

# Canyon del Ray Master Drainage Plan - Draft



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Prepared for:

Monterey Peninsula Water Management District

Monterey County Water Resources Agency

City of Seaside, California

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Prepared for:

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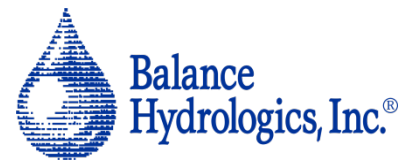
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## EXECUTIVE SUMMARY

This report presents an update to the Master Drainage Plan for Canyon del Rey originally prepared for the Monterey County Water Resources Agency (MCWRA) in 1977. This updated plan accounts for the changes in hydrologic and hydraulic conditions in the watershed, as well as the addition of new and updated flood management facilities. It also provides a new investigation and evaluation of sediment related processes in the watershed, including analyses of sediment transport, erosion, and deposition within the stream channel system. Project activities included:

- field investigation of existing storm water management facilities,
- surveying of culverts and storm water basin outlet structures,
- field investigations of stream channel morphology and sediment migration,
- bathymetric surveys of Roberts Lake and Laguna Grande,
- collection of available rainfall and stream flow gauge data within and in proximity to the watershed
- updating of rainfall data and depth-duration-frequency estimates and mean annual rainfall estimates ,
- completion of a comprehensive hydrologic model of the entire watershed including both designed and de facto stormwater storage areas,
- hydraulic analysis (using FHA HY-8) of conveyance capacity of culverts and crossing to determine adequacy for handling design large storm events,
- preliminary cost estimating for recommended upgrades to selected facilities,
- analysis of sediment mobilization, transport and deposition processes in the watershed, and
- consider alternative future watershed and flood management activities.

A set of recommendations for ongoing management of the watershed is provided for your consideration.

The following summarizes the principal results, conclusions, and recommendations.

1. Work in this study included the survey and subsequent hydrologic and hydraulic analyses of 51 culverts, 32 water and sediment basins, and the two lakes in the overall 16.8 square mile watershed.
2. Bathymetric surveys of Roberts Lake and Laguna Grande revealed that very little deposition of sediments has occurred since the last time that



the lakes were dredged. This indicates that relatively small amounts of sediment have been transported into the lakes from the creek. Fine sediments have accumulated to a greater degree in Laguna Grande than in Lake Roberts but both sedimentation rates have been markedly low.

3. Management practices before, and particularly since, the 1977 plan have resulted in the construction of numerous stormwater basins within the watershed. Furthermore, flow restrictions at the many highway crossings and associated culverts create significant additional de facto detention storage areas which dramatically alter stream flows and sediment transport throughout the system.
4. The evaluation of available precipitation gauge records concludes that local gauge data are not sufficiently robust to be used to update the 1977 mean annual rainfall isohyet map. This data are also not sufficient to enable development of improved depth/duration/frequency relationships for the watershed.
5. However, the detailed analyses underlying the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data are appropriate and were used to generate depth-duration-frequency estimates for hydrologic modeling purposes.
6. Analogously, data from the Parameter-elevation Relationship on Independent Slopes model (PRISM) is technically robust and was used to produce an updated mean annual precipitation isohyetal map for the watershed.
7. A comprehensive hydrologic model using the U.S. Army Corps of Engineers' HEC-HMS platform was created for the watershed, which was divided into 37 sub-watersheds for modeling purposes. Model operation was calibrated using data from the former USGS gage site now operated by the Monterey Peninsula Water Management District, with very close correlation.
8. Predicted peak discharge for the watershed is summarized at numerous points for both 10-year and 100-year design storms. Predicted peak discharge at Fremont Boulevard in Seaside is 209 cfs for the 10-year storm and 753 cfs for the 100-year storm. These values are somewhat lower than predictions of future flows in the 1977 plan, which were 214 cfs for the 10-year storm and 870 cfs for the 100-year storm. For comparison, the FEMA 2009 Flood Insurance Study predicts discharges at Fremont Boulevard equal to 250 cfs for the 10-year storm and 675 cfs for the 100-year event. In all three cases, the ratios of 100 year peak flows to 10 year peak flows (approximately 3 to 1 up to 4 to 1) differ noticeable from the regional norm of about 2 to 1, reflecting the unique attributes of the sandy soils.
9. Analysis of the behavior of the constructed and de facto detention basins, many of which are located on the main stem, indicates that the basins are an important contributor to flood flow management under existing conditions. Seven of the basins reduced incoming peak storm

flows by 50% or more, and supplemental hydrologic runs indicate that peak flow entering Laguna Grande is reduced by approximately 60% due to the combined effects of upstream storage.

10. Upgrades to 16 culverts are recommended, based on their inability to safely pass the 100-year peak discharge. The recommended upgrades are designed to reduce the depth of overtopping of the roadway associated with the culvert to 0.5 feet or less.
11. The impacts of the recommended upgrades on flows in the creek were estimated by modifying the HEC-HMS model to represent the changed culvert hydraulics. The model predicts that peak flows would increase in some locations by no more than 20% and decrease in some locations by no more than 7%.
12. The costs of the recommended upgrades were estimated using a preliminary design and a unit pricing methodology. Unit prices were obtained from the CalTrans Contract Cost Database and bid results for similar projects. Total cost for all 16 upgrades is estimated at \$6.5 million, with the individual costs varying from \$158,000 to \$1,645,000.
13. Extensive amounts of data were collected during this work and are provided in a set of electronic files. It is recommended that these data be placed in an active data server and made available to District personnel and other users.
14. Changes in runoff due to changes in the watershed are likely to change storm flows and sediment transport. Decisions regarding land development, wildfire management, road improvements, and upgrades to the flood conveyance facilities should be made with full understanding of potential impacts on peak flows, creek channel stability, and sediment transport into the lakes. The HEC-HMS model developed for this project can be used in the future to estimate hydrologic effects of changes in the watershed.
15. Regular upgrades to this plan, on an approximately 10 year schedule, are recommended to ensure that the plan remains reasonably up to date and useful in planning for the watershed.

## 1 INTRODUCTION

### 1.1 Background

This master drainage plan update was authorized by the Monterey Peninsula Water Management District and funded in part through a grant from the California Department of Water Resources. The purposes and scope of this update acknowledge the changes in hydrologic and hydraulic conditions in the watershed, as well as the addition of new and updated flood management facilities within the watershed, that have occurred since the prior master drainage plan (Koretsky, et al, 1977) was completed. In addition, changes in land use have also occurred as a result of building within the watershed. There is also evidence that erosion and sediment transport have changed stream channel conditions, which should be evaluated from a flood management perspective.

The Master Drainage Plan for Canyon del Rey (Koretsky, et al, 1977) was produced in 1977 for the Monterey County Flood Control and Water Conservation District. The purpose of the previous report was to provide a basis for orderly land development and design of associated flood control facilities. Within this general purpose were specific objectives, including: establishing flood control facility design criteria, assessing the adequacy of existing flood control facilities, determining the drainage patterns and hydraulic characteristics, defining the need for an estimated cost of needed flood control facilities, and recommending legal instruments needed to implement the plan.

The 1977 plan included a hydrologic analysis of existing data, predictions of future flows, a hydraulic analysis of existing facilities, and made recommendations for future improvements. One recommendation in that plan was "A periodic updating of the Master Plan to reflect actual conditions, as development occurs, is strongly recommended as the basis on which to provide for future conditions." No update of the plan has occurred since completion of the study.

Improvements recommended in the 1977 drainage study were proposed to reduce flooding damage to structures as a result of the expected 100-year return period flood. Additional analyses and recommendations were made in the 1977 study to pass the expected 10-year storm flows at road and highway drainage facilities. To fund needed improvements, the 1977 study recommended both property tax assessments and fees for new developments. However, with the passage of Proposition 13 in June 1978, property taxes were capped and only the development fee was initiated. In the interim, some improvements and erosion prevention measures on individual parcels developed since that time have been completed.

## 1.2 Location Description

The Canyon Del Rey watershed is located in Monterey County on the Central Coast of California, approximately 120 miles south of San Francisco (see Figure 1-1). Canyon Del Rey Creek is an ephemeral stream that drains to the Pacific Ocean from an area of 16.8 square miles (approximately 10,750 acres) along Highways 68 and 218, beginning near the Laguna Seca raceway at the eastern end of the watershed and flowing west into the Monterey Bay (see Oversized Figure 1). The watershed includes portions of Seaside, Del Rey Oaks, Monterey, and unincorporated Monterey County.

## 1.3 Study Objectives

This report and the efforts contributing to these results and recommendations are focused on updating the 1977 plan to account for: changes to the watershed over the intervening 37 years; additions to flood control facilities; additional hydrologic, hydraulic and geologic information that is available now; improvements in analytical, computational, and modeling methods; and changing needs for development and flood management. In particular, this report provides expanded analyses of sediment production, transport and fate within the watershed and relates those analyses to facility improvement and management. Specific study objectives include:

1. Updating the hydrologic model contained in the 1977 Drainage Study. The 1977 study included rainfall data from the mid-1930's to the mid-1970s. An additional 35 years of rainfall data are now available for use in updating isohyetal maps and depth-duration-frequency curves. In addition, assumptions about land use, the effects of development, and the effect of various drainage facilities on surface flows were evaluated and updated.
2. Surveying and documenting the design and condition of the existing flood conveyance and management facilities.
3. Evaluating the hydraulic capacity of facilities to pass existing flows. Using information gathered in the field and an update of flow estimates, the hydraulic characteristics of each primary and secondary drainage facility will be evaluated.
4. Updating expected erosion and sedimentation rates in the tributaries, main stem and in the lakes at the terminus of the watershed (optional task, if funding is available). The 1977 drainage study postulated that the creek was in a "juvenile" stage of development with a new floodplain as a result of "5 to 10" feet of incision and that, despite transportation of silt from the headwaters, the amount of sediment carried by the creek was limited, due to the limited transport power. The stability of tributaries and

the main stem creek will be evaluated. If possible, the historic, existing, and future rate of sediment transport to the lakes will be evaluated.

5. Producing a plan report which updates the 1977 plan and provides the new results and findings.

## 2 WATERSHED AND FACILITIES DESCRIPTIONS

### 2.1 Hydrologic setting

High flows during the extremely wet years of 1995 and 1998 enable observations of drainage system behavior and confirmed some of the predictions made in the 1977 study, especially concerning head-cutting in Canyon Del Rey Creek (the creek or CdR creek) and culvert sedimentation of road drainage facilities. Upland areas in the watershed continued to experience erosion and observations indicated sediment transport in the channel system. These conditions raised questions regarding potential sedimentation and resultant reduction of flood storage (volumetric) capacity in Laguna Grande and Roberts Lakes.

It should be noted that Monterey County implemented regulations to prevent or reduce sediment and runoff from new development beginning in the 1960's. In addition, since completion of the 1977 drainage plan, the City of Monterey has implemented all recommendations from that plan for new development within the city limits of Monterey.

Along the Central California Coast, which contains a significant number of watersheds underlain with sandy soils, it has been noted recently that the hydrologic effects of development may be much greater in deep sandy soils than in loamy, clay and/or shallow soils (citation to be added). Only limited data regarding lake sedimentation, bed load, and suspended load in the creek, at the time of the 1977 study.

There have been reports that the stream channel suffers from bank instability, head-cutting, and erosion problems during high flows in multiple locations due to a variety of factors such as increased stream flows during rain events, changes in sediment supply in the watershed, and creek side development. Evidence of these effects has been limited, making interpretation difficult.

The watershed is heterogeneous and its creek system complex. Land use, soils, slopes, and ground cover vary widely (see Sections 2.2 and 4.5), with particularly large differences between the sub-watersheds north of Hwy 68 and those south of the highway. Urbanization has occurred in some sub-watersheds and has been completely absent in others (see Section 2.3 and the map plates in Appendix A), increasing watershed diversity. The morphology of creek channels and depositional areas is highly variable (see Chapter 7), with erosion dominating in some reaches while deposition dominates in other reaches. The results from this study provide considerably more detail regarding these conditions and propose a set of hydrologic and sedimentation behaviors that conform to observations in the watershed (see Chapters 4 and 7).

## 2.2 Watershed description

The study area, with an overall area of 16.8 square miles, is made up of 37 sub-watersheds. Of these, 16 flow into CdR creek from the south and 19 from the north. The shape and extent of these sub-watersheds were developed to enable and simplify simulation of hydrologic processes, leading to variation in area from 8 acres to 1.88 square miles. While the sub-watershed boundaries generally follow drainage divides, boundaries also are set to represent changes in land use or soils. The delineations of these sub-watersheds are shown in Oversized Figure 1 and on the map plates in Appendix A. A map showing areas within the watershed with certain ranges of ground slopes is provided as Oversized Figure 2. Slopes vary from essentially flat to well in excess of 25%. High slope areas extend throughout the southern and western portions of the watershed.

Significant portions of the watershed to the south of Highway 68 are also sparsely developed and rise to 1,300 feet in elevation with a mix of coastal scrub, pine, and oak woodlands. Much of the runoff to the creek is from this area, which is also subject to relatively high rates of erosion. Areas to the north of Highway 68 are generally low rolling grassy hills covered with sandy soils that provide little runoff to the creek, except during the wettest periods. The west end of the basin, in the Cities of Monterey, Seaside, and Del Rey Oaks there is a high degree of urbanization with a mix of single- and multi-family units and commercial development.

The peak 100-year flow in the creek (from the 1977 drainage study) ranged from 800 cfs (existing) to 1,000 cfs (future conditions). Many of the primary facilities surveyed in 1977 could pass less than one-half of the 100-year peak. The most recent update of the FEMA Flood Insurance Rate Map (April 2, 2009) shows zones of shallow flooding in the 100-year event that would affect residences and businesses adjacent to the creek between Roberts Lake and the intersection of Highway 68/Highway 218. Portions of both highways would be inundated during a 100-year flood.

Geologic evidence and soil moisture budget (Yates, et al, 2003) analyses both indicate the presence of a shallow alluvial aquifer system that sustains wetlands and phreatophytic vegetation and also supports base flow in Canyon Del Rey in wet years. Hydro-geologic conditions along Canyon Del Rey (see Chapter 7) suggest that infiltration into the aquifer system from the channel is dominant and runoff in the creek normally represents a small fraction of the annual rainfall.

The peak 100-year flow used by the previous study (Koretsky et al, 1977) in the creek ranged from 800 cfs (existing) to 1,000 cfs (future conditions). Many of the primary facilities surveyed in 1977 could pass less than one-half of the 100-year peak. The most recent update of the FEMA Flood Insurance Rate Map (FEMA, 2009) shows zones of shallow flooding in the 100-year event that would affect residences and businesses adjacent to the creek between Roberts Lake and

the intersection of Highway 68/Highway 218. Portions of both highways are shown by that study as being inundated during a 100-year flood.

Geologic evidence and soil moisture budget analyses (Yates, et al, 2003) both indicate the presence of a shallow alluvial aquifer system that sustains wetlands and phreatophytic vegetation and also supports base flow in Canyon Del Rey in wet years. Hydro-geologic conditions along Canyon Del Rey suggest that infiltration into the aquifer system from the channel is dominant and runoff in the creek normally represents a small fraction of the annual rainfall (citation to be added).

### 2.3 Development within the watershed

Since 1977, a significant amount of development has occurred and many of the recommended improvements have been implemented. General Plans for development in the cities and unincorporated areas have changed, water quality standards for storm water runoff have become more stringent, and tools to understand and predict water and sediment flows have improved.

Monterey County implemented regulations to prevent or reduce sediment and runoff from new development beginning in the 1960's. In addition, since completion of the 1977 drainage plan, the City of Monterey has implemented all recommendations from that plan for new development within the city limits of Monterey. It is unknown which improvements have been implemented within the city of Del Rey Oaks.

### 2.4 Facilities overview

Existing storm water conveyance and management facilities within the study area which were evaluated and included in the modeling and analysis consist of: 51 culverts (primarily under roadway crossings), 32 water and sediment detention basins, and the Roberts and Laguna Grande impoundments. These facilities vary greatly in size, design, and physical condition. Table 2-1 provides a list of the detention basins. Table 2-2 provides a list of the road crossing culverts. Details of these facilities and their condition are provided in Section 2.5.

The 1977 study (Koretsky, et al, 1977) differentiated between primary and secondary facilities, with primary facilities defined as structures (culverts) providing at least 12 square feet of usable flow area. Secondary facilities were those culverts with lesser usable flow area. The 1977 plan recommended improvements for primary structures. Evaluation of structures was based on ability to carry the 10 year peak storm flow for secondary facilities and the 100 year peak storm flow for primary facilities.

This plan update does not differentiate between primary and secondary facilities. It does exclude certain very small structures which are located on



private property. All facilities are evaluated according to the same criteria (described in Section 5.4).

Canyon del Rey creek (main stem) has its source at the crest of Hwy 68, runs mostly westerly along Hwy 68 until the junction of Hwy 68 with Hwy 218, at which point it follows Hwy 218 north and west to Laguna Grande, Roberts Lake, and finally Monterey Bay. Both highways cross the creek at many locations, creating a series of flow restrictions and associated impoundments. These restrictions and impoundments, along with both naturally occurring ephemeral lakes and marshes and basins constructed for storm water detention, dramatically alter the natural runoff from the watershed and the peak storm flows in the creek.

Table 2-1: Detention basin facilities in Canyon del Rey watershed.

Facility ID	Location
LS_B_01	Lake at Laguna Seca Raceway.
04_B_01	South of Hwy 68 at S.P.C.A. facility.
04_B_02	South of Hwy 68 at S.P.C.A. facility.
05_B_01	South of Hwy 68, approx. 1'650 feet west of S.P.C.A. entrance road.
06_B_01	North of Hwy 68, approx. 500 feet west of S.P.C.A. entrance road.
07_B_01	North of Hwy 68, approx. 1,000 feet east of Boots Road.
08_B_01	South of Hwy 68. Approx. 250 feet southeast of Boots Road.
08_B_02	South of Hwy 68. Approx. 250 feet southeast of Boots Road. Not modeled.
09_B_01	Approx. 200 feet south of where Boots Road and Whip Road meet near Hwy 68.
10_B_01	Pasadera golf course pond, approx. 200 feet south of Las Laderas Drive.
10_B_02	Pasadera golf course pond, approx. 230 feet west of Las Brisas Drive.
10_B_03	Pasadera golf course pond, approx. 200 feet southeast of Pasadera Country Club.
11_B_01	Pasadera golf course pond, approx. 180 feet west of Mirasol Ct. Not modeled.
11_B_02	Pasadera golf course pond, at the intersection of Pasadera Drive and Via Del Milagro. Modeled as one (10_B_04).
10_B_04	
11_B_03	1'400 feet west of Pasadera Drive and 180 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
12_B_01	1'650 feet west of Pasadera Drive and 270 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
12_B_02	2'050 feet west of Pasadera Drive and 270 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
14_B_01	Canyon del Rey reach west of Pasadera Road and South of Hwy 68.
19_B_01	Directly west of where Wilson Road and York Road meet.
21_B_01	North of Hwy 68. Approx. 1'300 feet east of Ragsdale Drive.
22_B_01	North of Hwy 68. Approx. 1'000 feet east of Ragsdale Drive.
24_B_01	West side of Hwy 218. Approx. 1'400 feet south of the Hwy 68 and Hwy 218 interchange.
24_B_02	West side of Hwy 218. Approx. 1'400 feet south of the Hwy 68 and Hwy 218 interchange.
25_B_01	Approx. 650 feet northwest of the Ragsdale Drive and Lower Ragsdale drive T intersection. South of the Harris Ct business development.
25_B_02	Directly south of the Hwy 68 and Hwy 218 interchange. South of the Monterra Subdivision.
26_B_01	South of Hwy 68 and west of 218 at interchange. North of the Monterra subdivision entrance.
27b_B_01	Directly east of Hwy 218 at Pheasant Ridge Road.
29_B_01	Frog Pond Wetland Preserve.
29_B_02	Northeast of the Monterey Airport. North of N road.
29b_B_01	Park behind Safeway, west of hwy 218 and south of Wilson Way.
30_B_01	Laguna Del Rey and Roberts Lake combined. North and south of Del Monte Blvd.

Table 2-2: Roadway crossing culverts in Canyon del Rey watershed.

Facility ID	Location	Description
LS_C_01	Lake at Laguna Seca Raceway	15" circular CPE
01_C_01	Crossing under Hwy 68, approx. 1'240 feet east of Laureles Grade	18" circular CMP
01_C_02	North of Hwy 68 across from Laureles Grade. Parallel to Hwy 68.	18" circular CMP
01_C_03	Crossing under Laureles Grade.	24" circular CMP
02_C_01	Crossing under Hwy 68, just west of Laureles Grade.	double 28" x 20" oval CMP
02_C_02	Crossing just east of the S.P.C.A. entrance and parallel to Hwy 68. South of	18" circular CMP
02_C_03	Crossing under S.P.C.A. driveway entrance.	18" circular CPE
03_C_01	Crossing under the east gate to Laguna Seca Raceway.	48" x 30" oval CMP
03_C_02	Crossing under the main entrance to the Laguna Seca Raceway.	40" circular HDPE-S
04_C_01	Crossing under Hwy 68 just west of S.P.C.A.	24" circular CMP
04_C_02	Crossing under Hwy 68, approx. 770 feet west of S.P.C.A.	24" circular HDPE-S
05_C_01	Crossing under Hwy 68, approx. 1'750 feet west of Laguna Seca Raceway	24" circular CMP
06_C_01	Crossing under gated access road, approx. 2'130 feet west of Laguna Seca	48" and 30" circular CMP
07_C_01	Crossing under Hwy 68, approx. 1'160 feet east of Pasadera entrance.	24" circular HDPE-S
08_C_02	Crossing under Hwy 68, just west of Boots Road.	52" circular RCP
09_C_01A	Crossing under Whip Road and Boots Road.	40" circular HDPE-S
10_C_01	Crossing diagonally under Hwy 68, approx. 950 feet east of Pasadera entrance	36" circular CMP
10_C_02	Crossing under Boots Road, south of Hwy 68.	60" circular RCP
10_C_03	Crossing under Pasadera entrance, north of Hwy 68. Flows from Pasadera	36" circular RCP/CMP
12_C_01	Crossing under Hwy 68 at Laguna Seca Golf Ranch.	48" circular CMP
14_C_01	Crossing under Hwy 68 at Laguna Seca Golf Ranch. West of 12_C_01.	48" circular CMP
15_C_01	Crossing parallel to Hwy 68, approx. 2'800 feet east of York Road. North of	48" circular CMP
16_C_01	Crossing under Hwy 68, approx. 3'600 feet east of York Road.	24" circular CMP
17_C_01	Crossing under York Road.	14.4' x 8' concrete box with earth floor
18_C_01	Crossing under Hwy 68, just west of York Road.	6' x 4' RCB
21_C_01	Crossing under Hwy 68, approx. 1'800 feet west of York Road.	triple 28" x 24" synthetic fiberglass pipes
25_C_01	Crossing under Monterra entrance (Hwy 218).	double 48" and triple 18" circular RCP
25_C_02	Crossing under Hwy 68, just west of Monterra entrance.	double 48" circular RCP

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Table 2-2: Roadway crossing culverts in Canyon del Rey watershed (continued).

Facility ID	Location	Description
25_C_03	Crossing under southeast entrance of the Stone Creek Center. Parallel to	14' x 7.7' RCB
26_C_01	Crossing under Hwy 68. Starting approx. 650 feet northwest of Monterra	36" circular HPDE-S
27_C_01	Crossing under northeast entrance of the Stone Creek Center. Parallel to	14' x 8' RCB
27_C_02	Crossing under entrance to storage lot, just north of the Stone Creek Cer	14' x 6.7' RCB
27_C_03	Crossing under Del Rey Gardens Drive, west of Hwy 218. Parallel to Hwy	87.6" circular CMP
27_C_04	Crossing under Hwy 218, approx. 520 feet southeast of General Jim Moor	6' x 8' RCB
28_C_01	Crossing under General Jim Moore Blvd. at Hwy 218.	10.1' x 8' RCB
28_C_02	Crossing under General Jim Moore Blvd approx. 500 feet northeast of Hw	3' x 3' RCB
29_C_01	Crossing under Hwy 218 at the Frog Pond, approx. 50 feet northwest of V	6' x 8' RCB
29_C_02	942 Angelus Way.	not modeled
29_C_03	938/934 Angelus Way driveway.	wooden bridge with concrete walls
29_C_04	930/926 Angelus Way.	wooden bridge with concrete walls
29_C_05	Across Angelus Way from Altura Pl.	48" circular CMP
29_C_05A	Across Angelus Way from Altura Pl.	12' x 8' concrete bridge
29_C_06	Angelus Way, just west of Avalon Pl.	concrete bridge
29_C_07	Crossing under Rosita Road at Angelus and Rosita intersection.	6' x 8.25' RCB
29_C_08	Crossing under Fremont Blvd, starting at the park behind Safeway.	8' x 8' RCB
30_C_01	Crossing at the southeast end of Laguna Grande Park. East of Laguna Gran	6' x 6' RCB
30_C_02	Bridge crossing at Laguna Grande Park southeast of Branner Ave.	100' x 7'(in middle) Wooden arched bridge
30_C_03	Laguna Del Rey Lake crossing under Del Monte Avenue.	double 16' x 7' RCBs
30_C_03B	Laguna Del Rey Lake crossing under Del Monte Avenue.	double 21.36' x 7' RCBs
30_C_04	Roberts Lake crossing under Roberts Avenue.	double 8' x 6' RCBs
30_C_05	Crossing under Hwy 1 off-ramp at Hwy 218. Outlet at Seaside beach east	Quad 6' x 6' RCBs
<b>Materials:</b>		
CMP:	CORRUGATED METAL PIPE	
CPE:	CORRUGATED POLYETHYLENE PIPE - CORRUGATED EXTERIOR/INTERIOR	
HDPE-S:	HIGH DENSITY POLYETHYLENE PIPE - TYPE S - CORRUGATED EXTERIOR/SMOOTH INTERIOR	
PVC:	POLYVINYL CHLORIDE PIPE	
RBC:	REINFORCED BOX CULVERT	
RCP:	REINFORCED CONCRETE PIPE	
OTHER:	OTHER MATERIAL; SEE FIELD NOTES	

## 2.5 Descriptions of existing facilities

### SUB-WATERSHED LS:

- Map Panel: C-7
- Basins: LS\_B\_01
- Culverts: LS\_C\_01
- Drainage area (acres): 188
- Hydrologic Characteristics: This watershed encompasses the Laguna Seca Lake (LS\_B\_01) and its contributory drainage area.
- Hydraulic Facilities: A single 15 inch pipe, LS\_C\_01, runs 2,640 feet to a creek which is tributary to the main stem, dropping in elevation from 743 feet to 508 feet. An outlet gate in a 3 foot wide flume controls flow from the lake into the pipe. The gate controls lake water level between 738.85 and 746.85 feet.

### SUB-WATERSHED 01:

- Map Panel: C-7 and C-8
- Basins: None
- Culverts: 01\_C\_01, 01\_C\_02, 01\_C\_03
- Drainage area (acres): 128
- Hydrologic Characteristics: Sub-watershed 01 is located at the eastern upstream limit of the study area at the watershed divide. While the watercourse is poorly defined in places, three culverts carry flow under roads.
- Hydraulic Facilities: Culvert 01\_C\_01 is a 18 inch RCP carrying local drainage to the north side of Hwy 68. Culvert 01\_C\_02 is a pair of 18 inch CMP pipes in series which carry flow along the north side of Highway 68. Culvert 01\_C\_03 is a structure consisting of 18 inch and 24 inch RCP, a junction manhole, and a 24 inch CMP running under Laureles Grade Road. This structure drains a detention pond on the southwest side of the intersection of Hwy 68 with Laureles Grade Road.

### SUB-WATERSHED 02:

- Map Panel: C-7 and C-8
- Basins: None
- Culverts: 02\_C\_01, 02\_C\_02, 02\_C\_03
- Drainage area (acres): 484
- Hydrologic Characteristics: Sub-watershed 02 is located on the south side of Hwy 68 and is drained by a swale running in part along Laureles Grade Road. Runoff is concentrated where the swale approaches the highway.

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- Hydraulic Facilities: Culvert 02\_C\_01 is a pair of 28 inch by 20 inch elliptical RCP, which carry flow from this sub-watershed north across Hwy 68. Culvert 02\_C\_02 is a pair of 15 inch CMP running along the north side of Hwy 68, carrying flow under a side road. Culvert 02\_C\_03 is an 18 inch CPP running under a driveway.

### SUB-WATERSHED 03:

- Map Panel: C-7
- Basins: None
- Culverts: 03\_C\_01, 03\_C\_02
- Drainage area (acres): 250
- Hydrologic Characteristics: Sub-watershed 03 is located between sub-watersheds LS and 01, north of Hwy 68, and drains steep slopes between Laguna Seca lake and the highway. Much of the runoff is routed to the highway via a drainage swale running due south.
- Hydraulic Facilities: Culvert 03\_C\_01 is a 48 x 30 inch CMP running under the Laguna Seca access road and gate, on the north side of Hwy 68. 03\_C\_02 is a 40 inch HDPE pipe running under the Laguna Seca main entrance road on the north side of Hwy 68.

### SUB-WATERSHED 04:

- Map Panel: C-7 and C-8
- Basins: 04\_B\_01, 04\_B\_02
- Culverts: 04\_C\_01, 04\_C\_02
- Drainage area (acres): 53
- Hydrologic Characteristics: Sub-watershed 04 is a small shed located immediately south of Hwy 68 between sheds 02 and 05. A small creek drains the area.
- Hydraulic Facilities: Basins 04\_B\_01 and 04\_B\_02 are located on the creek in series just south of Hwy 168. Basin 04\_B\_01 flows over a concrete weir into basin 04\_B\_02, which drains to a swale south of Hwy 68 via a 12 inch PVC pipe. Culvert 04\_C\_01 carries the flow from the basins north under Hwy 68, while culvert 04\_C\_02 carries local flow under the highway.

### SUB-WATERSHED 05:

- Map Panel: C-7 and C-8
- Basins: 05\_B\_01
- Culverts: 05\_C\_01
- Drainage area (acres): 290
- Hydrologic Characteristics: Sub-watershed 05 is located on the south side of Hwy 68 and the Laguna Seca ranger station. It drains mostly steeps

slopes that extend nearly to the southern drainage divide via narrow valleys.

- Hydraulic Facilities: Basin 05\_B\_01 captures virtually all of the runoff from the sub-watershed. Culvert 05\_C\_01, a 24 inch CMP, drains water from the basin and carries it north under Hwy 68.

SUB-WATERSHED 06:

- Map Panel: C-7
- Basins: 06\_B\_01
- Culverts: 06\_C\_01
- Drainage area (acres): 229
- Hydrologic Characteristics: Sub-watershed 06 is located between Hwy 68 and the Laguna Seca Raceway basin and drains mostly steep slopes that extend to the northern drainage divide via a narrow valley. The channel runs parallel to the Laguna Seca main entrance road and carries flow from Laguna Seca sub-shed (LS). A number of minor basins and small culverts along the west side of the road (not modeled or field surveyed) carry water downslope.
- Hydraulic Facilities: Basin 06\_B\_01 has a substantial storage area, is controlled by culvert 06\_C\_01 and extends 2000 feet eastward along the north side of Hwy 68. Culvert 06\_C\_01, consisting of 30 inch and 48 inch CMP, run on the north side of Hwy 68 and carry water under the ranger station access road. A wetland area has developed upstream from the culvert, while the culvert outlets are suspended 8-12 feet above the downstream channel.

SUB-WATERSHED 07:

- Map Panel: C-7 and C-8
- Basins: 07\_B\_01
- Culverts: 07\_C\_01
- Drainage area (acres): 86
- Hydrologic Characteristics: Sub-watershed 07 is a small shed which spans Hwy 68 between sheds 05-06 and sheds 08-11. A small creek drains the southern area. Detention basin 07\_B\_01 is a long, narrow storage area controlled by culvert 10\_C\_01.
- Hydraulic Facilities: Culvert 07\_C\_01, a 24 inch CPP, carries water from the south side under Hwy 68 to the main stem. This culvert has grated concrete box inlet.

SUB-WATERSHED 08:

- Map Panel: C-7 and C-8
- Basins: 08\_B\_01, 08\_B\_02

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- Culverts: 08\_C\_01, 08\_C\_02
- Drainage area (acres): 388
- Hydrologic Characteristics: Sub-watershed 08 is located between Hwy 68 and the south drainage divide. A single channel drains much of the shed, which are mostly steep slopes.
- Hydraulic Facilities: The two basins, 08\_B\_01 and 08\_B\_02, which are in series, control nearly all of the runoff. Basin 08\_B\_01 is very shallow and has a riser outlet with a grate on top. The downstream location of the outlet was not found in the field survey. Basin 08\_B\_02 is located immediately downslope from basin 08\_B\_01 and is a shallow, small depression without obvious outlet or inlet structures. Culvert 08\_C\_01 is a short 24 inch CMP which drains basin 08\_B\_01. Culvert 08\_C\_02, a 52 inch RCP, carries all of the main stem flow north under Hwy 68. Both the inlet and outlet are on concrete headwalls; the outlet is at creek bed while the inlet is partially silted.

### SUB-WATERSHED 09:

- Map Panel: C-6 and C-8
- Basins: 09\_B\_01
- Culverts: 09\_C\_01
- Drainage area (acres): 189
- Hydrologic Characteristics: Sub-watershed 09 extends from south of Hwy 68 to the southern drainage divide. A narrow ravine along Boots Road drains the area, which has moderate to very steep slopes.
- Hydraulic Facilities: Basin 09\_B\_01 is a large, constructed detention basin with an engineered notched weir outlet structure. Culvert 09\_C\_01 is a 40 inch HDPE pipe which captures water from the basin outlet structure via a wide swale, carries the flow under Whip Road, and then under Boots Road, with manhole access between the crossings. Flow exits the culvert via an energy dissipation outlet structure into sub-watershed 08.

### SUB-WATERSHED 10:

- Map Panel: C-7
- Basins: 10\_B\_01, 10\_B\_02, 10\_B\_03, 10\_B\_04
- Culverts: 10\_C\_01, 10\_C\_02, 10\_C\_03
- Drainage area (acres): 308
- Hydrologic Characteristics: Sub-watershed 10 extends from the northern drainage divide to Sub-watershed 07. Slopes vary from steep to relatively flat and the lower slope portions of the shed are occupied by the Pasadera Golf Course. Multiple basins and drainage pipes form the golf course storm water retention and drainage system. Of these, four basins and three culverts were investigated and modeled in this study.



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- Hydraulic Facilities: Basins 10\_B\_01, 10\_B\_02, 10\_B\_03, 10\_B\_04 interconnect via pipes and surface swales such that storm water moves down slope in series through the basins. The storage in the basins was included in the hydrologic modeling, but the pipes and swales were not investigated in detail or analyzed. Culvert 10\_C\_01 is a 36 inch CMP carrying flow from basin 07\_B\_01 south under Hwy 68. Culvert 10\_C\_02 is a 60 inch RCP which carries the main stem under Boots Road at the Hwy 68 junction. Culvert 10\_C\_03 is a 36 inch CMP which drains basin 10\_B\_04 and carries the flow west under the Pasadera entrance at Hwy 68.

### SUB-WATERSHED 11:

- Map Panel: C-5 and C-7
- Basins: 11\_B\_01, 11\_B\_02, 11\_B\_03
- Culverts: None
- Drainage area (acres): 344
- Hydrologic Characteristics: Sub-watershed 11 is west of shed 10, includes the north and west portions of Pasadero Golf Course and portions of Laguna Seca Golf Ranch, and contains several detention ponds associated with the golf courses. Three basins were included in the hydrologic modeling, but no culverts or other pipes were included in the hydraulic analyses or field investigation.
- Hydraulic Facilities: Basin 11\_B\_01 is a large pond in the south-central portion of the shed and receives water from a small portion of the shed. It is drained by two risers leading to 18 inch and 30 inch CMPs. Basin 11\_B\_02 was combined with 10\_B\_04 for modeling purposes. It has a single submerged pipe which carries water to basin 10\_B\_04. Basin 10\_B\_04 outlet is a grated concrete structure with a 36 inch CMP, leading to a junction with culvert 10\_C\_03. Basin 11\_B\_03 (sheet C-5) sends water to basin 12\_B\_01 via an overflow across a golf cart path; the installed outlet pipe is buried.

### SUB-WATERSHED 12:

- Map Panel: C-5 and C-7
- Basins: 12\_B\_01, 12\_B\_02
- Culverts: 12\_C\_01
- Drainage area (acres): 90
- Hydrologic Characteristics: Sub-watershed 12 drains a portion of the Laguna Seca Golf Ranch. Slopes vary from moderate in the north to relatively low in the vicinity of the basins.
- Hydraulic Facilities: The two basins operate in series with two 18 inch CMPs connecting them under a cart path. Basin 12\_B\_02 drains to a swale via 24 inch and 12 inch CMPs. Culvert 12\_C\_01 carries the main stem flow southward under Hwy 68 in a 48 inch CMP.

SUB-WATERSHED 13:

- Map Panel: C-5
- Basins: None
- Culverts: None
- Drainage area (acres): 99
- Hydrologic Characteristics: Sub-watershed 13 is a narrow drainage north of Hwy 68 which extends to local hilltops. There is no well-defined water course; runoff continues overland to the main stem.
- Hydraulic Facilities: None

SUB-WATERSHED 14:

- Map Panel: C-5 and C-6
- Basins: None
- Culverts: 14\_C\_01
- Drainage area (acres): 148
- Hydrologic Characteristics: Sub-watershed 14 extends south from Hwy 68 up a very steep rise to a local ridge separating this shed from shed 18. A single incised channel carries the bulk of the runoff to the main stem.
- Hydraulic Facilities: Culvert 14\_C\_01, a 48 inch CMP, carries the main stem and runoff from this shed north under Hwy 68. The channel is narrow with steep sides. The culvert entrance is at a concrete headwall, while the outlet is above a concrete apron designed to resist scour. The apron is undercut and failing.

SUB-WATERSHED 15:

- Map Panel: C-5
- Basins: None
- Culverts: 15\_C\_01
- Drainage area (acres): 156
- Hydrologic Characteristics: Sub-watershed 15 extends north from Hwy 68 and includes much of Laguna Seca Golf Ranch. It consists of a broad westward sloping apron along Hwy 68 with steep slopes to the north.
- Hydraulic Facilities: Culvert 15\_C\_01, a 48 inch CMP, carries the main stem parallel to Hwy 68 and under a drive way. The culvert entrance is a vertical shaft with a trash rack (not currently installed). The outlet is through a head wall with invert at channel invert.

SUB-WATERSHED 16 A & B:

- Map Panel: C-5 and C-6

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- Basins: None
- Culverts: 16\_C\_01
- Drainage area (acres): a: 65, b: 104
- Hydrologic Characteristics: Sub-watershed 16 a & b is a narrow shed along the south side of Hwy 68 which extends to a ridge dividing it from shed 18. Nearly the entire area is very steep, with a single defined drainage running north to the highway.
- Hydraulic Facilities: Culvert 16\_C\_01, a 24 inch CMP, carries local runoff northward under Hwy 68. The culvert entrance is flared, while the outlet opens above the main stem channel.

### SUB-WATERSHED 17:

- Map Panel: C-5
- Basins: None
- Culverts: 17\_C\_01
- Drainage area (acres): 149
- Hydrologic Characteristics: Sub-watershed 17 extends north from Hwy 68 to slightly beyond \_\_ Road. Slopes are moderate, with a single drainage channel extended ½ way up the slope.
- Hydraulic Facilities: Culvert 17\_C\_01 is 14.5 foot by 8 foot elliptical culvert with a dirt floor. This culvert carries the main stem parallel to Hwy 68 and under York Road. Both entrance and outlet are flared with concrete headwalls.

### SUB-WATERSHED 18:

- Map Panel: C-5 and C-6
- Basins: None
- Culverts: 18\_C\_01
- Drainage area (acres): 964
- Hydrologic Characteristics: Sub-watershed 18 is a large shed extending south from Hwy 68 to the watershed divide. A single dendritic creek drains the area, which converges at the highway immediately west of York Road. Slopes are highly variable, with multiple steep rises to hilltops. Numerous dirt roads cross the area.
- Hydraulic Facilities: Culvert 18\_C\_01, a 6 foot by 4 foot box culvert, carries runoff from the shed north under Hwy 68 to the main stem. There are headwalls on both ends of the culvert.

### SUB-WATERSHED 19:

- Map Panel: C-5
- Basins: 19\_B\_01

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- Culverts: None
- Drainage area (acres): 99
- Hydrologic Characteristics: Sub-watershed 19 is a small shed on the north side of Hwy 68 with York Road running through its center. Slopes are moderate with no well defined channel. A local storm drain network drains into basin 19\_B\_01
- Hydraulic Facilities: Basin 19\_B\_01 is a small basin at the southeast end of the shed immediately north of the main stem channel. Inflow is primarily from a 24 inch RCP and outflow is via a 24 inch CMP with a 24 inch riser covered by a trash rack. High flows are passed by a 3 foot wide trapezoidal grass overflow spillway and grass swale.

### SUB-WATERSHED 20:

- Map Panel: C-3, C-5 and C-6
- Basins: None
- Culverts: None
- Drainage area (acres): 320
- Hydrologic Characteristics: Sub-watershed 20 is located between Hwy 68 and the southern drainage divide. Slopes are generally steep with one dendritic channel draining much of the area.

### SUB-WATERSHED 21:

- Map Panel: C-5
- Basins: 21\_B\_01
- Culverts: 21\_C\_01
- Drainage area (acres): 123
- Hydrologic Characteristics: Sub-watershed 21 drains a relatively low slope developed industrial area between Hwy 68 and shed 28 via a local storm drain network. The network elements drain to a swale which flows to basin 21\_B\_01.
- Hydraulic Facilities: Basin 21\_B\_01 receives flow from a small upstream basin (not field investigated or modeled) via a concrete weir and spillway. Both basins are located in the downslope, southwest corner of the shed. The upstream basin receives the runoff from the storm drains. The outflow from basin 21\_B\_01 is controlled by a concrete outlet structure containing a square notch weir. Culvert 21\_C\_01 consists of three 28 inch by 24 inch elliptical fiberglass pipes and carries the main stem south across Hwy 68. Both inlet and outlet are in concrete headwalls.

### SUB-WATERSHED 22:

- Map Panel: C-5
- Basins: 22\_B\_01

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- Culverts: None
- Drainage area (acres): 9.6
- Hydrologic Characteristics: Sub-watershed 22 is a very small shed encompassing a single steep drainage immediately north of Hwy 68.
- Hydraulic Facilities: Basin 22\_B\_01 receives flow from the drainage swale; outflow to local drainage swale is controlled by a weir in a narrow concrete flume.

### SUB-WATERSHED 23:

- Map Panel: C-6 and C-3
- Basins: None
- Culverts: None
- Drainage area (acres): 454
- Hydrologic Characteristics: Sub-watershed 23 is a large shed south of Hwy 68 which extends to the watershed divide and is drained by an extensive dendritic channel network. Slopes are general steep with incised valleys. There are no natural basins or ponds.

### SUB-WATERSHED 24:

- Map Panel: C-3 and C-2
- Basins: 24\_B\_01, 24\_B\_02
- Culverts: None
- Drainage area (acres): 160
- Hydrologic Characteristics: Sub-watershed 24 is located between sheds 23 and 26 and drains a moderately steep, narrow area with a single swale. Two basins have been constructed in series at the north end of the shed, with lower basin discharging into the main stem.
- Hydraulic Facilities: Basin 24\_B\_01 receives flow from the swale; outflow to basin 24\_B\_02 is controlled by the combination of a 36 inch CMP vertical riser plus culvert and an 8.7 foot wide spillway. The riser opening is at the same elevation as the spillway crest. Basin 24\_B\_02 drains via three 15 inch CMP, which run under a driveway.

### SUB-WATERSHED 25, 25B, 25C:

- Map Panel: C-2 and C-5
- Basins: 25\_B\_01, 25\_B\_02
- Culverts: 25\_C\_01, 25\_C\_02, 25\_C\_03
- Drainage area (acres): 161
- Hydrologic Characteristics: These sub-watersheds, combined, drain relatively low sloped areas between the main stem and shed 28, primarily

on the northeast side of Hwy 68. Most of the runoff occurs overland, with two short defined channels in the vicinity of the highway.

- Hydraulic Facilities: Basin 25\_B\_01 is located in Ryan Ranch business park and intercepts local runoff. Outflow from this basin is via both a 24/36 inch vertical, perforated riser (with perforated cap) connected to an 18 inch CMP culvert and a separate 18 inch CMP culvert. Basin 25\_B\_02, basin on the main stem, was not surveyed, but is controlled by culvert 25\_C\_01. Culvert 25\_C\_01 consists of three 18 inch RCP and two 48 inch RCP, which carry the main stem westward under Monterra Ranch Road. Culvert 25\_C\_02 consists of two 48 inch RCP, which carry the main stem northward under Hwy 68. Culvert 25\_C\_03 is a 14 foot wide by 7.7 foot high concrete box culvert which carries the main stem under a driveway on the west side of Hwy 218.

#### SUB-WATERSHED 26:

- Map Panel: C-2 and C-3
- Basins: 26\_B\_01
- Culverts: 26\_C\_01
- Drainage area (acres): 324
- Hydrologic Characteristics: Sub-watershed 26 is long, narrow shed with an incised channel and moderately steep to very steep slopes, located between Hwy 68 and the southern drainage divide. Portions of this shed border the Monterey airport. The channel has one basin located near the highway.
- Hydraulic Facilities: Basin 26\_B\_01 controls much of the runoff from this shed and is located in the northern, downstream part of the shed. Outflow is controlled by a high flow spillway and a lower flow outlet consisting of three 24 inch CMP risers and pipes through the containment berm. Culvert 26\_C\_01 is a 36 inch CPP which carries runoff from this shed northward under Hwy 68 and enters the storm drain system via a 3 foot by 4 foot concrete box with an 18 inch inflow and 36 inch outflow pipe.

#### SUB-WATERSHED 27 AND 27B:

- Map Panel: C-2
- Basins: 27b\_B\_01
- Culverts: 27\_C\_01, 27\_C\_02, 27\_C\_03, 27\_C\_03
- Drainage area (acres): 129
- Hydrologic Characteristics: Sub-watersheds 27 and 27b contain the Stone Creek Center and other commercial properties. Shed 27 extends from the airport boundary nearly to the Fort Ord reservation boundary and includes the main stem and Hwy 218. Shed 27b extends along the east side of Hwy 218 to the regional park. Slopes are highly variable, from very steep at the airport boundary to very flat in the valley floor. Local storm drains route most of the flow in shed 27.

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- Hydraulic Facilities: Culverts 27\_C\_01 and 27\_C\_02 are 14 foot by 8 foot high concrete boxes which carry the main stem under Stone Creek Center entrances from Hwy 218. Culvert 27\_C\_03 is a 7.3 foot diameter CMP which carries the main stem under the Del Rey Gardens entrance on the west side of Hwy 218. Culvert 27\_C\_04 is a 6 foot wide by 8 foot high concrete box culvert which carries the main stem eastward under Hwy 218. Both inlet and outlet have retaining wing walls.

### SUB-WATERSHED 28:

- Map Panel: C-1, C-2, C-4, C-5
- Basins: None
- Culverts: 28\_C\_01, 28\_C\_02
- Drainage area (acres): 1201
- Hydrologic Characteristics: Sub-watershed 28 is a large, elongated shed which is entirely within the Fort Ord reservation and drains northwestward via both local swales and a well-defined channel near the south boundary of the shed. Slopes vary from relatively high in the eastern portions to low in the far west portion.
- Hydraulic Facilities: Culvert 28\_C\_01 is a 9.6 foot by 8 foot high box culvert which carries the main stem under General Jim Moore Road on the north side of its intersection with Hwy 218. Culvert 28\_C\_02 is a 3 foot by 3 foot concrete box which carries the runoff from this shed westward under General Jim Moore Road and into basin 29\_B\_01.

### SUB-WATERSHED FP:

- Map Panel: C-1 and C-2
- Basins: 29\_B\_01
- Culverts: 29\_C\_01
- Drainage area (acres): 67
- Hydrologic Characteristics: Sub-watershed FP is a small area immediately surrounding the Frog Pond basin which includes portions of the regional park. Slopes are relatively low; much of the shed, other than the park, is developed. The main stem winds through a woodland before entering the basin.
- Hydraulic Facilities: Basin 29\_B\_01 is the frog pond, which detains flows on the main stem. It is a natural depression, with water level controlled by a spillway which is part of culvert 29\_C\_01. This culvert is a 6 foot wide by 8 foot high box culvert which carries the basin outflow south under Hwy 218.

### SUB-WATERSHEDS 29 AND 29B:

- Map Panel: C-2
- Basins: 29\_B\_02

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- Culverts: 29\_C\_02, 29\_C\_03, 29\_C\_04, 29\_C\_05, 29\_C\_06, 29\_C\_07, 29\_C\_08
- Drainage area (acres): 29: 138; 29b: 246
- Hydrologic Characteristics: Sub-watershed 29 encompasses a relatively flat, high area and includes the majority of the municipal airport. Drainage, including portions of the airport drained by culverts, flows west and north to a single swale with a basin controlling flow to shed 29b and the main stem. Sub-watershed 29b is a largely developed area, with exception of park lands along the channel. The channel runs alongside the park and through developments; it is a narrow, deep notch with limited capacity. Local runoff enters the channel via storm drains. Multiple bridges and culverts carry the flow under driveways and streets.
- Hydraulic Facilities: Basin 29\_B\_02 captures much of the drainage from the eastern portions of the airport. Outlet control consists of a 12 foot wide trapezoidal spillway, a 30 inch RCP under the berm, and a 48 inch RCP and riser with a 36 inch grate on the entrance. Culvert 29\_C\_03 is a private wood deck over the channel. Culvert 29\_C\_04 is a driveway bridge. Culvert 29\_C\_05 is a driveway bridge with a 48 inch CMP under a concrete apron. Culvert 29\_C\_06 is a driveway bridge. Culvert 29\_C\_07 is a 6 foot wide by 6.8 feet high concrete box carrying flow under Rosita Ave. Culvert 29\_C\_08 is a 8 foot wide by 8 foot high concrete box with wing walls carrying flow under Fremont Blvd. The inlet has a trash rack.

### SUB-WATERSHEDS 30:

- Map Panel: C-1 and C-2
- Basins: Laguna Grande, Roberts Lake
- Culverts: 30\_C\_01, 30\_C\_02, 30\_C\_03, 30\_C\_03, 30\_C\_04, 30\_C\_05
- Drainage area (acres): 1011
- Hydrologic Characteristics: Sub-watershed 30 includes most of the regional airport and much of Seaside. Almost the entire shed is urbanized and drained by storm drain networks. Slopes are mild to flat. Roberts Lake and Laguna Grande and associated park land are located immediately upstream of Hwy 1 and the beach. These lakes control outflow to the ocean.
- Hydraulic Facilities: Culvert 30\_C\_01, a 6 foot by 6 foot concrete box, is located immediately north of Fremont Blvd. and carries flow under an earthen berm. Culvert 30\_C\_02 is a park foot bridge set on pilings over the channel at its entrance into Laguna Grande. Culvert 30\_C\_03 consists of a 16 foot wide by 7 foot high concrete channel connecting Laguna Grande to Roberts Lake. Bridges for Del Monte Blvd. and a foot path span the channel. Culvert 30\_C\_04 consists of two 8 foot wide by 6 foot high concrete boxes and two 24 inch gate valved low flow pipes. An inlet weir sets the normal lake elevation. This culvert runs under Roberts Avenue. Culvert 30\_C\_05 consists of four 6 foot wide by 6 foot high concrete boxes. The outlets are partially filled with sand. This culvert carries flow under the



Hwy 1 interchange structure and highway overpass and discharges adjacent to the Beach Hotel.

