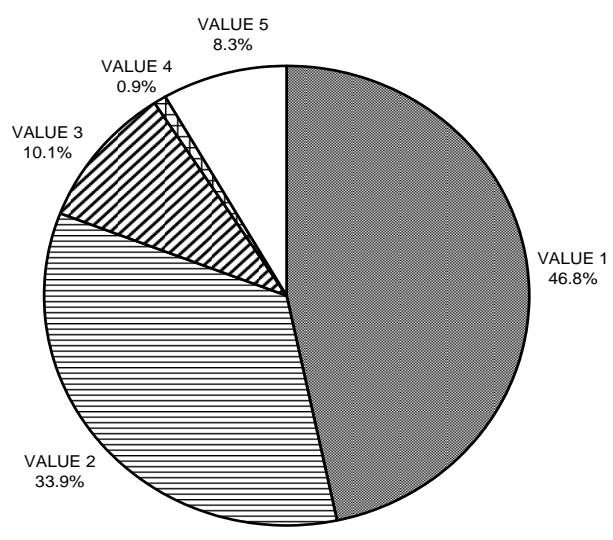
GRAPH 4

**APANOLIO CREEK 2011
MAXIMUM DEPTH IN POOLS**



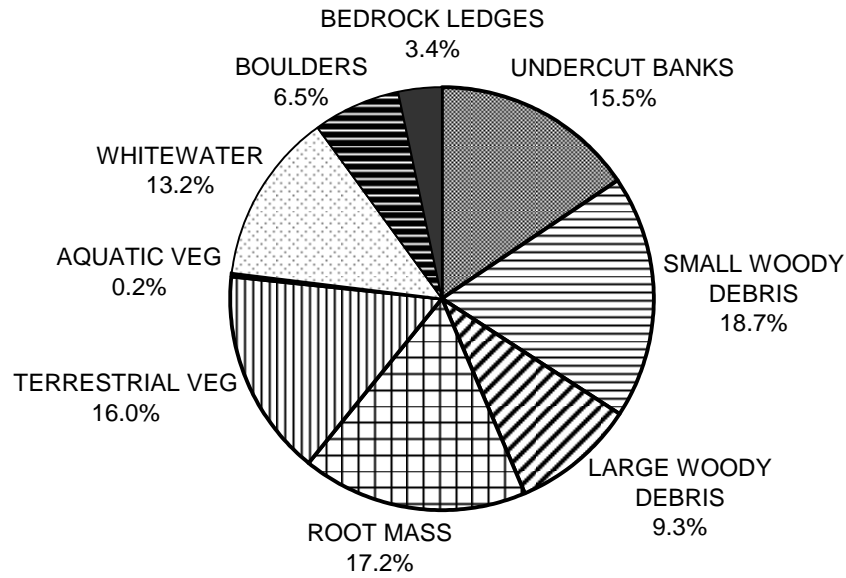
GRAPH 5

**APANOLIO CREEK 2011
PERCENT EMBEDDEDNESS**



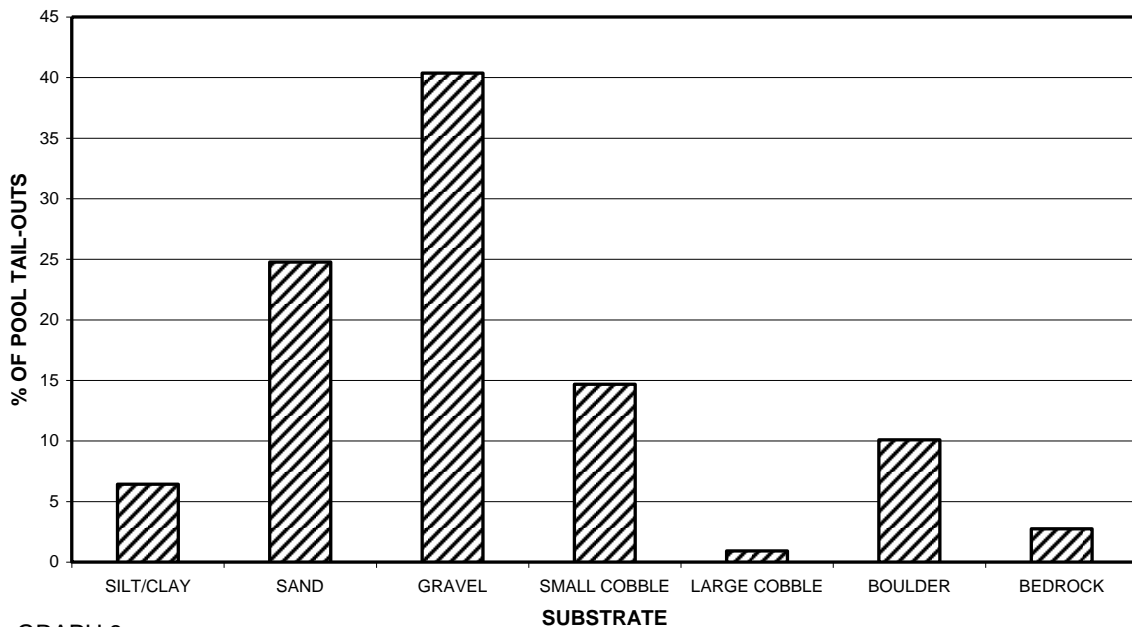
GRAPH 6

APANOLIO CREEK 2011 MEAN PERCENT COVER TYPES IN POOLS



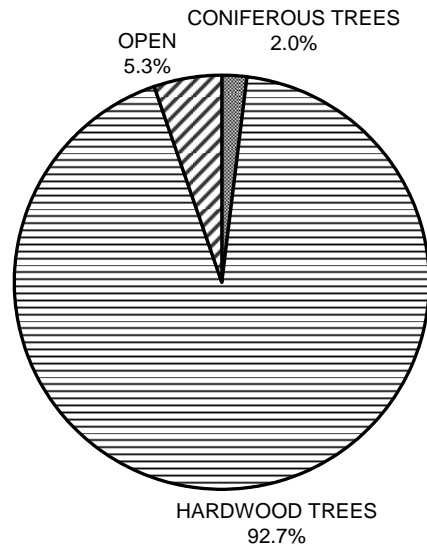
GRAPH 7