## 2.6 Lake surveys and mapping

The condition of the Laguna Grande - Roberts Lake complex and the rate of accumulation of sediment in the lakes were evaluated via a field investigation and a bathymetric survey of bottom elevations.

### HYDROGRAPHIC MAPPING METHODS

The CSUMB Seafloor Mapping Lab performed comprehensive high resolution hydrographic survey was conducted of both Roberts Lake and Laguna Grande during April 7-10, 2013. Swath bathymetry and acoustic backscatter data were collected using an SEA SwathPlus interferometric sidescan sonar system coupled with an Applanix POS MV inertially aided GPS positioning and attitude measurement system mounted on a small skiff. All measurements were reference to the vertical and horizontal control benchmark specified by the sponsor (figure 1). This benchmark was occupied with a Trimble NetR5 geodetic grade GPS receiver during the survey and the data were used to post-process the POS MV position data to better than 0.05 ft precision. The channel area located just south of the roadway separating the two bodies of water was surveyed manually using a leadline and GPS because the very low foot bridge at the south end of that channel prevented access by the sonar survey vessel.

All bathymetry data were processed to IHO Special Order standards in CARIS hydrographic software, and used to generate final bathymetry DEMs and soundings at 2ft horizontal spacing and 0.01 ft vertical precision. Sounds were gridded at 2ft cell size with 5x5 interpolations to eliminate any minor data gaps. Acoustic backscatter data were processed into mosaics using SAE SwathPlus software and the results classified by echo return intensity in ArcGIS to reveal sediment texture patterns on the basin floors.

All results were project and referenced as follows:

- Coordinate system: State Plane NAD83 CA 4 US Feet
- Datum: NAVD88(Geoid12a) feet
- Reference bench mark position: N: 2115125.842 E: 5723380.903 EL:19.155 (NGS '83, CA Zone IV, NAVD '88, based on Geoid 12A)

### FINAL PRODUCTS

Products provided in digital submittals include:

- digital elevation models (DEM) in ArcView Grid formats
- shaded relief images in greyscale and colored by depth in GeoTiff format

- xyz point data at 2ft spacing as text files
- classified acoustic backscatter mosaics in GeoTiff format
- Survey vessel tracks in shapefile format
- Channel xyz data in text and shapefile format
- ArcGIS project with all associated product data layers

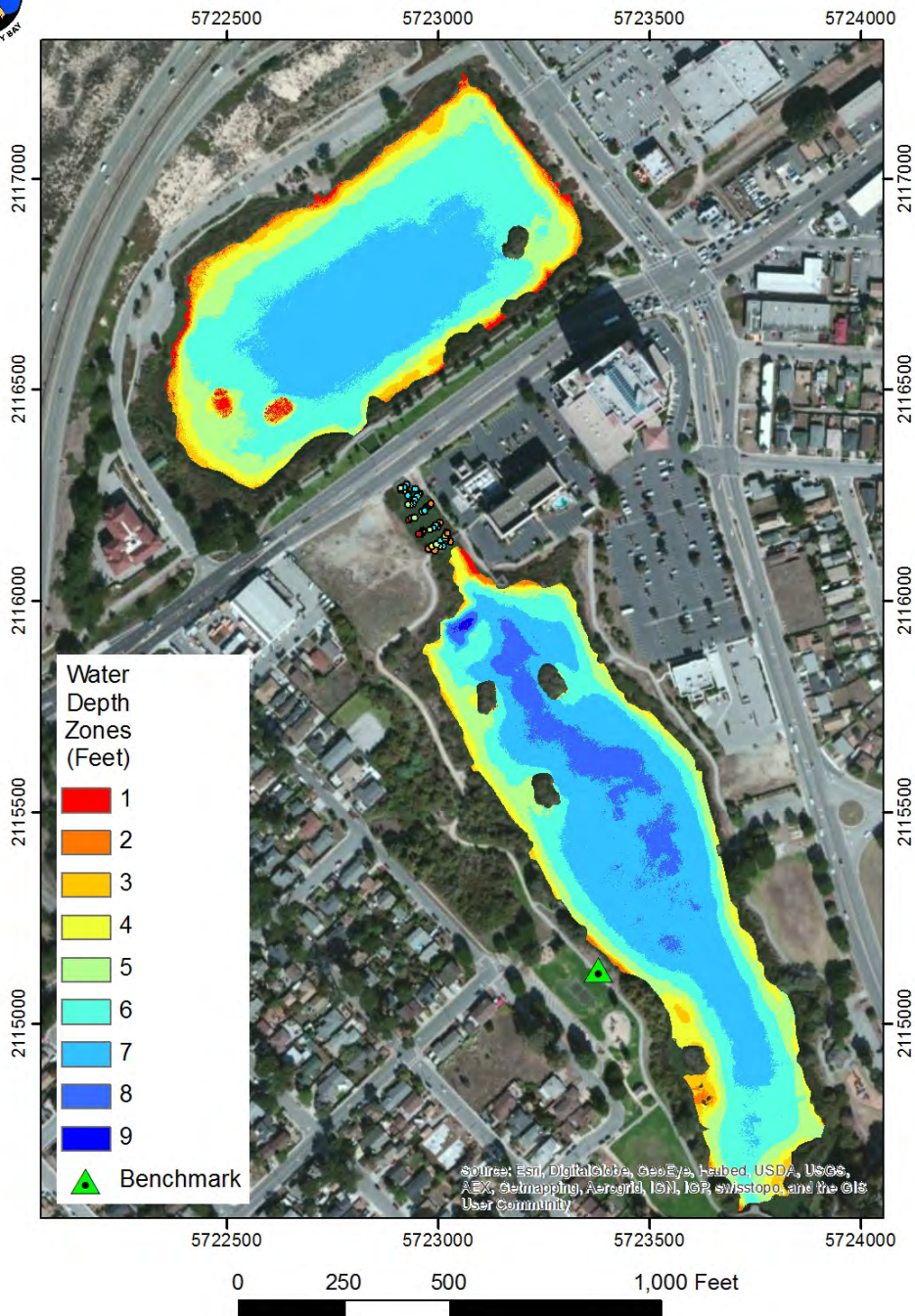
### MAPPING RESULTS

The bathymetric mapping results (Figure 2-1 and Table 2-3) show all of Roberts Lake and > 85% of Laguna Grande to be shallower than 7 ft. deep. The bottoms of the basins are both quite flat with the only relief found along the banks and associated with the small islands. Curves relating elevations (NAVD) to lake volumes are provided in Figure 2-2.

The acoustic backscatter (sidescan sonar) echo return intensity results suggest a greater coverage by finer sediments in the deeper areas of Laguna Grande than in Roberts Lake (purple class in Figure 2-1). Finer sediments have weaker echo returns. Of particular note are the surface tracks still visible on the floor of Roberts Lake that show in the backscatter image because they appear to have been filled in with finer (purple) sediments. These track marks are visible in both the classified mosaic (Figure 2-3) and the unclassified sidescan sonar mosaic (Figure 2-4), and were likely created either during basin construction or subsequent dredging. The fact that the tracks are still visible suggests that there has been relatively little in the way of sediment accumulation since they were formed.



### Laguna Del Rey April 7-10, 2013



Cooler colors are deeper and warmer colors shallower. Horizontal and vertical control benchmark is shown on southwest shore of Laguna Grande.

Figure 2-1: Bathymetry of Roberts Lake (top) and Laguna Grande (bottom) shown in 1 foot depth zones as elevation in feet NAVD88.

Table 2-3: Percent area and volume of Lakes for corresponding depth zones..

Depth Zone (ft)	Laguna Grande			Roberts Lake		
	Area (acres)	Percent Area	Percent Volume	Area (acres)	Percent Area	Percent Volume
1	0.02	0.2%	0.0%	0.18	1.6%	0.3%
2	0.08	0.7%	0.2%	0.27	2.4%	0.9%
3	0.25	2.1%	1.0%	0.57	5.1%	2.7%
4	0.87	7.4%	4.7%	0.95	8.6%	6.1%
5	1.68	14.3%	11.5%	1.76	15.9%	14.1%
6	2.77	23.5%	22.6%	3.89	35.1%	37.2%
7	4.86	41.3%	46.4%	3.48	31.4%	38.8%
8	1.22	10.4%	13.3%	0.00	0.0%	0.0%
9	0.01	0.1%	0.2%	0.00	0.0%	0.0%
Total	11.77	100.0%	0.0%	11.10	100.0%	100.0%

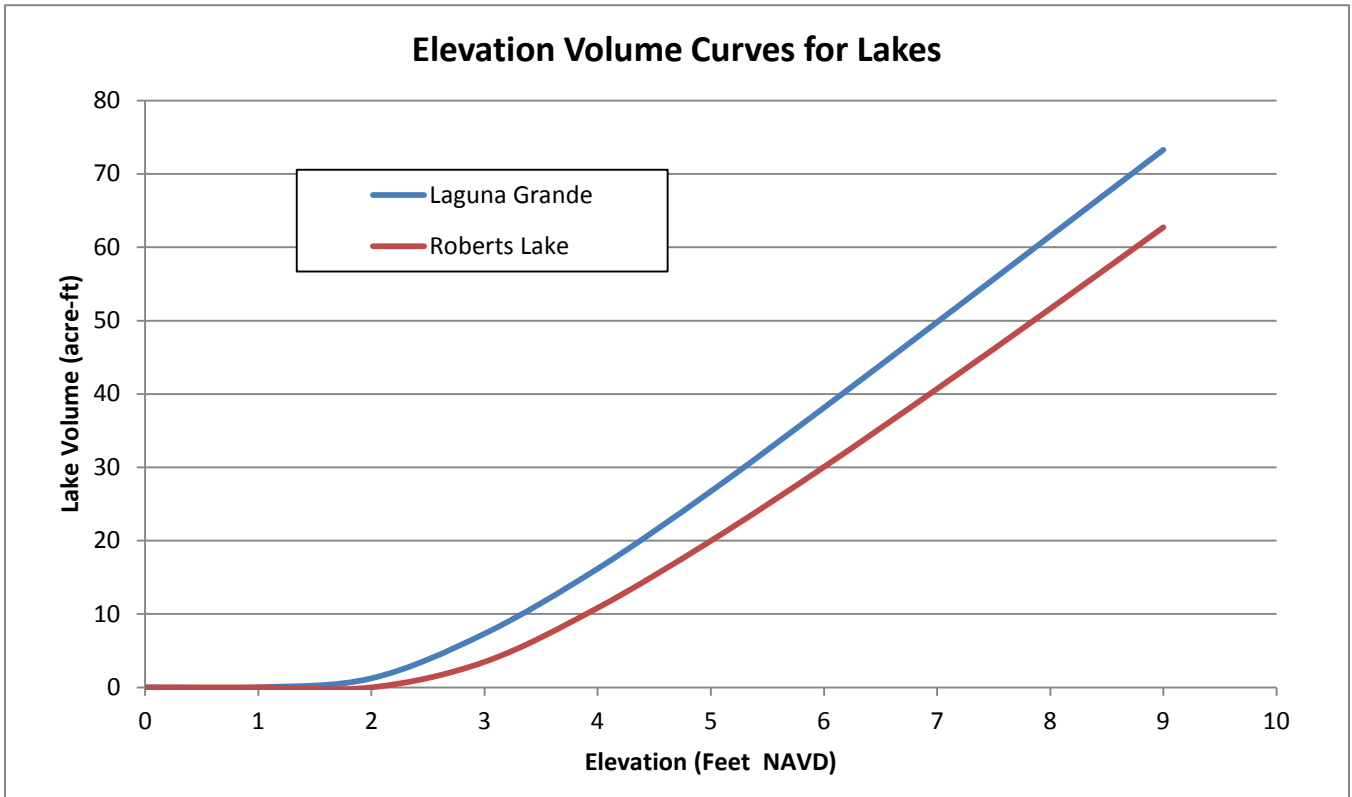
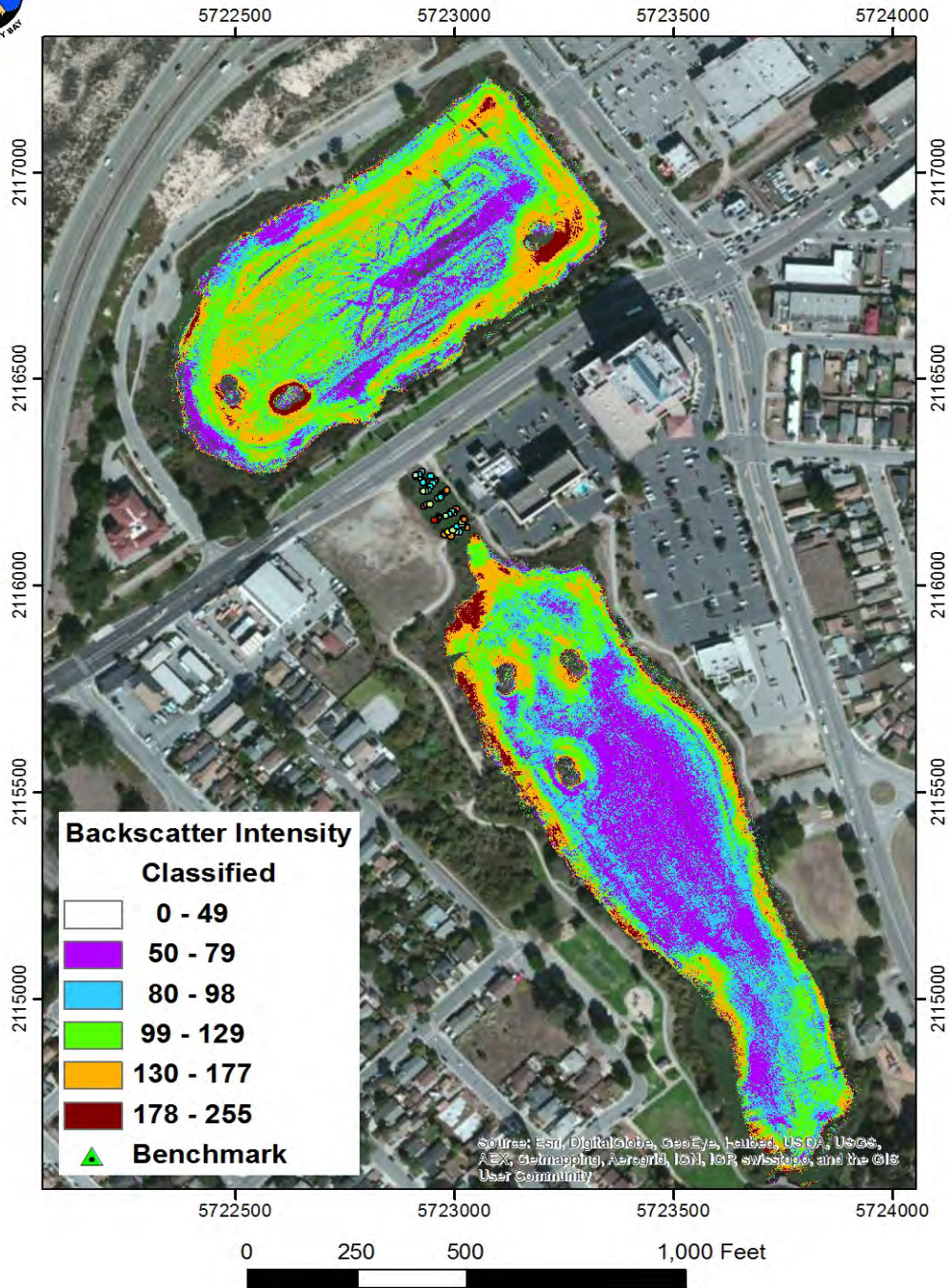


Figure 2-2: Elevation-volume curves for Laguna Grande and Lake Roberts.



### Laguna Del Rey Acoustic Backscatter April 7-10, 2013



Results suggest a higher coverage of fine sediments (purple class) in the deeper areas of Laguna Grande than in Roberts Lake. Note the remnants of tracks now filled with finer sediments on the bottom of Roberts Lake still visible from either the original basin construction or past dredging.

Figure 2-3: Acoustic backscatter echo return intensity classified into natural breaks.



### Laguna Del Rey April 7-10, 2013



Stronger returns are shown as lighter and weaker returns as darker grey. The relic track marks in the deeper parts of Roberts Lake are also clearly visible in these "raw" data.

Figure 2-4: Unclassified sidescan sonar backscatter intensity mosaic - hydrologic conditions and precipitation estimates

### 3 HYDROLOGIC CONDITIONS AND PRECIPITATION ESTIMATES

#### 3.1 Available precipitation gages and data

The following rainfall records were found for the vicinity of Canyon Del Rey.

- Salinas Airport (Hrly) - 7/1/48-9/1/1951, 4/1/2001-11/20/2011 - incomplete
- Del Monte, Monterey (15 min) - 5/2/1971 - 6/29/1995 generally complete, some missing data
- Naval Post Graduate School (Daily) - 1970 – 2010 generally complete, some missing data
- Monterey County ALERT Data Stations (Cumulative Rainfall) - Point Pinos : 1/3/2007 - 2/11/2013 readings every approximately 12 hrs
- Mt Toro: 7/27/2006 - 2/11/2013 readings every approximately 12 hrs - Blanco Circle: 7/27/2006 - 2/11/2013 readings every approximately 12 hrs
- CIMIS Data - Carmel, #210: 10/24/2008 – current, hourly; Pacific Grove, #193: 10/26/2011 – current, hourly
- Fort Ord CDEC Station ( Hourly Rainfall) - WY 2002 -2011, Full record, good quality
- KMRY - Monterey Regional Airport, NWS (Daily Rainfall) - 1/1/1970 - 12/31/2010, Full record, good quality
- MPWMD - 187 Eldorado (Daily Rainfall) - 10/25/1991 - 9/23/2000 Hand recorded, good quality
- MPWMD - 5 Harris Ct., Ryan Ranch, Monterey (Daily Rainfall) - 10/10/2000 - 9/11/2012, Hand recorded, good quality
- Laguna Seca Golf Course (Daily Rainfall) - obtained limited data set: WY2012 - current
- Weather Underground data sources - daily data, short term records

The locations of rain gages with useful records are shown in Figure 3-1, which is a reproduction of the 1977 master plan isohyet map with gage locations added.



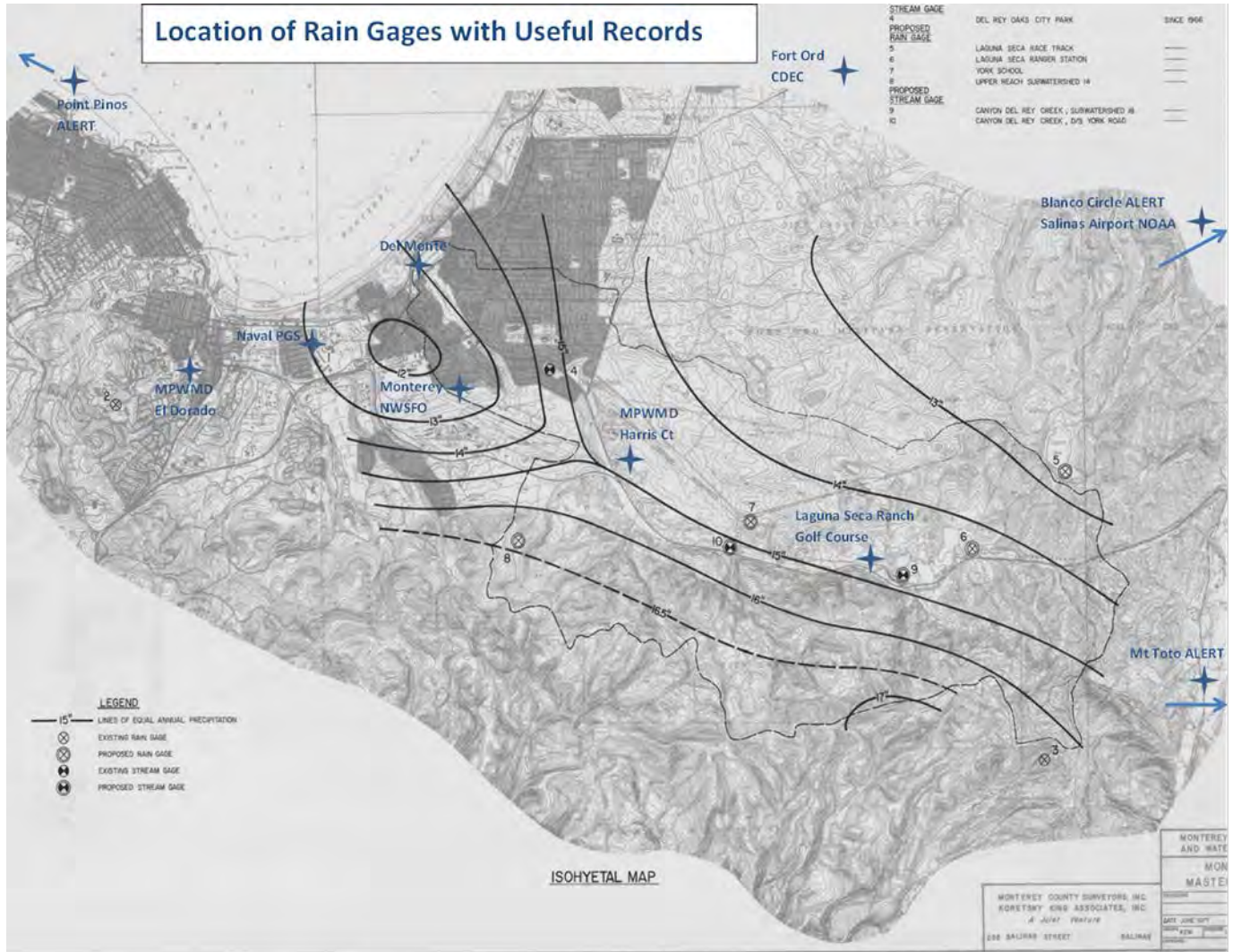


Figure 3-1: Rainfall gages with useful records.

### 3.2 Precipitation data quality and utility

Long term rainfall records are required to generate usable depth/duration/frequency relationships. With the exception of the NOAA del Monte and the NOAA Monterey gages, none of the gage records have a long enough duration to yield usable statistics. In addition, most of the records provide only daily values, rather than the hourly and 15 minute records needed for frequency analyses. Correlations between records (gage cross-correlation) can sometimes be used to fill and extend missing data in a gage records using the full data set for another gage record. Such correlations can also be used, when records are sufficiently long and detailed, to create hourly or 15 minute data for a gage record which is limited to daily or hourly data.

In order to quickly assess the potential for record filling using correlations, the annual precipitation values for all of the useful gages over the overlapping record periods were correlated, producing correlation coefficients for each gage pair. Table 3-1 provides the results of that exercise.

Table 3-1: Correlations of annual precipitation values between gage records.

	CDEC Fort Ord	MPWMD Harris	MPWMD El Dorado	NOAA del Monte	NOAA Monterey	Naval Post Grad School	Laguna Seca Golf Course
CDEC Fort Ord		0.91			0.84	0.94	
MPWMD Harris	0.91				0.75	0.98	
MPWMD El Dorado				0.9	0.95	1	
NOAA del Monte			0.9		0.97	0.82	
NOAA Monterey	0.84	0.75	0.95	0.97		0.88	
Naval Post Grad School	0.94	0.98	1	0.82	0.88		
Laguna Seca Golf Course							

For most gage pairs, the number of values in the calculations varied from 3-12. The lightly shaded results are for gage pairs using 23-39 values. Higher numbers of values produce correlation estimates which are more reliable, so that a number close to 1 for a gage pair with over 23 values indicates a well correlated gage pair. The strengths of the correlations, with the exception of the NOAA del Monte – NOAA Monterey pair, are poor to fair. Together, these two gages provide a record spanning 1949-2012, which is sufficient to generate long term statistics. However, poor correlations with the other useful gage records make extending and filling the other gage records unrealistic.

Conclusions regarding the utility of the available rainfall gage data for generating depth/duration/frequency estimates and other statistics are summarized below.

- Record lengths vary from 2 to 40 years; gage correlations only fair
- Measurement frequencies are mostly daily; exceptions: Salinas AP is hourly; Monterey NWS is 15 min; ALERT twice daily
- Gage locations are mostly near sea level; exceptions: Laguna Seca Golf gage is at 370 ft, Ft Ord at 490 ft
- Quality of the data is generally good, but not tested
- Extension of short gage records using longest records is possible, but the quality of results questionable; correlations are based on < 12 yrs

- Poor spatial distribution of gages and inconsistency between gages limits use of gages for isohyet development
- Adjustment of precipitation estimates for elevation and topographic orientation problematic due to lack of data
- Production of adequate precipitation/ frequency estimates from gage data seems unlikely

The conclusion is that wholesale modification of the 1977 isohyet map cannot be supported by the available data. This is particularly true because the gage data produces substantially different MAP estimates over much of the watershed, so that isohyet map modifications would be controversial and difficult to support with the data. Further, the precipitation records are not sufficient to enable development of depth/duration/frequency relationships.

### 3.3 Selected methodology for developing rainfall depth estimates and storm hyetographs

NOAA Atlas 14 is the data server implemented precipitation-frequency atlas for the United States; Volume 6 of the atlas provides the data for California. The details of the atlas, including technical bases for its development, are provided in a very thorough report (National Weather Service, 2012). NOAA Atlas 14 contains precipitation frequency estimates for a range of durations and frequencies and other information on temporal distribution of rainfall in California. Estimates are provided with 90% confidence intervals and at a 30 arc-second (approximate ½ mile) spatial resolution. Event durations range from 5 minutes to 60 days. Recurrence intervals range from 1 year to 1,000 years.

Locations for estimates are selected graphically on a California map, by specifying latitude and longitude, or by selecting specific stations where the detailed analyses were developed.

Complete documentation of the NOAA Atlas 14 server is available at [http://www.nws.noaa.gov/oh/hdsc/PF\\_documents/Atlas14\\_Volume1.pdf](http://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume1.pdf). Precipitation-frequency estimates are obtained from the Atlas using a graphical user interface available at the following URL: [http://hdsc.nws.noaa.gov/hdsc/pfds/pfds\\_map\\_cont.html?bkmrk=ca](http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca).

Examples of Atlas 14 results for the Canyon Del Rey watershed are provided in Table 3-2, which shows precipitation depths for specific storm durations and frequencies at 10 points which represent a variety of elevations and orientations to incoming storm events.

Table 3-2: Precipitation-Duration-Frequency results for Canyon Del Rey watershed.

<b>Grid Results from NOAA Atlas 14</b>									
Location	Lattitude	Longitude	Elevation	100 yr 24 hr	100 yr 6 hr	100 yr 60 day	10 yr 24 hr	10 yr 6 hr	10 yr 60 day
Laguna Del Rey	36.6037	-121.8556	13	4.78	2.76	21.2	2.95	1.73	14.5
Naval Post Graduate School	36.5972	-121.8776	35	4.7	2.74	21.1	2.89	1.72	14.2
Hwy 68/ 218 junction	36.5812	-121.8279	123	5.13	2.92	22.9	3.16	1.84	15.8
Hwy 218/ Moore Blvd Jct	36.5911	-121.8322	146	5	2.86	22.3	3.08	1.8	15.3
Laguna Seca Golf Ranch	36.572	-121.7876	382	5.54	3.08	24.5	3.43	1.96	17.2
Fort Ord CDEC gage	36.627	-121.786	480	5.12	2.87	22.7	3.17	1.81	15.9
S Boundary Rd, N of Laguna Seca Ranch	36.5795	-121.7885	600	5.48	3.05	24.5	3.39	1.94	17.2
Tehama Golf, S of 68/218 Jct	36.5587	-121.8329	750	5.34	3	24.1	3.29	1.9	16.7
Boots and Saddle Rd Jct, S of Laguna SR	36.5528	-121.7825	1056	5.76	3.15	25.4	3.58	2.02	17.9
Laureles Grade, top of grade	36.5446	-121.7534	1243	5.83	3.16	25.7	3.65	2.04	18.1

These results are internally consistent and reasonable when compared with PRISM results and the San Francisco Bay Depth-Duration-Frequency tables which were used in the 1977 Master Plan. Table 3-3 provides a brief comparison of results for locations at low, moderate and higher elevations.

Table 3-3: Comparison of Atlas 14 and 1977 Master Plan DDF estimates.

<b>Comparison of NOAA Atlas 14 DDF Results with 1977 Master Plan - SF Bay DDF Table</b>										
Longitude	Lattitude	Elevation	Mean Ann Precip (PRISM)	Precip from Plan Table	Atlas 14 100yr 12 hr	Master 100yr 12 hr	Atlas 14 10yr 12 hr	1977 Master 10yr 12 hr	Atlas 14 100yr 1 hr	1977 Master 100yr 1 hr
-121.75	36.546	668	20.18	20	4.17	3.45	2.63	2.6	1.33	1
-121.8131	36.5818	279	17.85	18	3.75	3.23	2.34	2.42	1.4	0.96
-121.8776	36.5972	36	15.95	16	3.35	3.01	2.08	2.24	1.43	0.91

The Atlas 14 results are generally higher than the Plan results for less frequent events and very similar for more frequent events. The variation of precipitation depths with mean annual precipitation is similar. The differences appear to be within the estimation error range.

### 3.4 Mean annual precipitation estimates

Table 3-4, below, summarizes the mean annual precipitation statistics for the useful gaging stations and compares them with the average annual precipitation estimates taken from the 1977 Master Drainage Plan.

Table 3-4: Comparison of Mean Annual Precipitation Estimates.

	CDEC Fort Ord	MPWMD Harris	MPWMD El Dorado	NOAA del Monte	NOAA Monterey	Naval Post Grad School	Laguna Seca Golf Course
Record Duration	WY 2002- 2011	WY 2001- 2012	WY 1992- 2000	WY 1949- 1994	WY 1996- 2011	WY 1971- 2010	WY 2012- 2013
Avg Ann Precip (inch)	11.53	15.04	23.2	12.44	14.48	20.29	14.91
Long Term Avg Ann Precip		17.8	20.4				15.63
Location in watershed	NE of bndry	Central	W of bndry	N edge	W Central	NW Edge	E Central
Avg Ann Precip from Map	13-14	15	14-15	12.5	12.5	13	14.8
Ratio of gage to isohyet	85.4%	100.3%	160.0%	99.5%	115.8%	156.1%	100.7%

Long term average annual precipitation estimates were computed for three of the gages (MPWMD at Harris Court, MPWMD at El Dorado Way, and Laguna Seca Golf Course) by taking the ratio of mean annual precipitation (MAP) for each of these gages to the MAP for the NOAA Monterey gage for the same period of record and then multiplying that ratio times the long term average MAP for the NOAA Monterey gage.

Figure 3-2 provides the MAP at these gages on the 1977 Isohyetal map, allowing a quick comparison between the 1977 MAP estimates and those obtained from the gage data. Several observations can be made from Figure 3-2 and Table 3-4:

- The MAP for each gage is similar to the values shown on the isohyetal map in the 1977 Master Drainage Plan at only a few points: MPWMD Harris Court, NOAA del Monte, and Laguna Seca Golf Course. These gages are located along the centerline of the watershed.
- Gages located away from the watershed centerline have large variations from the isohyetal map. The reasons for this variation are not obvious; possibilities include: much longer records are now available for some gages – resulting in shifts in gage statistics, the 1977 map utilized gages whose records are no longer available, and more gage locations are available now.
- The table shows large differences in MAP for gages in close proximity, making interpretation of the results problematic.
- The spatial distribution of the gage sites is inadequate for defining new isohyet contours and, therefore, for generating a revised isohyet map.

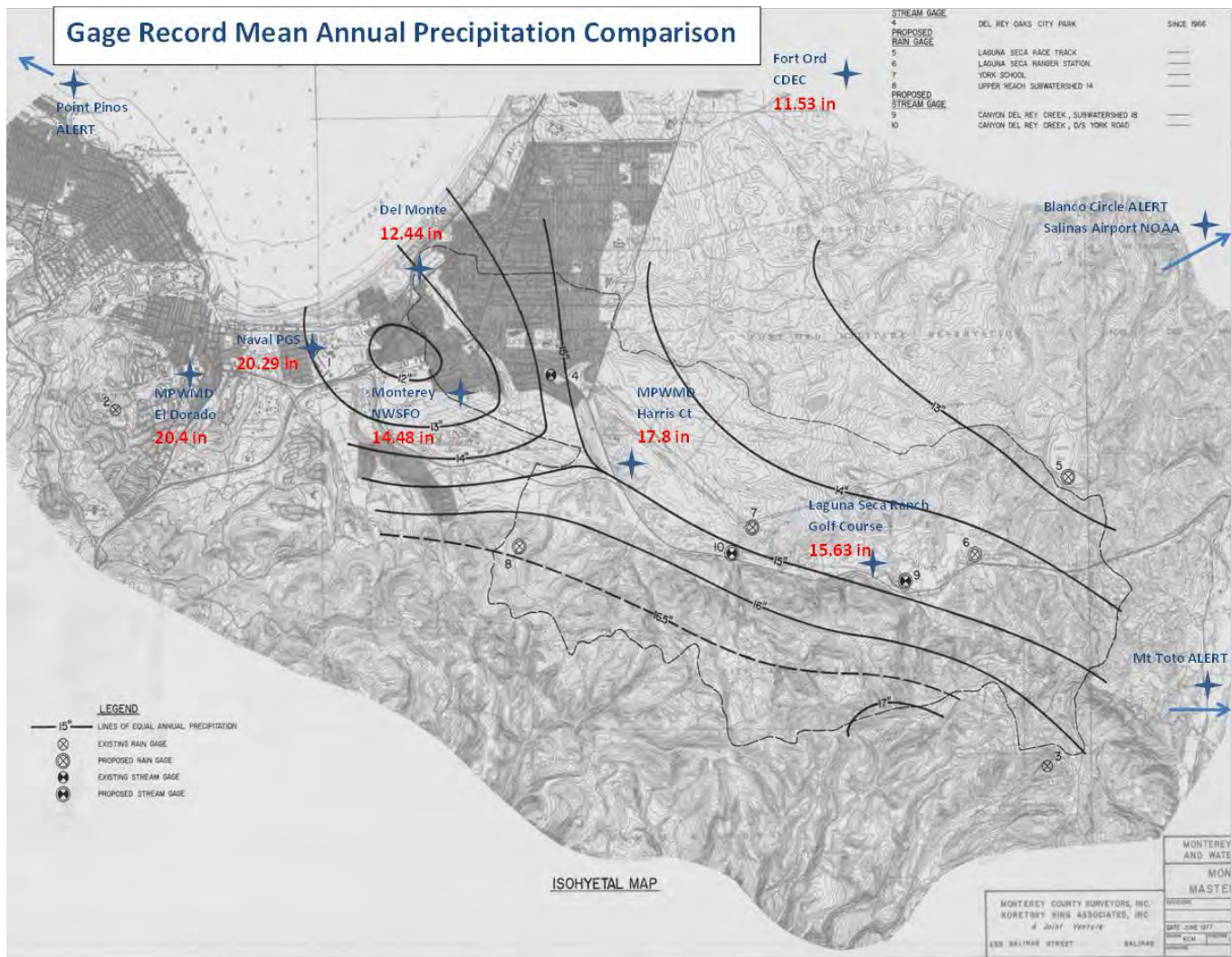


Figure 3-2: Mean Annual Precipitation statistics overlain on the 1977 isohyetal map.

The PRISM (Parameter-elevation Regressions on Independent Slope Model) climate mapping system produces estimates of long term climate parameter statistics and time series for any location in the United States. The technical basis for the PRISM methodology is published in Daly, et al, 2008. The PRISM data can be found at <http://prism.oregonstate.edu/normals/>, while descriptions of the PRISM data sets can be found at: <http://prism.oregonstate.edu/documents>. Mean annual precipitation (MAP) is one of the available parameters, making PRISM a possible source for long term annual precipitation estimates. The PRISM data server was queried for points within the Canyon Del Rey watershed. The resulting MAP data is shown as isohyetal lines in Figure 3-3. The PRISM results, when compared with the gage data, appear to under-predict the effects of orientation and elevation and generally reduce the spatial variability of rainfall within the watershed. The correlation between gage annual means and PRISM results is also relatively low. However, the PRISM system uses all of the long term precipitation gage records in the vicinity of the study area and, as a result, is the most complete estimate of mean annual precipitation.

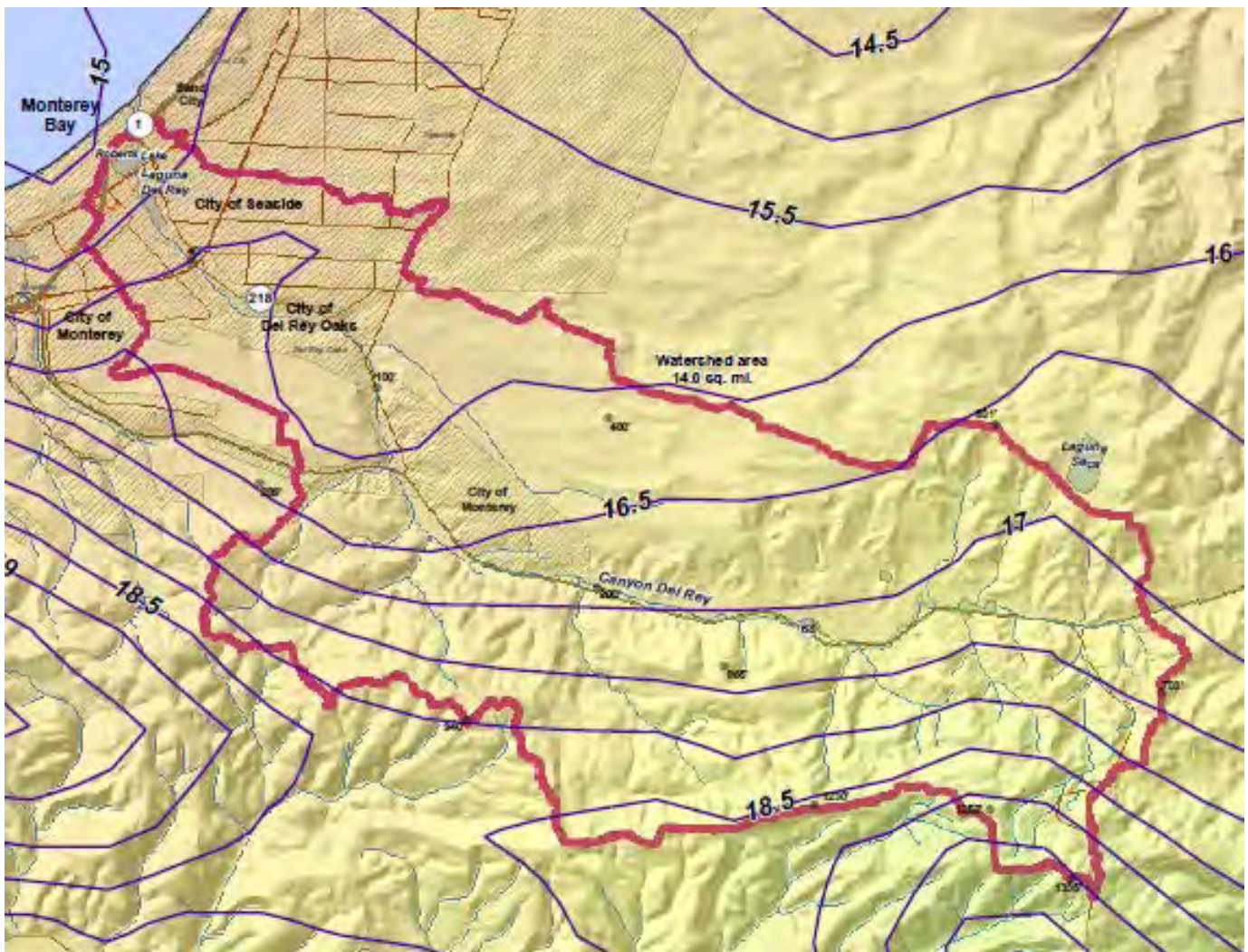


Figure 3-3: Mean Annual Precipitation Isohyets for Canyon del Rey.

### 3.5 Depth-Duration-Frequency estimation from NOAA Atlas 14 results

Rainfall depth estimates were generated from NOAA Atlas 14 output for each sub-watershed within the Canyon del Rey watershed. The centroid of each sub-watershed was used for the estimation location, which was input into the NOAA Atlas application. The depth values were extracted for return periods of 10 and 100 years and durations of 15 minutes through 24 hours. Table 3-5 provides a summary of generated depths for each of the sub-watersheds for 10 year and 100 year return periods and 24 hour durations.

Table 3-5: 10 year and 100 year, 24 hour duration rainfall depth estimates.

<b>TOTAL 24 HOUR RAINFALL DEPTHS (inches)</b>					
<b>Sub-watershed</b>	<b>10-year</b>	<b>100-year</b>	<b>Sub-watershed</b>	<b>10-year</b>	<b>100-year</b>
<b>Sub_LS</b>	3.42	5.50	<b>Sub_17</b>	3.38	5.47
<b>Sub_01</b>	3.49	5.60	<b>Sub_18</b>	3.50	5.65
<b>Sub_02</b>	3.56	5.72	<b>Sub_19</b>	3.32	5.39
<b>Sub_03</b>	3.47	5.58	<b>Sub_20</b>	3.32	5.39
<b>Sub_04</b>	3.51	5.65	<b>Sub_21</b>	3.27	5.30
<b>Sub_05</b>	3.57	5.74	<b>Sub_22</b>	3.21	5.22
<b>Sub_06</b>	3.48	5.61	<b>Sub_23</b>	3.24	5.27
<b>Sub_07</b>	3.50	5.68	<b>Sub_24</b>	3.17	5.16
<b>Sub_08</b>	3.56	5.74	<b>Sub_25</b>	3.21	5.22
<b>Sub_09</b>	3.51	5.66	<b>Sub_25b</b>	3.21	5.21
<b>Sub_10</b>	3.44	5.54	<b>Sub_25c</b>	3.16	5.13
<b>Sub_11</b>	3.47	5.60	<b>Sub_26</b>	3.15	5.12
<b>Sub_12</b>	3.51	5.66	<b>Sub_27</b>	3.16	5.13
<b>Sub_13</b>	3.43	5.54	<b>Sub_27b</b>	3.08	5.00
<b>Sub_14</b>	3.47	5.61	<b>Sub_28</b>	3.27	5.31
<b>Sub_15</b>	3.43	5.54	<b>Sub_FP</b>	3.08	5.00
<b>Sub_16a</b>	3.47	5.61	<b>Sub_29</b>	3.04	4.95
<b>Sub_16b</b>	3.43	5.54	<b>Sub_29b</b>	3.04	4.95
			<b>Sub_30</b>	2.97	4.82



## 4 HYDROLOGIC ANALYSES AND MODELING

### 4.1 Available data

Available stream flow gage data is limited to peak flow records for 1967-1978 and 2003-present and 15 minute stream flow data for 2003-2013. All records are for the Arroyo del Rey gage at Del Rey Oaks. Figure 4-1 shows the peak flow at this gage for the years of record. No large storm events are included in the years of record (in particular, the 1995 and 1998 events are missing), resulting in relatively low peak flows.

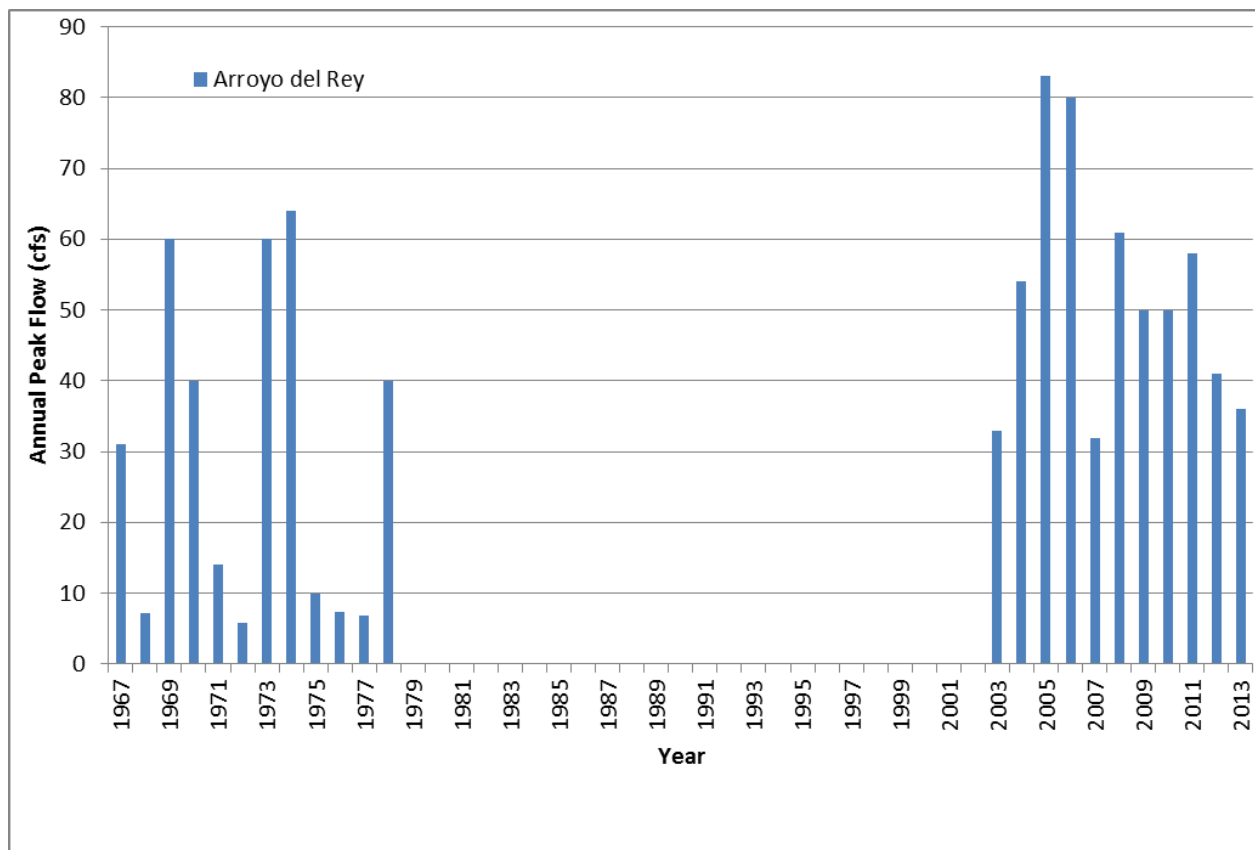


Figure 4-1: Annual peak flows for Arroyo del Rey at Del Rey Oaks gage.

Based on the available gage data, a return period analysis can be made, producing the relationship in Oversized Figure 3. While this relationship may be representative of frequent events (recurrence intervals of 5 years and less), it is not descriptive of less frequent events.

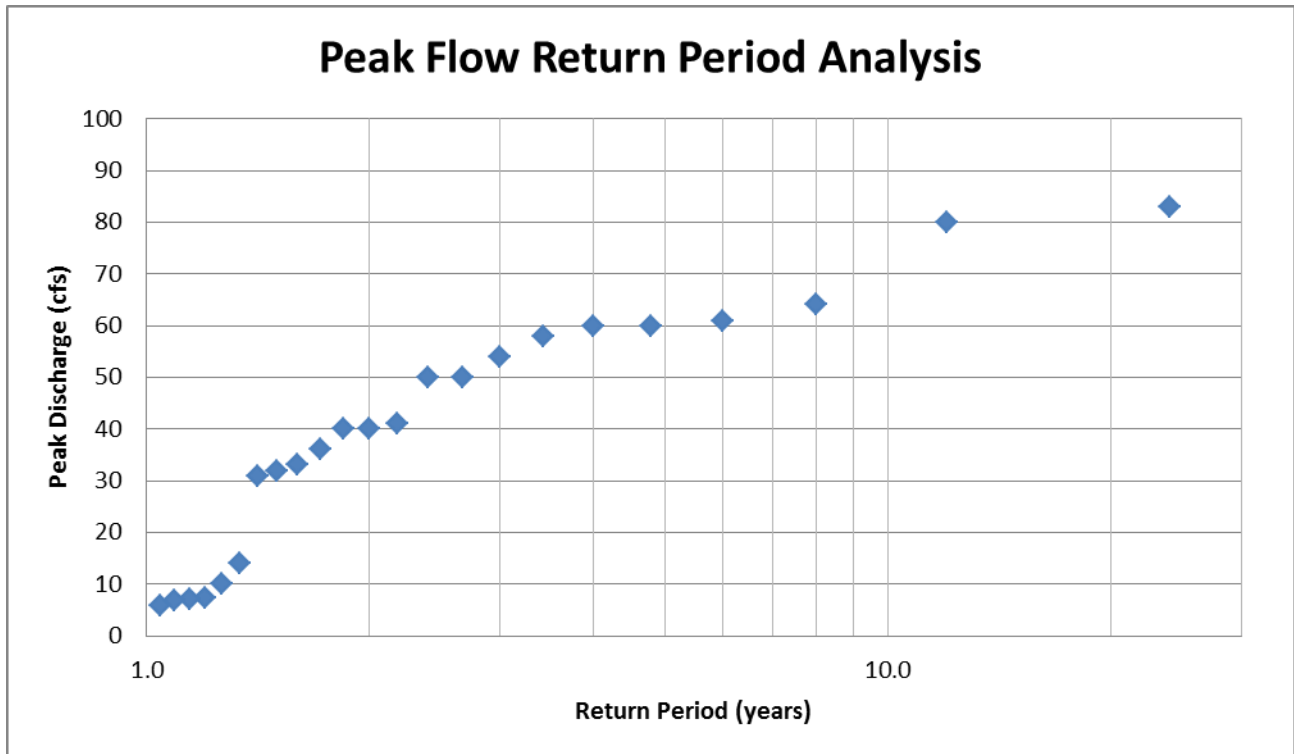


Figure 4-2: Arroyo del Rey at Del Rey Oaks annual peak flows plotted against return period.

#### 4.2 Description of alternative methodologies

The 1977 drainage plan used the following methods to develop runoff estimates:

- Define 28 sub-watersheds based on drainage divides, slope, land use
- Create a mean annual precipitation (MAP) isohyetal map from rainfall gage data
- Develop MAP for sub-basins from USGS MAP data (from Rantz)
- Estimate total storm precipitation from regional Depth Duration Frequency tables (Rantz)
  - 100 yr return period event used for primary structures
  - 10 yr return period event used for secondary structures
- Create design storm runoff for each sub-watershed using synthetic unit hydrograph method
- Obtain rainfall excess (volume of runoff) using: loss rates from USGS tables (Rantz) and times of concentration adjusted for urbanization
- Route runoff through the basin using Muskingum method, including effects of temporary storage above structures

For this study, both precipitation gage and stream flow gage data were collected and analyzed for application to the hydrologic analyses. Neither of these data sets were deemed adequate for use in developing design storm flows, due to short periods of record and inadequate areal coverage of the study area. As was true for the 1977 study, synthetic hydrologic methods are necessary.

Alternative hydrologic computation methods include:

- Frequency Analysis of Recorded Peak Flows for Study Stream
  - Adequate long, consistent time series record not available
- Correlation with Frequency of Recorded Peak Flows in Nearby Watershed
  - A 40 year stream gage record on El Toro Creek is available but no suitable gage within Canyon del Rey is available for correlation
- Regional Rainfall Frequency Analysis
  - PRISM and NOAA Atlas on line datasets available and accepted
- Rational Method
  - Accepted today only for very small watersheds
- Synthetic Unit Hydrograph
  - Method of choice for many settings; can be readily adjusted for variety of watershed conditions; provides complete hydrograph
  - Implementation via HEC-HMS, a widely used and accepted simulation package
- Continuous Simulation Modeling Using Detailed Moisture Accounting
  - Most robust method, representing detailed variations
  - Costs not within in current project scope

Considering the above methods, the most appropriate approach involves: development of design storm precipitation hyetographs, computation of runoff and stream flow from the rainfall for each sub-watershed, and routing of the runoff through the channel network. For this approach, selection of a rainfall loss method is required. Alternative methods include:

- Initial and Constant
  - Appropriate only for watersheds lacking soil details
- Housing and Urban Development Methodology
  - Similar to SCS method, but oriented specifically to central coastal region of California
- SCS Curve Number

- Curve numbers assigned to different soil-cover complexes; pervious losses built into curve numbers
- Works well for highly pervious soils
- Soil Moisture Accounting (continuous, long term simulation)
  - Most complex; costs not included in project scope

Rainfall temporal distributions must also be developed and storm return periods selected. Methods for developing rainfall distributions include:

- Individual rainfall distributions for each storm duration and frequency, based on historical storms
  - Available storm rainfall data is inadequate to enable this method
- Balanced rainfall distribution with one distribution for all events
  - Includes 3, 12, 24 hour peaks in one hyetograph
  - Conservative; usually adequate for flood planning

#### 4.3 Modeling methodology applied for this work

The following methodology was selected from the methods previously described. This methodology incorporates generally accepted best practices for flood analysis, management, and design which can be executed with available information regarding the local rainfall and watershed conditions.

- Storm rainfall depths obtained from the NOAA Atlas 14 regional rainfall frequency analysis application
  - Comprehensive and well documented; makes maximum use of available rainfall data
- Synthetic Unit Hydrograph for hyetograph development
  - Provides full storm hydrograph; allows for routing and variable losses
- Balanced storm hyetograph for 24 hr rainfall event
  - Includes shorter duration events; commonly accepted for flood control planning
- 10 year and 100 year return period events
  - Represent appropriate range of risk; typically used in flood management planning and design
- SCS Curve Number method for rainfall loss estimation
  - Widely accepted for use with permeable soils
- Muskingum routing of flows through channel system
  - Properly represents runoff timing, storage, and travel lag times in natural channels

- Use HEC-HMS simulation platform to develop stream flow hydrographs in locations within the study area
  - Widely accepted as appropriate for runoff simulation and routing
- Calibrate HEC-HMS against Del Rey Oaks and Frog Pond gage data
  - Rainfall and stream flow gage data available for several events
  - Improves and demonstrates representativeness of simulation results

#### 4.4 HMS model development

The HEC-HMS simulation platform used in this study is thoroughly described in the program user manual available at

[http://www.hec.usace.army.mil/software/hec-hms/documentation/HEC-HMS\\_Users\\_Manual\\_3.5.pdf](http://www.hec.usace.army.mil/software/hec-hms/documentation/HEC-HMS_Users_Manual_3.5.pdf)

and the technical reference manual available at

[http://www.hec.usace.army.mil/software/hec-hms/documentation/HEC-HMS\\_Technical%20Reference%20Manual\\_\(CPD-74B\).pdf](http://www.hec.usace.army.mil/software/hec-hms/documentation/HEC-HMS_Technical%20Reference%20Manual_(CPD-74B).pdf).

In this platform, a stream channel network and associated watershed is described as a series of sub-watersheds with connecting flow paths in a dendritic construction. Runoff is calculated from precipitation in each sub-watershed using parameters including slope, sub-watershed geometry, percent impervious area, soil type, ground cover, and antecedent moisture. A runoff hydrograph is produced at the downstream end of each sub-watershed for a specific rainfall history (hyetograph). The hydrograph is then routed from the downstream end of the sub-watershed to a channel junction, combined at the junction with flows from other sub-watersheds and junctions, and then routed to a further downstream junction. Flow routing is calculated in the Muskingum-Cunge method using parameters including channel roughness, length, slope, and cross section.

Oversized Figure 3 depicts the HEC-HMS model used to simulate runoff and stream flow in the Canyon del Rey basin. The model is built using runoff elements (sub-basins), stream channel routing elements (reaches), stream confluence elements (junctions), and water storage or detention elements (reservoirs). All of these elements are shown in the figure. Water sources, sinks and diversions can also be simulated, but are not used in this study. The connectivity between sub-basins, reaches, junctions, and reservoirs are shown in the figure.

Runoff related parameters, including slope, ground cover, soil type, percent impervious, and surface roughness were developed from aerial photographs, topographic mapping, and geologic mapping. Specific input parameters for the HEC-HMS simulation platform were assigned, based on the above attributes, to each sub-watershed. The parameters used for the watersheds are provided in Table 4-1.

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Table 4-1: Runoff related HEC-HMS input parameters for Canyon del Rey sub-watersheds.

<b>Sub-Watershed ID</b>	<b>Area (sq miles)</b>	<b>Time Lag (min)</b>	<b>Curve Number</b>	<b>Percent Impervious</b>
Sub_LS	0.293	2	45.6	55
Sub_01	0.2	21.4	61.3	8
Sub_02	0.757	37.2	56.4	6
Sub_03	0.391	29	64	2
Sub_04	0.083	11	61.9	10
Sub_05	0.454	28.8	54	2
Sub_06	0.358	26.8	63.9	6.1
Sub_07	0.134	7.3	64.1	3
Sub_08	0.606	29.9	53.8	10
Sub_09	0.295	20	51.7	5
Sub_10	0.481	25.2	58.7	8
Sub_11	0.538	26.9	52.5	20
Sub_12	0.14	9.9	60.1	5
Sub_13	0.154	19	54.2	8
Sub_14	0.231	12.6	50.6	3
Sub_15	0.244	21	45.4	15
Sub_16a	0.101	11.5	48.8	0.5
Sub_16b	0.162	22.5	51	1
Sub_17	0.233	12.8	47.4	25
Sub_18	1.506	41.6	50.1	1.5
Sub_19	0.127	11.8	52.1	15
Sub_20	0.5	23.7	50.7	1
Sub_21	0.192	13.3	57	35
Sub_22	0.015	4	61.5	25
Sub_23	0.71	25	53	3.5
Sub_24	0.25	25.6	58.9	3.1
Sub_25	0.131	17.3	60.5	54
Sub_25b	0.018	5.4	56.2	75
Sub_25c	0.103	14.3	53.3	10
Sub_26	0.507	38.7	51.7	5
Sub_27	0.146	8.5	52.3	55
Sub_27b	0.056	12.2	42.6	20
Sub_28	1.876	60.5	28.8	2
Sub_FP	0.105	8	24.6	65
Sub_29	0.365	10.7	21.8	30
Sub_29b	0.385	12.4	28.4	35
Sub_30	1.506	17.4	22.6	70

Stream flow routing parameters, including channel length and geometry, hydraulic roughness, and channel slope, were developed from field reconnaissance, surveying of key cross sections, topographic mapping, and data from local agencies. Specific input parameters for the HEC-HMS simulation platform were assigned, based on the above attributes, to each routing reach. The parameters used for the reaches are provided in Table 4-2.

Table 4-2: Stream flow routing related HEC-HMS input - Canyon del Rey basin.

Reach	Length (ft)	Slope (ft/ft)	Manning's n	Shape
R_02_03	545	0.022	0.05	Trapezoid
R_06_07	807	0.0223	0.075	Trapezoid
R_07_08	1120	0.011	0.075	Trapezoid
R_11_12	1117	0.0143	0.075	Trapezoid
R_12_14	2122	0.029	0.075	Trapezoid
R_16a_15	2665	0.0056	0.075	Trapezoid
R_15_17	2086	0.012	0.075	Trapezoid
R_17_19	2064	0.0116	0.075	Trapezoid
R_19_20	1846	0.013	0.085	Trapezoid
R_23_25	3334	0.0093	0.15	Trapezoid
R_26_27	1650	0.00485	0.075	Trapezoid
R_27_27b	945	0.0106	0.075	Trapezoid
R_29	2900	0.0152	0.075	Trapezoid
R_29b	1060	0.0622	0.075	Trapezoid
R_29_30	268	0.0373	0.075	Trapezoid

A large number of detention basins currently exist in the watershed. Table 4-3 provides a list of the basins, with their location described. Some of the basins developed naturally and certain of those basins were further defined by culverts acting as outlet structures. Other basins were built specifically as storm water detention basins with engineered outlet structures.

Basins were characterized in the model by a stage-storage table and outlet parameters. Two of the basins were not included in the HEC-HMS model. Table 4-4 provides information about how these basins were represented in the HEC-HMS model. As water flows into each basin, the basin begins to fill. As water level in the basin rises, water begins to flow out of the basin, with outflow increasing as the water level in the basin increases. When a basin overflows, then the outflow relationship changes to represent overbank or overtopping flow.

Table 4-3: Detention basins within the Canyon del Rey watershed.

Facility ID	Location
LS_B_01	Lake at Laguna Seca Raceway.
04_B_01	South of Hwy 68 at S.P.C.A. facility.
04_B_02	South of Hwy 68 at S.P.C.A. facility.
05_B_01	South of Hwy 68, approx. 1'650 feet west of S.P.C.A. entrance road.
06_B_01	North of Hwy 68, approx. 500 feet west of S.P.C.A. entrance road.
07_B_01	North of Hwy 68, approx. 1,000 feet east of Boots Road.
08_B_01	South of Hwy 68. Approx. 250 feet southeast of Boots Road.
08_B_02	South of Hwy 68. Approx. 250 feet southeast of Boots Road. Not modeled.
09_B_01	Approx. 200 feet south of where Boots Road and Whip Road meet near Hwy 68.
10_B_01	Pasadera golf course pond, approx. 200 feet south of Las Laderas Drive.
10_B_02	Pasadera golf course pond, approx. 230 feet west of Las Brisas Drive.
10_B_03	Pasadera golf course pond, approx. 200 feet southeast of Pasadera Country Club.
11_B_01	Pasadera golf course pond, approx. 180 feet west of Mirasol Ct. Not modeled.
11_B_02	Pasadera golf course pond, at the intersection of Pasadera Drive and Via Del Milagro. Modeled as one (10_B_04).
10_B_04	
11_B_03	1'400 feet west of Pasadera Drive and 180 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
12_B_01	1'650 feet west of Pasadera Drive and 270 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
12_B_02	2'050 feet west of Pasadera Drive and 270 feet north of Hwy 68. Part of the Laguna Seca Golf Ranch.
14_B_01	Canyon del Rey reach west of Pasadera Road and South of Hwy 68.
19_B_01	Directly west of where Wilson Road and York Road meet.
21_B_01	North of Hwy 68. Approx. 1'300 feet east of Ragsdale Drive.
22_B_01	North of Hwy 68. Approx. 1'000 feet east of Ragsdale Drive.
24_B_01	West side of Hwy 218. Approx. 1'400 feet south of the Hwy 68 and Hwy 218 interchange.
24_B_02	West side of Hwy 218. Approx. 1'400 feet south of the Hwy 68 and Hwy 218 interchange.
25_B_01	Approx. 650 feet northwest of the Ragsdale Drive and Lower Ragsdale drive T intersection. South of the Harris Ct business development.
25_B_02	Directly south of the Hwy 68 and Hwy 218 interchange. South of the Monterra Subdivision.
26_B_01	South of Hwy 68 and west of 218 at interchange. North of the Monterra subdivision entrance.
27b_B_01	Directly east of Hwy 218 at Pheasant Ridge Road.
29_B_01	Frog Pond Wetland Preserve.
29_B_02	Northeast of the Monterey Airport. North of N road.
29b_B_01	Park behind Safeway, west of hwy 218 and south of Wilson Way.
30_B_01	Laguna Del Rey and Roberts Lake combined. North and south of Del Monte Blvd.



Table 4-4: Detention basin parameters used in the HEC-HMS model.

Basin ID	Sub-watershed location	Peak Storage Elevation Before Overflow (ft)	Max Storage Capacity (acre-feet)	Modeling Method	Outlet Type
LS_B_01	Sub_LS	748	12.8	Outflow Structures	Culvert
04_B_01	Sub_4	413	0.2	Outflow Structures	Spillway, horizontal grate, & orifice
04_B_02	Sub_5	400	0.1	Outflow Structures	Culvert
05_B_01	Sub_5	388	14.7	Outflow Structures	Culvert
06_B_01	Sub_6	388	28.7	Outflow Structures	2 Culverts
07_B_01	Sub_7	356	7.9	Outflow Structures	Culvert
08_B_01	Sub_8	348	2.3	Outflow Curve	Horizontal grate
09_B_01	Sub_9	375	1.7	Outflow Structures	Weir & orifices
10_B_01	Sub_10	464	2.4	Outflow Curve	Horizontal grate
10_B_02	Sub_10	449	0.7	Outflow Curve	Horizontal grate
10_B_03	Sub_10	409	1.3	Outflow Curve	Horizontal grate and weir
10_B_04	Sub_11	358	3.4	Outflow Curve	Horizontal grate
11_B_03	Sub_12	318	0.4	Outflow Structures	Spillway
12_B_01	Sub_12	318	1.6	Outflow Structures	2 Culverts
12_B_02	Sub_12	314	1.2	Outflow Structures	2 Culverts
14_B_01	Sub_14	304	64.6	Outflow Structures	Culvert
19_B_01	Sub_19	194	0.2	Outflow Structures	Spillway
21_B_01	Sub_21	142	1.3	Outflow Structures	Weir & 2 orifices
22_B_01	Sub_22	140	0.1	Outflow Structures	Weir
24_B_01	Sub_24	142	4.4	Outflow Curve	Spillway and riser culvert
24_B_02	Sub_24	128	1.2	Outflow Structures	3 Culverts
25_B_01	Sub_25b	226	0.7	Outflow Structures	2 Culverts
25_B_02	Sub_25	122	7.6	Outflow Structures	5 culverts
26_B_01	Sub_26	210	4.0	Outflow Curve	3 Riser culverts & spillway
27b_B_01	Sub_27b	90	70.1	Outflow Structures	Culvert
29_B_01	Sub_FP	82	32.5	Outflow Structures	Box culvert
29_B_02	Sub_29	108	3.5	Outflow Structures	2 Culverts & Spillway
29b_B_01	Sub_29b	34	43.7	Outflow Structures	Culvert
30_B_01	Sub_30	14	177.6	Outflow Structures	2 Box culverts

The total precipitation depths for the 10 and 100 year events, described in Chapter 3 and Table 3-5, provided the basis for developing balanced 24 hour storm hyetographs. These hyetographs provided the temporal rainfall pattern

used in the model for each sub-basin. Consequently, runoff and routing simulations used a 24 hour period. Given the relatively small size of the watershed (16.8 square miles) and the relatively short maximum stream length (6.9 miles), a 24 hour period was sufficient to adequately represent variations in both runoff and stream flow during the selected design events.

Balanced 24 hour storm hyetographs were generated using standard methods. An example of a typical application of this method can be found at: [http://onlinemanuals.txdot.gov/txdotmanuals/hyd/hyd\\_apxf.pdf](http://onlinemanuals.txdot.gov/txdotmanuals/hyd/hyd_apxf.pdf). Specifically, rainfall depths are obtained for durations ranging from 15 minutes to 24 hours from the NOAA Atlas 14 application. The differences between rainfall depths are then plotted, with the first (and largest) difference plotted at 12 hours and then succeeding differences plotted at alternating later and earlier times until all values are used and the 24 hour hyetograph is completely specified. In this way a hyetograph which represents the 24 hour storm as well as the lesser duration storms is defined. While this hyetograph does not represent any particular storm event, it is representative of the rainfall depths which can be expected for storms of 24 hour and lesser duration. Figure 4-3 provides an example hyetograph for a 100 year, 24 hour rainfall event in one of the sub-watersheds in Canyon del Rey. Rainfall depths shown are for 15 minute periods.

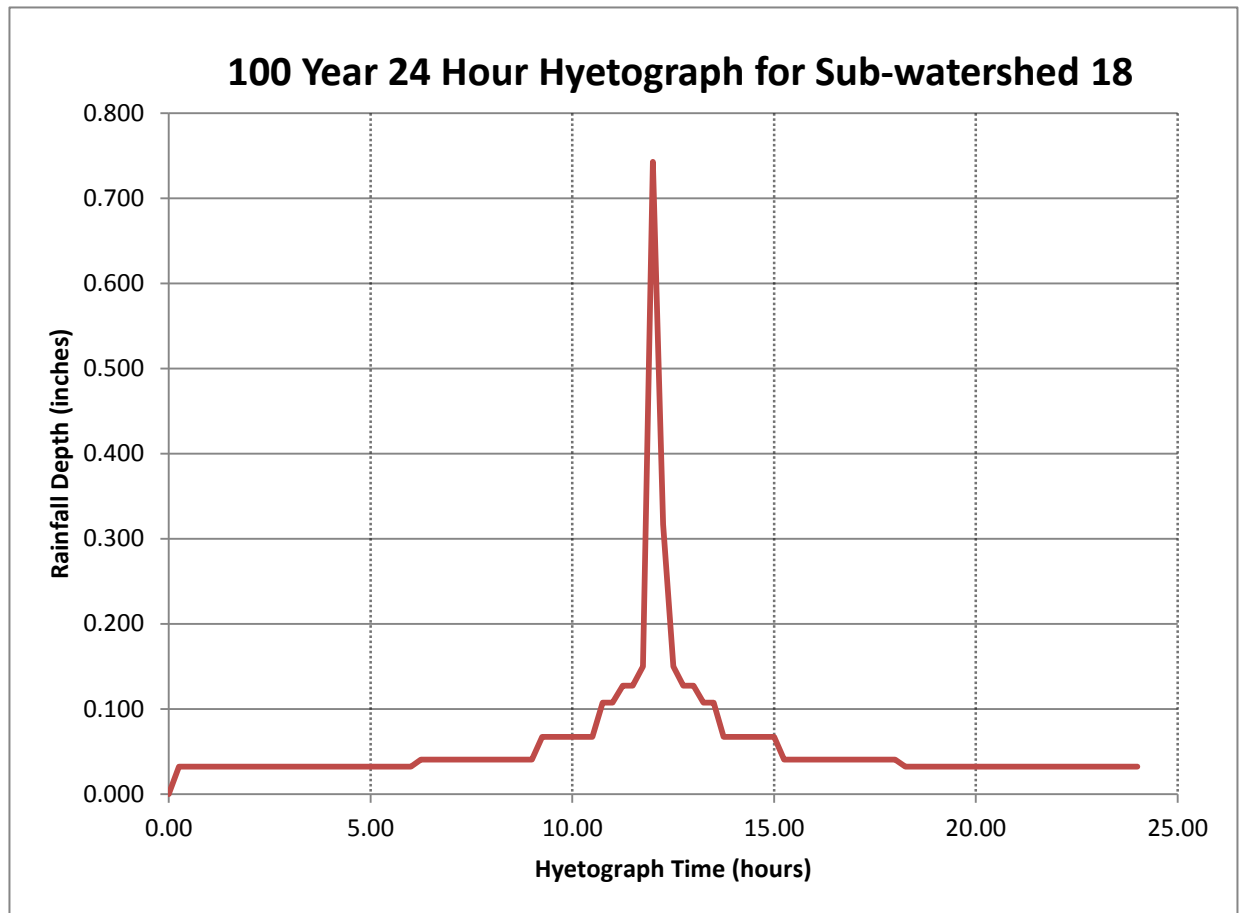


Figure 4-3: Example 100 year, 24 hour rainfall hyetograph, sub-watershed 18.

#### 4.5 Conditions modeled

The highly pervious nature of watershed soils, particularly on the north side of the valley enables the watershed to absorb and retain large amounts of rainfall before substantial runoff is initiated. However, a long duration rainfall event or series of rainfall events will saturate the soils and cause much higher runoff to result from additional rainfall events. The 24 hour hyetograph that is used in this study is insufficiently long to create fully saturated soil conditions and thus can under-predict runoff. This behavior was confirmed in simulations which were initiated with minimal antecedent rainfall. Comparison of this behavior with available stream gage data indicated that more substantial antecedent rainfall (and high soil saturation) was needed to achieve results similar to gage data. Therefore, the SCS moisture accounting calculations were set to use Antecedent Moisture Condition I instead of condition II.

Impervious versus pervious conditions in each sub-watershed were assessed by calculating paved area for each sub-watershed using GIS databases. The results were then adjusted based on inspection of aerial photography for the watershed. It was found that model results were quite sensitive to percent impervious specification, due to the highly pervious nature of the soils. Adjustment of this parameter was used in the model calibration process.

The constructed model was used to simulate the following conditions:

- 10 year, 24 hour storm with existing land use and flood management infrastructure
- 100 year, 24 hour storm with existing land use and flood management infrastructure
- 10 year, 24 hour storm with existing land use and proposed flood management infrastructure improvements
- 100 year, 24 hour storm with existing land use and flood management infrastructure improvements

Runoff and routing simulations using HEC-HMS were used to provide flow data for hydraulic calculations and assess performance of detention facilities and ponding areas. These data were produced for both existing conditions and potential future conditions. After hydraulic assessments were made and potential upgrades to the flood management infrastructure identified, the effects of such changes on runoff and routing of flows were calculated using the model.

### 4.6 HEC-HMS model calibration

The HEC-HMS model was calibrated by comparing model results with measured stream flow at the CSUMB "Frog Pond" gage. This stream flow gage record included adequate data for two short storm events: on April 3-4, 2006 and March 3-4, 2005. Corresponding data was available from the Fort Ord rain gage.

Antecedent moisture conditions were adjusted to decrease rainfall loss rates in the watershed; AMC II conditions were used initially and then changed to AMC I to allow for the effect of multiple and longer duration rainfall events on soil moisture. Percent impervious calculations were also reviewed using aerial photographs and field investigation, resulting in increases in percent impervious for many sub-watersheds. These changes increased sub-watershed runoff and stream discharge results in the model. The calibration results are summarized in Table 4-5. Figures 4-5 and 4-6 show the correspondence between measured flow and HEC-HMS model results for the two events.

Both peak flow rates and total discharge volume correspond well with the gage results for the two rainfall events. The shapes of the HEC-HMS hydrographs correspond quite well with the gage record graphs. The model does appear to be somewhat more responsive to rainfall variations, as indicated by the somewhat larger response to early rainfall and the faster decline in flow after rainfall rates diminish. This level of calibration was deemed satisfactory for the current study purposes.

Table 4-5: HEC-HMS model calibration results.

<b>Calibration Results- April 2006 Storm</b>		
	<b>Peak Flows (cfs)</b>	<b>Total Volume (ac-ft)</b>
Known flow gage	80	191
HEC_HMS flow	96	214
<b>Calibration Results - March 2005 Storm</b>		
	<b>Peak Flows (cfs)</b>	<b>Total Volume (ac-ft)</b>
Known flow gage	83	79
HEC-HMS flow	78	80

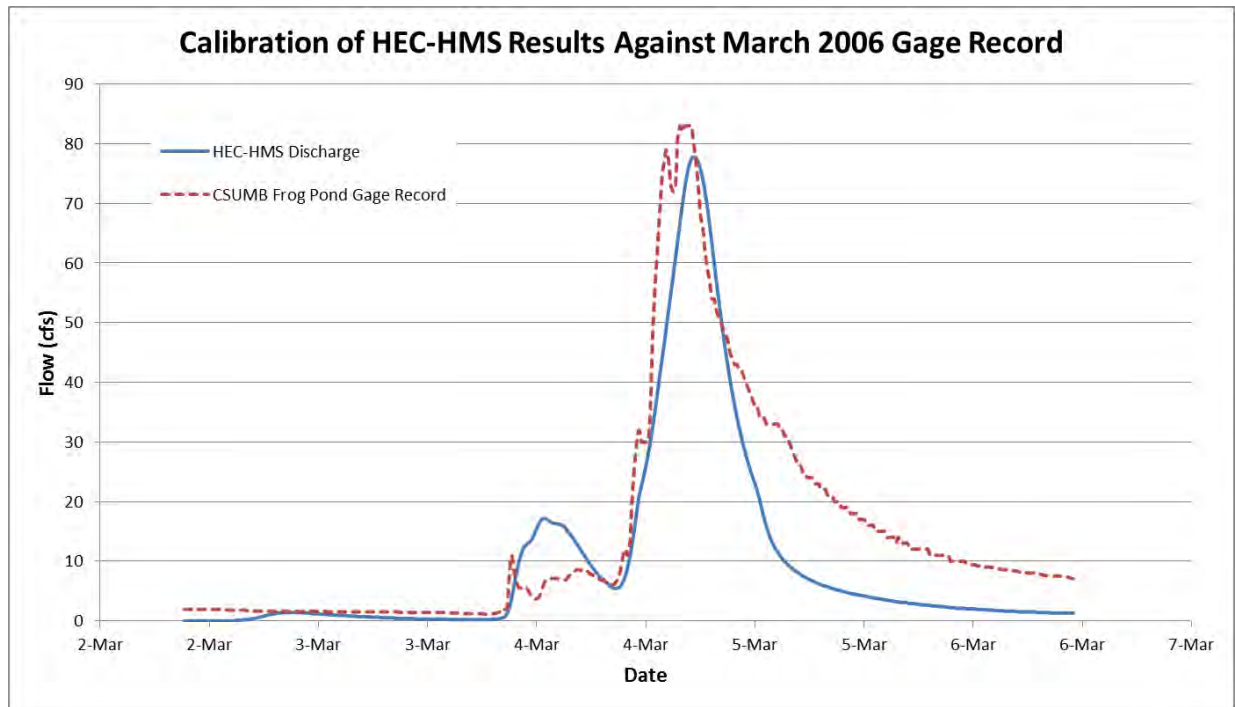


Figure 4-4: Stream flow at Frog Pond Gage for the March 2006 Calibration Event.

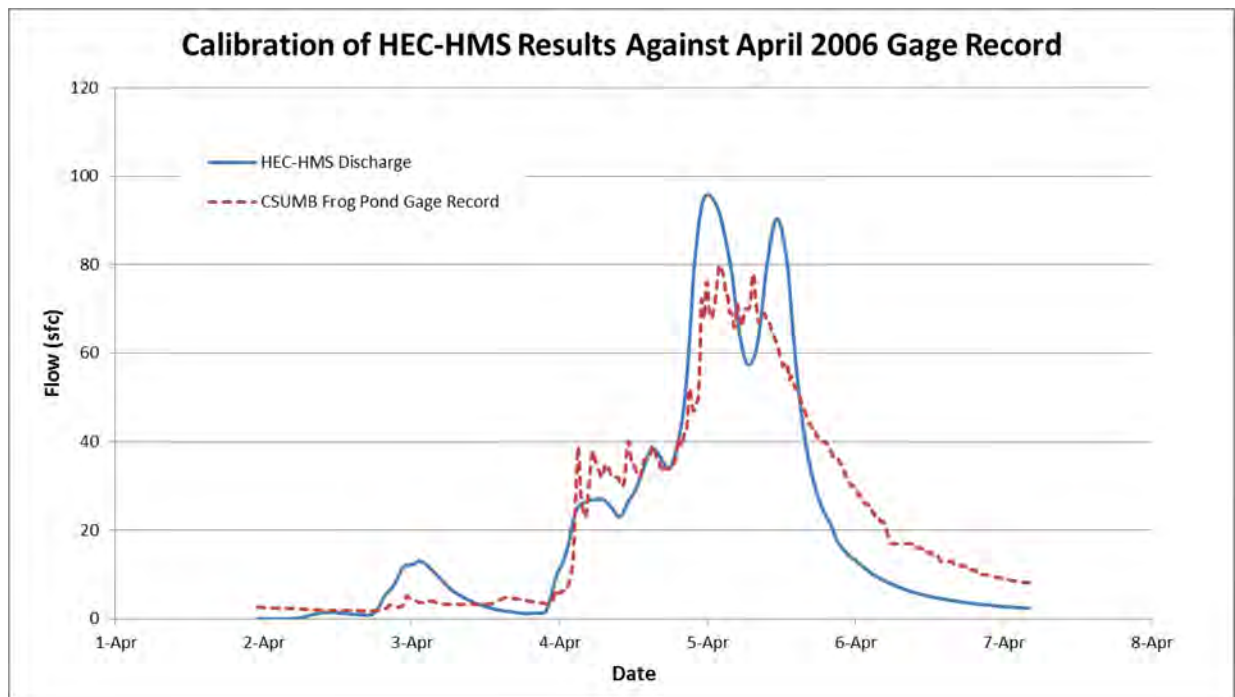


Figure 4-5: Stream flow at Frog Pond Gage for the April 2006 Calibration Event.

#### 4.7 Runoff modeling results

The HEC-HMS model of the watershed was used to produce runoff rates and volumes for the sub-watersheds, flow results for stream channels, operational data for the storage basins, and performance data for the culverts. Runoff statistics for each of the sub-watersheds is provided in Table 4-6. Peak flow and total flow volume in the stream channels (routing reaches), at confluences of channels (junctions), and from storage basins (basins) are provided in Table 4-7. Figure 4-6 provides HEC-HMS output hydrographs for reach 29, which is immediately downstream of the “frog pond” basin.

A graph of peak flow at each stream channel location for the 10 year and 100 year events is provided in Figure 4-7. The locations along the channel from most upstream to most downstream (outlet) are identified with the station (facility) ID number. While stream flow generally increases from upstream to downstream, significant variations in stream flow can be seen and are caused by tributary flows from sub-watersheds and storage in basins within the channel sections.

Operating statistics for the storage basins – peak discharge, total outflow, peak storage, and peak water surface elevation – are shown for the 10 year and 100 year events in Table 4-8. The details of the basins are described in Chapter 6.

The impact of culverts at stream crossings on routing of flow is included in these results. Details of culvert geometry are provided in Chapter 6. The performance and adequacy of each culvert will be discussed in Chapter 7.

Statistics for the performance of the basins are shown in Table 4-9, which presents information on attenuation of the peak discharge by the basin and the portion of the basin nominal capacity that is utilized during a storm event. Peak attenuation varies from negligible to 94%, depending on the outlet characteristics of the basin, storage volume available, volume of the storm hydrograph entering the basin, and the shape of the flow hydrograph. Storage volume utilized during the storm events varies from 2% to 878% of the nominal capacity of the basins. Nominal capacity is defined as the volume of water in the basin when the water level reaches the crown of the outlet culvert. Utilized capacity exceeds nominal capacity when the outlet culvert is surcharged.

The wide range in utilization of basin volumes and the effectiveness of the basins in attenuating storm runoff peaks emphasizes the reality that few of the basins were designed. Most basins resulted from road crossings and culverts designed and built to enable traffic and protect roadways and people. None-the-less, seven of the basins reduced storm peak flows by 50% or more and nearly all of the basins were filled to more than nominal capacity during the storm events. Consequently, these basins are an important contributor to flood flow management within the Canyon del Rey watershed.

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Table 4-6: Canyon del Rey sub-watershed runoff before routing.

<b>Sub-watershed ID</b>	<b>10-year Peak Runoff (cfs)</b>	<b>10-year Runoff Volume (ac-ft)</b>	<b>100-year Peak Runoff (cfs)</b>	<b>100-year Runoff Volume (ac-ft)</b>
Sub_LS	143	29.9	240	51.7
Sub_01	22	8.6	76	21.9
Sub_02	42	23.4	178	67.5
Sub_03	40	15.2	139	41.8
Sub_04	13	4.0	39	9.8
Sub_05	14	9.4	93	32.8
Sub_06	45	16.1	141	41.4
Sub_07	23	5.7	80	15.4
Sub_08	42	20.5	157	54.8
Sub_09	11	6.3	63	20.5
Sub_10	42	17.5	154	46.8
Sub_11	65	25.5	173	57.0
Sub_12	16	5.1	62	14.2
Sub_13	10	4.4	44	12.6
Sub_14	5	3.7	47	13.9
Sub_15	24	7.5	49	17.8
Sub_16a	1	0.9	15	4.8
Sub_16b	3	2.0	25	8.8
Sub_17	42	11.5	86	23.8
Sub_18	22	18.8	174	81.1
Sub_19	14	4.5	43	11.1
Sub_20	6	5.2	70	24.7
Sub_21	53	13.9	119	27.3
Sub_22	4	0.9	11	2.0
Sub_23	18	11.6	136	42.3
Sub_24	13	5.8	71	18.8
Sub_25	55	13.4	106	24.3
Sub_25b	13	2.4	23	4.0
Sub_25c	8	2.7	30	7.4
Sub_26	13	7.9	72	27.5
Sub_27	73	14.1	132	25.0
Sub_27b	8	1.9	15	3.8
Sub_28	16	6.4	25	10.6
Sub_FP	64	11.2	107	18.2
Sub_29	86	17.7	146	28.8
Sub_29b	101	21.8	170	35.5
Sub_30	772	166.2	1313	269.7



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Table 4-7: Stream flow statistics for 10 year and 100 year simulated events.

HEC-HMS Station ID	Existing Conditions 10-year Peak Flow	Existing Conditions 10-year Runoff Volume (ac-ft)	Existing Conditions 100-year Peak Flow	Existing Conditions 100-year Runoff Volume (ac-ft)
J_01_02	59.9	31.9	241.4	89.4
R_02_03	59.8	31.9	238.5	89.3
J_03_04	110.1	50.8	412.5	140.5
06_B_01	54.3	41.3	377.7	170.6
R_06_07	54.1	41.1	375.2	170.3
07_B_01	56.4	46.1	389.2	175.5
R_07_08	56.3	45.8	371.7	174.8
J_08_09	77.3	72.6	494.1	249.7
J_10	139.3	114.9	684.8	351.2
R_11_12	138.4	114.3	669.5	350.1
11_B_03	138.1	113.1	660.9	347.4
12_B_01	145.4	116.2	662.2	358.1
12_B_02	144.7	114.2	660	354.3
R_12_14	143.1	113.4	648.9	352.8
14_B_01	143.4	120.6	480.4	325.1
J_16a	144.3	121.5	484.9	330.0
R_16a_15	144.1	119.4	471.1	325.6
J_15	149.1	126.9	482.6	343.4
R_15_17	149	125.7	477.4	340.7
J_17	156.4	137.1	489.1	364.4
J_19a	180.5	158.0	583.2	454.3
R_17_19	180.4	156.0	572.3	450.1
J_19	183.8	160.5	578.2	461.1
R_19_20	183.6	158.1	576.1	456.5
J_19_20	205	175.9	619.4	506.2
J_20_23	218.3	188.5	670.7	550.4
R_23_25	217.9	175.7	662.1	526.0
25_B_02	227.3	193.8	702.5	553.1
J_25_25c_26	236.5	204.1	760.4	586.6
R_26_27	236	202.0	745.7	582.0
J_27	240.7	216.1	768.9	607.0
R_27_27b	240.5	215.1	764.6	604.9
27B_B_01	232.3	208.9	756.4	583.3
29_B_01	197	189.0	723.9	552.0
R_29	197	186.0	712.6	546.3
J_29_fp_29b	203.2	207.8	731.1	581.7
J_29b	208.8	224.8	752.8	609.6
R_29_30	208.8	223.6	752.7	609.3
29b_B_01	208.7	222.3	701	599.5
30_B_01	246.8	273.8	752.4	664.5
Outfall	246.8	273.8	752.4	664.5

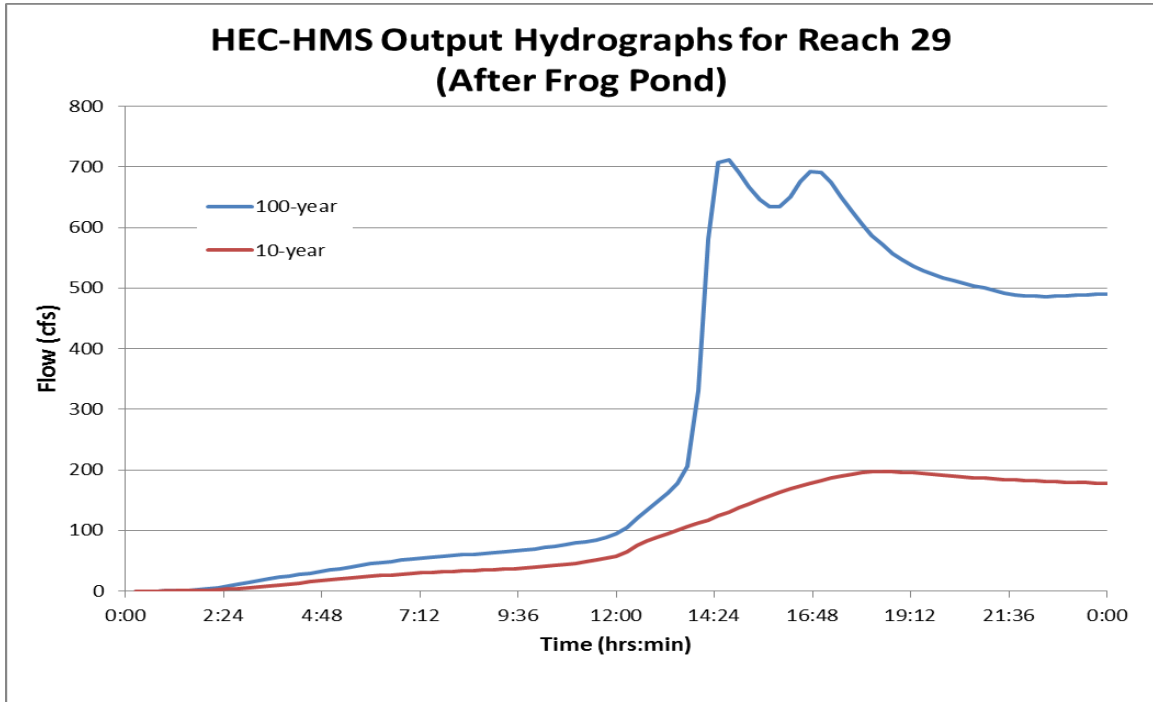


Figure 4-6: Sample HEC-HMS output hydrographs for Reach 29.

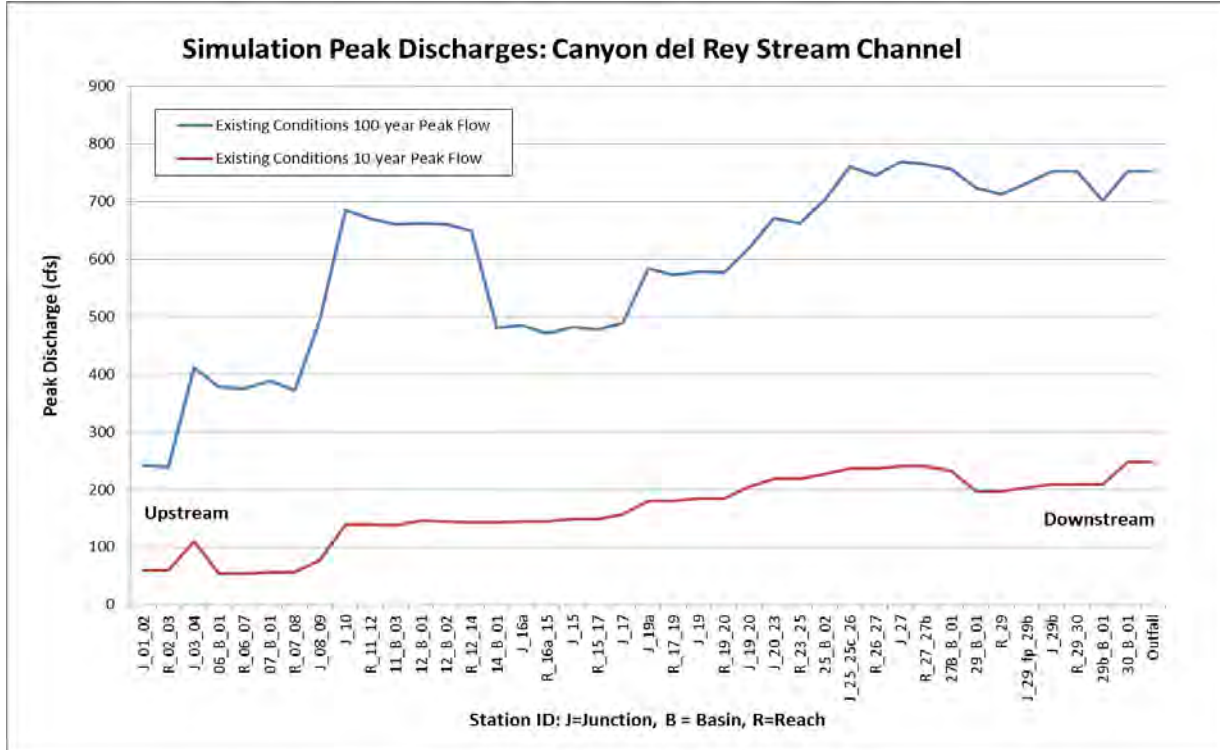


Figure 4-7: Simulation peak discharge results for Canyon del Rey.

Table 4-8: Storage basin operating statistics for the 10 year and 100 year events.

Basin ID	10-year Peak Discharge (cfs)	10-year Total Outflow (ac-ft)	10-year Peak Storage (ac-ft)	10-year Peak Elevation (ft)	100-year Peak Discharge (cfs)	100-year Total Outflow (ac-ft)	100-year Peak Storage (ac-ft)	100-year Peak Elevation (ft)
LS_B_01	10	7.8	22.2	749	14	14.4	37.38	750.5
04_B_01	13	3.7	0.38	414	39	9.5	0.45	415
04_B_02	12	3.7	0.06	399	35	9.4	0.79	400
05_B_01	2	1.5	12.80	388	24	12.8	24.97	390
06_B_01	54	41.3	37.43	389	378	170.6	48.43	390
07_B_01	56	46.1	0.48	347	389	175.5	12.05	358
08_B_01	41	20.5	2.48	348	158	54.6	2.99	349
09_B_01	9	6.3	0.21	370	61	20.3	1.03	373
10_B_01	38	17.3	0.76	463	119	46.2	3.66	465
10_B_02	33	17.1	0.65	449	131	45.9	2.70	452
10_B_03	32	17.5	1.24	409	107	45.8	2.77	410
10_B_04	64	42.3	2.92	358	199	101.5	11.66	362
11_B_03	138	113.1	0.31	318	661	347.4	0.66	319
12_B_01	145	116.2	1.52	318	662	358.1	3.29	320
12_B_02	145	114.2	1.37	314	660	354.3	2.49	316
14_B_01	143	120.6	1.48	276	480	325.1	64.28	304
19_B_01	14	4.5	0.32	195	41	11.1	0.41	195
21_B_01	20	12.6	3.85	144	44	25.0	7.26	145
22_B_01	3	0.9	0.25	141	9	1.9	0.33	142
24_B_01	7	5.6	0.85	137	28	14.5	5.22	143
24_B_02	7	5.1	1.67	129	20	13.4	3.01	130
25_B_01	7	2.4	0.77	226	12	4.0	1.02	227
25_B_02	227	193.8	5.11	121	703	553.1	15.05	124
26_B_01	11	7.6	0.53	205	93	26.1	1.69	207
27b_B_01	232	208.9	12.76	89	756	583.3	27.53	92
29_B_01	197	189.0	43.80	83	724	551.9	65.18	85
29_B_02	14	6.1	2.06	107	23	10.2	2.99	108
29b_B_01	205	211.5	1.58	22	694	581.9	15.78	29
30_B_01	258	282.4	154.27	13	758	679.7	253.13	16

Table 4-9: Storage basin performance statistics for the 10 and 100 year events.

Basin ID	Nominal Storage Capacity (ac-ft)	10-year		100-year	
		% Attenuation through Basin	% of Nominal Storage Capacity Utilized	% Attenuation through Basin	% of Nominal Storage Capacity Utilized
LS_B_01	12.8	93%	174%	94%	293%
04_B_01	0.2	2%	213%	2%	249%
04_B_02	0.1	7%	69%	10%	878%
05_B_01	14.7	85%	87%	75%	170%
06_B_01	28.7	66%	130%	33%	169%
07_B_01	7.9	2%	6%	2%	152%
08_B_01	2.3	2%	109%	-1%	131%
09_B_01	1.7	16%	12%	3%	60%
10_B_01	2.4	9%	32%	23%	156%
10_B_02	0.7	13%	97%	-10%	403%
10_B_03	1.3	2%	96%	19%	213%
10_B_04	3.4	17%	85%	7%	339%
11_B_03	0.4	0%	85%	1%	179%
12_B_01	1.6	1%	96%	2%	207%
12_B_02	1.2	0%	112%	0%	204%
14_B_01	64.6	7%	2%	29%	99%
19_B_01	0.2	1%	139%	6%	179%
21_B_01	1.3	63%	306%	63%	576%
22_B_01	0.1	24%	250%	20%	327%
24_B_01	4.4	46%	19%	61%	118%
24_B_02	1.2	6%	137%	26%	247%
25_B_01	0.7	47%	109%	49%	144%
25_B_02	7.6	3%	67%	1%	197%
26_B_01	4.0	20%	13%	-29%	42%
27b_B_01	70.1	4%	18%	1%	39%
29_B_01	32.5	17%	135%	7%	200%
29_B_02	3.5	41%	100%	26%	100%
29b_B_01	43.7	0%	4%	6%	37%
30_B_01	177.6	74%	85%	54%	100%
Nominal storage capacity is impounded volume when water surface is at spill crest					

## 5 STORM DRAINAGE CRITERIA USED IN THIS STUDY

### 5.1 General

This discussion of design criteria is limited to the philosophy and criteria used in this study. Criteria and requirements for implementation of future decisions regarding land development and facility upgrades will be the subject of a future drainage design manual for the District.

Design of improvements to storm drainage facilities should, in order to most effectively reduce flood related risks and damage, be based on more than rote formulas and standard methodologies. The impacts of choices and designs on the behavior of the natural system need to be investigated and included.

One of the most important benefits of numerical simulation in hydrology is the ability to explore and represent details of the natural processes which cannot be captured in fixed formulae and "rules of thumb". The results of synthetic rainfall analysis and hydrologic simulation of the Canyon del Rey watershed are presented in previous chapters. We consider briefly here, as a prelude to design criteria selection, the interactions between culvert design, detention storage, and increases in runoff due to development.

The HEC-HMS model of the watershed and existing facilities was used to simulate a range conditions, including amount of impervious area (due to development), the discharge capacities of culverts, and the impoundment volumes active during flood events. The results are summarized in Figures 5-1 and 5-2. These figures provide, respectively, peak flows and runoff volumes along the main stem for the 10 year and 100 year events under three alternative conditions. The simulated conditions are: a) existing facilities and existing development, b) existing development but no storage within the basin, and c) no development and not storage within the basin. Condition (a) is the current conditions used to adequacy of facilities. Condition (b) simulates hydrologic behavior of the watershed and stream system with existing development but no detention storage – as if all of the culverts and outlet structures in the watershed had the capacity to pass any flow rate. Condition (c) represents a watershed with no development and no storage – this is roughly the natural condition before man's activities modified the watershed.

The effect of storage in the basins, created primarily by culverts under roadways, can be seen by comparing conditions (a) and (b). The basins reduce peak flows by roughly 60% for both the 10 year and 100 year events. The large step function change in peak flow at the lakes is due to the large flows from the urbanized areas tributary to the lakes. The effect of urbanization on runoff can be seen by comparing conditions (b) and (c). Urbanization increases runoff for the 10 year event by roughly 125% in watersheds other than the intensely urbanized area and by roughly 435% in the intensely urbanized areas. The existing detention storage in the basins reduces peak flows under existing urbanized conditions to the same level as the natural condition for the

10 year event (compare conditions (a) and (c)). The existing basins reduce peak flows to 45% below natural conditions for the 100 year event, effectively reducing flood flows below what would occur naturally. An evaluation of runoff volumes in Figure 5-2 leads to similar conclusions.

This analysis demonstrates the importance of detention storage in managing flows during flood events. Any modifications to culverts and outlet works, particularly along the main stem of Canyon del Rey creek, have the potential to change storage performance and alter both peaks flows and runoff volumes during storm events. Such changes could increase flood risks and damages. Increased flows have the potential to change sediment movement, bank erosion, channel incision, and channel stability. Sediment movement will be discussed in detail in Chapter 8.

Decisions regarding culvert capacity increases, consequently, must consider impacts on detention storage, peak flows, and runoff volume.

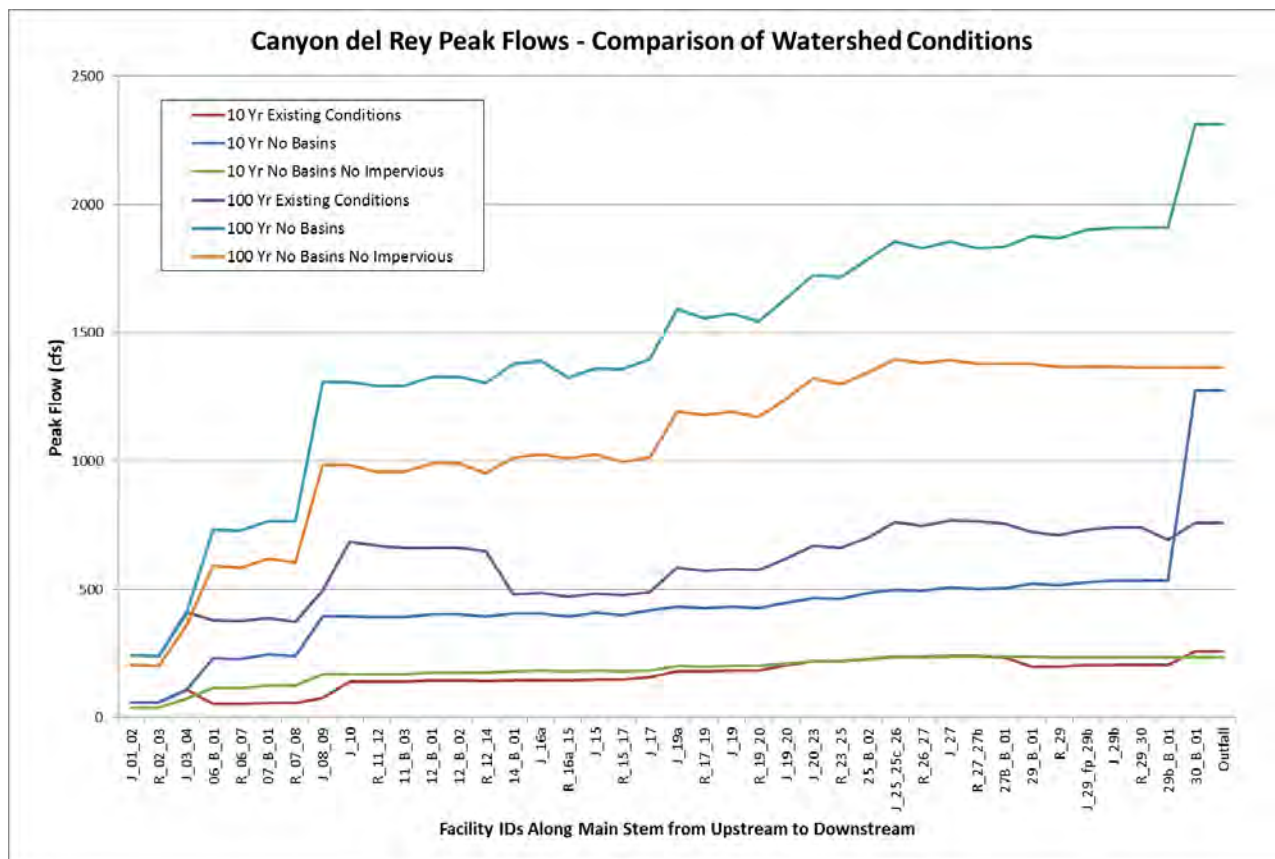


Figure 5-1: Peak flow rates along main stem for alternate conditions.