APANOLIO CREEK 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



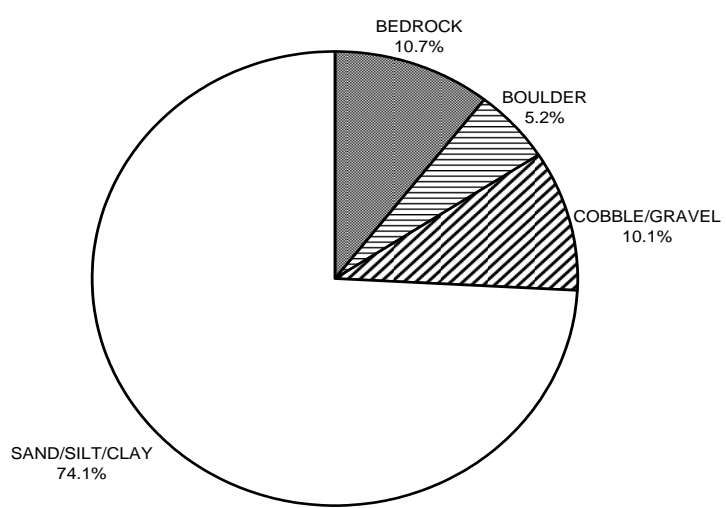
GRAPH 8

**APANOLIO CREEK 2011
MEAN PERCENT CANOPY**



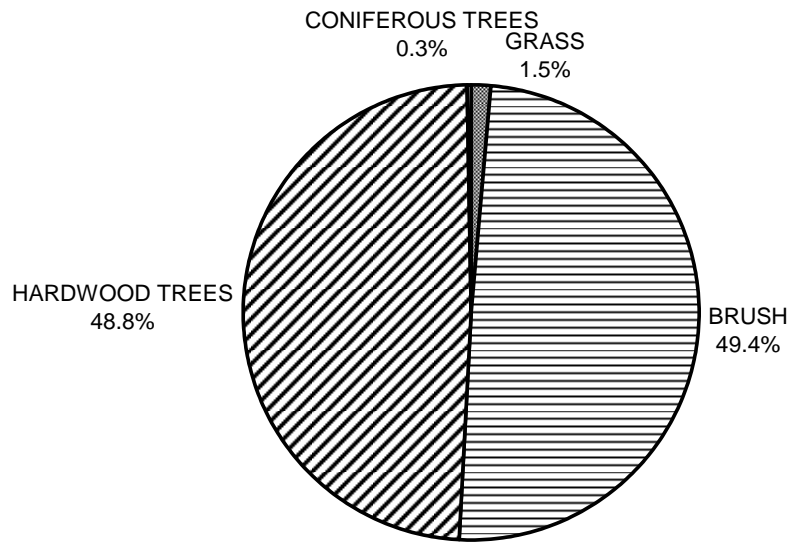
GRAPH 9

**APANOLIO CREEK 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**APANOLIO CREEK 2011
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11