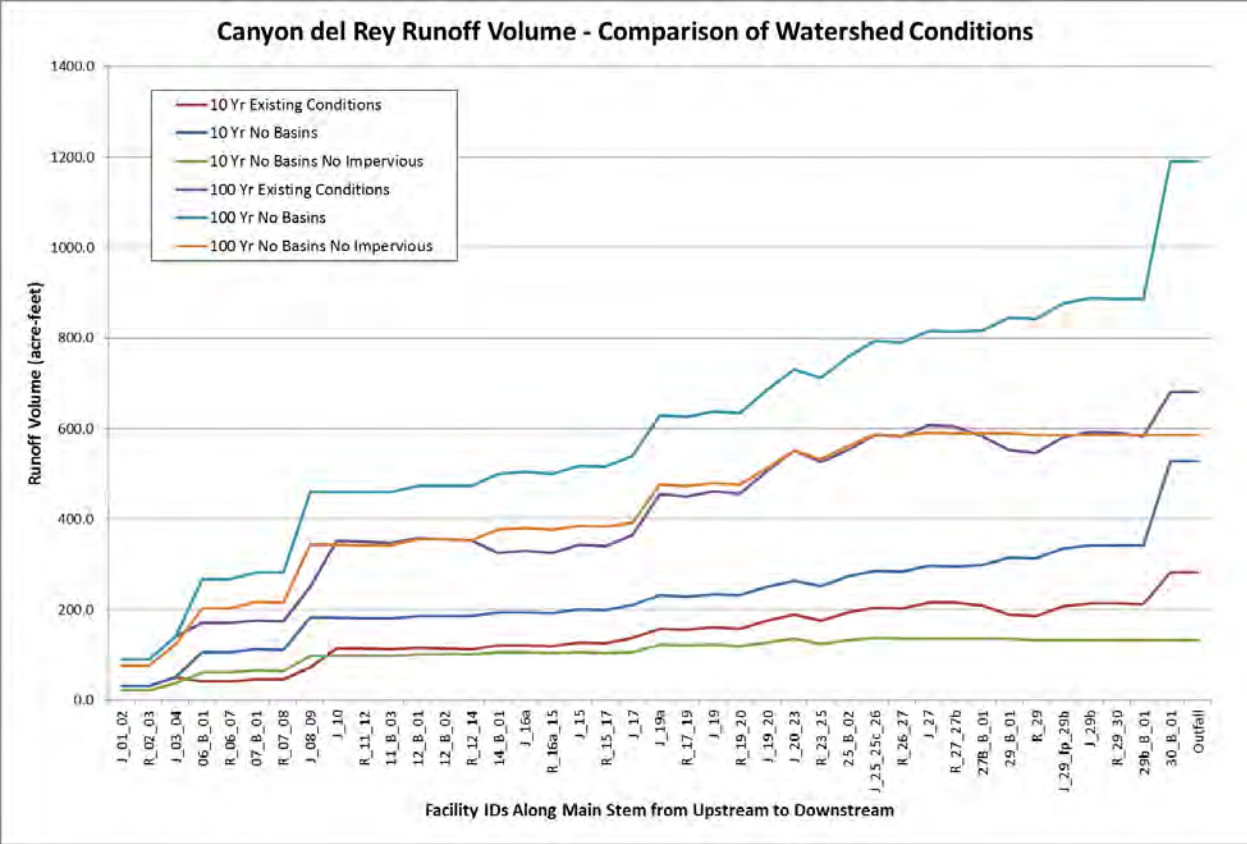


Figure 5-2: Runoff volumes along main stem for alternative conditions.

5.2 Hydrologic analysis approach

Rainfall patterns were developed for specific storms based on regional rainfall frequency analysis, due to a lack of adequate local rainfall records. Refer to Chapter 3 for details.

Due to the highly variable watershed conditions, including soil type, ground cover, slopes, and extent of development, simple hydrologic calculations are not appropriate. While manual unit hydrograph methods have the potential to be sufficiently accurate and locally representative, hydrologic simulation packages such as HEC-HMS are readily available, relatively easy to apply, and sufficiently detailed to represent the highly variable watershed conditions. Detailed representation of rainfall hyetographs and runoff hydrographs are necessary to properly handle routing through the sub-watersheds, storage in the basins, and discharge from one channel reach to another. In this study HEC-HMS was used to represent the response of the watershed to specific rainfall patterns. Details of the hydrologic modeling methodology and results are provided in Chapter 4.

### 5.3 Hydraulic analysis approach

Hydraulic analyses were performed for each of the culverts listed in Chapter 4 and described further in Chapter 2. These analyses were performed using the Federal Highway Administration HY-8 Culvert Hydraulic Analysis Program. This program, further described in Chapter 6, automates standard calculations used for culvert design.

Hydraulic analyses were not executed for the natural stream channels, except as needed for morphological and sediment transport analyses, described in Chapter 8. The operations of basins were simulated in HEC-HMS using elevation-volume curves for each basin. The results of those simulations, in terms of utilization of available storage volume and effect of storage on outflow hydrographs, are provided in tables in Chapter 4.

### 5.4 Hydraulic design methodology and criteria

Evaluation of existing culvert adequacy and development of upgrade recommendations is described in Chapter 6. The resultant recommendations are provided in Table 6-3.

California Department of Transportation criteria for design of culverts specify the following:

- The upstream water surface elevation shall not exceed the top of the culvert inlet for the 10 year peak flood flow, and
- The upstream water surface elevation shall not exceed an elevation which would cause objectionable backwater depths or outlet velocities.

California Department of Fish and Game criteria for design of culverts specify the following:

- The upstream water surface elevation shall not exceed the top of the culvert inlet for the 10 year peak flood flow, and
- The upstream water surface elevation shall not exceed 50 percent of the culvert height or diameter above the top of the culvert inlet for the 100 year peak flood flow.

As discussed in section 5.1, the effect of detention storage along the main stem of Canyon del Rey creek is substantial, reducing both peak flows and runoff volumes for both the 10 year and 100 year storm events. The potential impacts of increased culvert capacity on detention storage need to be considered along with improvements in safety, traffic flow during events, and protection of



the roadway crossings. A compromise was established for this work, consisting of the following criteria:

- During the 10 year storm event, the water level upstream of the culvert should not exceed the top of the culvert inlet, and
- During the 100 year storm event, the water level upstream of the culvert should not exceed a depth of 0.5 feet above the lowest roadway crest elevation.

The intention of these criteria is to maintain as much detention storage as is feasible while allowing emergency vehicles to traverse the roadway crossing and while minimizing erosion related damage to the culvert and roadway berm.

## 6 HYDRAULIC ANALYSES

### 6.1 Hydraulic performance calculation methods

Hydraulic capacity calculations were produced for many, but not all, of the culverts in the watershed. Where culverts on private land and privately maintained were generally not analyzed. Table 6-1 provides design details for the culverts analyzed.

The culvert design details were used in the Federal Highway Administration HY-8 Culvert Hydraulic Analysis Program to determine the hydraulic capacity of each of the culverts. Details of this program, including a quick start guide, can be found at <http://www.fhwa.dot.gov/engineering/hydraulics/software/hy8/>. For a particular culvert the following parameters were input:

### 6.2 Facility capacity estimates

Peak flow rates generated by the HEC-HMS modeling for the reaches associated with each of the culverts were compared with the hydraulic analysis results to determine whether the existing culverts provided adequate conveyance capacity. The bases for that comparison for the each of the culverts are provided in Table 6-2. This table provides both the HEC-HMS predicted flow rates and the calculated capacities. The HEC-HMS reaches used for the predicted flow rates are provided in the last column. In some cases, a culvert is located in the middle of a reach or sub-watershed, such that peak flows were prorated based on drainage area contributory to the culvert.

The adequacy of a culvert was determined by calculating the water surface elevation required to drive the 10 year and 100 year peak flow rates through the existing culvert. If the 10 year water surface elevation was higher than the culvert inlet pipe crest or the 100 year water surface elevation was 0.5 ft or more above the lowest point along the crest of the road crossing, then the capacity of the culvert was deemed inadequate.

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Table 6-1: Culvert design parameters used in hydraulic analyses.

Culvert	Culvert Length (ft)	Diam. (ft)/ W x H	Type	Shape	Invert Elev. (ft)	Outlet Elev. (ft)	Road elev. (ft)
01_C_01	95.68	18"	CMP	circular	444.64	443.4	460
01_C_02A	41.20	18"	CMP	circular	424.39	424.12	426.45
01_C_02B	40.26	18"	CMP	circular	423.84	423.43	426
01_C_03	74.77	24"	CMP	circular	424.44	422.36	426.4
02_C_01	105 & 110	28" x 20"	double barrel CMP	oval	414.52	413.17	417.03
02_C_02	30.00	18"	CMP	circular	402.59	401.72	404.4
02_C_03	50.88	18"	CPE	circular	398.21	397.02	400.3
03_C_01	59.17	48" x 30"	CMP	oval	404.32	404	408.01
03_C_02	55.85	40"	HDPE-S	circular	394.35	393.02	398.67
04_C_01	71.20	24"	CMP	circular	395.99	391.67	398.7
04_C_02	59.40	24"	HDPE-S	circular	388.43	385.64	391.7
05_C_01	60.32	24"	CMP	circular	384.61	384.47	389.1
06_C_01A	98.25	48"	CMP	circular	383.64	379.96	388.2
06_C_01B	98.25	30"	CMP	circular	383.58	382.15	388.2
07_C_01	100.00	24"	HDPE-S	circular	361.59	347.86	370.3
08_C_02	118.44	52"	RCP	circular	326.88	325.16	346
09_C_01A	478.83	40"	HDPE-S	circular	367.01	333.7	40
10_C_01	164.00	36"	CMP	circular	342.14	339.59	360.4
10_C_02	104.97	60"	RCP	circular	331.69	330.46	346
10_C_03	745.55	36"	RCP/CMP	circular	352.68	338.39	361
12_C_01	109.27	48"	CMP	circular	294.85	293.78	315.5
14_C_01	162.18	48"	CMP	circular	265.94	262.27	303
15_C_01	124.57	48"	CMP	circular	225.34	215.33	233.5
16_C_01	56.23	24"	CMP	circular	271.77	269.51	275.5
17_C_01	35.07	14.4' x 8'	Concrete Earth Floor	Box w/dome roof	189.22	188.74	204.26
18_C_01	55.36	6' x 4'	RCB	Box	196.66	196	202.5
21_C_01	65.26	triple 28" x 24"	Synthetic Fiberglass	Oval	164.16	163.26	169
25_C_01A	130.10	double 48"	RCP	circular	115.59	112.6	123.5
25_C_01B	130.10	triple 18"	RCP	circular	113.86	110.09	123.5
25_C_02	120.34	double 48"	RCP	circular	112.73	111.31	118.53
25_C_03	59.00	14' x 7.7'	RCB	Box	110.23	110.23	120.65
26_C_01	67.13	36"	HDPE-S	circular	120.87	117.5	124.63
27_C_01	43.40	14' x 8'	RCB	Box	108.8	108.45	120.1
27_C_02	27.10	14' x 6.7'	RCB	Box	109.85	109.55	119.4
27_C_03	379.75	87.6"	CMP	circular	103.6	98.3	111.7
27_C_04	41.10	6' x 8'	RCB	Box	88.32	88	98.2
28_C_01	91.50	10.1' x 8'	RCB	Box	81.9	81.4	91.3
28_C_02	102.8	3' x 3'	RCB	Box	83.46	79.76	101
29_C_01	67.5	6' x 8'	RCB	Box	76.52	75.63	84.25
29_C_03	14	user defined	Wood w/concrete walls	Bridge	62.87	60.68	71
29_C_04	12	user defined	Wood w/concrete walls	Bridge	59.66	58.44	69.54
29_C_05	13	48"	CMP	circular	51.1	50.88	55
29_C_05A	10	12' x 8'	concrete	bridge	55.1	54.88	65
29_C_06	11.7	user defined	concrete	bridge	45.8	45.6	57.9
29_C_07	40.66	6' x 8.25'	RCB	Box	42.27	40.1	51
29_C_08	706.3	8' x 8'	RCB	Box	16.54	12.79	30
30_C_01	136.9	6' x 6'	RCB	Box	10.77	10.43	46.12
30_C_02	10.75	100' x 7'(in middle)	wood	arched bridge	10.3	10	14.5
30_C_03	91	double 16' x 7'	RCB	Box	6.2	6.1	15.3
30_C_03B	17	double 21.36' x 7'	RCB	Box	6	6	16.57
30_C_04	51.3	double 8' x 6'	RCB	Box	9.3	9	16.4
30_C_05	768.9	Quad 6' x 6'	RCB	Box	8.66	7.3	17.1
LS_C_01	2640	15"	CPE	circular	743.14	507.75	751

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**Table 6-2: Comparison of culvert capacities with 10 and 100 year flows.**

Culverts 30\_C\_02, 30\_C\_03, and 30\_C\_03B are within the lakes – flow rates are not computed.

<b>Culvert</b>	<b>Culvert Capacity (cfs)</b>	<b>10-year Flow (cfs)</b>	<b>100-year Flow (cfs)</b>	<b>Modeled Outflow from:</b>
01_C_01	25	16	55	Prorated
01_C_02A	7	33	115	Prorated
01_C_02B	8	33	115	Prorated
01_C_03	13	4	15	Prorated
02_C_01	31	42	178	Sub_2
02_C_02	7	2	8	Prorated
02_C_03	10	2	8	Prorated
03_C_01	41	95	362	Prorated
03_C_02	65	100	379	Sub_3 + R_02_03
04_C_01	16	12	35	04_B_02
04_C_02	19	2	6	Prorated
05_C_01	20	7	22	05_B_01
06_C_01A	111	54	378	06_B_01
06_C_01B				
07_C_01	43	10	36	Prorated
08_C_02	294	76	507	J_08_09
09_C_01A	70	9	61	9_B_01
10_C_01	89	56	389	07_B_01
10_C_02	422	56	372	R_07_08
10_C_03	89	64	199	10_B_04
12_C_01	220	145	660	12_B_02
14_C_01	285	144	481	14_B_01
15_C_01	130	150	483	J_15
16_C_01	21	1	15	Sub_16a
17_C_01	1282	156	489	J_17
18_C_01	198	25	195	J_16b_17_18
21_C_01	105	184	578	J_19
25_C_01A	367	227	703	25_B_02
25_C_01B				
25_C_02	236	227	703	25_B_02
25_C_03	1028	236	760	J_25_25c_26
26_C_01	78	13	72	Sub_26
27_C_01	1497	236	760	J_25_25c_26
27_C_02	901	236	760	J_25_25c_26
27_C_03	330	241	769	J_27
27_C_04	450	253	790	J_27 + prorated sub 29b
28_C_01	932	232	756	27b_B_01
28_C_02	230	16	25	Sub_28
29_C_01	334	197	724	29_B_01
29_C_03	450	203	731	J_29_fp_29b
29_C_04	899	203	731	J_29_fp_29b
29_C_05	62	203	731	J_29_fp_29b
29_C_05A	935			J_29_fp_29b
29_C_06	885	203	731	J_29_fp_29b
29_C_07	409	203	731	J_29_fp_29b
29_C_08	805	205	694	29b_B_01
30_C_01	898	366	968	29b_B_01 + Prorated 30
30_C_02	3035			30_B_01
30_C_03	740			30_B_01
30_C_03B	1920			30_B_01
30_C_04	537	258	758	30_B_01
30_C_05	1389	258	758	30_B_01
LS_C_01	16.4	9.5	14	LS_B_01

### 6.3 Effects of facilities on existing and future flows

Certain of the facilities listed in Table 6-1 were included in the HEC-HMS model, where the impounding of water by culvert restrictions has the potential to alter flow rates and volumes along the main stem of the creek. The HEC-HMS model was run for both existing and proposed conditions. Proposed conditions are defined by the recommended upgrades to culverts. Recommended culvert upgrades are discussed in Chapter 8. No changes in watershed development, land use, or storm water collection systems were included.

Recommended upgrades to culverts are shown in Table 6-3. These upgrades are based on the increase in capacity needed to pass the modeled 100 year peak discharge with a maximum depth above the roadway of 0.5 feet. In some cases, the resulting depth is lower than this criteria because standard culvert sizes were specified.

Table 6-3: Recommended upgrades to existing culverts.

Culvert	Replacement Recommendations
01_C_02	Replace with 10 ft <sup>2</sup> area culvert or ditch. 2' X 5' box culvert.
02_C_01	Replace with 16 ft <sup>2</sup> area box culvert. 2' X 8' box culvert.
03_C_01	Replace 18 ft <sup>2</sup> area box culvert. 3' X 6' box culvert.
03_C_02	Replace with 24 ft <sup>2</sup> area box culvert. 4' X 6' box culvert.
10_C_01	Add 48" concrete pipe or equivalent total capacity of 20 ft <sup>2</sup> .
12_C_01	Add parallel 60" RCP.
14_C_01	Add parallel 30" RCP, or equivalent total capacity of 18 ft <sup>2</sup> .
15_C_01	Replace with 40 ft <sup>2</sup> area box culvert. High priority.
21_C_01	Replace with 70 ft <sup>2</sup> area box culvert. High priority.
25_C_01	Replace with 65 ft <sup>2</sup> area box culvert. Will reduce detention storage.
25_C_02	Replace with 81 ft <sup>2</sup> area box culvert.
27_C_03	Replace with 90 ft <sup>2</sup> area box culvert. 12' X 7.5' box as suggested in the 1977 report.
27_C_04	Add parallel 6' X 8' box as suggested in the 1977 report.
29_C_01	Add parallel 6' X 8' box as suggested in the 1977 report.
29_C_03	Replace with 100 ft <sup>2</sup> box culvert. Private facility.
29_C_07	Add parallel 100 ft <sup>2</sup> box culvert. 6' X 8' box as suggested in the 1977 report.

Figure 6-1 provides plots of the 10 year and 100 year peak flows predicted by the HEC-HMS model along the main stem of Canyon del Rey Creek from the upper most sub-watershed (at the left of the graph) to the outlet from Lake Roberts. Two sets of predictions appear on the graph: one for existing conditions and the other for proposed conditions. Figure 6-2 provides the same plots for total runoff volume.

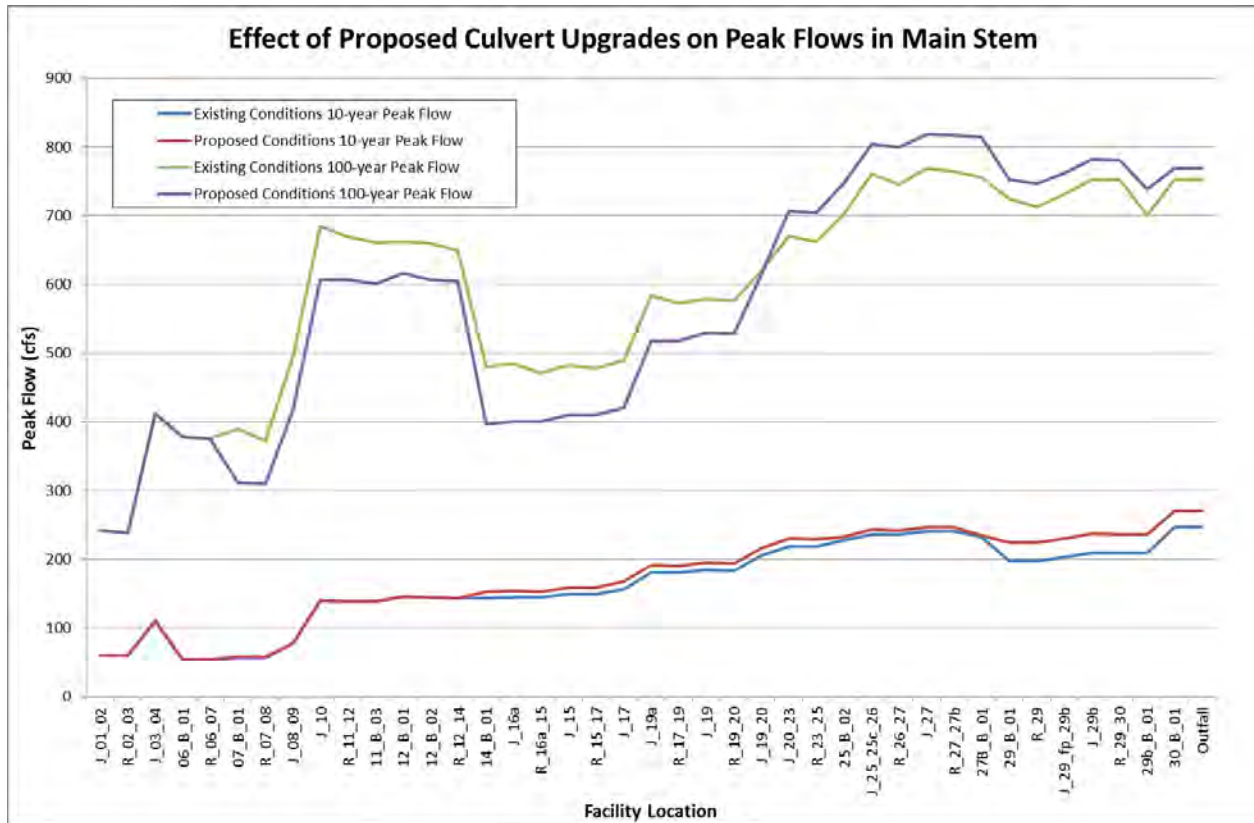


Figure 6-1: Effect of proposed culvert upgrades on future peak flows.

The impact of changes in storage due to enlargement of culver capacity at several locations can be seen in these graphs. Reductions in water storage at these locations during both the 10 year and 100 year events result in higher runoff volume. The effect, as would be expected, is more pronounced for the 100 year event. Changes in peak discharge due to enlargement of culverts are more complex, particularly for the 100 year event. Timing of peak flows in the main stem relative to peak flows entering the main stem from sub-basins is altered by reductions in storage volume and passage of higher flows through the affected culverts. For some locations peak flows increase by no more than 20%, while at other locations peak flows decrease by no more than 7%. The overall effect of increases in culvert capacity is to increase peak flows and increase runoff volumes during the storm events, both by relatively modest amounts.

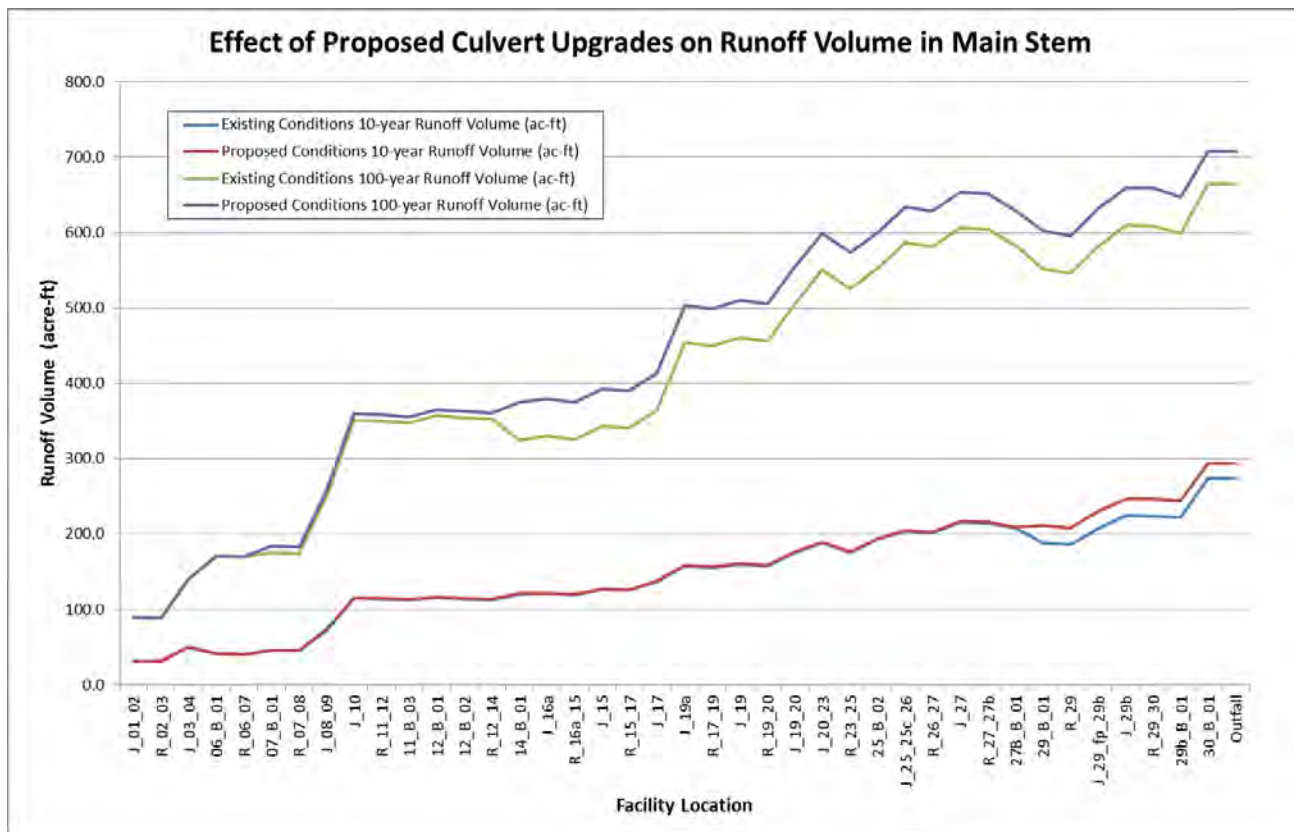


Figure 6-2: Effect of proposed culvert upgrades on future flow volumes.

## 7 EROSION AND SEDIMENTATION

To be added later.

### 7.1 Geologic setting

INITIAL PARADIGM

PLEISTOCENE HISTORY (BH)

REVISIONS NEEDED BASED ON FIELD OBSERVATIONS

REVISED APPROACH

OVERVIEW OF NEW FINDINGS

GEOLOGY

SOILS

STRUCTURES

SEDIMENT COMPARTMENTS

### 7.2 Historical and archival analysis

MAJOR EVENTS IN WATERSHED

CHANNEL MORPHOLOGY

AERIAL PHOTO ANALYSIS

### 7.3 Sediment loading

METHODOLOGY

SEDIMENT SOURCES

SEDIMENT SINKS AND COMPARTMENTALIZATION

SEDIMENT MEASUREMENTS

SEDIMENT TRANSPORT AND LOADING



## 8 RECOMMENDED FACILITY IMPROVEMENTS

### 8.1 General

Recommended improvements to facilities and the cost of those improvements are provided in this section. The existing facilities are described in Chapter 2, with photographs assembled in Appendix C and field inspection notes provided in Appendix B. Both the photographs and notes are organized sequentially by facility number. The locations of the facilities are shown on the sub-watershed map panels provided in Appendix A. The facility descriptions in Chapter 2 also indicate which map panel shows the particular facility.

Digital file submittals, which are not an integral part of this report, include: AutoCAD drawings of each sub-watershed which provide considerably more detail regarding location, orientation, and elevation of each facility; and cost calculation details.

### 8.2 Recommended improvements

Table 8-1 provides a list of recommended upgrades for specific culverts that were found to be inadequate for safely conveying the 100 year peak flows. Certain of these recommendations match improvements recommended by the 1977 report. These recommended improvements are proposed primarily to increase high flow carrying capacity, so that roads are not excessively overtopped by high water and safe conditions are maintained. The improvements are specifically not proposed to decrease detention of high flows, as such detention is integral to flood management in the watershed.

### 8.3 Additional rain and stream gages

The 1977 Plan provided specific recommendations regarding addition of rain gages and stream gages within the watershed, designed to provide more complete hydrologic data suitable for future storm water analyses and planning. While some additional meteorological data is available today in the watershed, hydrologic data remains sparse. The 1977 recommendations mostly remain appropriate and would provide highly useful information. New rain gages could include:

- at Laguna Seca Race Track (elevation 750 feet);
- at a central point along highway 68, if the Pasadera Golf Course weather station does not provide adequate rainfall information;
- at the southeasterly boundary of the watershed, perhaps at the junction of Laureles Grade Road and El Toro Road (elevation 850 feet); and

- at an accessible location in one of the southwestern sub-watersheds (26 or 23) at moderate elevation (400-600 feet).

Assuming that the Frog Pond gage operated by CSUMB continues to provide usable stream flow data, an additional gage could be usefully sited at the York Road crossing.

Table 8-1: Recommended culvert upgrades.

Culvert	Replacement Recommendations
01_C_02	Replace with 10 ft <sup>2</sup> area culvert or ditch. 2' X 5' box culvert.
02_C_01	Replace with 16 ft <sup>2</sup> area box culvert. 2' X 8' box culvert.
03_C_01	Replace 18 ft <sup>2</sup> area box culvert. 3' X 6' box culvert.
03_C_02	Replace with 24 ft <sup>2</sup> area box culvert. 4' X 6' box culvert.
10_C_01	Add 48" concrete pipe or equivalent total capacity of 20 ft <sup>2</sup> .
12_C_01	Add parallel 60" RCP.
14_C_01	Add parallel 30" RCP, or equivalent total capacity of 18 ft <sup>2</sup> .
15_C_01	Replace with 40 ft <sup>2</sup> area box culvert. High priority.
21_C_01	Replace with 70 ft <sup>2</sup> area box culvert. High priority.
25_C_01	Replace with 65 ft <sup>2</sup> area box culvert. Will reduce detention storage.
25_C_02	Replace with 81 ft <sup>2</sup> area box culvert.
27_C_03	Replace with 90 ft <sup>2</sup> area box culvert. 12' X 7.5' box as suggested in the 1977 report.
27_C_04	Add parallel 6' X 8' box as suggested in the 1977 report.
29_C_01	Add parallel 6' X 8' box as suggested in the 1977 report.
29_C_03	Replace with 100 ft <sup>2</sup> box culvert. Private facility.
29_C_07	Add parallel 100 ft <sup>2</sup> box culvert. 6' X 8' box as suggested in the 1977 report.

## 9 FACILITY IMPROVEMENT COST ESTIMATES

### 9.1 Cost estimation methodology

Concept-level plans were developed for each of the identified upgrade projects for the purpose of project scoping and cost estimation. The scope of each culvert upgrade is described in Table 9.1, below.

The estimates utilize unit pricing for the major work items such as structures, pipes, inlet/outlet protection, and pavement replacement. Bid item scope, where an "item code" is given, generally follows the 2010 edition of the Caltrans Standard Specifications and Standard Plans. Unit costs for these bid items were developed based on an analysis of costs reported in the Caltrans Contract Cost Database (CCDB) and bid results from similar, selected projects completed in Caltrans Districts 4 and 5. Details of those projects are provided in the separate electronic record submittal.

A concept sketch was developed for each culvert upgrade for the purpose of general project scoping, estimating quantities for the major items of work, and developing budgets for temporary traffic and environmental controls and final landscaping and restoration. These concept sketches and quantity calculations are provided in the separate electronic record submittal.

Temporary controls, including temporary traffic control, construction area signs, staged construction, excavation storing, temporary environmental pollution controls, construction of temporary access roads, and temporary creek diversions, were included as lump sum items. Temporary controls account for between 5% and 35% of the total estimated cost.

Electrical and landscape work were similarly included as lump sum items. Landscape items are referred to generally in the estimates as one of the following (listed in order of increasing cost): highway planting (basic erosion control and seeding); planting and irrigation (highway planting plus container plants and temporary irrigation); and creek/riparian restoration and planting. In relative terms, highway planting accounts for 1% to 2% of the total project cost, and creek/riparian restoration and planting accounts for between 8% and 15% of the total estimated project cost.

Minor work items, supplemental work and contingencies are each included as a percentage mark-up to the work items identified above. "Minor items" are those items which are not specifically enumerated, due to the preliminary nature of the estimate, but which are anticipated to be included in the final construction documents. Supplemental work is work which could be identified and added to the project after bidding, during the construction process. The "contingencies" category accounts for potential scope items which are not anticipated at this conceptual stage.

Detailed cost estimates for each of the identified projects are provided in Appendix E.

Plans and bid results for several Caltrans projects of similar scope and cost were obtained and compared to the projects evaluated herein. We reviewed these projects for total project scope and cost, unit costs for individual work items, and costs for temporary environmental and traffic controls and landscape work. The bid summaries for these projects are provided in the electronic submittal that accompanies this report.

## 9.2 Facility improvement costs

The preliminary cost estimates for the identified culvert upgrades are provided in Table 9.1, below.

**Table 9-1: Preliminary construction cost estimates.**

ID	Conceptual Project Scope	Construction Cost Estimate
01-C02	Remove two (2) existing 18" CMP culverts located in north shoulder of and running parallel to Highway 68 at Laureles Grade. Construct 5'W x 2'H x 130'L RCB, and install RSP inlet and outlet protection. Includes traffic signal conduit relocation and reconstruction of existing bus stop.	\$ 158,000
02-C01	Remove existing double 20"x28" CMP culvert which crosses Highway 68 just west of Laureles Grade. Construct 2'H x 8'W x 110'L RCB, and install RSP inlet and outlet protection. Existing culverts are shallow and existing utility crossings are anticipated to require similarly shallow RCB. Staged construction.	\$ 599,000
03-C01	Remove existing 30"x48" CMP culvert which crosses under secondary Laguna Seca Recreation Area access road. Construct 3'H x 6'W x 70'L RCB, and install RSP inlet and outlet protection.	\$ 187,000
03-C02	Remove existing 40" HDPE culvert which crosses under Laguna Seca Recreation Area entrance road. Construct 4'H x 6'W x 80'L RCB, construct concrete wing walls and grade control apron on inlet side, and install RSP outlet protection.	\$ 253,000
10-C01	Jack 48" dia x 170'L RCP culvert parallel to existing 36" CMP culvert which crosses Highway 68. Construct concrete head walls and RSP inlet and outlet protection. Perform creek restoration and planting.	\$ 574,000
12-C01	Construct temporary roads to access construction areas. Jack 60" dia x 110'L RCP culvert parallel to existing 48" CMP culvert which crosses Highway 68. Construct concrete head walls and RSP inlet and outlet protection. Perform creek restoration and planting.	\$ 537,000

CANYON DEL REY MASTER DRAINAGE PLAN - DRAFT

14-C01	Construct temporary roads to access construction areas. Jack 48" dia x 160'L RCP culvert parallel to existing 48" CMP culvert which crosses Highway 68. Construct concrete head wall at inlet and RSP outlet protection. Perform creek restoration and planting.	\$ 566,000
15-C01	Remove existing 48" CMP culvert which crosses under emergency access road located off Blue Larkspur Lane. Construct 5'H x 8'W x 110'L RCB, construct concrete wing walls on inlet side, and install RSP outlet protection.	\$ 352,000
21-C01	Remove existing double 24" x 28" culvert which crosses Highway 68. Construct double 5'H x 7'W x 68'L RCB, head walls, and RSP inlet and outlet protection. Staged construction.	\$ 417,000
25-C01	Remove existing 2-48" and 3-18" culverts which cross under Monterra Ranch entrance road. Construct 6'H x 12'W x 135'L RCB, construct inlet control structure, and install RSP outlet protection.	\$ 573,000
25-C02	Remove existing double 48" RCP culvert which crosses Highway 68 just west of the Highway 218 intersection. Construct 7'H x 12'W x 120'L RCB, head walls, and RSP outlet protection. Staged construction.	\$ 683,000
27-C03	Remove existing 88" CMP culvert located in the west shoulder of and running parallel to Highway 218 at the entrance to Del Rey Gardens Drive. Provide temporary shoring and creek diversion and construct 7.5'H x 12'W x 380'L RCB, head walls, and RSP inlet and outlet protection.	\$ 1,645,000
27-C04	Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Highway 218 and provide RSP inlet protection. Staged construction.	\$ 341,000
29-C01	Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Highway 218 and provide RSP outlet protection. Staged construction.	\$ 324,000
29-C03	Remove existing privately owned 18' span wood deck bridge and concrete abutments. Construct new abutments and 24' span wood deck bridge and concrete abutments and relocate associated private utilities.	\$ 139,000
29-C07	Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Rosita Road and provide RSP outlet protection.	\$ 324,000

Notes:

1. Estimate includes supplemental work and contingencies.
2. Estimate does not include "soft costs", i.e., project management, engineering, environmental, permitting, inspections, or testing.
3. Costs are provided in year 2014 dollars. Costs should be escalated for later years.

## 10 RECOMMENDATIONS

### 10.1 Utilization of this report and electronic submittals

Large amounts of data were collected, organized and archived electronically during this study. Data sets include:

- rainfall and stream flow gauge locations and records;
- geographic information including land use, soils, ground slopes and impervious cover;
- facilities data including location, dimensions, configuration, and physical condition;
- stream channel morphology and condition;
- facilities upgrade information including rough designs, cost calculations, unit costs;
- HEC-HMS hydrologic model set up and parameter definitions; and
- HEC-HMS model predictions of stream flow hydrographs at multiple locations with the watershed and for multiple return period and duration rainfall events.

These data has been transmitted to the MPWMD. We recommend that these data sets be placed on an active data server and made available to District and local city staff members as well as engineers and planners working on projects in the watershed. Appendix F, attached to this report, provides a list of available data.

### 10.2 Lake management and preservation recommendations

Bathymetric surveys of Roberts Lake and Laguna Grande were used to define the extent of sediment deposition in the lakes. These surveys produced clear indications that very little sediment has accumulated in either lake over the past several decades. The lack of sediment deposition in the lakes correlates with the extensive evidence of sediment deposition in the watershed, the low peak flows reaching the lakes, and the lack of sediment transport through the creek.

Changes in the runoff due to fires, urbanization or upgrades to flood facilities have the potential to increase sediment transport into the lakes, accelerate deposition of sediments and change lake conditions. Possible changes include

shoaling, impaired water quality, eutrophication, and weed growth. Decisions regarding land development, wild fire management, road improvements, and upgrades to the flood conveyance facilities should be made with full understanding of potential impacts on sediment transport into the lakes.

### 10.3 Facility improvement priorities and execution

The flood management facility improvements recommended in this plan are estimated to cost, in aggregate, \$6.5 million. With limited construction budgets, it is important to focus efforts on the most important improvement actions, based on the magnitude of problems with a structure, the expected efficacy of the improvement, and the cost of the improvement. Highest priority proposed improvements are as follows.

- Culvert 21\_C\_01: capacity is sufficient to pass safely 57% of the peak 10 year flow and 18% of the peak 100 year flow
- Culvert 15\_C\_01: capacity is sufficient to pass safely 87% of the peak 10 year flow and 27% of the peak 100 year flow; drop inlet design is restrictive
- Culverts 3\_C\_01 and 3\_C\_02: capacity is sufficient to pass safely 43-65% of the peak 10 year flow and 11-18% of the peak 100 year flow
- Culvert 27\_C\_03: capacity is sufficient to pass safely all of the peak 10 year flow and 43% of the peak 100 year flow; capacity needs to match that of upstream culverts

Many other existing culverts have inadequate capacity to safely pass the 100 year peak flow; a few additional culverts (01\_C\_02A, 01\_C\_01B, 02\_C\_01) have inadequate capacity to pass the peak 10 year flow. These projects are the next priority.

### 10.4 Impact of facility improvements on flood flows

The HEC-HMS hydrologic model was used to simulate flood flows under a hypothetical condition where no restrictions on flow and no detention storage exist in the watershed (see figures 5-1 and 5-2 and associated text). This condition is the extreme case where all culverts and controls on detention basins are removed from the watershed, thus maximizing peak flows and runoff volume. The model predicts that removing all storage would increase peak 10 year and 100 year flow at the discharge to Laguna Grande by approximately 250% and 290%, respectively. Total storm volumes for the 10 year and 100 year events increase by 160% and 150%, respectively.

Additional model simulations were made to predict the effect of the proposed culvert upgrades on storm related flows in the creek (see figures 6-1 and 6-2 and the associated text). Maximum percentage increases in peak flows are predicted for basin 14\_B\_01 (120%) during the 100 year event and for basin 29\_B\_01 (115%) during the 10 year event. These increases are relatively modest because most detention storage is unaffected by the recommended facility improvements.

These model predictions exemplify the potential impact of improving conveyance on storm related flows in the creek and highlight the importance of detention storage within the watershed.

#### 10.5 Flow control measures for future development

Currently applicable runoff management and flood control regulations provide the fundamental means to manage the impacts of development and other changes in the watershed. In addition to the regional regulations, oversight of any modifications to existing detention basins (both created by culverts or designed with outlet works) will be essential to maintaining storage capacity. Further development in the watershed, particularly in the vicinity of the creek channel, has the potential to disrupt the equilibrium conditions that maintain channel morphology and stability, as well as change the dynamics of sediment deposition and erosion. Such changes should be studied carefully before those changes are permitted. Provided that current detention storage is maintained, there is no obvious need for additional detention storage facilities or channel protection works.

#### 10.6 Recommendations regarding sediment management

-- To be added --

#### 10.7 Use of this Master Drainage Plan in ongoing planning and design of storm

The HEC-HMS model of the Canyon del Rey watershed and creeks, together with the precipitation predictions, provide an easily accessed and relatively simple to use method for predicting the hydrologic impacts of changes to the watershed. The model input files and related spreadsheets are provided in the separate electronic submittals. Changes to input data can be readily made to represent proposed development or changes in flood management facilities. The HEC-HMS model, when run with the appropriate changes, will provide detailed flow predictions which can be compared with the results shown in this report.

The descriptions of flood management facilities, including the appendices and electronic submissions, contain a wealth of information about each of the flood management facilities, including current condition. A number of the culverts have identified problems with deterioration, erosion of the channel at the



culvert outlet, and/or accumulation of sediment deposits that partially or fully occlude the culver entrance. For culverts that have identified problems (see filed notes in Appendix B and field photographs in Appendix C) but are not going to be upgraded, it is recommended that cleanup and repairs be accomplished. In addition, culverts that have identified siltation or erosion problems should be inspected periodically (every 3-5 years) and maintenance performed as needed to maintain full culvert function.

Detention basin functionality depends on maintenance of adequate storage volume. Over time sediment will enter the basins and deposit there, decrease available storage volume. Detention basins must be regularly inspected for excess sediment deposition and sediment removed to maintain capacity. Areas within the creek channel system and specific detention basins which are most prone to sediment deposition are detailed in Chapter 8. These designations can be used to inform a detention basin management program.

Reaches of the creek which are designated as eroding in Chapter 8 of this report are likely to suffer continuing creek channel instabilities such as down-cutting or channel migration. Periodic inspection of these reaches will be helpful in defining channel changes and the need for restoration.

#### 10.8 Future revisions and updates to this plan

Revisiting and updating of this plan is recommended on a ten year cycle. This will ensure that the plan remains reasonably up to date and useful in planning of further urbanization and flood management facility repairs and upgrades.

11 REFERENCES

To be added.

## **OVERSIZED FIGURES**

# MONTEREY COUNTY MASTER DRAINAGE PLAN CANYON DEL REY WATERSHED



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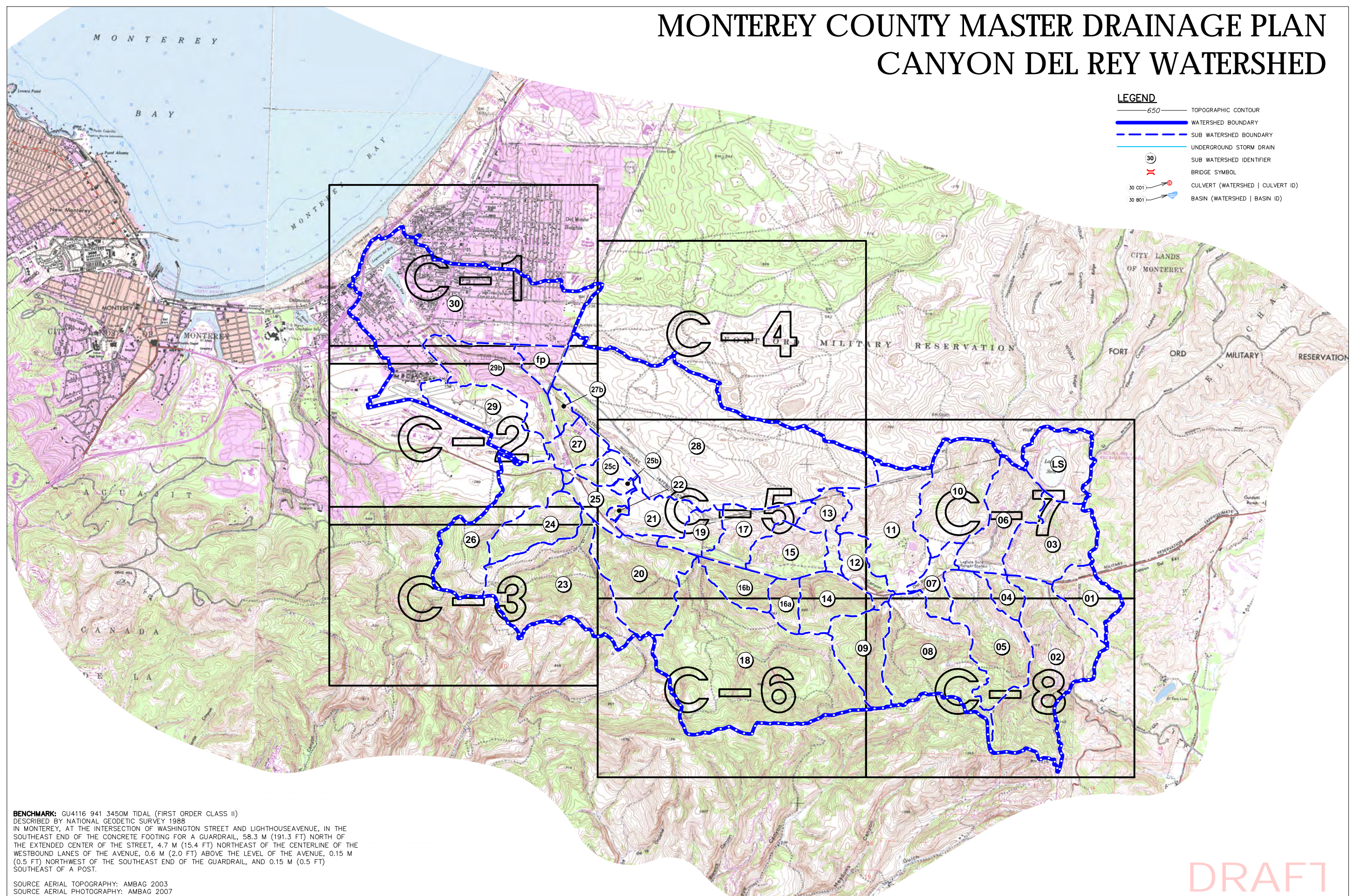
CANYON DEL REY WATERSHED  
MONTEREY COUNTY MASTER DRAINAGE PLAN  
MONTEREY COUNTY WATER RESOURCES AGENCY

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1 OF 9

- LEGEND**
- 650 TOPOGRAPHIC CONTOUR
  - WATERSHED BOUNDARY
  - SUB WATERSHED BOUNDARY
  - UNDERGROUND STORM DRAIN
  - SUB WATERSHED IDENTIFIER
  - BRIDGE SYMBOL
  - CULVERT (WATERSHED | CULVERT ID)
  - BASIN (WATERSHED | BASIN ID)

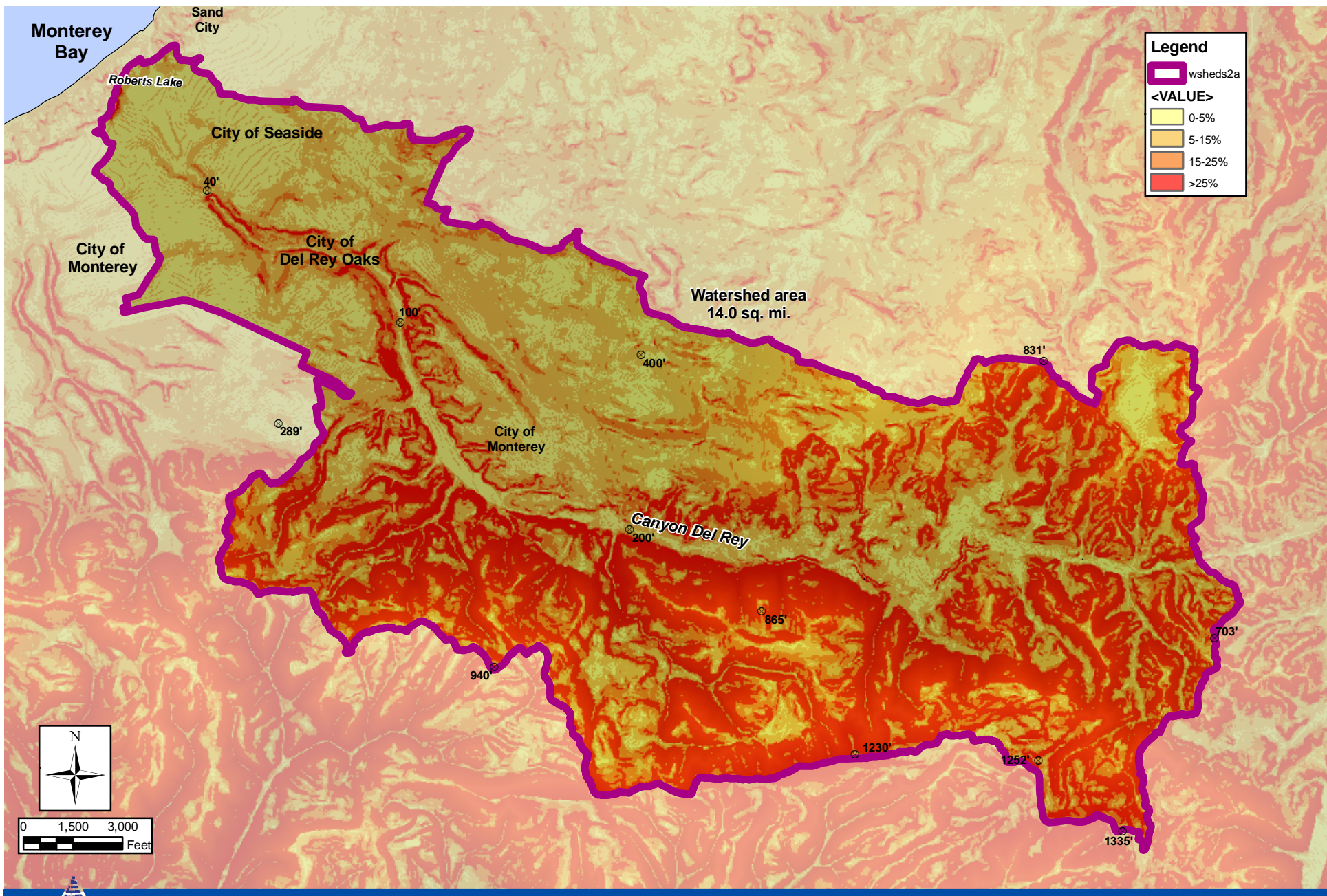


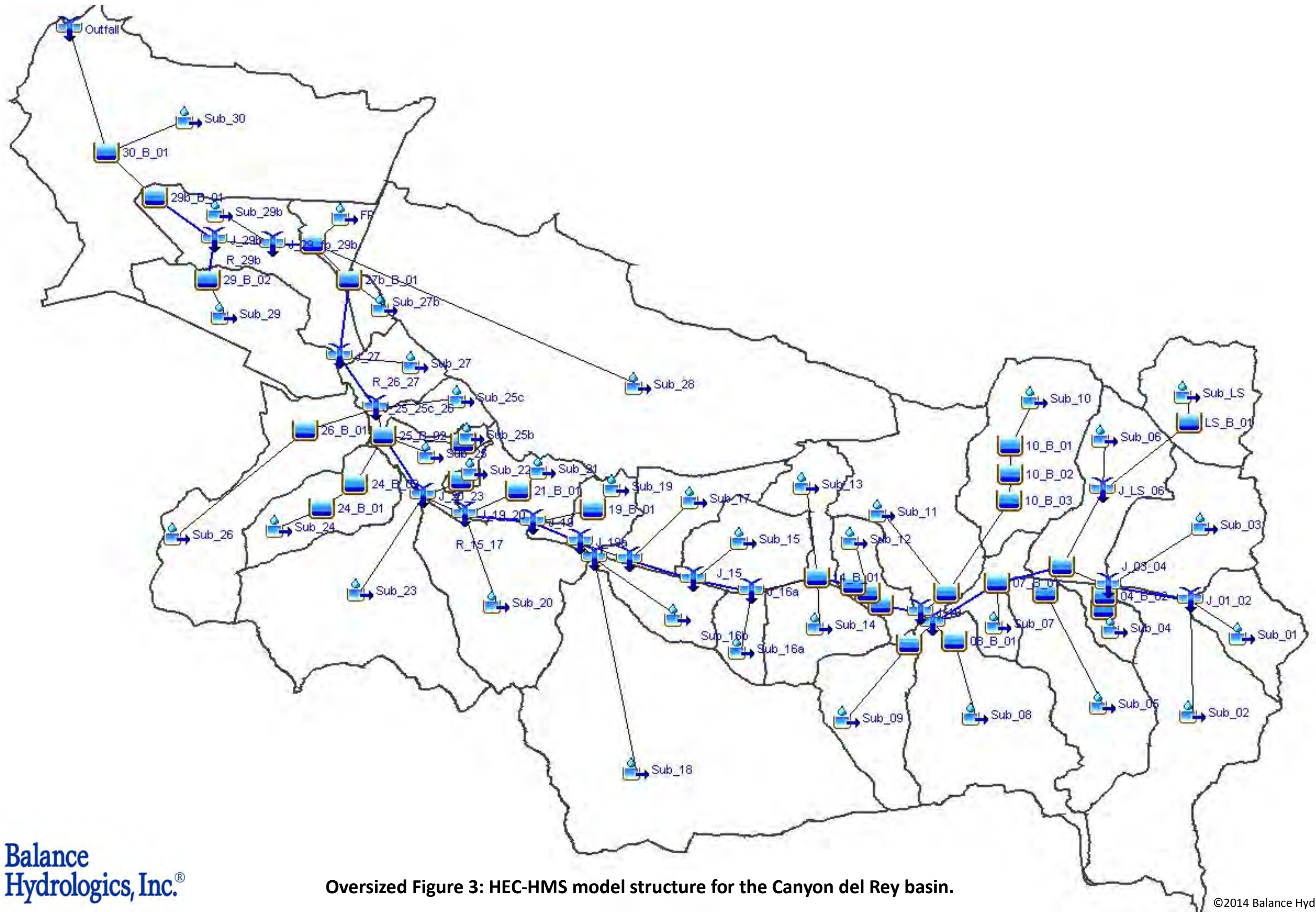
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SOUTHEAST END OF THE CONCRETE FOOTING FOR A GUARDRAIL, 58.3 M (191.3 FT) NORTH OF  
THE EXTENDED CENTER OF THE STREET, 4.7 M (15.4 FT) NORTHEAST OF THE CENTERLINE OF THE  
WESTBOUND LANES OF THE AVENUE, 0.6 M (2.0 FT) ABOVE THE LEVEL OF THE AVENUE, 0.15 M  
(0.5 FT) NORTHWEST OF THE SOUTHEAST END OF THE GUARDRAIL, AND 0.15 M (0.5 FT)  
SOUTHEAST OF A POST.

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SOURCE AERIAL PHOTOGRAPHY: AMBAG 2007

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Oversized Figure 3: HEC-HMS model structure for the Canyon del Rey basin.

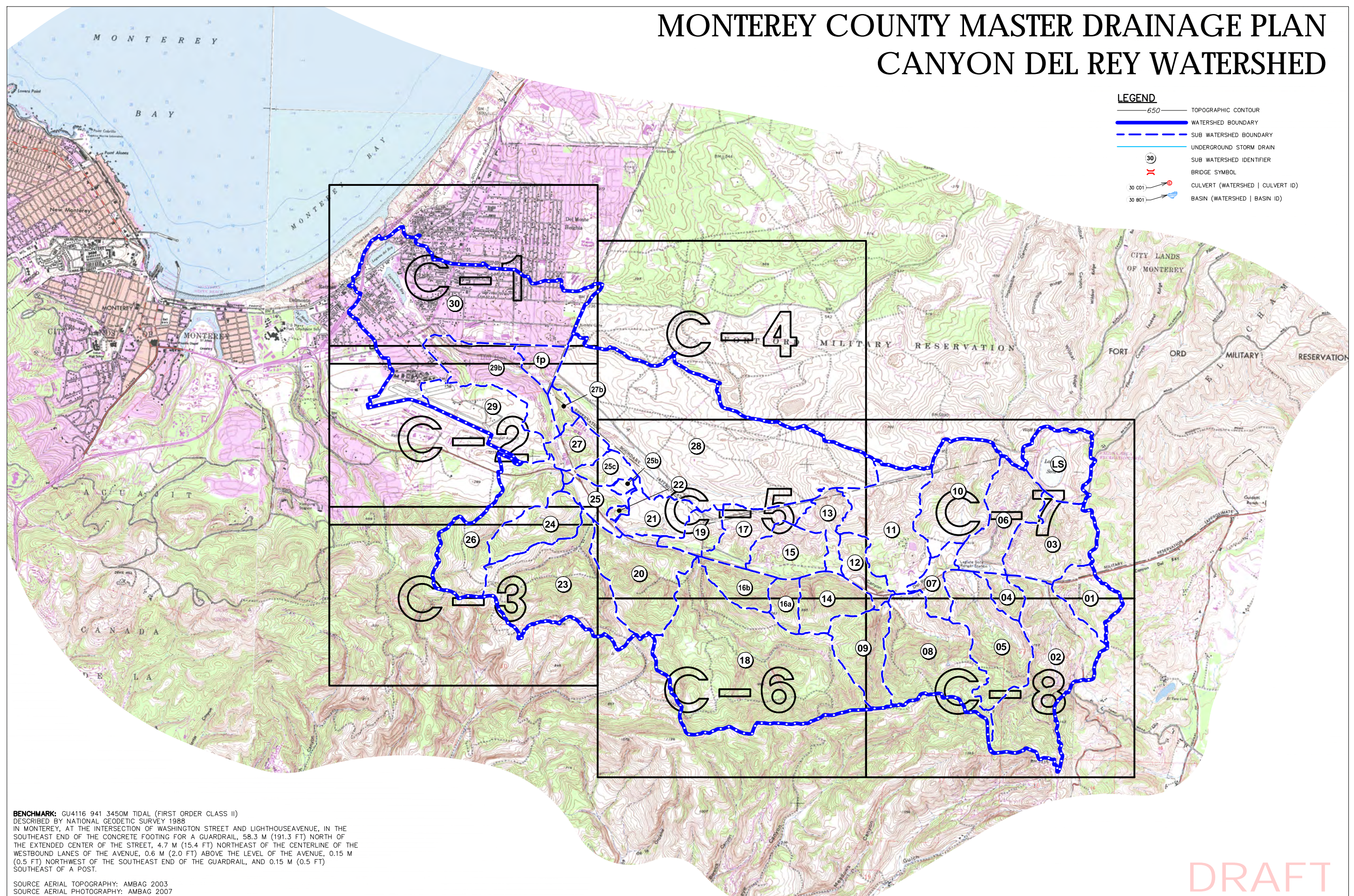
## **APPENDICES**

**APPENDIX A**  
**SUB-WATERSHED MAPS**



# MONTEREY COUNTY MASTER DRAINAGE PLAN CANYON DEL REY WATERSHED

- LEGEND**
- 650 TOPOGRAPHIC CONTOUR
  - WATERSHED BOUNDARY
  - SUB WATERSHED BOUNDARY
  - UNDERGROUND STORM DRAIN
  - SUB WATERSHED IDENTIFIER
  - BRIDGE SYMBOL
  - CULVERT (WATERSHED | CULVERT ID)
  - BASIN (WATERSHED | BASIN ID)



**BENCHMARK:** GU4116 941 3450M TIDAL (FIRST ORDER CLASS II)  
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(0.5 FT) NORTHWEST OF THE SOUTHEAST END OF THE GUARDRAIL, AND 0.15 M (0.5 FT)  
SOUTHEAST OF A POST.

SOURCE AERIAL TOPOGRAPHY: AMBAG 2003  
SOURCE AERIAL PHOTOGRAPHY: AMBAG 2007

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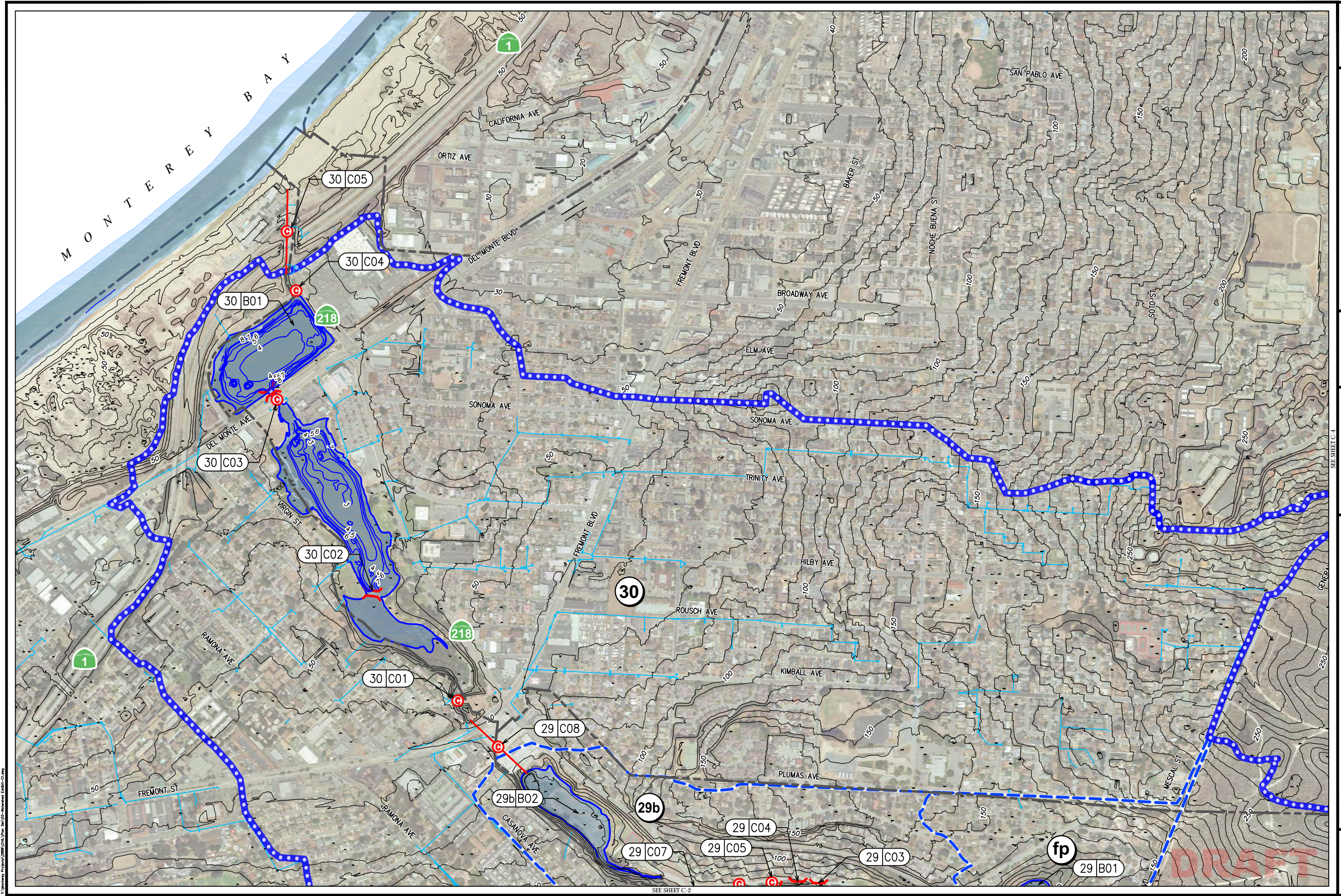
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CANYON DEL REY WATERSHED  
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Map 2/21/2014 - 2:10pm  
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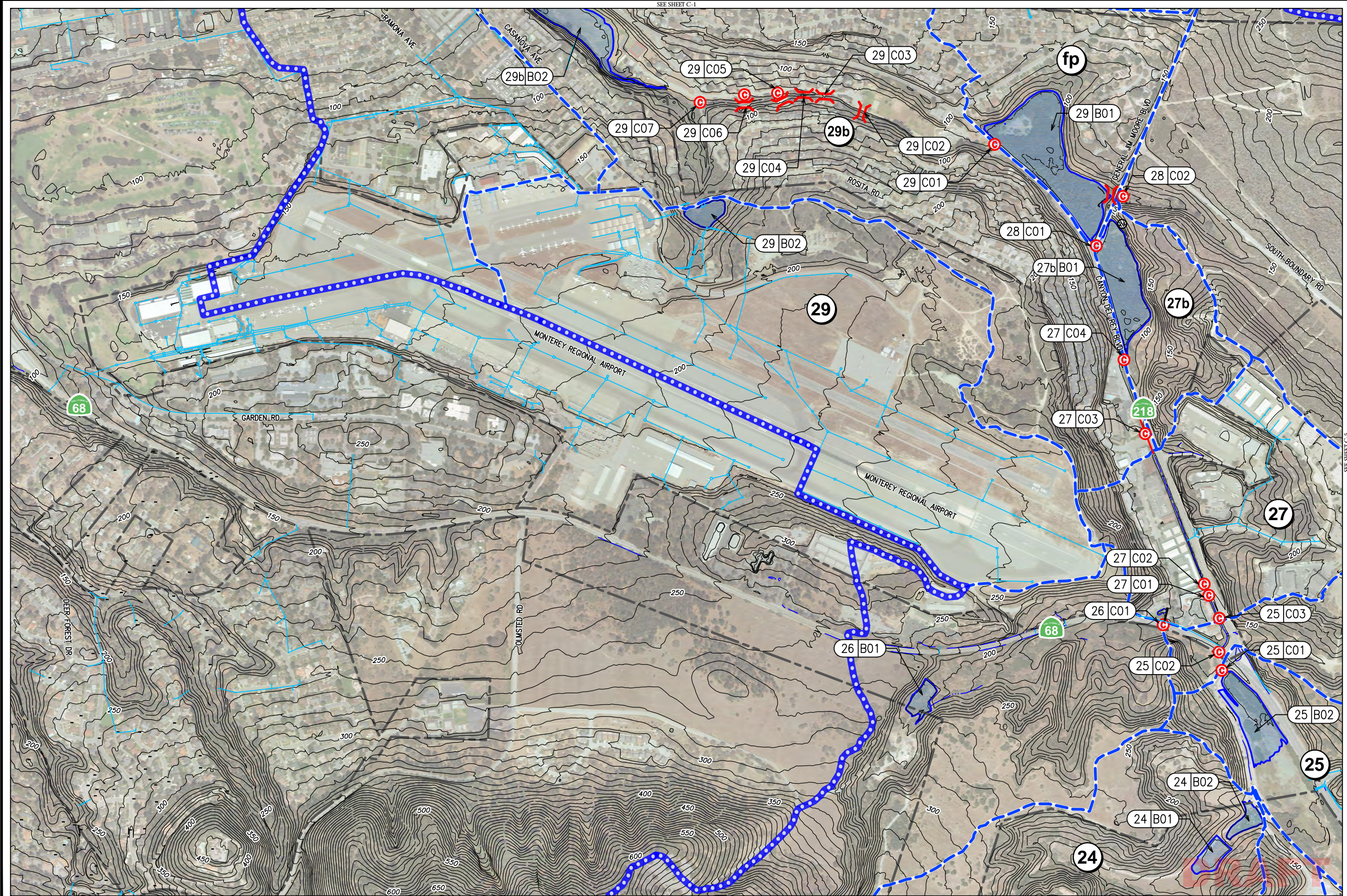
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 MONTEREY COUNTY WATER RESOURCES AGENCY

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 2 OF 9

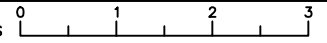


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SEE SHEET C-3

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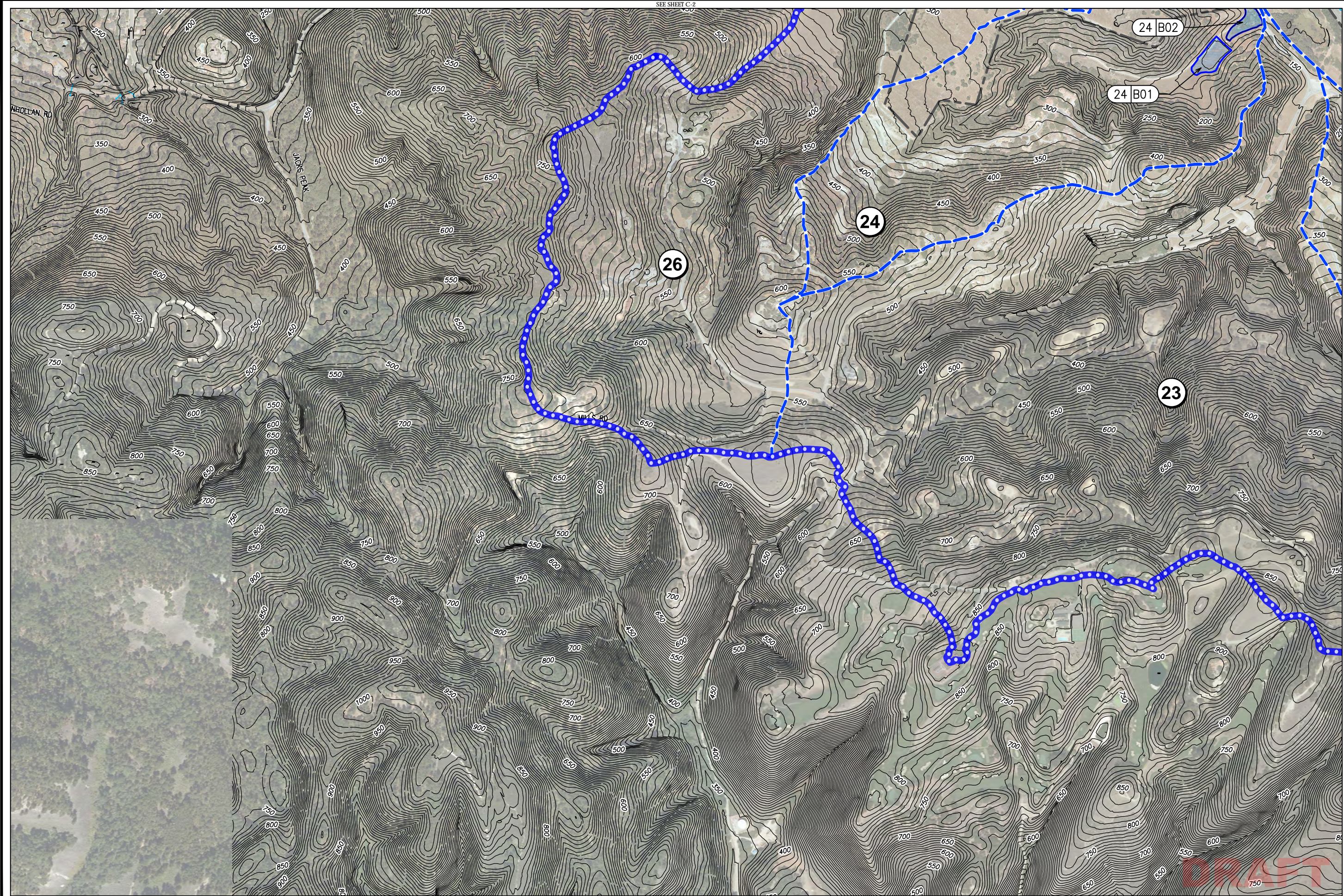
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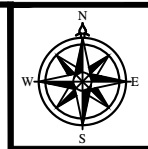
CANYON DEL REY WATERSHED  
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 1000 El Estero Lane, Suite 100, San Jose, CA 95128  
 Phone: (408) 434-2222 Fax: (408) 434-2222

**Balance Hydrologics, Inc.**  

 300 Broadway, Suite 100, San Francisco, CA 94111  
 Phone: (415) 774-1101

DATE: JUN. 27, 2013  
 SCALE: 1" = 400'  
 DRAWN BY: RPW  
 JOB #: 2885.01

SEE SHEET C-6

NO.	DATE	DESCRIPTION

**CANYON DEL REY WATERSHED**  
**MONTEREY COUNTY MASTER DRAINAGE PLAN**  
**MONTEREY COUNTY WATER RESOURCES AGENCY**

SHEET  
**C-3**

FOR REDUCED PLANS  
 ORIGINAL SCALE IS IN INCHES

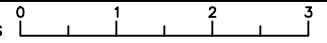


MAR 23, 2014 - 2:00PM  
 C:\Users\jwhitson\Documents\Projects\Monterey\Monterey County Master Drainage Plan\Monterey County Master Drainage Plan.dwg  
 JWHITSON

SEE SHEET C-1

SEE SHEET C-5

FOR REDUCED PLANS  
ORIGINAL SCALE IS IN INCHES



**WHITSON**  
**ENGINEERS**  
 CIVIL ENGINEERING AND LAND SURVEYING  
 300 BARNWELL WAY, SUITE 101, BLOOMINGTON, CA 94010  
 PHONE: 415.831.7510 FAX: 415.831.7506

**Balance**  
**Hydrologics, Inc.**  
 300 BARNWELL WAY, SUITE 101, BLOOMINGTON, CA 94010  
 PHONE: 415.831.7510 FAX: 415.831.7506



DATE: MAR 18, 2014  
 SCALE: 1" = 100'  
 DRAWN BY: RPW  
 JOB #: 2885.01

BY	DATE	DESCRIPTION

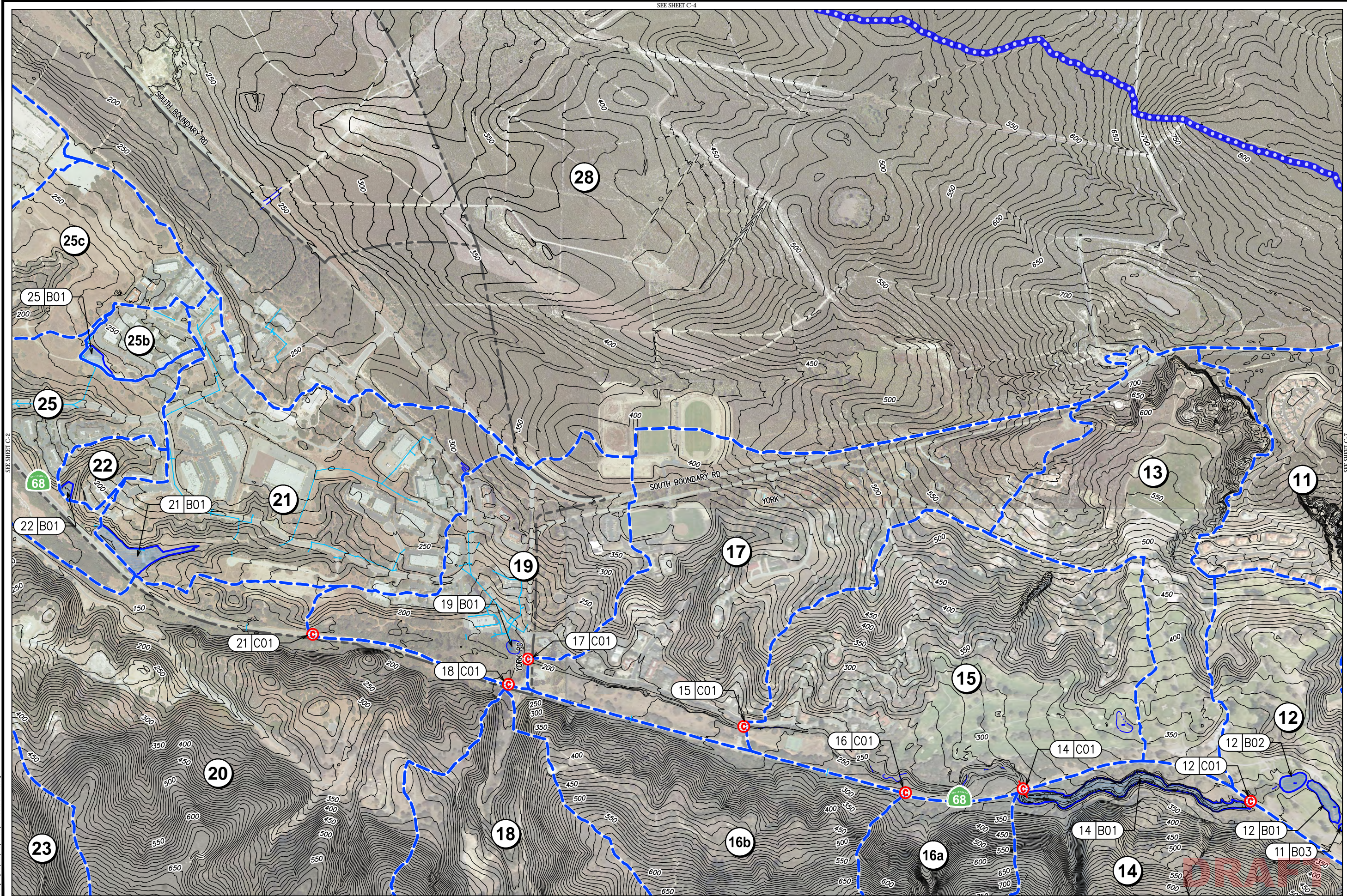
CANYON DEL REY WATERSHED  
 MONTEREY COUNTY MASTER DRAINAGE PLAN  
 MONTEREY COUNTY WATER RESOURCES AGENCY

SHEET

**C-4**

5 OF 9

SEE SHEET C-4

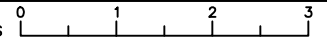


SEE SHEET C-2

DATE: 2/21/2014  
DRAWN BY: RPL  
JOB #: 2885.01

SEE SHEET C-6

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES



**WHITSON ENGINEERS**  
 CIVIL ENGINEERING & LAND SURVEYING  
 1000 Elgin Road, Suite 100, San Jose, CA 95128  
 Phone: (415) 448-2222 • Fax: (415) 448-2222

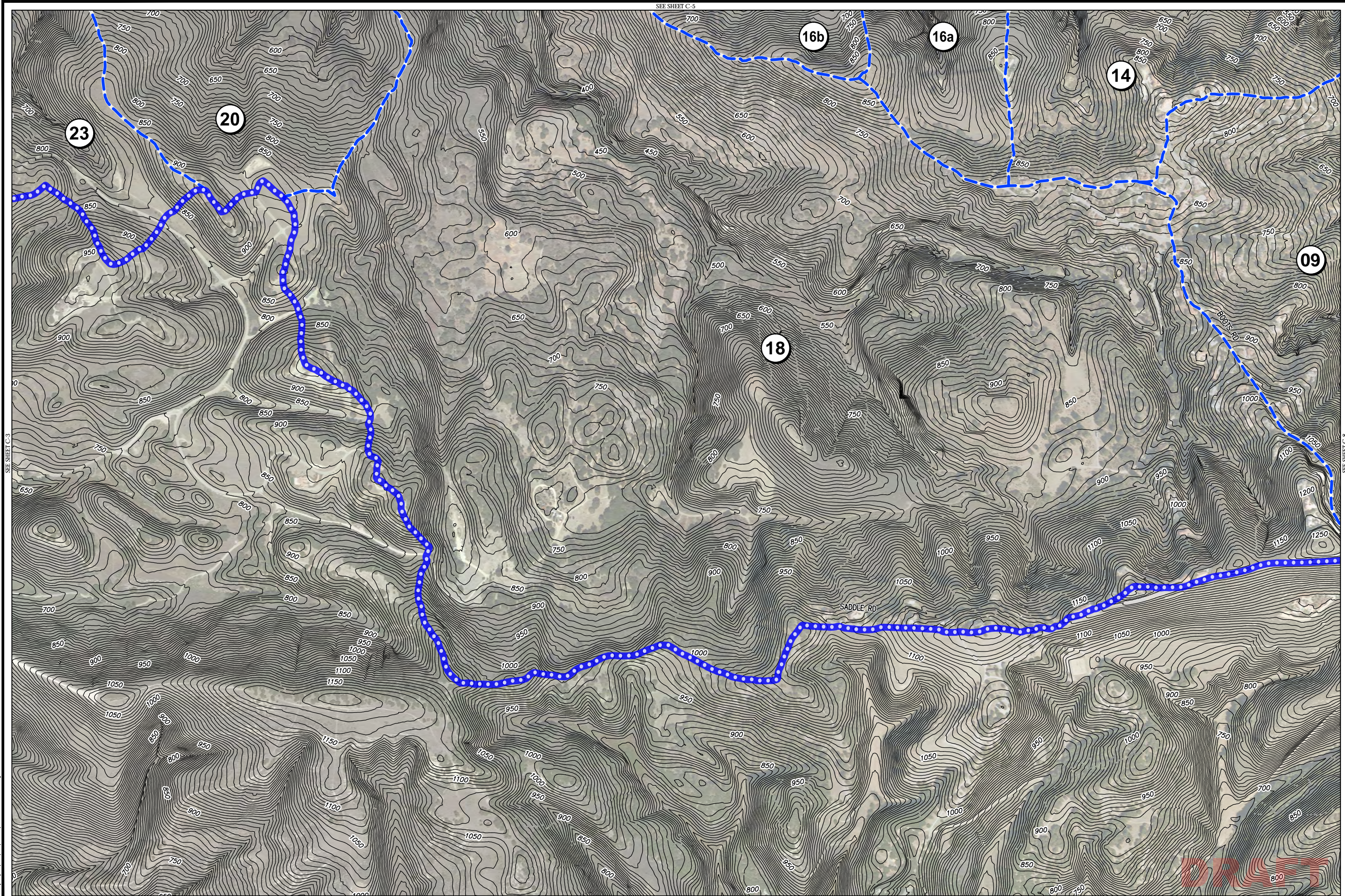
**Balance Hydrologics, Inc.**  
 300 Broadway, Suite 100, Berkeley, CA 94710  
 Phone: (415) 848-2222 • Fax: (415) 848-2222

DATE: MAR. 18, 2014  
 SCALE: 1" = 400'  
 DRAWN BY: RPL  
 JOB #: 2885.01

BY	DATE	DESCRIPTION

CANYON DEL REY WATERSHED  
 MONTEREY COUNTY MASTER DRAINAGE PLAN  
 MONTEREY COUNTY WATER RESOURCES AGENCY

SHEET  
**C-5**  
 6 OF 9



SEE SHEET C-3

SEE SHEET C-5



**WHITSON ENGINEERS**  
1000 Elgin Road, Suite 100, San Jose, CA 95128  
 Phone: (408) 253-1100 Fax: (408) 253-1101

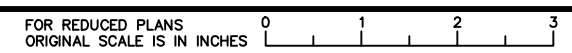
**Balance Hydrologics, Inc.**  
300 Broadway, Suite 100, Berkeley, CA 94710  
 Phone: (415) 863-2222 Fax: (415) 863-2222

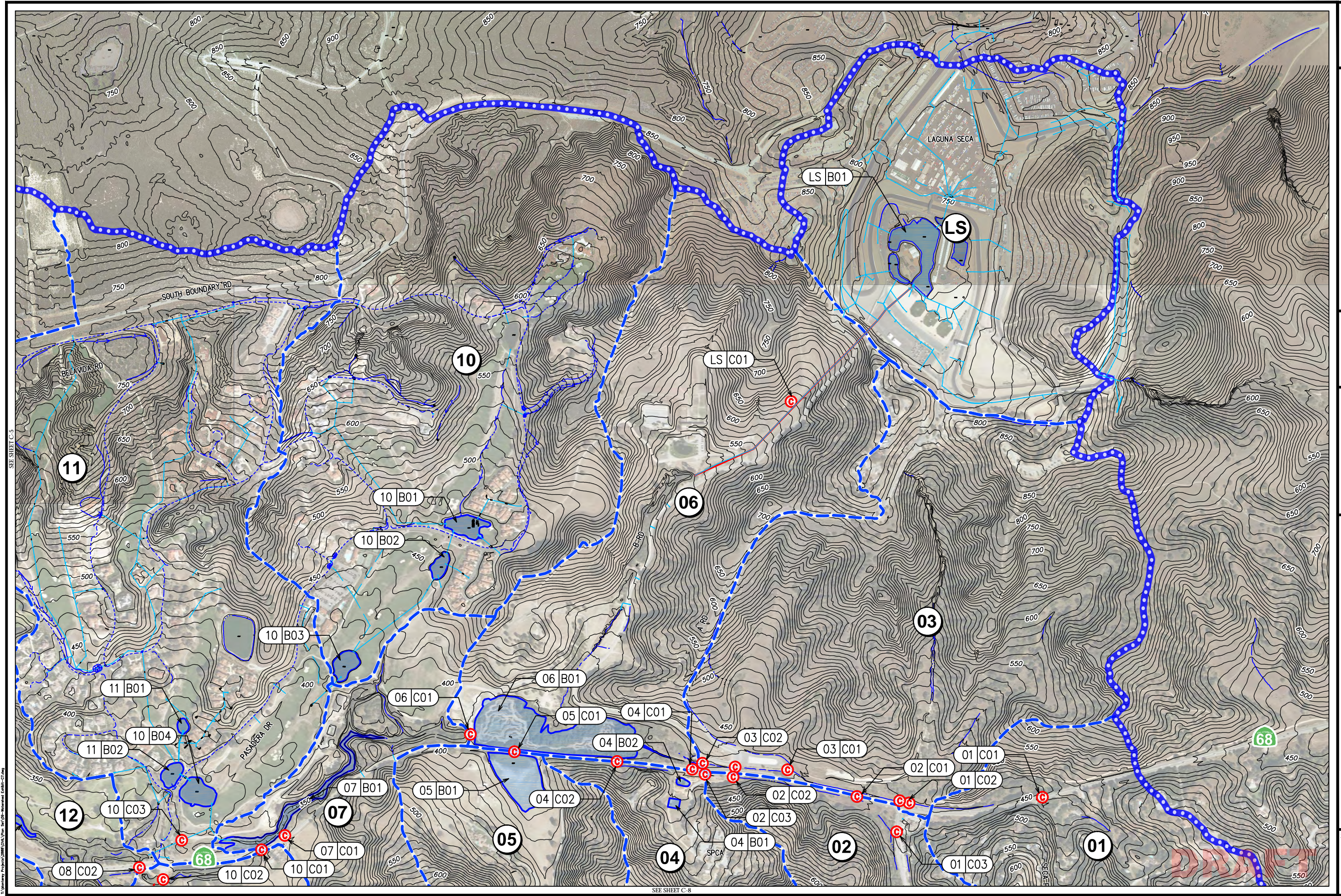
DATE: MAR. 18, 2014  
 SCALE: 1" = 100'  
 DRAWN BY: RPW  
 JOB #: 2885.01

BY	DATE	DESCRIPTION

CANYON DEL REY WATERSHED  
 MONTEREY COUNTY MASTER DRAINAGE PLAN  
 MONTEREY COUNTY WATER RESOURCES AGENCY

SHEET  
**C-6**





SEE SHEET C-5

DATE: 03/18/2014  
 SCALE: 1" = 100'  
 DRAWN BY: RPW  
 JOB #: 2885.02



**WHITSON ENGINEERS**  
 CIVIL ENGINEERING AND SURVEYING  
 1000 Elgin Road, Suite 100, San Jose, CA 95128  
 Phone: (408) 434-2222 Fax: (408) 434-2222

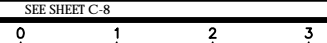
**Balance Hydrologics, Inc.**  
 800 Broadway, Suite 100, Berkeley, CA 94710  
 Phone: (415) 848-2222 Fax: (415) 848-2222

REVISIONS:	DATE:	DESCRIPTION:

**CANYON DEL REY WATERSHED  
 MONTEREY COUNTY MASTER DRAINAGE PLAN  
 MONTEREY COUNTY WATER RESOURCES AGENCY**

SHEET  
**C-7**  
 8 OF 9

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES







**APPENDIX B**  
**FACILITY INSPECTION RECORDS**

BASIN ID / PT. # RANGE: LS B-01

PROJECT# 2888.00

11447-11449

SURVEY DATE: 2013-0430

LOCATION: LAKE AT LAGUNA

SURVEY PARTY: TOM HANNAN

SECA RACEWAY

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \_\_\_\_\_

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 3' W. 8' N.

DESCRIBE DEBRIS: NONE

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: X

ELEV. HIGH WATER MARKS: 748.64

MED. FLOW ORIFICE/OUTLET DIMENSIONS: X

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: X

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 15" DIA.

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: ~~739.05~~ 743.14 (1 IN. - 15")

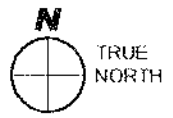
CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:

NO RISER

WATER LINE, 4/29/13 @ 1 P.M. = 746.74

VISIBLE HIGH WATER MARK: 748.64



COMMENTS:

FLOW LEVEL ADJUSTABLE BY MEANS OF

GATE. 746.85 (HIGHEST) 738.85 (LOWEST)

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET  
**1**  
OF

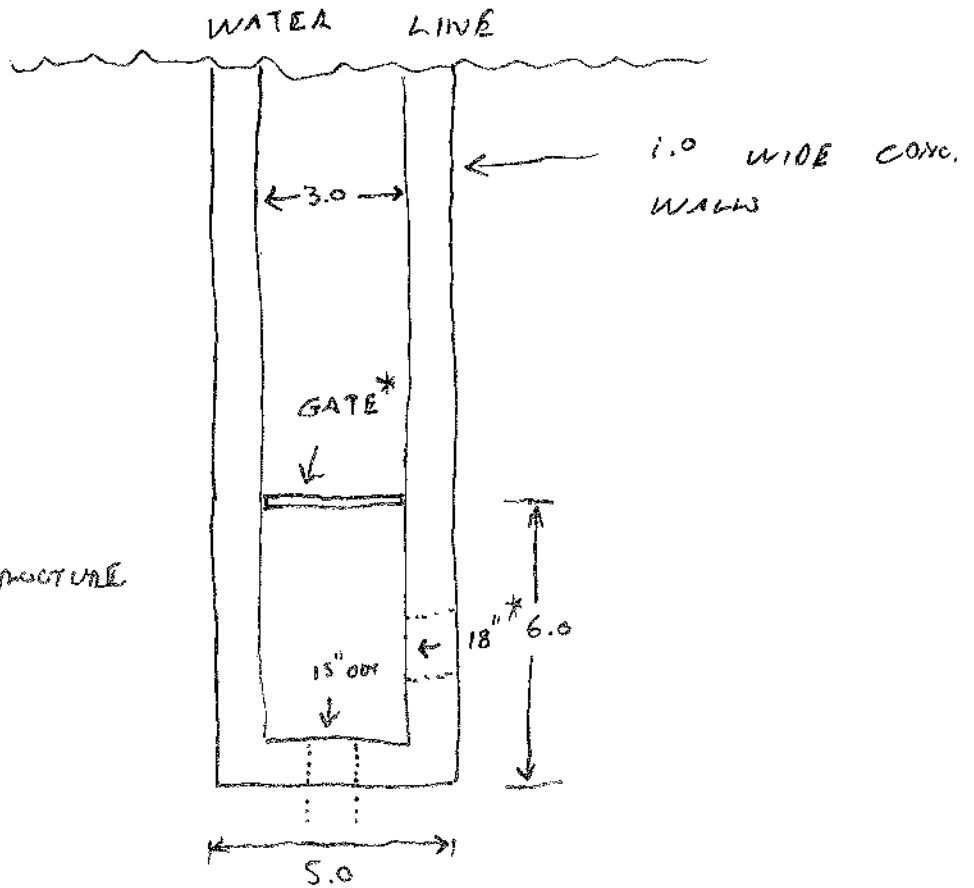


# WITTON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

CANYON DEL REY 2888.00  
2013-0430  
SANTA CRUZ TN  
DATE:

STRUCTURE AT LS\_B\_01



BOTTOM OF STRUCTURE  
= 742.94

INV. = 743.14

\* GATE ADJUSTABLE

\* ORIGIN OR DESTINATION OF 18" H.D.P.E. UNKNOWN

15" OUT TO SOUTHWEST ASSUMED TO BE LS\_C\_01

CULVERT ID: LS\_C\_01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0430

GENERAL LOCATION: LAKE AT LAGUNA

SURVEY PARTY: TOM HANNAH

SECA RACEWAY

SURVEY POINT #'s: 11452

INVERT (UPSTREAM) ELEVATION: 743.14  
~~739.05~~

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

INVERT (DOWNSTREAM) ELEVATION: 507.75

UPSTREAM DEBRIS DESCRIPTION

LENGTH 2640' +/- SHAPE ROUND

NONE

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION  
BROKEN CONCRETE / RUBBLE

DIMENSIONS (DIAMETER / W X H): 15" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.P.P.

HIGH WATER (UPSTREAM) ELEVATION: 748.64

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NONE

VISIBLE

SPIII CREST ABOVE CULVERT: 751.0

ANGLE (FROM NORTH) N. 49° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NO (STRUCTURE)

-SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING ■ LAND SURVEYING ■ PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

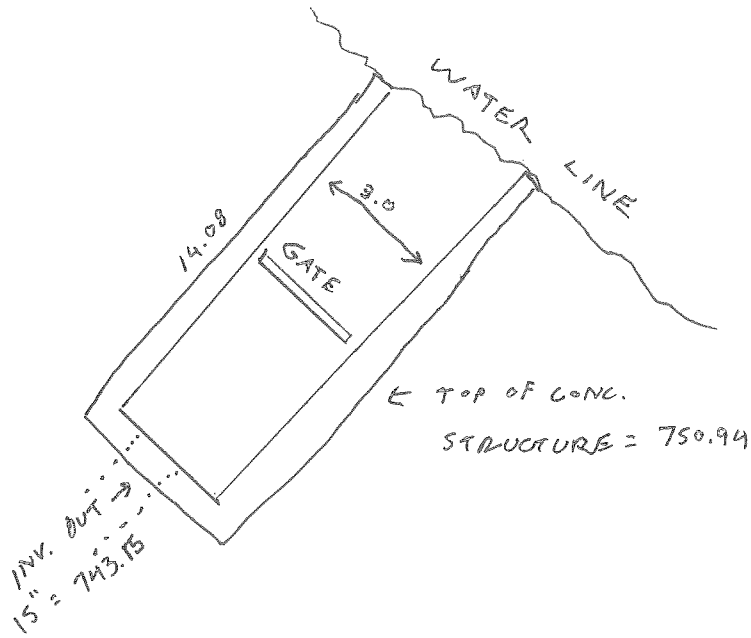
DATE 2013-0515 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.W. DATE \_\_\_\_\_

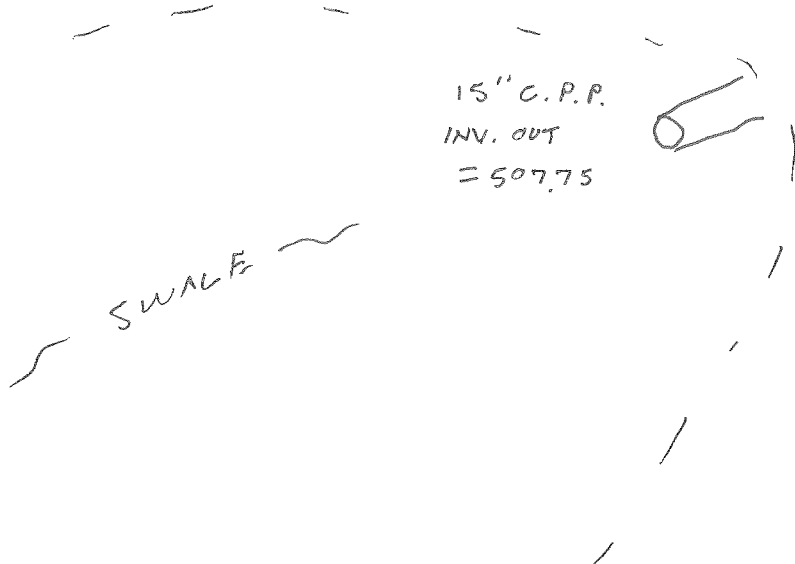
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

LS-C-01 NORTH (UPSTREAM)

NOT TO SCALE



LS-C-01 SOUTH (DOWNSTREAM)



CULVERT ID: 01\_C\_01

PROJECT# 2888.00

1977 ID (IF ANY) 2

SURVEY DATE: 2013-0204

GENERAL LOCATION: CROSSING UNDER

SURVEY PARTY: TOM HANNAH

HWY. 68 1/4 Mi.

SIMON LAGUENS

EAST OF LAURELES GRADE

SURVEY POINT #s: 10156-10166

INVERT (UPSTREAM) ELEVATION: 444.64

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SAND / MUD

INVERT (DOWNSTREAM) ELEVATION: 443.40

UPSTREAM DEBRIS DESCRIPTION  
LEAF LITTER, TRASH

LENGTH 95.68' SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION  
LEAF LITTER

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 18" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P. w/ CONC.

HIGH WATER (UPSTREAM) ELEVATION: NOT  
VISIBLE

TRASH RACK? Y N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT  
VISIBLE

SPILL CREST ABOVE CULVERT: 460.0 +/-

ANGLE (FROM NORTH) N 20° W

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
ALOTVE SAND / MUD

-SEE SKETCHES ATTACHED-



COMMENTS: STRUCTURE WAS CONC. HEADWALL AT SOUTH  
← (UPSTREAM) END AND A CONC. FLARE  
AT DOWNSTREAM END.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg PROJECT No.:



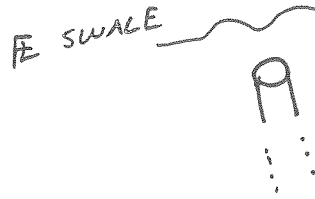
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

01-G-01

NOT TO SCALE



18" R.C.P.  
INV. = 443.80

HWY. 68



← 8" CONC. HEADWALL

18" R.C.P.  
INV. = 444.64



CULVERT ID: 01-C-02 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0204  
 GENERAL LOCATION: N. OF HWY 68, SURVEY PARTY: TOM HANNAH  
PARALLEL TO HWY. 68  
@ BOTTOM OF LIVABLESS GRADE  
 SURVEY POINT #s: 10026-10039 TWO CULVERTS - EAST AND WEST

INVERT (UPSTREAM) ELEVATION: E. - 424.39 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
W. - 423.84 NONE  
E. - 424.12  
 INVERT (DOWNSTREAM) ELEVATION: W. - 423.43 UPSTREAM DEBRIS DESCRIPTION  
E. - 41.20 WEEDS AND VEGETATION  
 LENGTH W. - 40.26 SHAPE ROUND  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
 DIMENSIONS (DIAMETER / W X H): 18" I.D. WEEDS, MINOR  
 CULVERT MATERIAL TYPE: C.M.P. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE OUTLET OF WEST CULVERT  
 DAMAGED, FLOW NOT AFFECTED.  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE TRASH RACK?  IF YES, DESCRIPTION:  
E. - 426.45  
 SPILL CREST ABOVE CULVERT: W. - 426.00 ANGLE (FROM NORTH) N. 77° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
2" SILT (EAST)  
2" SILT (WEST)



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____ OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.:	CHECKED: _____	



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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

01\_C\_02

NOT TO SCALE



18" C.M.P  
INV. IN = 423.84  
INV. OUT = 423.43

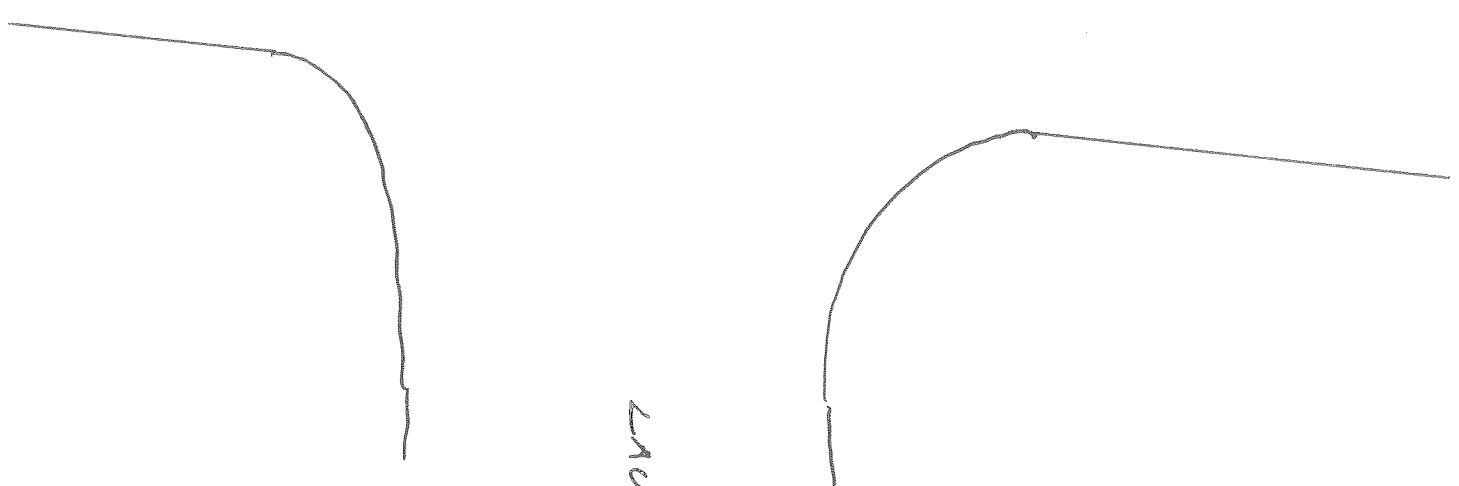
18" C.M.P  
INV. IN = 424.39  
INV. OUT = 424.12

SWALE



HWY. 68

LAURELESS GRADE ROAD



CULVERT ID: 01 - C - 03

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0204

GENERAL LOCATION: CROSSING UNDER  
LAURELES GRADE  
S. OF HWY. 68

SURVEY PARTY: TOM HANNAH  
SIMON LAGUENS

SURVEY POINT #'s: 10005-08, 10156

INVERT (UPSTREAM) ELEVATION: 424.45

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
OUTLET SILTED IN 75% (423.86)

INVERT (DOWNSTREAM) ELEVATION: 422.36

UPSTREAM DEBRIS DESCRIPTION  
NONE. (STRUCTURE HAD 0.5' +/-  
STANDING WATER)

LENGTH 74.77 SHAPE ROUND

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

NONE

DIMENSIONS (DIAMETER / W X H): 24" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /

CULVERT MATERIAL TYPE: C.M.P.

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: NOT  
VISIBLE (CATON BASIN)

TRASH RACK? Y  IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_  
- SEE COMMENTS -

SPILL CREST ABOVE CULVERT: 426.4 =  
TOP OF GRATE

ANGLE (FROM NORTH) N 88° W

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

NONE.



COMMENTS: CULVERT FLOWS OUT TO A SMALL,  
SHALLOW SWALE. NO HIGH WATER  
MARK VISIBLE.

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING ■ LAND SURVEYING ■ PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

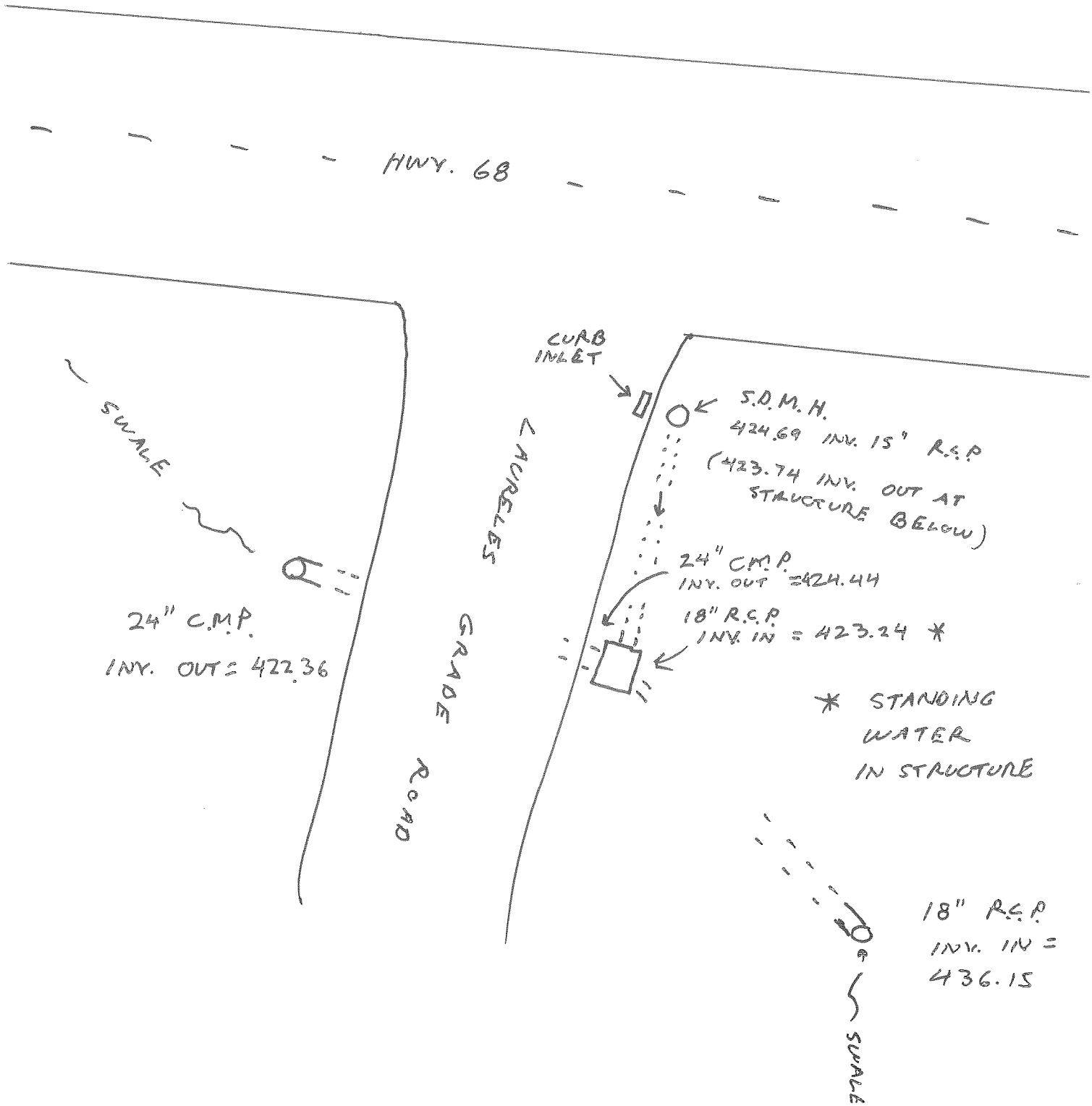
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

01-C-03

NOT TO SCALE



CULVERT ID: 02 - C - 01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0131

GENERAL LOCATION: CROSSING HWY.  
68 JUST WEST  
OF LAURELES GRADE

SURVEY PARTY: TOM HANNAM

SURVEY POINT #s: 10016-10024, 10040-10045

INVERT (UPSTREAM) ELEVATION: 414.52

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

SAND/SILT 2"-6"

INVERT (DOWNSTREAM) ELEVATION: 413.17  
105 (N.E.)

UPSTREAM DEBRIS DESCRIPTION

NONE

LENGTH 110 (S.W.) SHAPE OVAL

NUMBER OF BARRELS 2

DOWNSTREAM DEBRIS DESCRIPTION

NONE

DIMENSIONS (DIAMETER / W X H): 28" X 20" (2)

PHYSICAL CONDITION: SOUND / CRACKED /

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: NOT  
VISIBLE

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT  
VISIBLE

SPILL CREST ABOVE CULVERT: 417.03

ANGLE (FROM NORTH) N 29° W

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SAND/SILT 2"-6"

-SEE SKETCHES ATTACHED-



COMMENTS: UPSTREAM AND DOWNSTREAM ENDS

ARE FLARED, WITH RIP-RAP

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

02-C-01

NOT TO SCALE

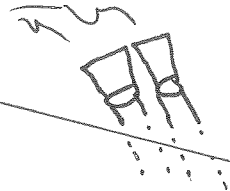


INV. OUT =  
413.17

28" W. X 20" H.  
ELLIPTICAL R.C.P. (2)

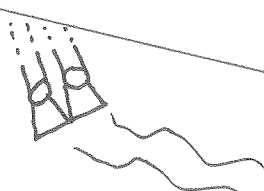
W/ FLARES AND RIP-RAP

SWALE ~



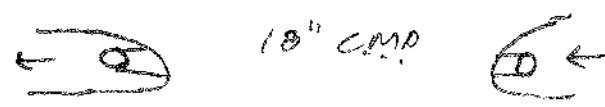
← HWY. 68 →

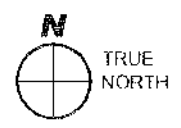
INV. IN = 414.52




SWALE ~

CULVERT ID: 02\_C\_02 PROJECT# 2888,00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0426  
 GENERAL LOCATION: JUST EAST OF SURVEY PARTY: TOM HANNAH  
S.P.C.A. ENTRANCE. SOUTH OF  
AND RANLELL WITH HWY 68  
 SURVEY POINT #s: 11353 - 11368

INVERT (UPSTREAM) ELEVATION: 402.59 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SAND/SILT 402.2  
 INVERT (DOWNSTREAM) ELEVATION: 401.72 UPSTREAM DEBRIS DESCRIPTION  
.2 SEDIMENT  
 LENGTH 30' SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
.5 SEDIMENT.  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 18" DIA. SOME DAMAGE TO ENDS  
 CULVERT MATERIAL TYPE: C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 404.4 ANGLE (FROM NORTH) N. 84° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
SAND/SILT 402.8  18" C.M.P.



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET  OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.: _____	CHECKED: _____	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

02-C-02 (NORTH)

NOT TO SCALE



15" C.M.P. (2)

INV. OUT =  
400.40

INV. IN = 400.72



← HWY. 68 →





# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY


LOS ANGELES

SANTA CRUZ


PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

02 - C - 02 SOUTH

- - - - - HWY. 68 - - - - -

~ SWALE ~   
 INV. OUT  
 = 401.72


DIRT DRIVEWAY

 ~ SWALE ~  
 18" C.M.P.  
 INV. IN  
 = 402.59

CULVERT ID: 02-C-03 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0426  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
S.P.C.A. DRIVEWAY  
ENTRANCE  
 SURVEY POINT #s: 11371-11394

INVERT (UPSTREAM) ELEVATION: 398.21 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SAND/SILT 397.52  
 INVERT (DOWNSTREAM) ELEVATION: 397.02 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 50.88 SHAPE ROUND  
 NUMBER OF BARRELS | DOWNSTREAM DEBRIS DESCRIPTION  
 DIMENSIONS (DIAMETER / W X H): 18" DIA. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: C.P.P. OUTLET 50% PLUGGED  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK?  IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 400.3 ANGLE (FROM NORTH) N. 86° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
SAND/SILT 398.3

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____ OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.: _____	CHECKED: _____	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES                      SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TN DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE



- - - - - ← HWY. 68 → - - - - -

- SWALE ~ O ~ ~ ~  
18" C.P.P.  
INV. OUT = 397.02

PAVED  
DRIVEWAY  
(S.P.C.A.)

~ ~ O ~ SWALE ~  
18" C.P.P.  
INV. IN = 398.21

CULVERT ID: 03-C-01

PROJECT# 2888.00

1977 ID (IF ANY) 4

SURVEY DATE: 2013-0131

GENERAL LOCATION: CROSSING UNDER  
E. GATE TO  
LAGUNA SECA

SURVEY PARTY: TOM HANNAH

SURVEY POINT #s: 10101-10122

INVERT (UPSTREAM) ELEVATION: 404.32

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
LIGHT SAND/SILT

INVERT (DOWNSTREAM) ELEVATION: 404.00

UPSTREAM DEBRIS DESCRIPTION

LENGTH 59.17 SHAPE OVAL

NONE

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

NONE

DIMENSIONS (DIAMETER / W X H): 48" x 30"

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
- SEE COMMENTS -

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

TRASH RACK? Y/N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: 408.01

ANGLE (FROM NORTH) N 81° E

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

LIGHT SAND/SILT



COMMENTS:

SOME DAMAGE TO PIPE AT BOTH UPSTREAM  
AND DOWN STREAM ENDS. DAMAGE DOES  
NOT APPEAR TO IMPACT FLOW.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET

PROJECT No.:

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.H. DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

03\_C.01

INY. OUT  
48" W. x 30" H.  
C.M.P. = 404.0

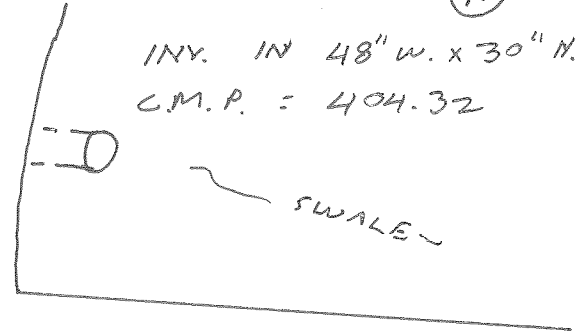


PAVED  
ACCESS  
(GATED)

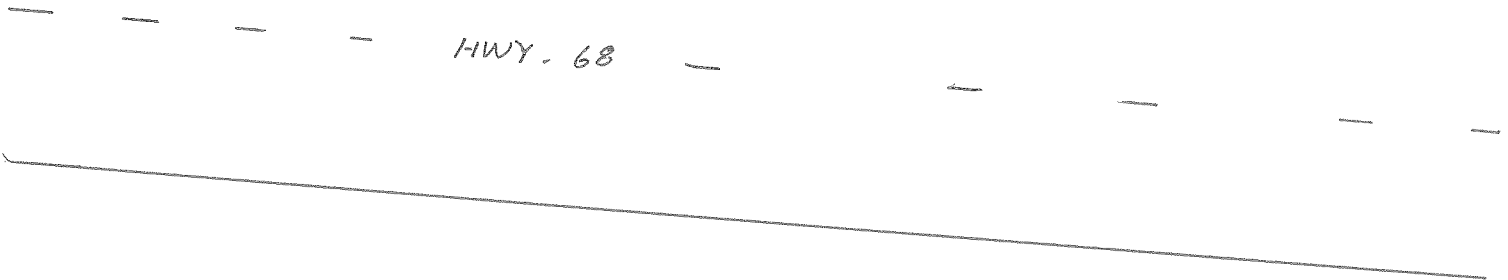
NOT TO SCALE



INY. IN 48" W. x 30" H.  
C.M.P. = 404.32



HWY. 68



CULVERT ID: 03\_C\_02

PROJECT# 2888.00

1977 ID (IF ANY) 7 IN (REPLACED SINGLE)

SURVEY DATE: 2013-0131

GENERAL LOCATION: CROSSING UNDER

SURVEY PARTY: TOM HAINNAM

MAIN ENT. TO

LAGUNA SECA RACEWAY

SURVEY POINT #s: 10123 - 10154

INVERT (UPSTREAM) ELEVATION: 394.35

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
PIPE IS CLEAN NO SEDIMENT

INVERT (DOWNSTREAM) ELEVATION: 393.02

UPSTREAM DEBRIS DESCRIPTION

LENGTH 55.85 SHAPE ROUND

NONE

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

NONE

DIMENSIONS (DIAMETER / W X H): 40" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
- SEE COMMENTS -

CULVERT MATERIAL TYPE: H.D.P.E.

HIGH WATER (UPSTREAM) ELEVATION: MARKS  
NOT VISIBLE

TRASH RACK? Y / N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: MARKS  
NOT VISIBLE

SPILL CREST ABOVE CULVERT: 398.67

ANGLE (FROM NORTH)

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

PIPE IS CLEAN NO  
SEDIMENT



COMMENTS: SOME SCOURING AT NORTH END OF HEADWALL

(UPSTREAM) SEE PHOTO. CONC. APRON AT

DOWNSTREAM END APPEARS TO BE UNDERMINED.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_

PROJECT No.: \_\_\_\_\_



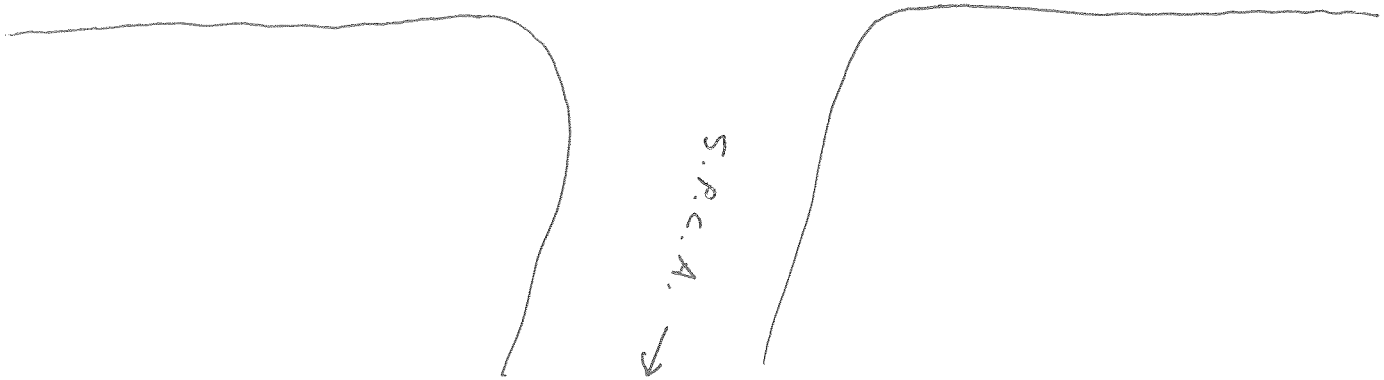
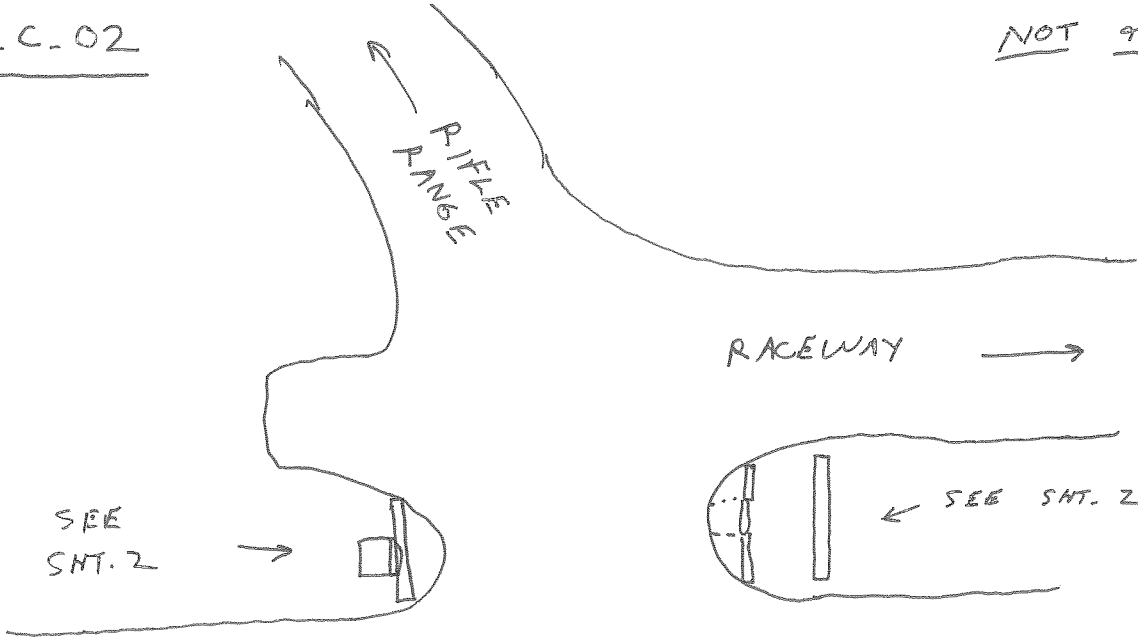
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY                      LOS ANGELES                      SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. 1 of 2  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

03\_C-02

NOT TO SCALE





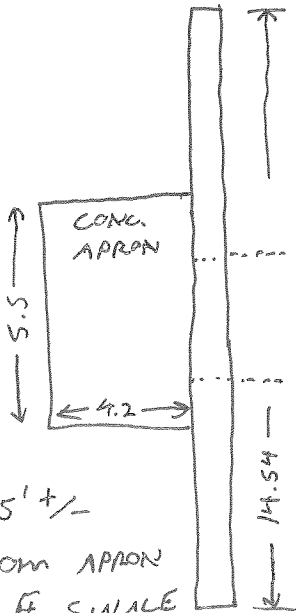
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-05-14 SHEET No. 2 of 2  
CALCULATED BY TW DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

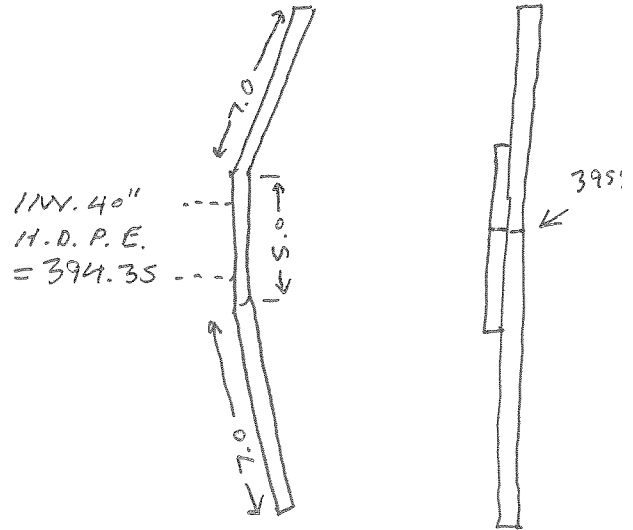
03\_C\_02

8" CONG. HEADWALL TOP = 390.51



1 IN. 40" H.D.P.E.  
= 393.02

10" CONG. HEADWALL

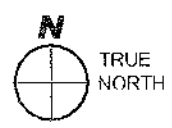


12" W. CONG. "V" WEIR  
(SEE PHOTOS)



BASIN ID / PT. # RANGE: 04\_B\_01 PROJECT# 2888.00  
11405-11417, 11427-11428 SURVEY DATE: 2013-0426  
 LOCATION: SOUTH OF HWY. 68 SURVEY PARTY: TOM HANNAH  
@ S.P.C.A.  
FACILITY

BASIN ON LINE OR OFF LINE: \_\_\_\_\_ DIMENSIONS OF RISER: 2.65x2.65 (2'x2' GRATE)  
 INVERT (IN) ELEVATION: NO INLET STRUCTURE ELEVATION OF SEDIMENT, IF ANY: NONE  
 LOW FLOW ORIFICE OUTLET DIMENSIONS: 0.5' DIA. DESCRIBE DEBRIS: NONE  
 LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 413.0 ELEV. HIGH WATER MARKS: 413.2  
2'x2'  
 MED. FLOW ORIFICE/OUTLET DIMENSIONS: 415.0 PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN  
(TOP OF GRATE) PHOTOS FOLDER:  
 MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 415.0 ATTACHED SKETCHES OF ABOVE  
 HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 5.7' WIDE, 0.85 HIGH  
 HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 415.0  
 CULVERT INLET OR OUTLET? (COMPLETE CULVERT  
 FORM) Y  
 RISER PRESENT? IF YES, COMPLETE THE CULVERT  
 FORM AND NOTE THE FOLLOWING:  
Y



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BASIN SURVEY</b>	DATE: _____	SHEET  <b>1</b>  OF
	MONTEREY COUNTY CALIFORNIA	SCAIF: _____	
	<b>CANYON DEL REY WATERSHED</b>	DRAWN: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg	CHECKED: _____	
		PROJECT No.: _____	

CULVERT ID: N.A. GORIS WITH 04\_B.01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0426

GENERAL LOCATION: SOUTH OF HWY. 68  
AT S.P.C.A.

SURVEY PARTY: TOM HANNAH

SURVEY POINT #s: 11413-11417

INVERT (UPSTREAM) ELEVATION: 415.0 (TOP OF BOX)  
411.5 (PIPE)

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

INVERT (DOWNSTREAM) ELEVATION: 410.52

UPSTREAM DEBRIS DESCRIPTION  
NONE

LENGTH 47.63 SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION  
NONE

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 18" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.P.P.

HIGH WATER (UPSTREAM) ELEVATION: 413.2

TRASH RACK? Y /  IF YES, DESCRIPTION:

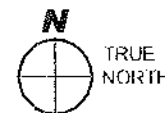
HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: 415.0

ANGLE (FROM NORTH) N. 10° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

-SEE SKETCHES ATTACHED-



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

PROJECT No.:

OF



# WHITSON ENGINEERS

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MONTEREY LOS ANGELES SANTA CRUZ

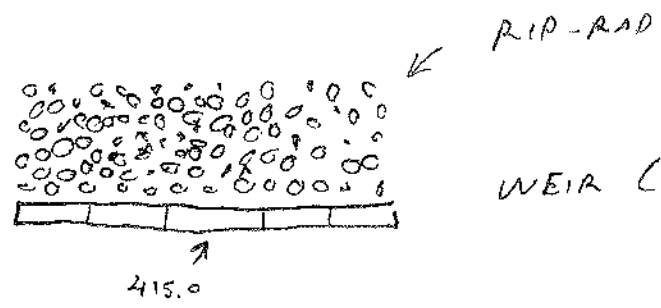
CANYON DEL REY  
2013-0501  
DATE PLOTTED: 7/11/13  
CHECKED BY:

2,888.00  
SHEET 1 OF 2  
DATE:

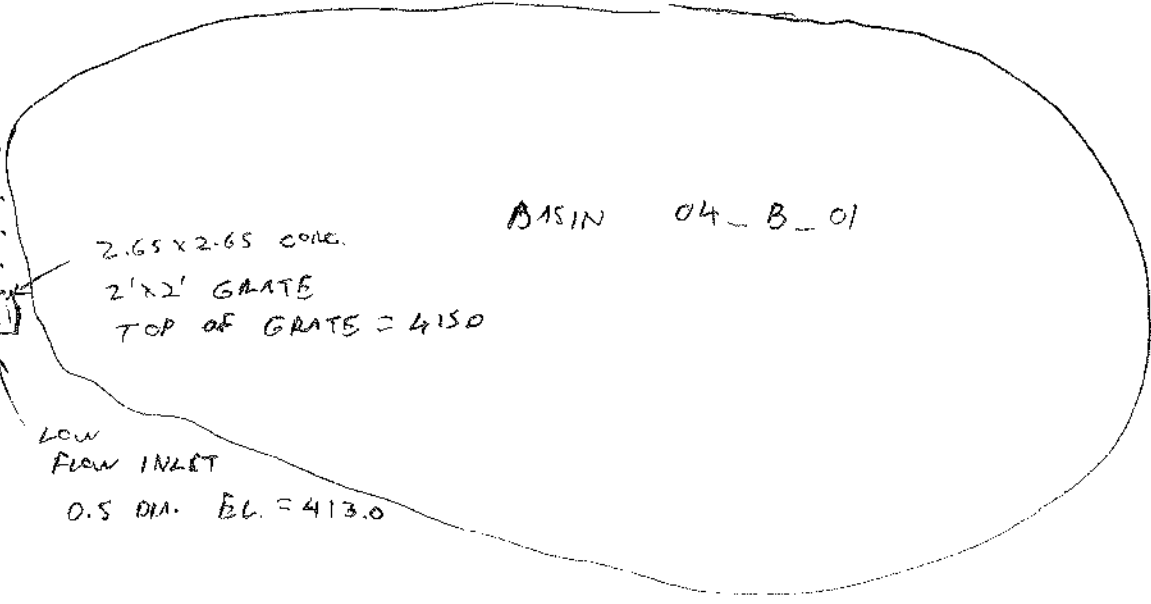
NOT TO SCALE



← RIP-RAP  
← 18" C.P.P.  
w/ FLARE



WEIR (SEE DETAIL NEXT PAGE)



2.65 x 2.65 CONC.  
2' x 2' GATE  
TOP OF GATE = 415.0

LOW  
FLOW INLET  
0.5 DIA. EL. = 413.0

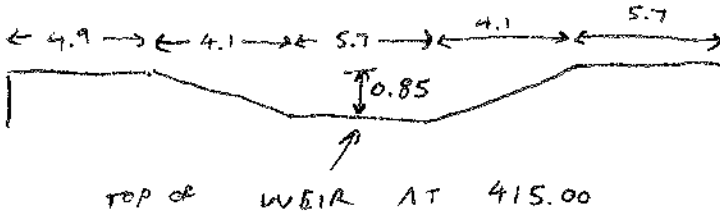


WITELSON ENGINEERS  
Civil Engineers & Land Surveyors - President: MANAGEOSKI  
LOS ANGELES SANTA CRUZ

PROJECT: CANYON DEL REY  
DATE: 2013-05-01  
DESIGNED BY: TM  
CHECKED BY:

PRICE: 2880.00  
SHEET: 2 OF 2  
DATE:  
JOB:

### DETAIL, WEIR



BASIN ID / PT. # RANGE: 04\_B\_02

PROJECT# 2888.00

11418-11437

SURVEY DATE: 2013-0426

LOCATION: SOUTH OF HWY. 68

SURVEY PARTY: TOM HANNAH

@ S.P.C.A.

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO STRUCTURE

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 12" DIA.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 400.30

ELEV. HIGH WATER MARKS: 401.86

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) 12" PVC OUTLET EL. = 400.30

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING: \_\_\_\_\_



COMMENTS: POND FED BY DRAINAGE SWALES.  
ONLY OUTLET VISIBLE IS 12" P.V.C. WHICH  
FLOWS OUT TO SWALE PARALLEL TO HWY. 68

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

#### CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET
1
OF



WHITSON ENGINEERS

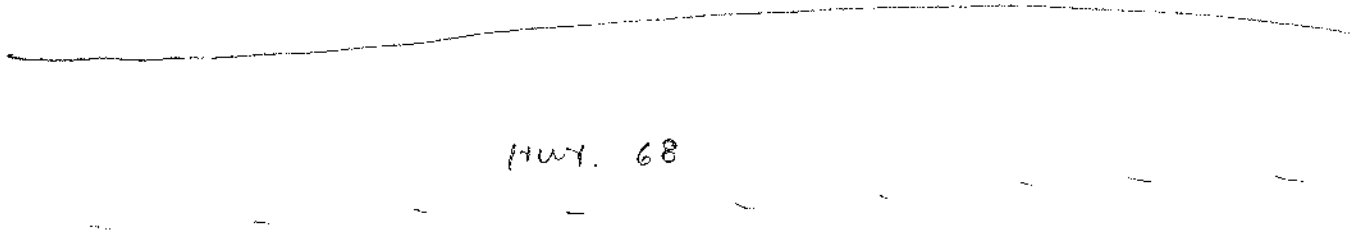
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT: CANYON DEL REY 2888.06  
DATE: 2013-05-01  
CALCULATED BY: FH  
CHECKED BY:  
DATE:

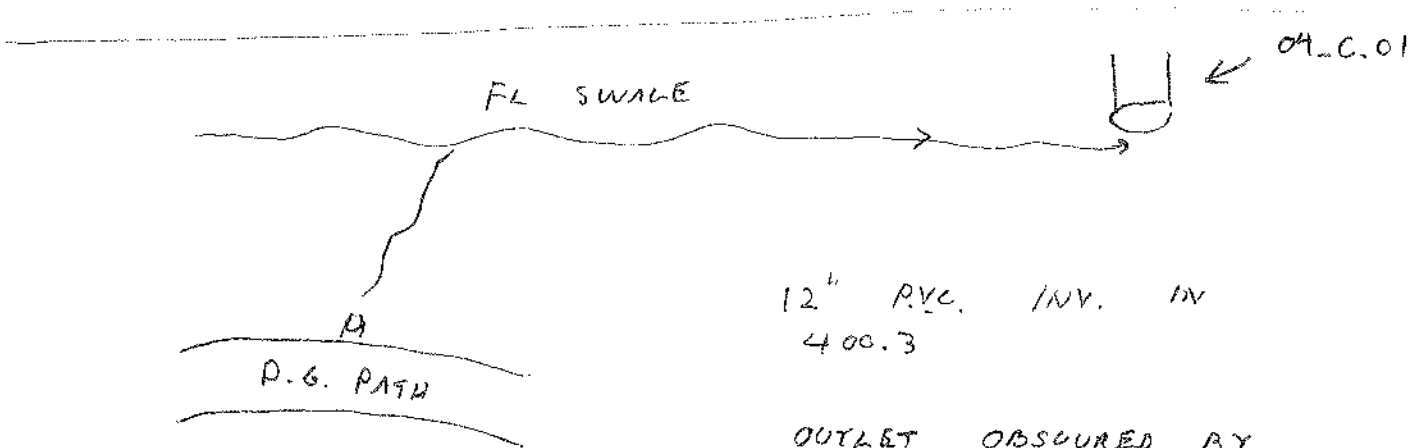
04\_B\_02



NOT TO SCALE



HWY. 68



FL SWALE

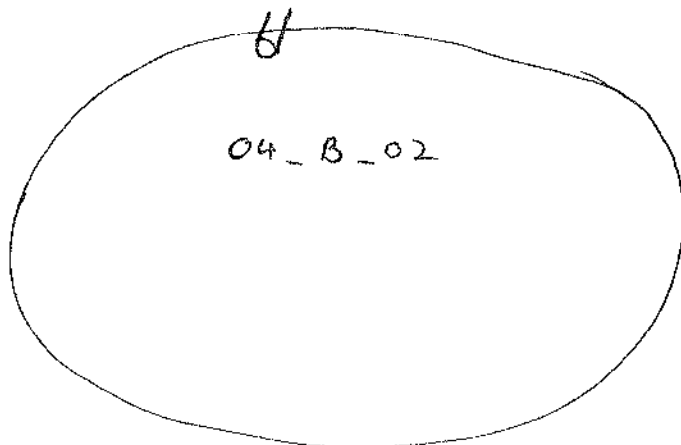
A

D.G. PATH

04\_C.01

12" P.V.C. INV. IN  
400.3

OUTLET OBSCURED BY  
LANDSCAPING

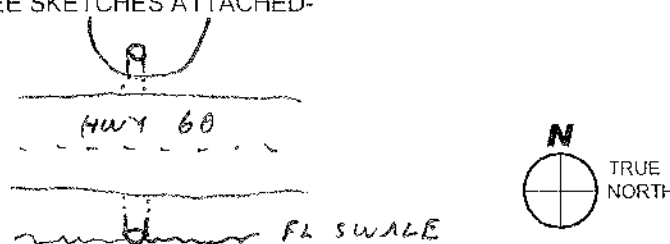


04\_B\_02


NO OTHER VISIBLE  
OUTLETS FOR 04\_B\_02

CULVERT ID: 04\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0426  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: \_\_\_\_\_  
HWY 68 JUST WEST  
OF S.P.C.A. D/W  
 SURVEY POINT #s: 11339-11350, 11395-11403

INVERT (UPSTREAM) ELEVATION: 395.99 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE  
 INVERT (DOWNSTREAM) ELEVATION: 391.67 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 71.2 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 24" DIA. NORTH END (OUT FLOW) OF PIPE  
 CULVERT MATERIAL TYPE: CMP BROKEN. (SEE PHOTOS) \*  
 HIGH WATER (UPSTREAM) ELEVATION: NOT TRASH RACK? Y/N IF YES, DESCRIPTION:  
VISIBLE  
 HIGH WATER (DOWNSTREAM) ELEVATION: 390.8  
 SPILL CREST ABOVE CULVERT: 398.7 ANGLE (FROM NORTH) N. 6° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
NONE



COMMENTS: \* BROKEN PIPE APPEARS TO BE CAUSING  
EROSION AT OUTFLOW  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____ OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.:	CHECKED: _____	

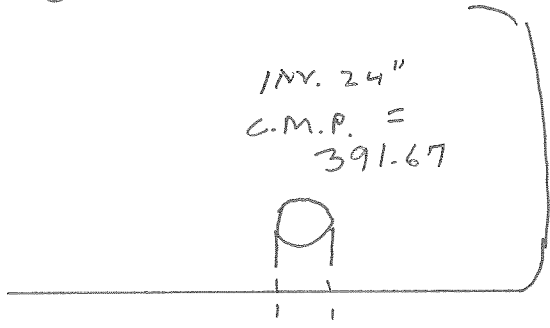


# WHITSON ENGINEERS

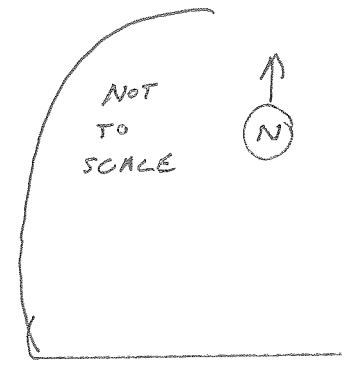
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY                      LOS ANGELES                      SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

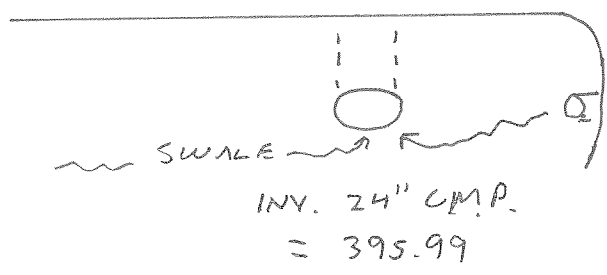
04-C-01



↑  
RACEWAY



← HWY. 68 →

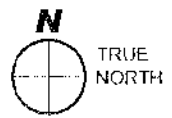
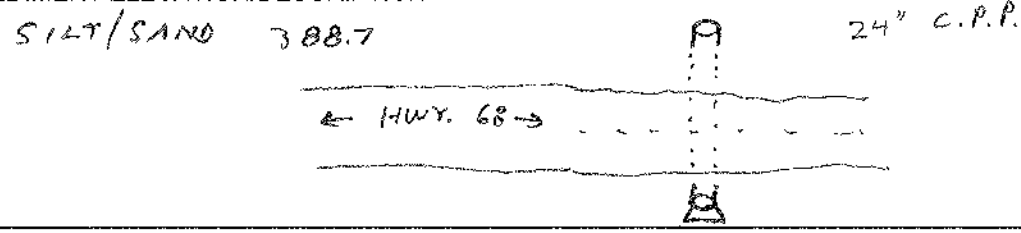


S.P.C.A. ↓




CULVERT ID: 04\_C\_02 PROJECT# 2888.00  
 1977 ID (IF ANY) 8 SURVEY DATE: 2013-0430  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: EVIN MURPHY  
HIGHWAY 68 AUSTIN SNYDER  
WEST OF S.P.C.A  
 SURVEY POINT #s: 11529-11546

INVERT (UPSTREAM) ELEVATION: 388.43 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SILT/SAND 385.8  
 INVERT (DOWNSTREAM) ELEVATION: 385.64 UPSTREAM DEBRIS DESCRIPTION  
388.7 DIRT/LEAVES  
 LENGTH 59.4 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
DIRT/LEAVES  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: (SOUND) / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 24" DIA.  
 CULVERT MATERIAL TYPE: C.P.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 391.7 ANGLE (FROM NORTH) N. 6° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-



COMMENTS: FLARE ON SOUTH END  
- SEE PHOTOS ->

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	CULVERT SURVEY	DATE:	SHEET
	CANYON DEL REY WATERSHED	SCALE:	
DRAWING PATH: T:\Monterey Projects\28881Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	PROJECT No.:	
DRAWING PATH: T:\Monterey Projects\28881Survey\Worksheets\Culvert Survey Form.dwg	CHECKED:	OF	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2088.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

04\_C\_02

NOT TO SCALE



24" C.P.P.

INV. = 385.64



← HWY. 68 →

24" C.P.P.

INV. = 388.43



FLARE END

BASIN ID / PT. # RANGE: 05\_B\_01

PROJECT# 2888.00

11550

SURVEY DATE: 2013-04-30

LOCATION: SOUTH OF HWY. 68

SURVEY PARTY: EVIN MURPHY

WEST OF S.P.C.A.

AUSTIN SNYDER

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO STRUCTURE

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 24" DIA. C.M.P.

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 384.61

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) YES - 05\_C\_01

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS:

WATER LEVEL APRIL 30, 2013 = 380.99

PHOTO FILE #S:

1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET

1

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DBL KEY JOB No. 2888.00  
DATE 2013-05-01 SHEET No. 1 of 1  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE



HIGHWAY 68



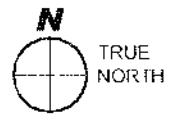
← CULVERT 05\_C\_01  
INV. IN = 384.61

BASIN 05\_B\_01

WATER LEVEL 4/30/13 380.99


CULVERT ID: 05\_C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 0 SURVEY DATE: 2013-0430  
 GENERAL LOCATION: FLOWING OUT OF SURVEY PARTY: EVIN MURPHY  
BASIN 05-B-01 AUSTIN SNYDER  
UNDER HWY 68, EAST OF SHEPHERD  
STATION ROAD  
 SURVEY POINT #s: 11543, 11549

INVERT (UPSTREAM) ELEVATION: 384.61 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SILT, MINIMAL  
 INVERT (DOWNSTREAM) ELEVATION: 384.47 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 60.32 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 24" DIA. CULVERT MATERIAL TYPE: C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? N IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE ANGLE (FROM NORTH) N. 4° E.  
 SPILL CREST ABOVE CULVERT: 389.1 -SEE SKETCHES ATTACHED-  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SILT, MINIMAL



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____ OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.: _____	CHECKED: _____	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY 2888.00

DATE 2013-05-01

CALCULATED BY T.H.

CHECKED BY

DATE

DATE

DATE

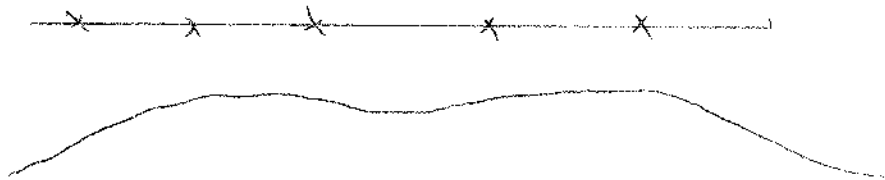
05\_C\_01



HWY 68

24" C.M.P.  
INV. = 384.61

WOOD FENCE



BASIN 05-B\_01

WATER LEVEL 2013-04-30

380.99

CULVERT ID: 06-C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 10 SURVEY DATE: 2013-04-04  
 GENERAL LOCATION: GATED ACCESS TO LAGUNA SECA WEST OF MAIN ENTRANCE SURVEY PARTY: TOM HANNAH  
EVIN MURPHY  
 SURVEY POINT #s: 11320 - 11337

INVERT (UPSTREAM) ELEVATION: 383.64 (48")  
383.58 (30") DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
379.96 (48") MINIMAL SEDIMENT.  
 INVERT (DOWNSTREAM) ELEVATION: 382.15 (30") UPSTREAM DEBRIS DESCRIPTION  
MARSH, AQUATIC VEGETATION  
 LENGTH 98.25 SHAPE ROUND  
 NUMBER OF BARRELS 2 DOWNSTREAM DEBRIS DESCRIPTION  
48" DIA. WILLOWS, BROKEN CONCRETE  
 DIMENSIONS (DIAMETER / W X H): 30" DIA. (SEE PHOTOS)  
 PHYSICAL CONDITION: (SOUND) / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 388.2 ANGLE (FROM NORTH) 5.87° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
MARSH LIKE WETLANDS



COMMENTS: - SEE PHOTOS AND SKETCH -  
 PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
		DRAWN:	
		CHECKED:	
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg		PROJECT No.:	OF



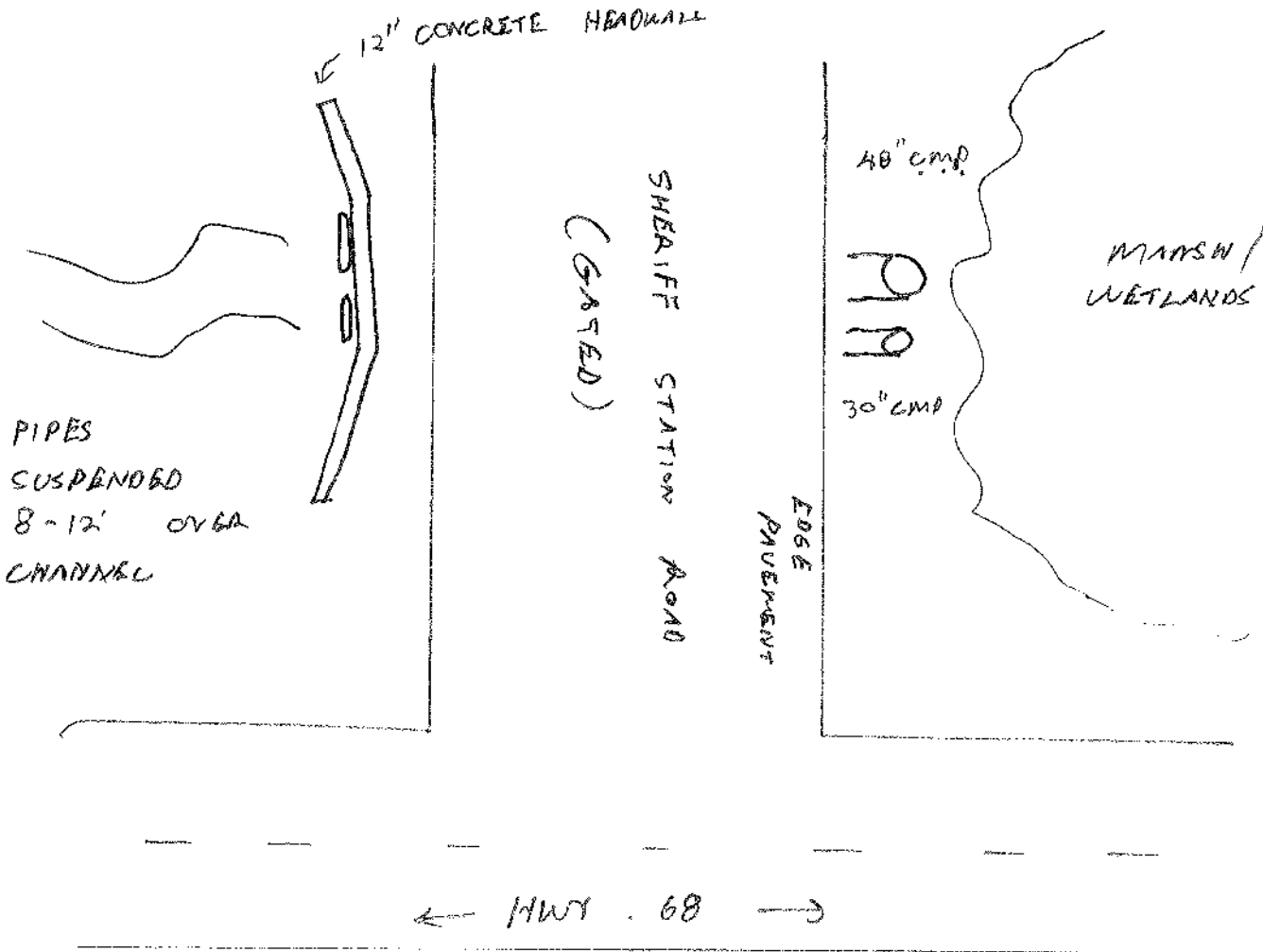
# WHITSON ENGINEERS

CIVIL ENGINEERS • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT: CANYON DEL REY TRACT 2888 00  
DATE: 2013-05-01  
DESIGNED BY:  
CHECKED BY:  
DATE:

06 - C - 01

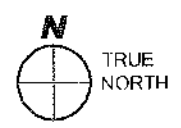
NOT TO SCALE





CULVERT ID: 07-C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 13 SURVEY DATE: 2013-05-01  
 GENERAL LOCATION: CROSSING UNOBA SURVEY PARTY: EVIN MURPHY  
HWY 68 EAST AUSTIN SNYDER  
OF PASADENA ENTRANCE  
 SURVEY POINT #s: 11566 - 11569, 98

INVERT (UPSTREAM) ELEVATION: 361.59 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE  
 INVERT (DOWNSTREAM) ELEVATION: 347.86 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 100' SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 DIMENSIONS (DIAMETER / W X H): 24" DIA. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: C. P. P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y IF YES, DESCRIPTION:  
NONE VISIBLE - SEE SKETCH -  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 370.3 ANGLE (FROM NORTH) N. 48° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION NONE -SEE SKETCHES ATTACHED-



COMMENTS:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	

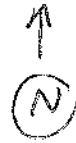


WHITSON ENGINEERS

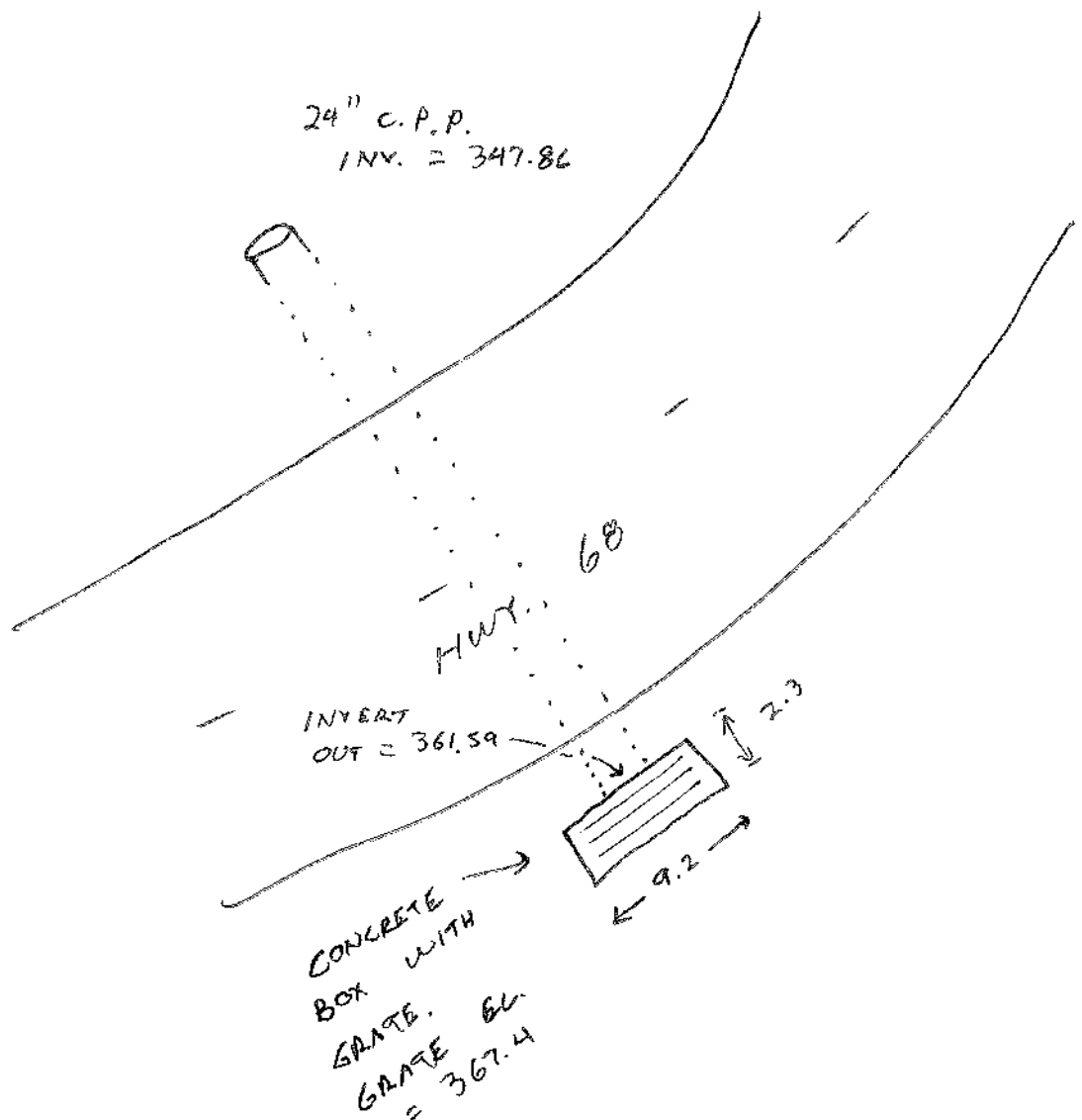
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT: CANYON DEL REY PLAN: 2888.00  
DATE: 2013-05-01  
CALCULATED BY: T-M  
CHECKED BY:  
DATE:

07 - C - 01



NOT TO SCALE



BASIN ID / PT. # RANGE: 08\_B\_01

PROJECT# 2888.00

SURVEY DATE: 2013-0322

LOCATION: SOUTH OF HWY. 68

SURVEY PARTY: TOM HANNAH

EAST OF BOOTS RD.

EVIN MURPHY

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: 2.8' x 6.0' CONC. BOX w/ GRATE

INVERT (IN) ELEVATION: NO STRUCTURE

ELEVATION OF SEDIMENT, IF ANY: NONE

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: NONE

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: 346.62

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 34 24" DIA.

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 348.1

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING: Y



COMMENTS: VERY SHALLOW BASIN.

BOTTOM = 345.48 HIGH WATER MARK = 346.62

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF

CULVERT ID: N.A. FOR 08-B-01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0322  
 GENERAL LOCATION: SOUTH OF HWY. 68 SURVEY PARTY: TOM HANNAH  
EAST OF BOOTS RD. EVIN MURPHY  
 SURVEY POINT #s: 11058-11068

INVERT (UPSTREAM) ELEVATION: APPROX. 345.0 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION \_\_\_\_\_  
 INVERT (DOWNSTREAM) ELEVATION: 342.96 UPSTREAM DEBRIS DESCRIPTION \_\_\_\_\_  
 LENGTH 129.3 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION \_\_\_\_\_  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED / COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED \_\_\_\_\_  
 DIMENSIONS (DIAMETER / W X H): 24" DIA. TRASH RACK? Y / N IF YES, DESCRIPTION: \_\_\_\_\_  
 CULVERT MATERIAL TYPE: C.M.P. ANGLE (FROM NORTH) N. 22° W.  
 HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_ -SEE SKETCHES ATTACHED-  
 HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_  
 SPILL CREST ABOVE CULVERT: \_\_\_\_\_  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION \_\_\_\_\_



COMMENTS: PIPE RUNS FROM RISER IN POND 08-B-01  
TO A CLEAROUT STRUCTURE, AND CONTINUES.  
POINT OF TERMINATION UNKNOWN

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
			OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-05-15 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH DATE \_\_\_\_\_

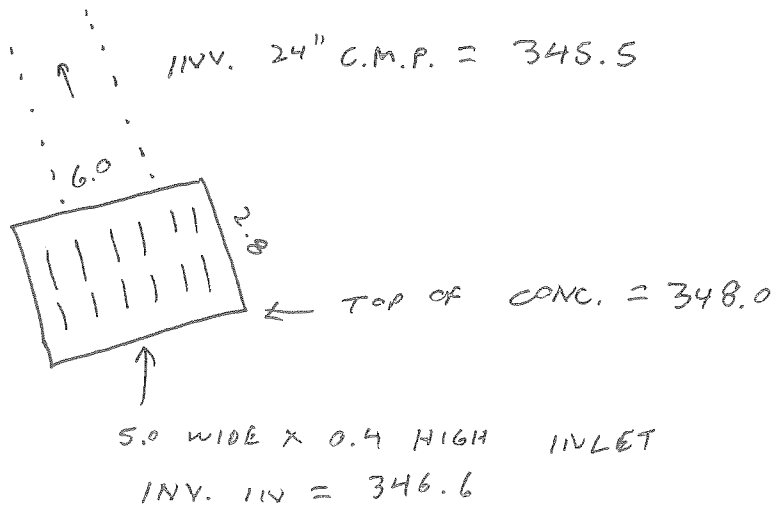
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

08\_B\_01

NOT TO SCALE



OUTLET: 6.0 x 2.8 CONC. STRUCTURE



BASIN ID / P.I. # RANGE: 08\_B\_02

PROJECT# 2888.00

SURVEY DATE: 2013-0322

LOCATION: SOUTH of HWY. 68

SURVEY PARTY: TOM HANNAN

EAST of BOOTS RD.

EVIN MURPHY

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \_\_\_\_\_

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: THIS IS A VERY SHALLOW AND SMALL DEPRESSION. NO STRUCTURES FOUND FOR INLET OR OUTLET.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

#### CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET

1

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

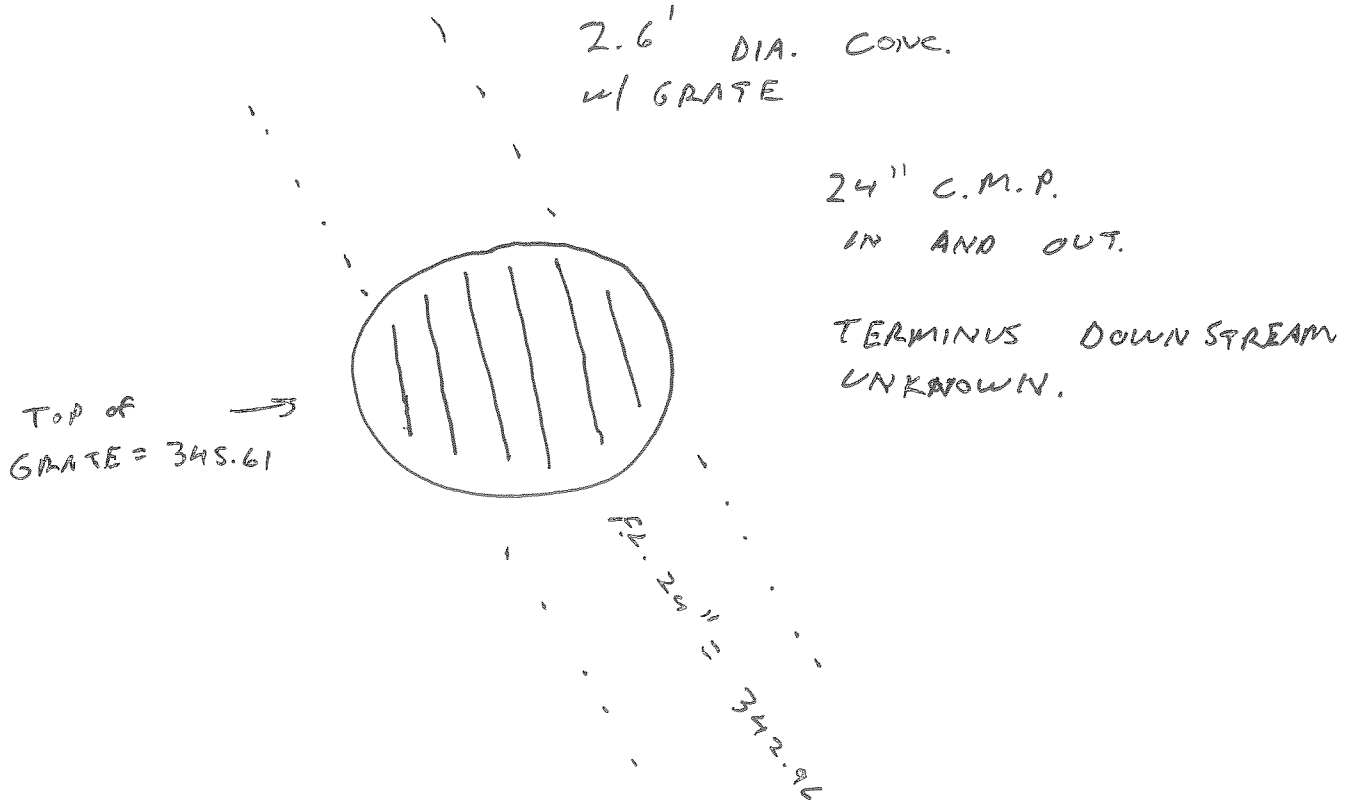
MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0515 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TW. DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

08 - B - 02



CULVERT ID: 08\_C\_01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013\_0322

GENERAL LOCATION: SOUTH OF HWY. 68  
EAST OF BOOTS  
ROAD

SURVEY PARTY: TOM HANNAH  
EVIN MURPHY

SURVEY POINT #'s: 11066-11068

INVERT (UPSTREAM) ELEVATION: 342.96

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

NA

INVERT (DOWNSTREAM) ELEVATION: \_\_\_\_\_

UPSTREAM DEBRIS DESCRIPTION

LENGTH UNKNOWN SHAPE ROUND

NONE

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

NONE

DIMENSIONS (DIAMETER / W X H): 24" I.D.

PHYSICAL CONDITION: SOUND / CRACKED /

CULVERT MATERIAL TYPE: C.M.P.

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: N.A.

TRASH RACK?  IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: N.A.

SPILL CREST ABOVE CULVERT: NA

ANGLE (FROM NORTH) N. 22° W.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-



COMMENTS: THIS IS A 24" GRATE COVERING A  
24" C.M.P. RUNNING THROUGH THE STRUCTURE.  
ORIGIN OF FLOW IS ~~ROAD~~ BASIN 08\_B\_01  
TERMINUS UNKNOWN.

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg PROJECT No.:

DATE:

SCALE:

DRAWN:

CHECKED:

SHEET

OF




CULVERT ID: 08\_c\_02 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0322  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY. 68, WEST EVIN MURPHY  
OF BOOTS ROAD  
 SURVEY POINT #s: 11095 -11104

INVERT (UPSTREAM) ELEVATION: 326.88 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
1.5' SAND IN BOTTOM OF PIPE  
 INVERT (DOWNSTREAM) ELEVATION: 325.16 UPSTREAM DEBRIS DESCRIPTION  
LIGHT VEGETATION  
 LENGTH 118.44 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
NONE SMALL WILLOWS  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 52" I.D.  
 CULVERT MATERIAL TYPE: RCP  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y  N IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: APPROX. 346' ANGLE (FROM NORTH) N. 4° 13' W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
NONE



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
		SCALE:	
		DRAWN:	
		CHECKED:	
CANYON DEL REY WATERSHED		PROJECT No.:	OF
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg			



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-05-14 SHEET No. of

CALCULATED BY TH DATE

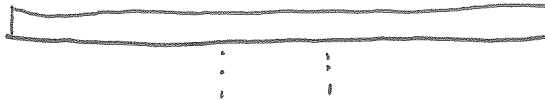
CHECKED BY DATE

08-C-02

NOT TO SCALE



INV. 52" R.C.P.  
= 325.16



12" CONC.  
HEADWALL  
TOP = 342.76

← HWY. 68 →



12" CONC.  
HEADWALL  
TOP = 343.88

INV. 52" R.C.P. = 326.88

BASIN ID / PT. # RANGE: 09-B-01

PROJECT# 2888.00

11001 - 11054

SURVEY DATE: 2013-0313

LOCATION: BOOTS ROAD

SURVEY PARTY: TOM HANNAH

AT WHIP ROAD

EVIN MURPHY

BASIN ON LINE OR OFF LINE: OFF  
370.7 (18")

DIMENSIONS OF RISER: N/A

INVERT (IN) ELEVATION: 368.4 (FL. SWALE)

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 367.36

DESCRIBE DEBRIS: NO SIGNIFICANT DEBRIS

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 12" x 12" ELEV. HIGH WATER MARKS: 368.9

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 12" x 12" PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 369.36 ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 16.1 x 3.0

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 372.20

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) YES 18" HDPE (IN)  
40" HDPE OUT (09-C-01)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: WATER LEVEL 3/13/13 36736 AT 3 P.M.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET

1

OF



# WHITSON ENGINEERS

MONTEREY

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

LOS ANGELES

SANTA CRUZ

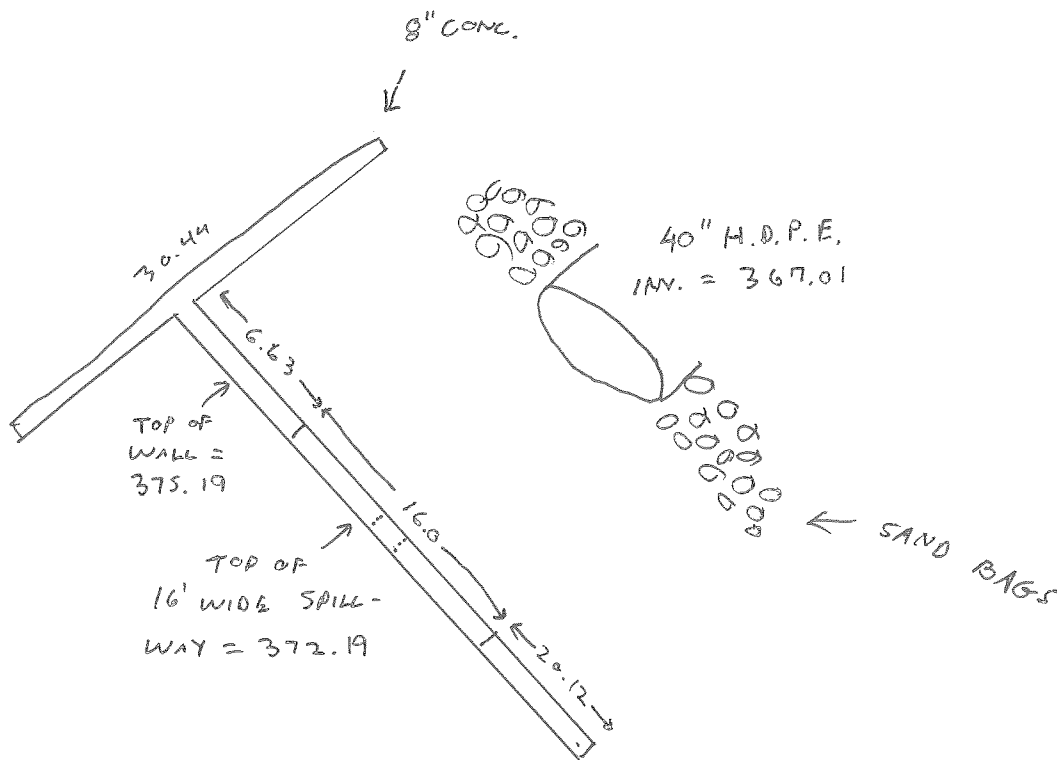
PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-05-15 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.H. DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE



- 2 CUTOUTS, 1.0 W. X .5 H. INV. = 369.84
- 1.0 W. X 1.0 H. INV. = 367.36

CULVERT ID: 09-C-01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0313

GENERAL LOCATION: CROSSING UNDER

SURVEY PARTY: TOM MANNAN

WHIP ROAD, SOUTH  
OF BOOTS ROAD

EVIN MURPHY

SURVEY POINT #s: 11001-11054

INVERT (UPSTREAM) ELEVATION: 367.01

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE (BOX)

INVERT (DOWNSTREAM) ELEVATION: 357.36

UPSTREAM DEBRIS DESCRIPTION  
NONE

LENGTH 100.50 SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION  
NONE

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 40" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: H.D.P.E.

HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_

TRASH RACK? Y N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_

ANGLE (FROM NORTH)

SPILL CREST ABOVE CULVERT: \_\_\_\_\_

-SEE SKETCHES ATTACHED-

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE



COMMENTS: FLows INTO 7.8 x 5.2 CONC. STRUCTURE.

40" HDPE EXITS TO MOUTH

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. 1 of 2  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

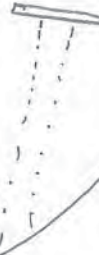
09-C-01

← HWY 68 →

NOT TO SCALE



SEE DETAIL →  
"A" NEXT SHT.



BOOTS ROAD

← SEE DETAIL "B" NEXT SHT.



SEE DETAIL  
"C" NEXT SHT.

WHIP ROAD



↑  
BASIN 09-B-01



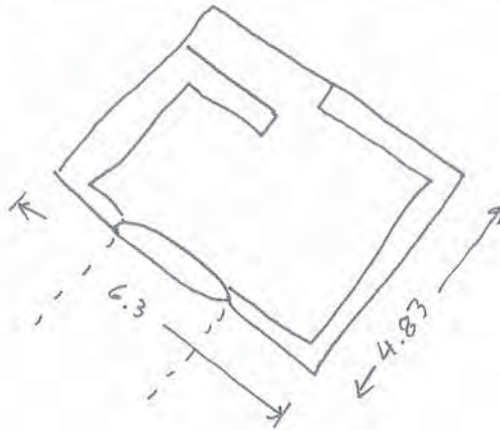
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

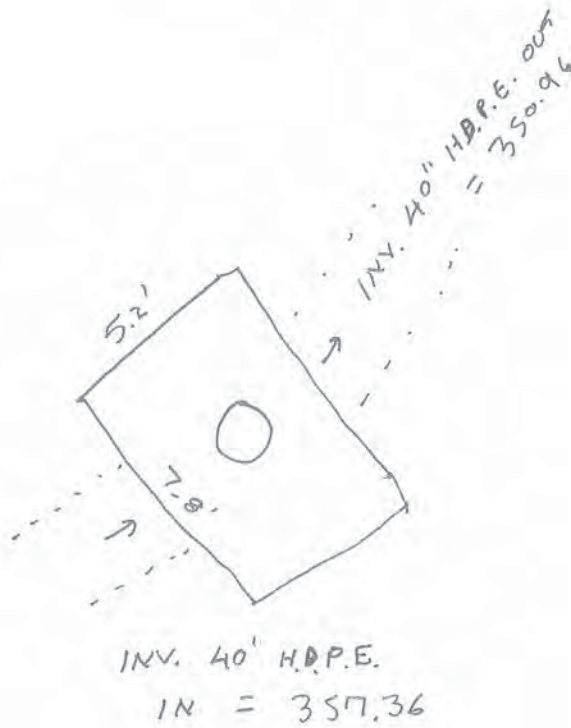
PROJECT	CANYON DEL REY	JOB No.	2888.00
DATE	2013-0514	SHEET No.	2 of 2
CALCULATED BY	TN	DATE	
CHECKED BY		DATE	

09-C-01

DETAIL "A"  
40" HDPE  
INV. = 333.70

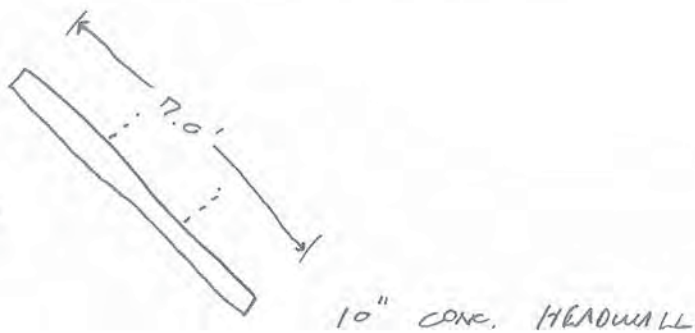


DETAIL "B"



DETAIL "C"

INV. 40"  
H.D.P.E  
INV. = 367.01



CULVERT ID: 09\_C-01  
(PART 2)  
1977 ID (IF ANY) \_\_\_\_\_  
GENERAL LOCATION: WEST OF BOOTS  
RD., SOUTH OF  
HWY, 68  
SURVEY POINT #s: 11086-11090

PROJECT# 2888.00  
SURVEY DATE: 2013-0322  
SURVEY PARTY: TOM HANNAH  
EYIN MURPHY

INVERT (UPSTREAM) ELEVATION: 350.96  
INVERT (DOWNSTREAM) ELEVATION: 333.70  
LENGTH 378.33 SHAPE ROUND  
NUMBER OF BARRELS 1  
DIMENSIONS (DIAMETER / W X H): 40" I.D.  
CULVERT MATERIAL TYPE: H.D.P.E.

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION \_\_\_\_\_  
UPSTREAM DEBRIS DESCRIPTION NONE  
DOWNSTREAM DEBRIS DESCRIPTION WILLOWS, OTHER VEGETATION  
PHYSICAL CONDITION: (SOUND) / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: NA. (CONC. STRUCTURE)

ANGLE (FROM NORTH) N. 28° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION NONE

-SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



## CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



BASIN ID / PT. # RANGE: 10-B-01

PROJECT# 2888.00

11509-11513

SURVEY DATE: 2013-04-29

LOCATION: PASADENA GOLF

SURVEY PARTY: TOM HANNAH

COURSE

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \_\_\_\_\_

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \* \_\_\_\_\_

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: \* 461.57  
\* 2013-04-29

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: \* NO OUTLET VISIBLE

INLET IS AN ARTIFICIAL STONE

SWALE SEE PHOTOS.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET

1

OF

BASIN ID / PT. # RANGE: 10-B-02

PROJECT# 2888.00

11514 - 11520

SURVEY DATE: 2013-0429

LOCATION: PASADENA GOLF

SURVEY PARTY: TOM HANNAH

COURSE

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \* 443.1

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 24" DIA.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 443.0

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

OUTLET STRUCTURE:

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CONC. D.I. GRATE =  
447.50.

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) Y

24" EXITS S. 30° W.  
INV. = 443.1

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:

WATER LEVEL 2013-0429 = 447.51



COMMENTS:

\* INVERT FOUND BY PROBING UNDER WATER.  
I THINK IT IS A 24" PIPE, COMING  
FROM 10-B-01

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:

SCALE:

DRAWN:

CHECKED:

PROJECT No.:

SHEET

1

OF

CULVERT ID: N/A OUT OF 10-B-02

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-04-29

GENERAL LOCATION: PASA DEBRA GOLF

SURVEY PARTY: TOM HANNAIN

COURSE POND

10-B-02

SURVEY POINT #s: 11517-520

INVERT (UPSTREAM) ELEVATION: 443.1

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: \_\_\_\_\_

UPSTREAM DEBRIS DESCRIPTION

LENGTH UNKNOWN SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 24" DIA

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.P.P.

HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_

TRASH RACK? Y / N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_

SPILL CREST ABOVE CULVERT: 447.5

ANGLE (FROM NORTH) N. 30° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING ■ LAND SURVEYING ■ PROJECT MANAGEMENT

MONTEREY

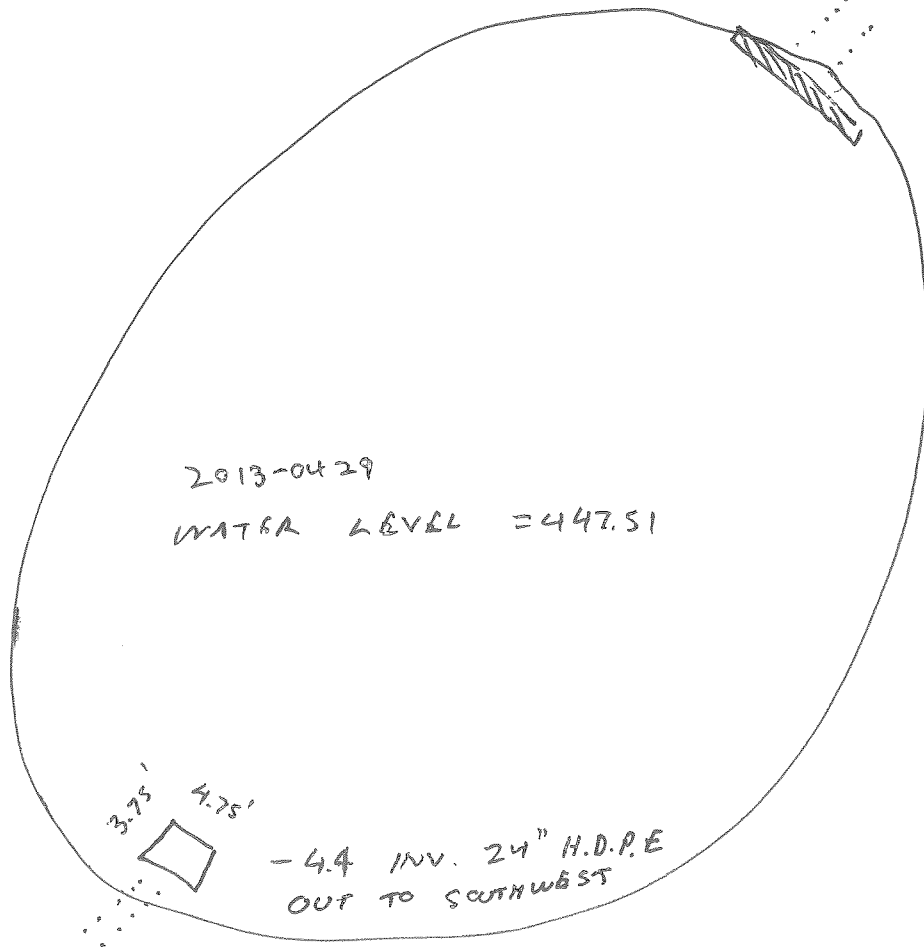
LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0503 SHEET No. 1 of 1  
 CALCULATED BY TM DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

10-B-02

8" CONC. HEADWALL (TOP = 447.6)  
 11.6' LONG  
 -4.5 24" \* BASED ON PROBE\*



CONC. STRUCTURE  
 w/ GRATE. TOP OF  
 GRATE = 447.5

BASIN ID / PT. # RANGE: 10-B-03

PROJECT# 2888.00

11499-11508

SURVEY DATE: 2013-0429

LOCATION: PASADERA GOLF

SURVEY PARTY: \_\_\_\_\_

COURSE

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO INLET

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 1.5w. x 2.5h.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 406.5 ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: -SWALE- PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 407.55

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 5.0 x 3.0 GATE

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 409.0

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) YES, 24" OUT TO WEST. 15" x 2 OUT TO EAST.

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:

\* DESTINATION / TERMINUS OF PIPES UNKNOWN AT THIS TIME.



COMMENTS: - NO INLET VISIBLE -

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF



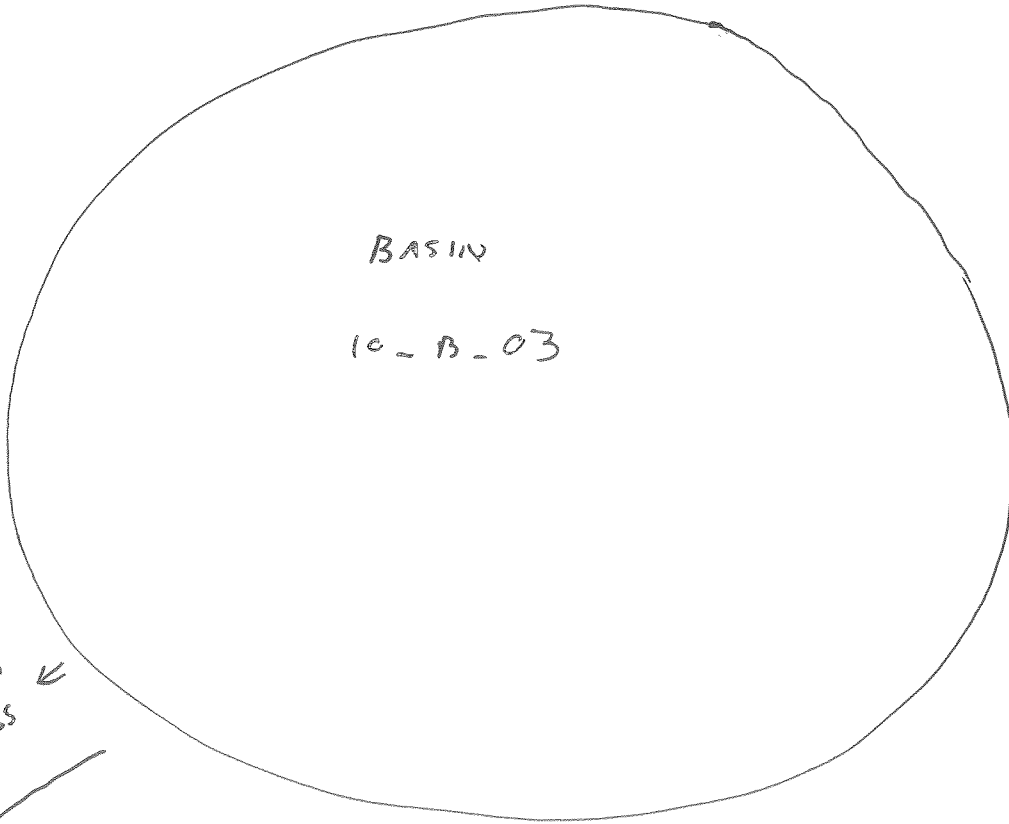
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0515 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY T.H. DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

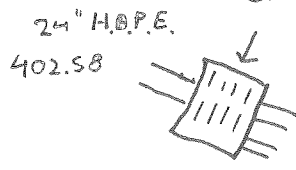
10-B-03

NOT TO SCALE



SWALE OUT  
FL. = 407.55 ←

BASIN  
10-B-03



GATE = 406.5 (1.5 WIDE)  
5.8 x 3.8 CONC. STRUCTURE  
TOP = 409.0  
15" H.D.P.E. (2) INV. = 402.9

BASIN ID / PT. # RANGE: 10-B-04

PROJECT# 2888.00

11485-11498

SURVEY DATE: 2013-0429

LOCATION: PASADENA GOLF

SURVEY PARTY: TOM HANNAH

COURSE

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: 3.8x6.3 CONC.

INVERT (IN) ELEVATION: 355.89  
351.93 - PIPE (SWAGE)

ELEVATION OF SEDIMENT, IF ANY: NONE

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 36" DIA.  
C.M.P.

DESCRIBE DEBRIS: NONE

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 352.68

ELEV. HIGH WATER MARKS: NONE

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 3.5x6.0 CONC. W/ GAATE  
RISE

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 356.50 INV. 36" C.M.P.

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) Y. \* SEE 10-C-03 AND 11-B-02

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:

SCALE:

DRAWN:

CHECKED:

PROJECT No.:

SHEET

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OF



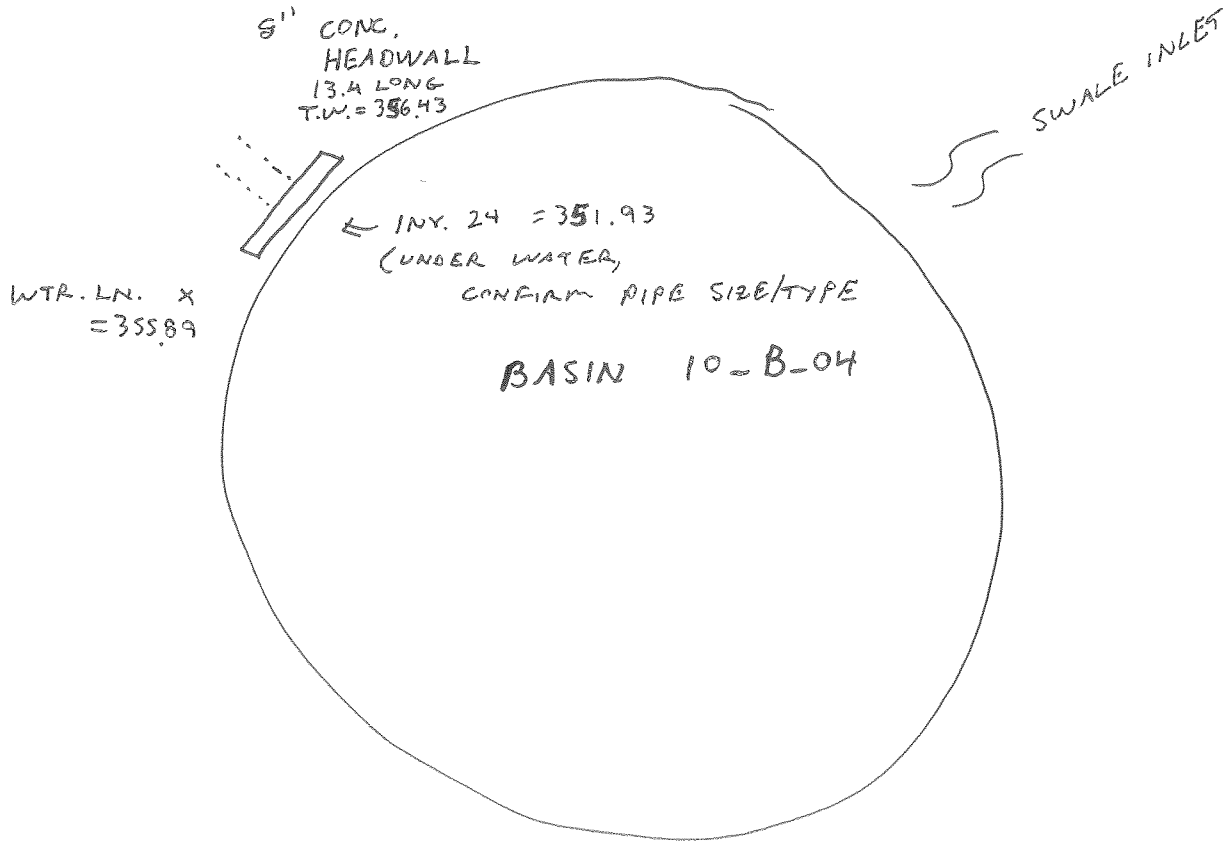
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-05-15 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

10\_B\_04

NOT TO SCALE

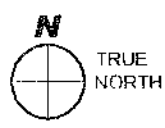


◻ ← SEE 10-C-03




CULVERT ID: 10-C-01 PROJECT#: 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0409  
 GENERAL LOCATION: CROSSING DIAGONALLY SURVEY PARTY: TOM HANNAH  
UNDER HWY. 68 EVIN MURPHY  
EAST OF PASADENA ENTRANCE  
 SURVEY POINT #s: 11299 - 11319

INVERT (UPSTREAM) ELEVATION: 342.14 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
A FALLEN TREE NEAR PIPE  
 INVERT (DOWNSTREAM) ELEVATION: 339.59 SAND IN CHANNEL OF STREAM  
 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 164' SHAPE ROUND SOME FALLEN TIMBER  
(SEE PHOTOS)  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
FALLEN TREE (SEE PHOTO)  
 DIMENSIONS (DIAMETER / W X H): 36" D.I.A. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: C.M.P.  
NOT VISIBLE  
 HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_ TRASH RACK? Y/N IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: 339.60  
 SPILL CREST ABOVE CULVERT: 360.4 ANGLE (FROM NORTH) N. 26° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
MINIMAL SAND / SILT.



COMMENTS: - SEE PHOTOS AND SKETCHES -  
 \_\_\_\_\_  
 \_\_\_\_\_  
 PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	



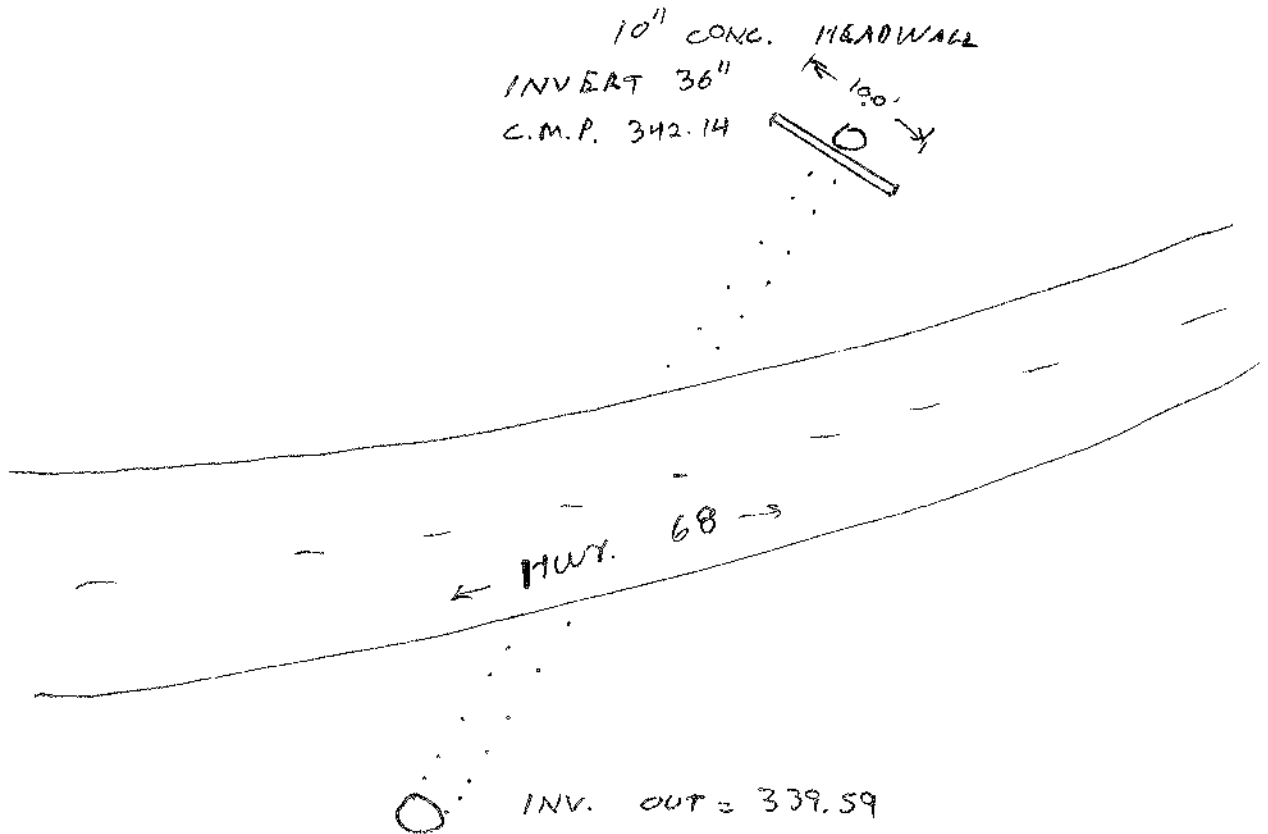
# WILSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

100' CANYON DEL REY 2868.00  
DATE 2013-0501  
CALCULATED BY T.H.  
CHECKED BY  
DATE

10\_C\_01

NOT TO SCALE



48" R.C.P.  
WITH CONC. BOX AND  
TRASH GRADE.  
ORIGIN OF STRUCTURE  
UNKNOWN.


CULVERT ID: 10\_C\_02 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0322  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
BOOTS ROAD EVIN MURPHY  
SOUTH OF HWY. 68  
 SURVEY POINT #s: 11070-080

INVERT (UPSTREAM) ELEVATION: 331.69 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
 INVERT (DOWNSTREAM) ELEVATION: 330.46 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 104.97 SHAPE ROUND WILLOW TREES, MULTIPLE,  
2" TRUNKS  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
WILLOW TREES  
 DIMENSIONS (DIAMETER / W X H): 60" DIA. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: R.C.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y/(N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 346' +/- ANGLE (FROM NORTH) N 85° W  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
MINIMAL



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____  OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.:	CHECKED: _____	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

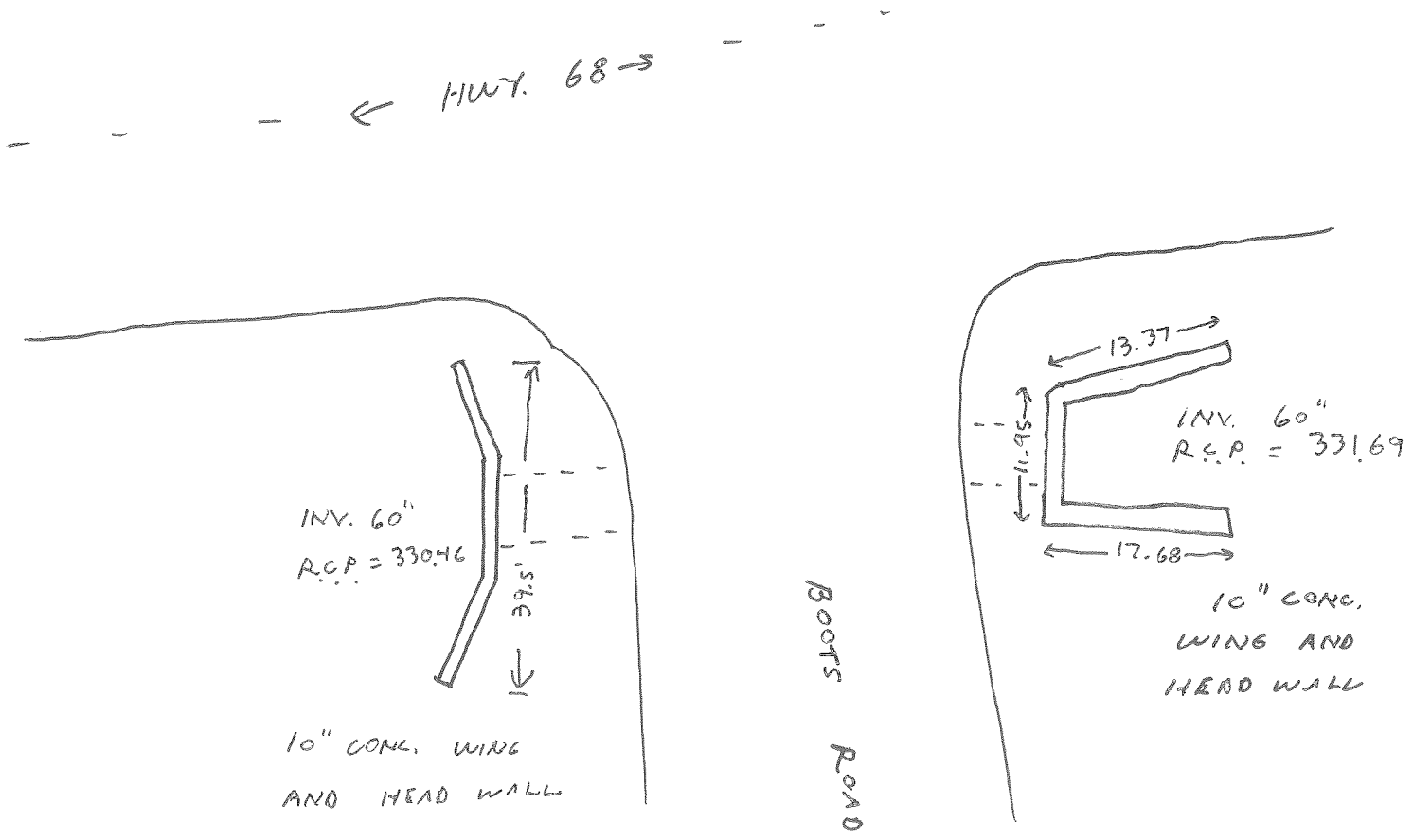
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

10-C-02

NOT TO SCALE



CULVERT ID: 10-C-03 (PART 1) PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0322  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
PASADENA ENTRANCE EYIN MURPHY  
NORTH OF HWY 68  
 SURVEY POINT #'s: 11104 11106, 11494-11498

Flows from Basin 10-B-04

INVERT (UPSTREAM) ELEVATION: 352.68 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE  
 INVERT (DOWNSTREAM) ELEVATION: 338.39 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 745.55 SHAPE ROUND (CONCRETE BOX)  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
MINIMAL  
 DIMENSIONS (DIAMETER / W X H): 36" I.D. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: R.C.P. / C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: 356.55 TRASH RACK? Y (N) IF YES, DESCRIPTION:  
NOT  
 HIGH WATER (DOWNSTREAM) ELEVATION: VISIBLE  
356.50 (UP)  
 SPILL CREST ABOVE CULVERT: 345.39 (DOWN) ANGLE (FROM NORTH) N. 51° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
NONE



COMMENTS: - SEE SKETCH, NOTES -

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



**CULVERT SURVEY**

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_ OF \_\_\_\_\_



# WHITSON ENGINEERS

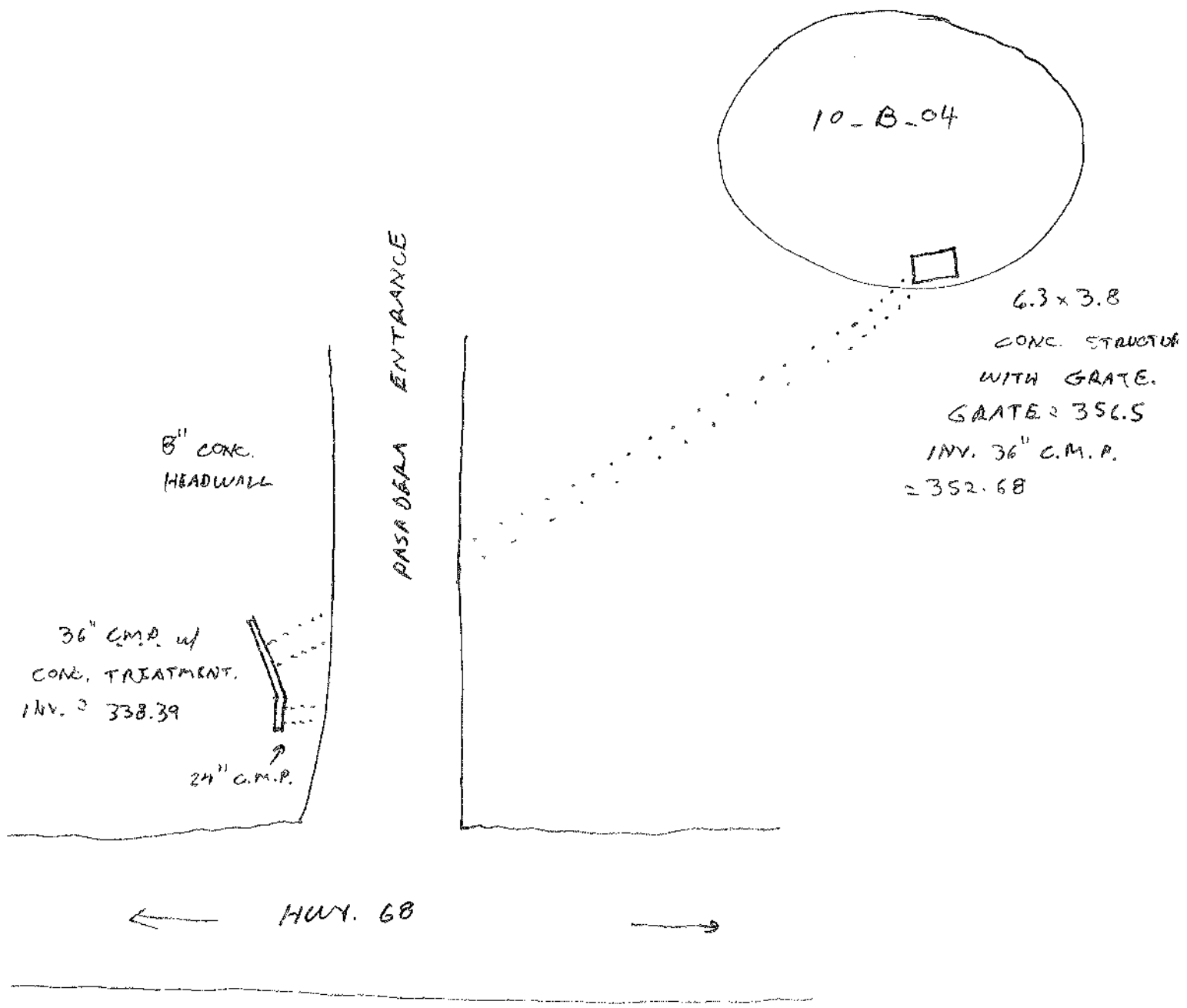
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY      LOS ANGELES      SANTA CRUZ

PROJECT: CANYON DEL REY      2888.00  
NO. 2013-0501      REV. 1 - 1  
CALCULATED BY: TW      DATE:  
CHECKED BY:      DATE:

10-C-03



NOT TO SCALE



BASIN ID / PT. # RANGE: 11-B-01

PROJECT# 2888.00

SURVEY DATE: 2013-0429

LOCATION: PASADERA GOLF  
COURSE

SURVEY PARTY: TOM HANNAH

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: 4'x4' AND 5.33' x 3.33'

INVERT (IN) ELEVATION: NO VISIBLE INLET

ELEVATION OF SEDIMENT, IF ANY: NONE

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 18" DIA.  
30" DIA.

DESCRIBE DEBRIS: NONE

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 367.98  
368.13

ELEV. HIGH WATER MARKS: NONE

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 6" DIA.

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 369.85

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 4'x4'  
5.33 x 3.33

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 373.58

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)  
FROM RISERS - SEE SKETCH --

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: - SEE SKETCH -

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-05-03

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T. H.

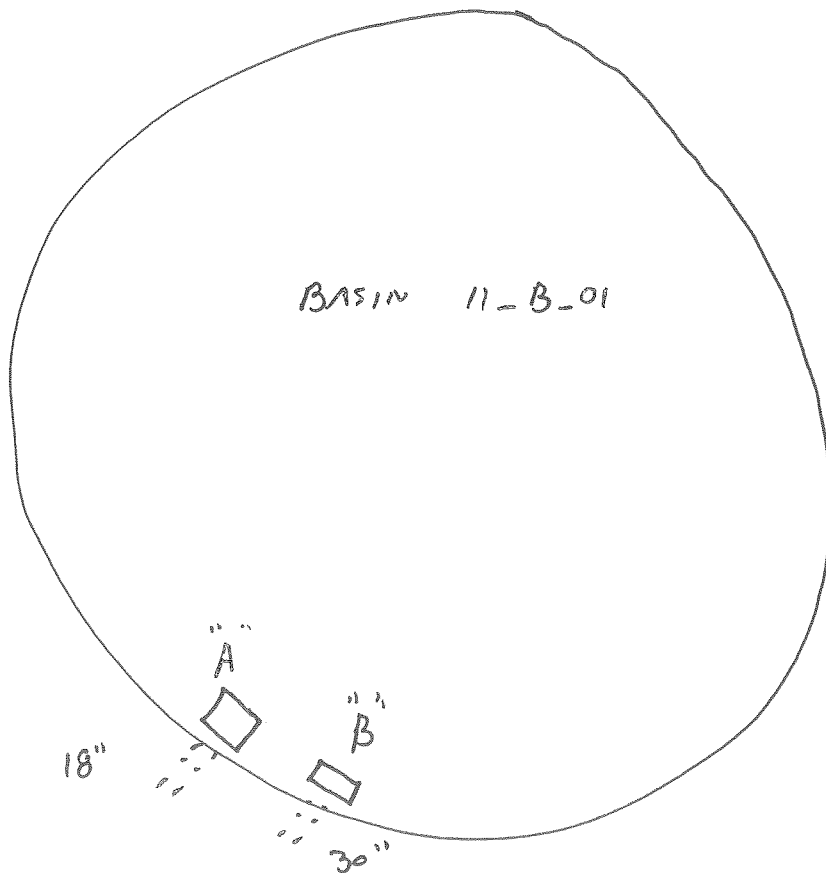
DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

11 - B - 01

NOT TO SCALE



"A" = 4' x 4' CONCRETE  
 BOX RISER W/ GRATE.  
 TOP OF GRATE = 373.58  
 - 5.6' TO 18" C.M.P. OUT

"B" 5.33' x 3.33' CONCRETE  
 BOX RISER WITH  
 GRATE. TOP OF GRATE =  
 373.58  
 - 5.45 TO INVERT 30" C.M.P.  
 OUT.



BASIN ID / PT. # RANGE: 11-B-02 PROJECT# 2888.00  
11481-11484 SURVEY DATE: \_\_\_\_\_  
 LOCATION: PASADERA GOLF SURVEY PARTY: \_\_\_\_\_  
COURSE \_\_\_\_\_  
 \_\_\_\_\_

BASIN ON LINE OR OFF LINE: \_\_\_\_\_ DIMENSIONS OF RISER: \_\_\_\_\_  
 INVERT (IN) ELEVATION: \* \_\_\_\_\_ ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_  
 LOW FLOW ORIFICE/OUTLET DIMENSIONS: \*\* 24" DESCRIBE DEBRIS: \_\_\_\_\_  
 LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 352.45 ELEV. HIGH WATER MARKS: \_\_\_\_\_  
 MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_ PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_  
 MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_ ATTACHED SKETCHES OF ABOVE \_\_\_\_\_  
 HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_  
 HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_  
 CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)  
 RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:  
WATER LIVE 2013-0429: 355.88  
HIGH WATER MARK: 356.69



COMMENTS: \* NO INLET VISIBLE. FOUNTAIN ACTIVE  
IN CENTER OF POND  
\*\* OUTLET FOUND BY PROBING. BELIEVED 24" DIA.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BASIN SURVEY</b>	DATE: _____	SHEET <b>1</b> OF
	MONTEREY COUNTY CALIFORNIA	SCALE: _____	
	<b>CANYON DEL REY WATERSHED</b>	DRAWN: _____	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg	CHECKED: _____	
		PROJECT No.: _____	



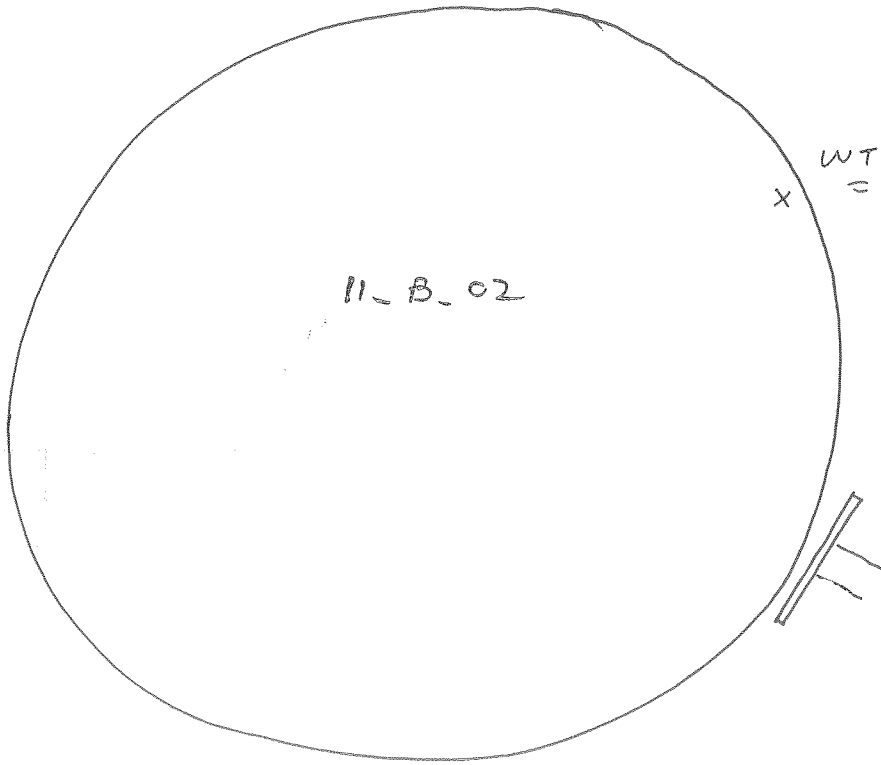
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0515 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TN DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

11\_B\_02

NOT TO SCALE ↑  
(N)



WTR LN.  
= 355.88

8" CONC. HEAD  
WALL 14.0 LONG.  
T.W. = 356.45

INV. 24" =  
352.45.

SUBMERGED  
CONFIRM PIPE  
SIZE/TYPE.

BASIN ID / PT. # RANGE: 11 B-03

PROJECT# 2888.00

SURVEY DATE: 2013-0429

LOCATION: NORTH OF HWY 68  
AT LAGUNA SECA  
GOLF RANCH

SURVEY PARTY: TOM HANNAH

BASIN ON LINE OR OFF LINE: ON

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO STRUCTURE

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 24" DIA.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 314.83 ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

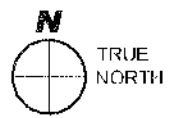
ATTACHED SKETCHES OF ABOVE  
SPILLWAY ACROSS GRANT PATH, APPROX. 19' WIDE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: SPILLWAY ACROSS GRANT PATH, APPROX. 19' WIDE

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 317.16

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) Y

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: THIS BASIN IS A WOODED AREA, A  
WIDE SPOT IN THE MAIN CHANNEL

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY CALIFORNIA

#### CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET  
**1**  
OF

CULVERT ID: N.A. - SEE 11-B-03

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: \_\_\_\_\_

GENERAL LOCATION: NORTH OF HWY. 68  
AT LAGUNA SECA  
GOLF RANCH

SURVEY PARTY: \_\_\_\_\_

SURVEY POINT #s: 11453 - 11456

INVERT (UPSTREAM) ELEVATION: 314.83

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

INVERT (DOWNSTREAM) ELEVATION: X

UPSTREAM DEBRIS DESCRIPTION

LENGTH 50.83 SHAPE ROUND

NONE

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

BROKEN CONCRETE

DIMENSIONS (DIAMETER / W X H): 24" DIA.

PHYSICAL CONDITION: (SOUND) / CRACKED /

CULVERT MATERIAL TYPE: C.P.P.

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

SOUND, EXCEPT THE CONCRETE  
ABOVE THE OUTLET

HIGH WATER (DOWNSTREAM) ELEVATION: 315.94

TRASH RACK? Y (N) IF YES, DESCRIPTION:

SPILL CREST ABOVE CULVERT: 317.32

ANGLE (FROM NORTH) N. 40° W.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

NONE



COMMENTS: \* OUTLET BURIED BY FAILING CONCRETE

SPILLWAY. SEE PHOTOS

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

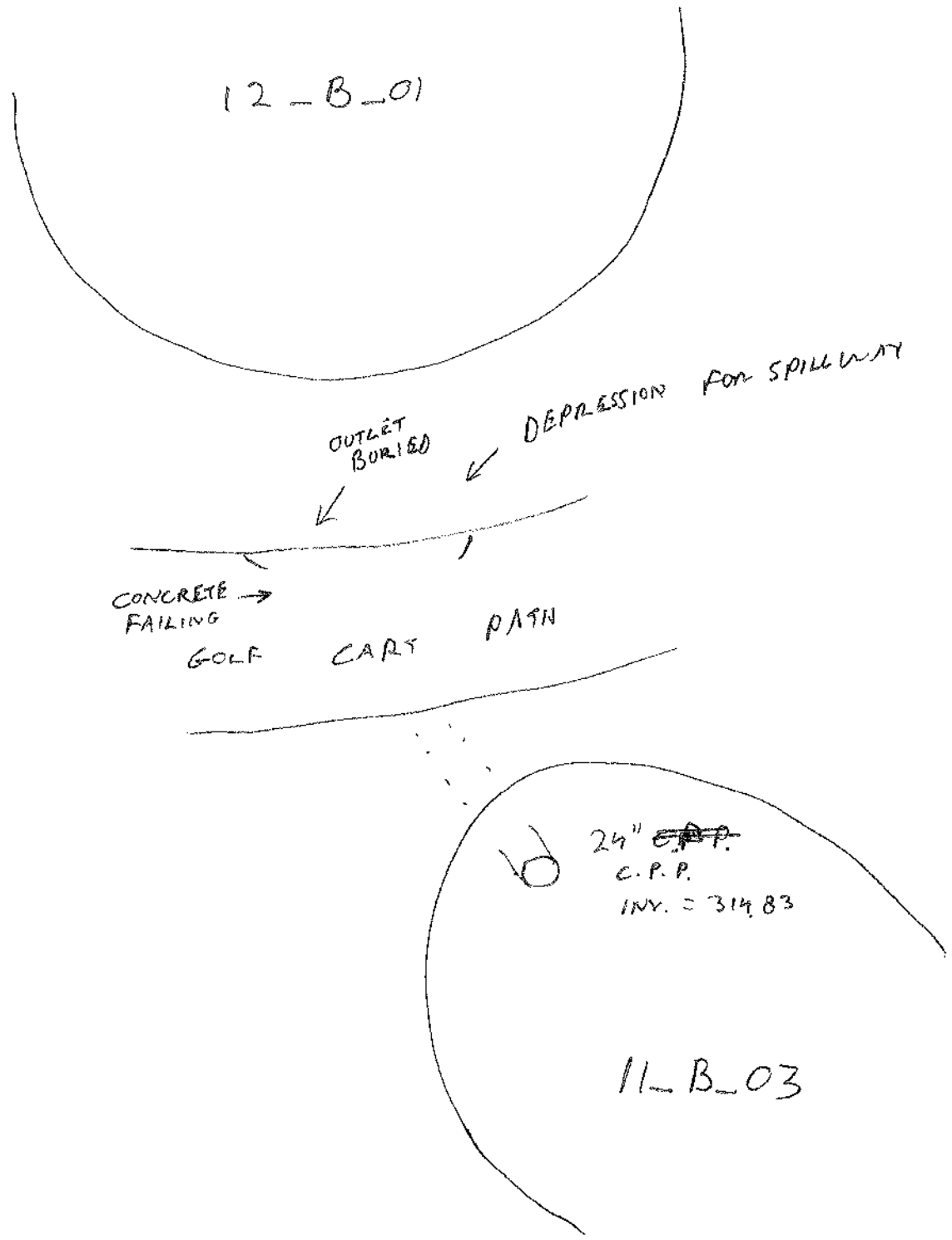


WILSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

CANYON DEL REY 2888.00  
2013-0501  
CALIF. # 711  
CHECKED BY  
DATE

11-B-03 AND 12-B-01  
CULVERT AND SPILLWAY



BASIN ID / PT. # RANGE: 12-B-01

PROJECT# 2888.00

11455-11466

SURVEY DATE: 2013-0429

LOCATION: LAGUNA SECA

SURVEY PARTY: TOM HANIKAH

GOLF RANCH

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \* 314 +/- INV. 24" C.P.P.

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 18" DIA. C.M.P. (2)

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 315.57

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:

\* WATER LINE 2013-0429 = 315.22

HIGH WATER MARK = 315.94



COMMENTS:

\* BROKEN CONCRETE OVER INLET. INVERT ELEVATION ESTIMATED. - SEE 11-B-03 -

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF

CULVERT ID: N.A., WITH 12-B-01,  
 1977 ID (IF ANY) OUTLET TO 12-B-02  
 GENERAL LOCATION: LAGUNA SECA  
GOLF RANCH  
 SURVEY POINT #'s: 11455 - 11466

PROJECT# 2888.00  
 SURVEY DATE: 2013-04-29  
 SURVEY PARTY: TOM HANNAH

INVERT (UPSTREAM) ELEVATION: 315.57  
 INVERT (DOWNSTREAM) ELEVATION: 311.94  
 LENGTH 49.23 SHAPE ROUND  
 NUMBER OF BARRELS 2  
 DIMENSIONS (DIAMETER / W X H): 18" DIA.  
 CULVERT MATERIAL TYPE: C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: 315.94  
 HIGH WATER (DOWNSTREAM) ELEVATION: 311.57  
 SPILL CREST ABOVE CULVERT: 317.31  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE  
 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 TRASH RACK? Y /  IF YES, DESCRIPTION:  
 ANGLE (FROM NORTH)  
 -SEE SKETCHES ATTACHED-



COMMENTS:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



**CULVERT SURVEY**

**CANYON DEL REY WATERSHED**

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_  
 PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
 OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

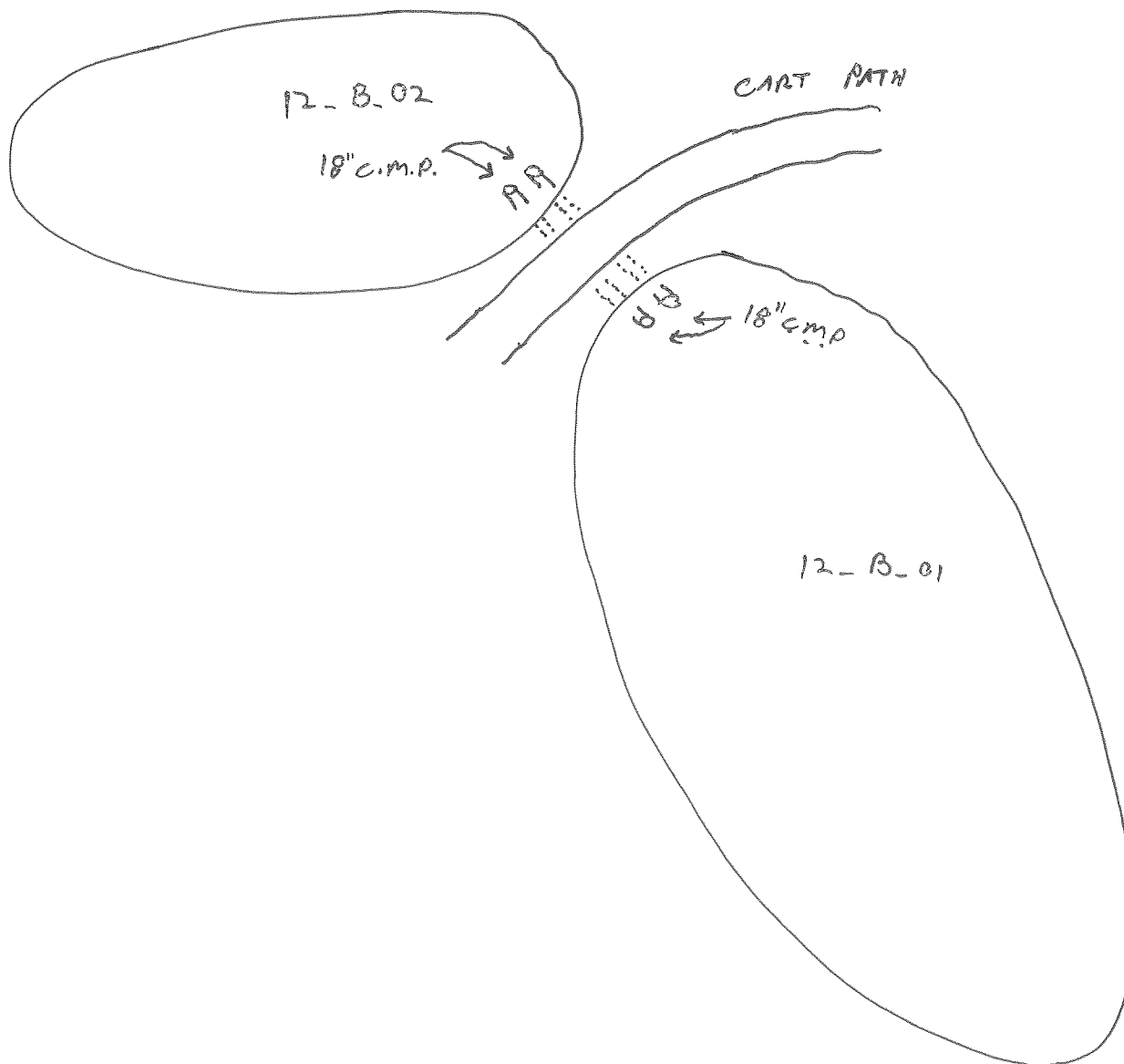
MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0503 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY T. H. DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE





BASIN ID / PT. # RANGE: 12-B-02

PROJECT# 2888.00

11462-11480

SURVEY DATE: 2013-0429

LOCATION: LAGUNA SECA

SURVEY PARTY: TOM HANNAH

GOLF RANCH

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: 311.94

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 24" DIA.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 311.43

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 12" DIA.

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 311.92

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) Y

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# BASIN SURVEY

MONTEREY COUNTY CALIFORNIA

## CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF

CULVERT ID: N.A., 12-B-02 OUTLET

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0429

GENERAL LOCATION: LAGUNA SECA  
GOLF RANCH

SURVEY PARTY: TOM HANNAN

SURVEY POINT #s: 11462-11480

INVERT (UPSTREAM) ELEVATION: 311.92 (12")  
311.43 (24")  
311.54 (12")

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

INVERT (DOWNSTREAM) ELEVATION: 309.10 (24")  
12.63 (12")

UPSTREAM DEBRIS DESCRIPTION  
NONE

LENGTH 23.10 (24") SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION  
NONE

NUMBER OF BARRELS 2

DIMENSIONS (DIAMETER / W X H): 12" DIA. / 24" DIA.

PHYSICAL CONDITION: (SOUND) / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: 311.57

TRASH RACK? Y  IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: N.A.

SPILL CREST ABOVE CULVERT: 313.34

ANGLE (FROM NORTH) N. 70° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

-SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg

DATE:

SCALE:

DRAWN:

CHECKED:

PROJECT No.:

SHEET

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0503

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TN

DATE \_\_\_\_\_

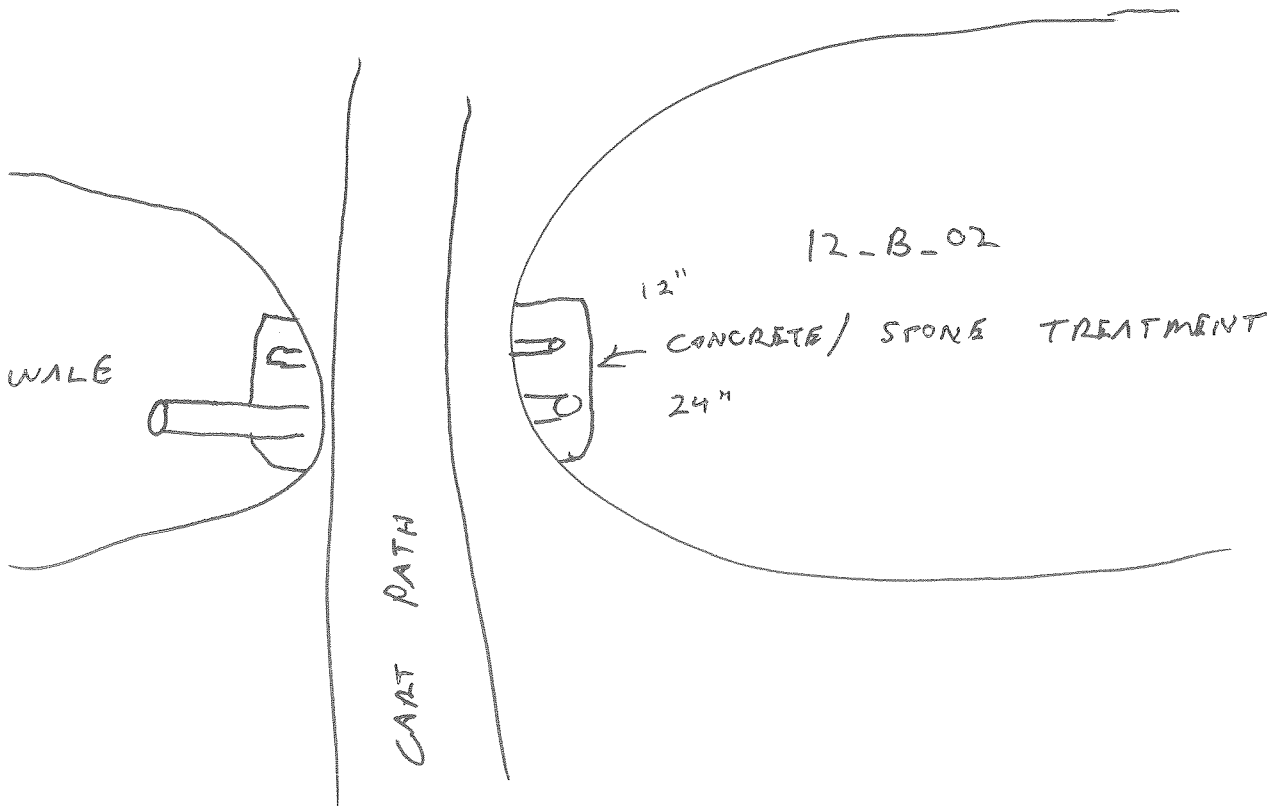
CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

NOT TO SCALE

12-B-02

OUTLET



12-B-02

12"

24"

CONCRETE / STONE TREATMENT

WALE

CART PATH

CULVERT ID: 12-C-01 PROJECT#: 2888.00  
 1977 ID (IF ANY) 21 SURVEY DATE: 2013-04-04  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY. 68 AT LAGUNA EYIN MURPHY  
SEGA GOLF RANCH  
 SURVEY POINT #s: 11220 - 11249

INVERT (UPSTREAM) ELEVATION: 294.85

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: 293.78

1.5' SILT (294.78)  
3.5' DEEP STANDING WATER

LENGTH 109.27 SHAPE ROUND

UPSTREAM DEBRIS DESCRIPTION

NUMBER OF BARRELS 1

LIGHT VEGETATION

DIMENSIONS (DIAMETER / W X H): 48" DIA.

DOWNSTREAM DEBRIS DESCRIPTION

LIGHT VEGETATION

CULVERT MATERIAL TYPE: C.M.P.

PHYSICAL CONDITION: SOUND / CRACKED /

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

TRASH RACK? Y  N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: 315.5

ANGLE (FROM NORTH) N. 51° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

1.4' SILT (296.25)  
2.2' STANDING WATER



COMMENTS:

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



## CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE:

SCALE:

DRAWN:

CHECKED:

PROJECT No.:

SHEET

OF



# WILSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

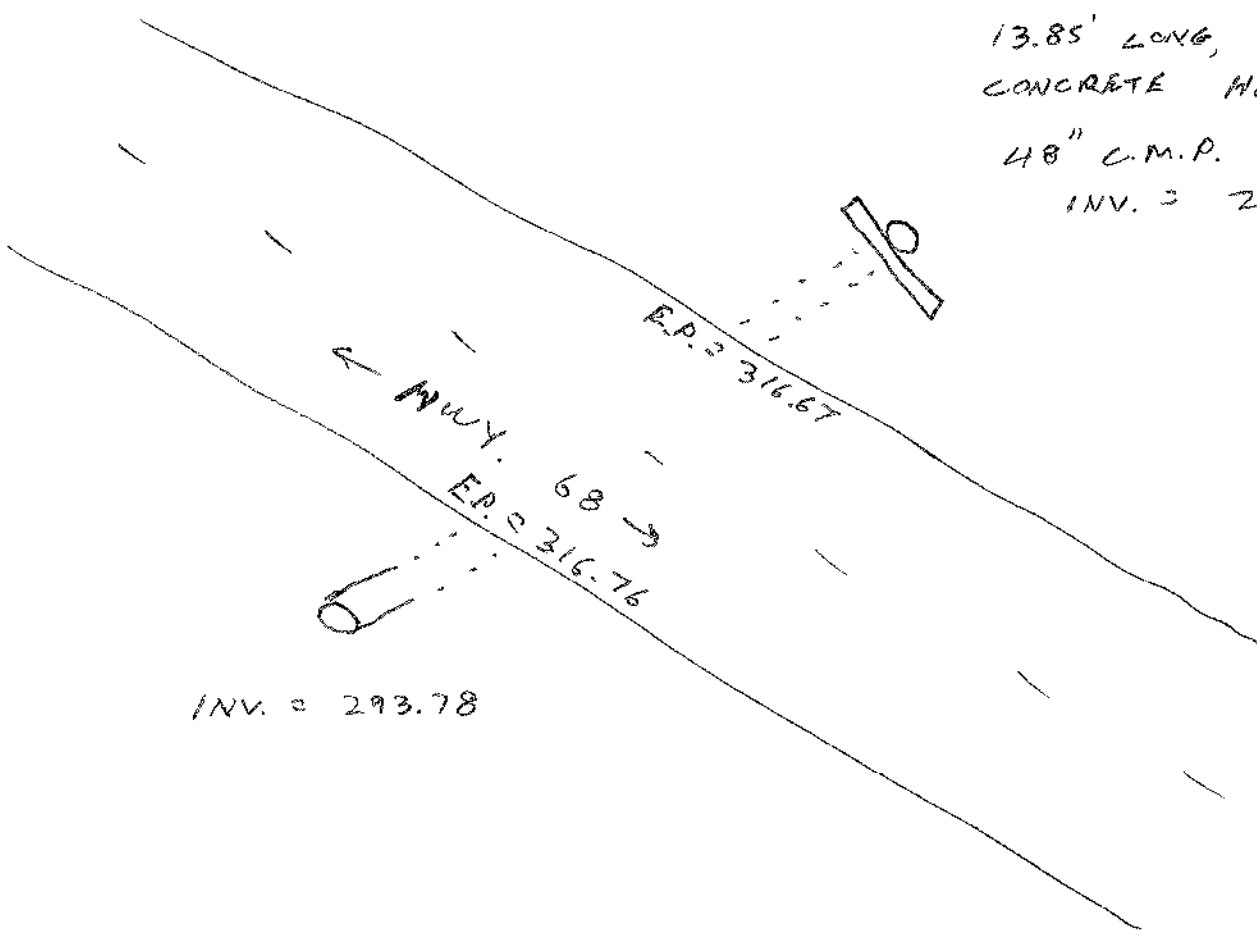
CANYON DEL REY 2888.00  
2013-0501  
CALCULATED BY TN  
CHECKED BY

12 - C.01

NOT TO SCALE



13.85' LONG, 10" WIDE  
CONCRETE HEADWALL  
48" C.M.P.  
INV. = 294.85



INV. = 293.78


CULVERT ID: 14-C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 22 SURVEY DATE: 2013-04-04  
 GENERAL LOCATION: CROSSING UNDER HIGHWAY 68 AT LAGUNA SELA GOLF RANCH SURVEY PARTY: TOM HANNAY EVIN MURPHY  
 SURVEY POINT #'s: 11258-11274

INVERT (UPSTREAM) ELEVATION: 265.94 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NO SEDIMENT. ROCKY BOTTOM  
 INVERT (DOWNSTREAM) ELEVATION: 262.27 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 162.18 SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 48" DIA.  
 CULVERT MATERIAL TYPE: C.M.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 303 +/- ANGLE (FROM NORTH) N. 27° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION NO SEDIMENT. ROCKY BOTTOM.  
 -SEE SKETCHES ATTACHED-

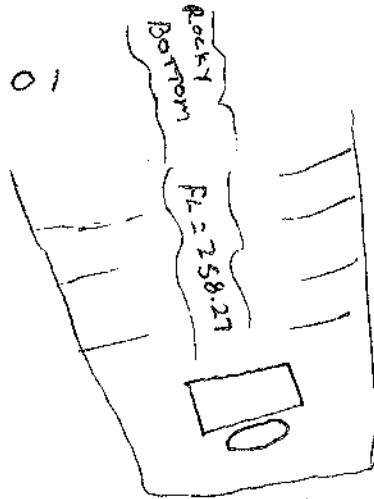


COMMENTS: \* CONCRETE APRON / SUPPORT ART AT NORTH (DOWNSTREAM) END FAILING.

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET   OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	

14-C-01



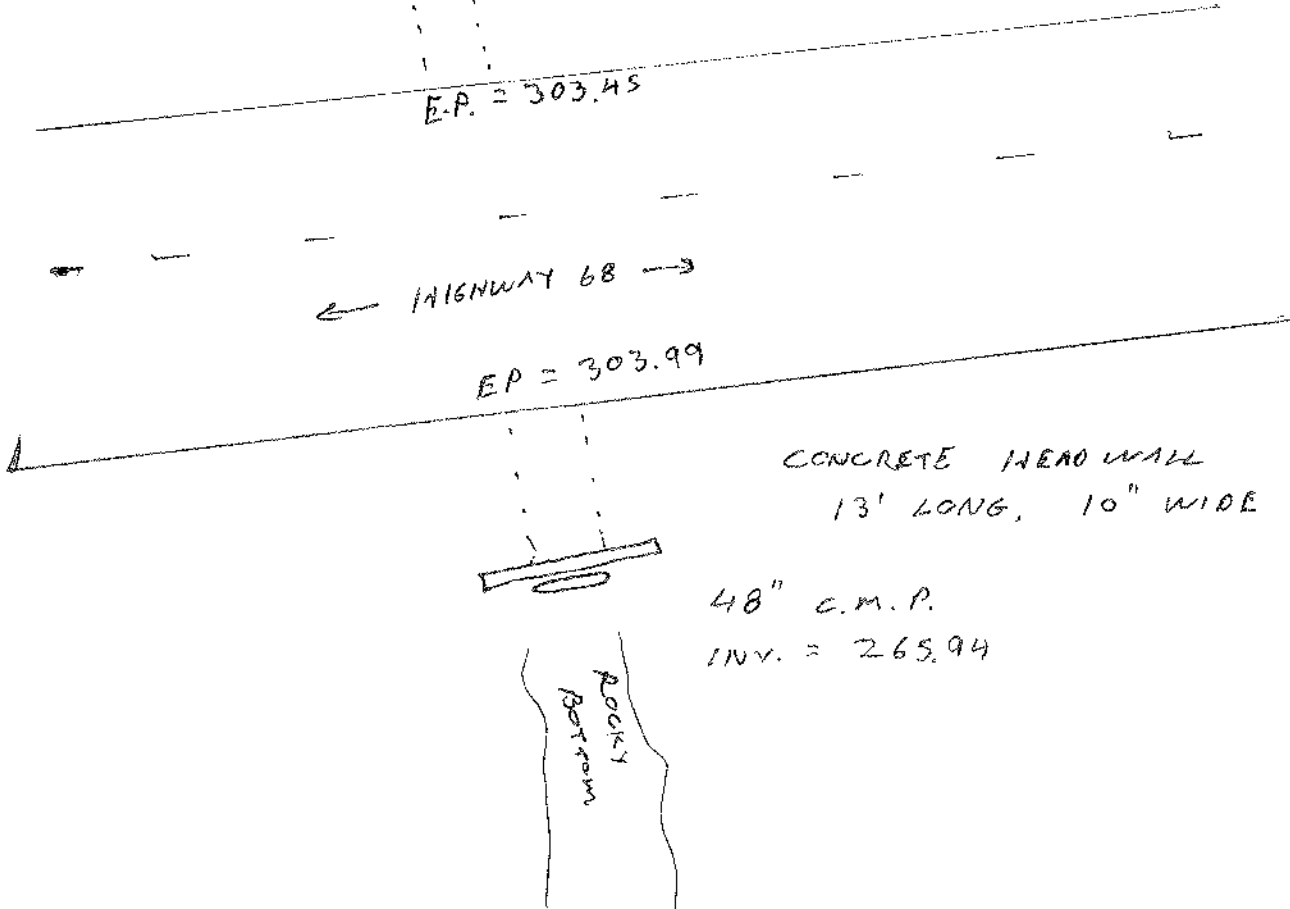
NOT TO SCALE



STEEP RAVINE

48" C.M.P. WITH CONCRETE APPROX.

INV. = ~~266.27~~  
 262.27



CONCRETE HEAD WALL  
 13' LONG, 10" WIDE

48" C.M.P.  
 INV. = 265.94



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LOS ANGELES SANTA CRUZ

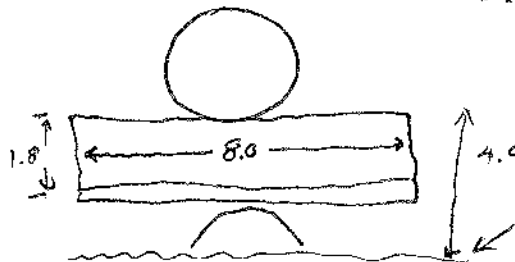
2013 CANYON DEL REY 2888.00  
2013-0501  
CALCULATED BY TIM  
CHECKED BY  
DATE  
DATE

14-C-01

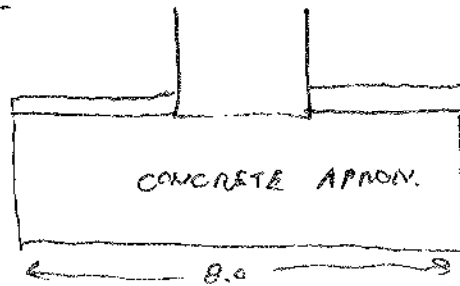
- DOWNSTREAM -

END VIEW

48" C.M.P. INV. = 262.27



TOP VIEW



APRON SUPPORTED BY PIECE OF  
C.M.P.

APRON FAILING. (SEE PHOTOS)



CULVERT ID: 15\_C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 25 SURVEY DATE: 2013-0322  
 GENERAL LOCATION: NORTH OF HWY 68, SURVEY PARTY: TOM HANNAH  
PARALLEL TO HWY, EVIN MURPHY  
CROSSING UNDER OLD DRIVEWAY  
 SURVEY POINT #s: 11108-11120

INVERT (UPSTREAM) ELEVATION: 225.34  
 INVERT (DOWNSTREAM) ELEVATION: 215.33  
 LENGTH 124.57 SHAPE ROUND  
 NUMBER OF BARRELS 1  
 DIMENSIONS (DIAMETER / W X H): 48" I.D.  
 CULVERT MATERIAL TYPE: E.M.P.

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MINIMAL SEDIMENT  
 UPSTREAM DEBRIS DESCRIPTION  
~~SOME TRASH, ROCKS AND~~  
~~VEGETATION~~  
 DOWNSTREAM DEBRIS DESCRIPTION  
 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: HIGH WATER  
MARK NOT VISIBLE  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT  
VISIBLE  
 SPILL CREST ABOVE CULVERT: 233.5

TRASH RACK? (Y) N IF YES, DESCRIPTION:  
TRASH RACK PRESENT (UPSTREAM)  
BUT N  
 ANGLE (FROM NORTH) N. 79° 38' W.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SOME SAND/SILT.  
STRUCTURE DRY (UPSTREAM)

-SEE SKETCHES ATTACHED-



COMMENTS: THE INLET OF THE STRUCTURE IS  
VERTICAL.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET   OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN: _____	
	PROJECT No.:	CHECKED: _____	



# WHITSON ENGINEERS

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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH

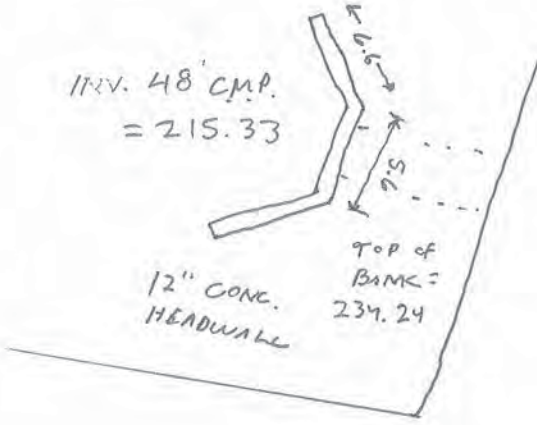
DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

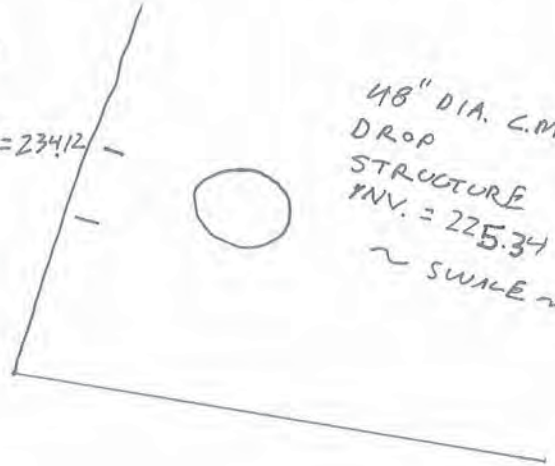
15-C-01

NOT TO SCALE



PAVED ACCESS  
- GATED -

EP=234.12



← HWY. 68 →

CULVERT ID: 16-C-01 PROJECT# 2888.00  
 1977 ID (IF ANY) 23 SURVEY DATE: 2013-04-04  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HIGHWAY 68 EVIN MURPHY  
EAST OF YORK ROAD  
 SURVEY POINT #s: 11276 - 11298

INVERT (UPSTREAM) ELEVATION: 271.77

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
.5 SILT AND LEAVES 270.09

INVERT (DOWNSTREAM) ELEVATION: 269.51

UPSTREAM DEBRIS DESCRIPTION  
NONE

LENGTH 56.23 SHAPE ROUND

DOWNSTREAM DEBRIS DESCRIPTION  
NONE

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 24" DIA.

PHYSICAL CONDITION: (SOUND) / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: <sup>NOT</sup>VISIBLE

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: <sup>NOT</sup>VISIBLE

SPILL CREST ABOVE CULVERT: 275.5

ANGLE (FROM NORTH) N. 14° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
.1 SILT AND LEAVES

-SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



## CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_

PROJECT No.:

SHEET

OF



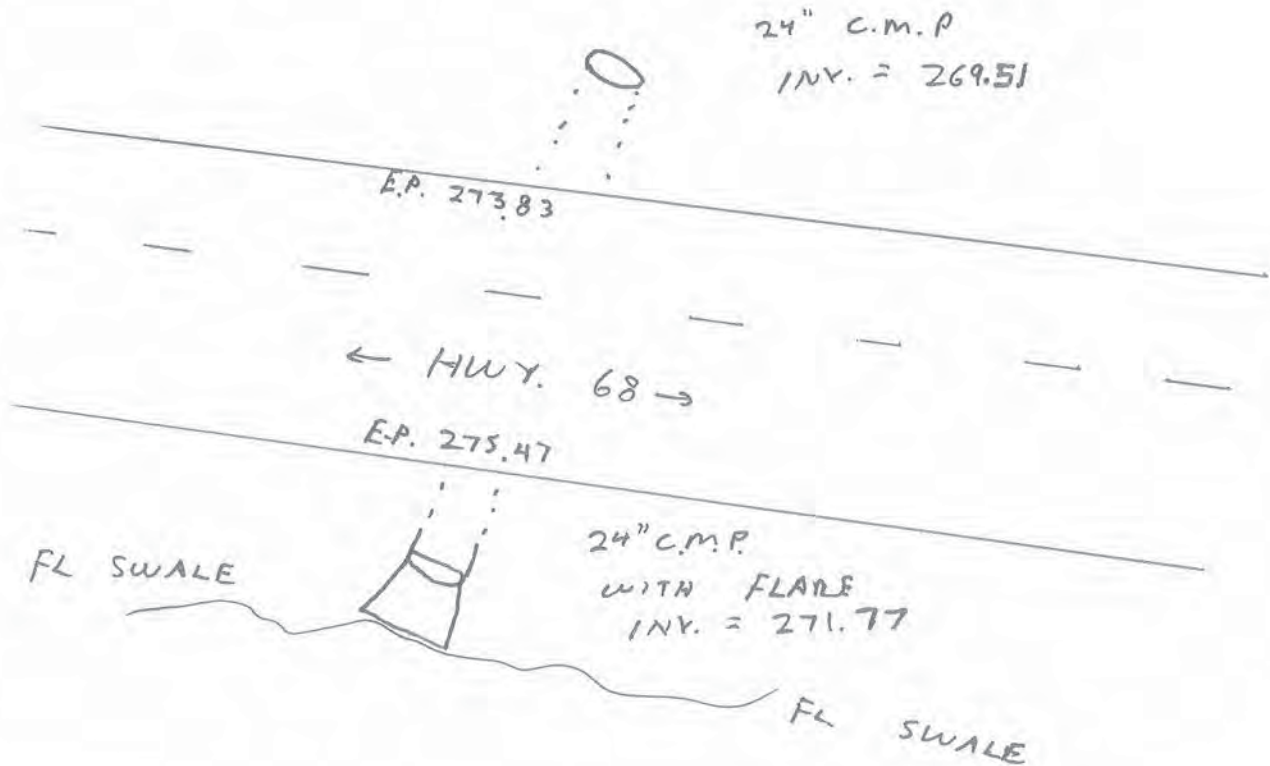
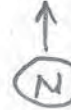
# WHITSON ENGINEERS

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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0501 SHEET No. 1 of 1  
CALCULATED BY T.H. DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

16 - C - 01

NOT TO SCALE



CULVERT ID: 17-C-01  
 1977 ID (IF ANY) 26  
 GENERAL LOCATION: CROSSING UNDER  
YORK RD. N. OF  
HWY 68  
 SURVEY POINT #'S: 10173-10238

PROJECT# 2888.00  
 SURVEY DATE: 2013-0204  
 SURVEY PARTY: TOM HANNAH  
SIMON LAGUENS

INVERT (UPSTREAM) ELEVATION: 189.22 \*

INVERT (DOWNSTREAM) ELEVATION: 188.74 \*

LENGTH 35.07 SHAPE Box w/ DOME ROOF

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H) 4.4' x 8.0'

CULVERT MATERIAL TYPE: CONC. EARTH FLOOR

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: 204.26

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
LIGHT SAND / MUD

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SAND / MUD CHECK - DAM 12' DOWNSTREAM  
ELEV. = 192.1  
 UPSTREAM DEBRIS DESCRIPTION  
LEAF LITTER

DOWNSTREAM DEBRIS DESCRIPTION  
WILLOWS, POISON OAK, LOGS

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
SCOURING UNDER S.W. COR.  
OF STRUCTURE.

TRASH RACK? Y (N) IF YES, DESCRIPTION:

ANGLE (FROM NORTH) N 74° W

-SEE SKETCHES ATTACHED-



COMMENTS: \* ~~2x~~ STRUCTURE HAS NO FLOOR. INVERT  
SHOTS ON GROUND.

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
		SCALE:	
	CANYON DEL REY WATERSHED	DRAWN:	
		CHECKED:	
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	PROJECT No.:	OF	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY                      LOS ANGELES                      SANTA CRUZ

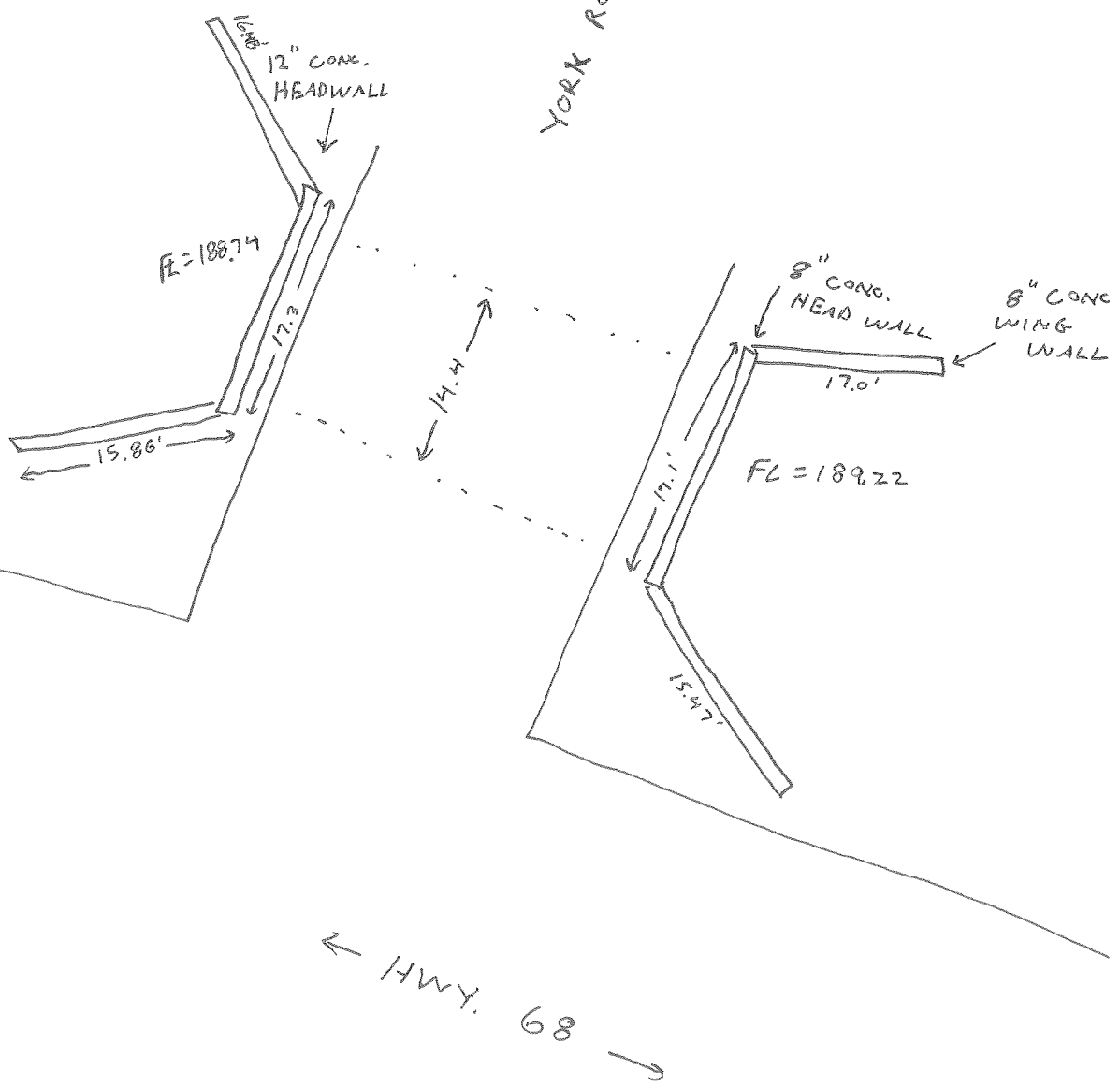
PROJECT CANYON DEL REY JOB No. \_\_\_\_\_  
DATE 2013-0514 SHEET No. 1 of 2  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

17\_C\_01

NOT TO SCALE



YORK ROAD





# WHITSON ENGINEERS

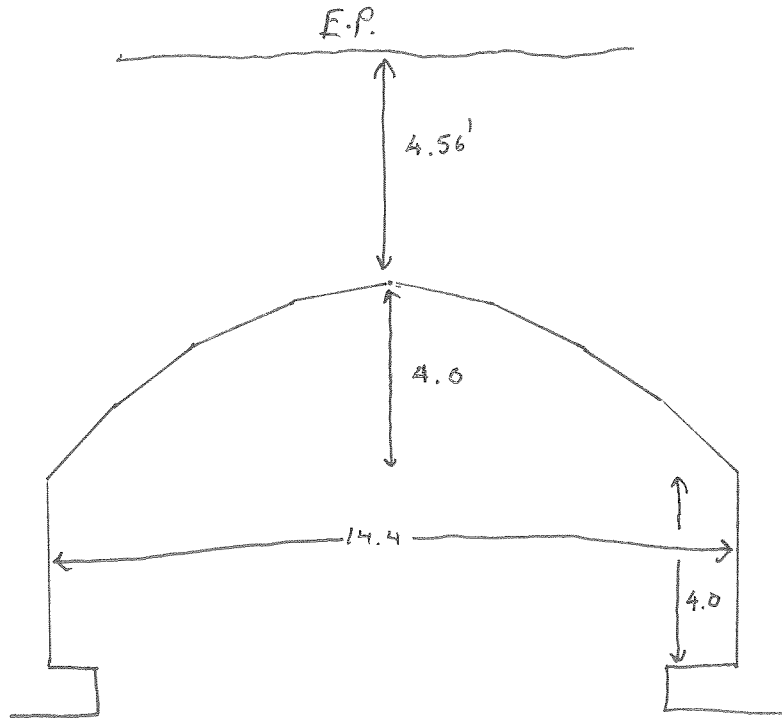
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. 2 of 2  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

17\_c\_01

VIEW FROM  
EAST END

(SEE PHOTOS)



CULVERT ID: 18\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) 27 SURVEY DATE: 2013-0228  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM NANNAN  
HIGHWAY 68 EVIN MURPHY  
WEST OF YOKA ROAD  
 SURVEY POINT #s: 10904 -10927 10936

INVERT (UPSTREAM) ELEVATION: 196.66 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MINIMAL.  
 INVERT (DOWNSTREAM) ELEVATION: 196.00 UPSTREAM DEBRIS DESCRIPTION  
POISON OAK  
 LENGTH 55.36 SHAPE BOX  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
POISON OAK  
 DIMENSIONS (DIAMETER / W X H): 6' X 4' PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y  IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 202.5 ANGLE (FROM NORTH) N. 16° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
APPROX. 1.5' MUD AND SILT  
IN UPSTREAM END.



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



## CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_

SHEET

PROJECT No.:

OF





# WHITSON ENGINEERS

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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TN DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

18 - C - 01

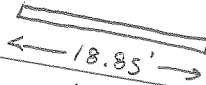
NOT TO SCALE



6.0 W. X 4.1 H. R.C.B.

6.0 WIDE REINFORCED  
CONCRETE BOX  
INY. = 196.00

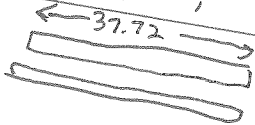
10" CONC.  
HEADWALL



YORK ROAD

← HWY. 68 →

10" GAS  
(SEE PHOTOS)



← 11" CONC. HEADWALL

INY. = 196.53

MANHOLE ID / PT. # RANGE: SDMH # 11133

PROJECT# 2888.00

LOCATION: RYAN RANCH RD.

SURVEY DATE: 3/22/13

Flows to 19-B-01

SURVEY PARTY: TH

EM

11133

DIAMETER/DIMENSIONS: 26" DIA.

RIM ELEV. (NAVD88): 197.23

SHAPE: R

NOTE THE INVERT, DIAMETER, DIRECTION, SIZE, AND MATERIAL IN SKETCH BELOW.

INVERT MIDDLE OF MH: 191.33

FLOW LEVEL: 0% / 25% / 50% / 75% / 100%

FLOW CONDITION: FREE / STAGNANT

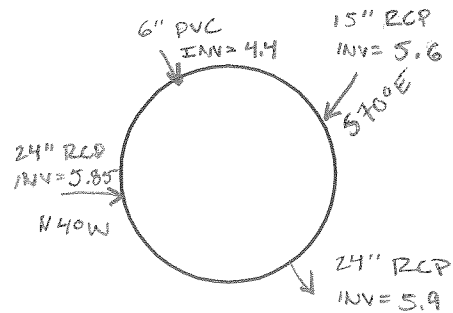
FLOW CONTROL: YES (NO) IF YES \_\_\_\_\_

RUNGS: (YES) / NO

PHYSICAL CONDITION: (SOUND) / CRACKED / MISSING MORTAR / REBAR EXPOSED / FAILING / PLUGGED

MANHOLE MATERIAL: BRICK (CONCRETE) LINED

PIPE MATERIAL: LINED / METAL / PVC (RCP) / VCP / UNK



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### SD MANHOLE SURVEY

COUNTY: \_\_\_\_\_ CITY: \_\_\_\_\_ CALIFORNIA

PROJECT DESC: \_\_\_\_\_

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Manhole Survey Form.dwg PROJECT No.: \_\_\_\_\_

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_

BASIN ID / PT. # RANGE: 19-B-01

PROJECT# 2888.00

11721-11144

SURVEY DATE: 2013-0322

LOCATION: NORTH OF HWY 68

SURVEY PARTY: TOM HANNAN

WEST OF YORK ROAD

EYIN MURPHY

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: 189.58

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: DENSE VEGETATION

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: 19320

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \*193.28

WATER LINE 190.44  
2013-0322

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) Y. INLET. 24"  
- SEE SKETCH -

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: \* OUTLET IS A GRADED SWALE, V-SHAPE,  
15' WIDE, 3' DEEP.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

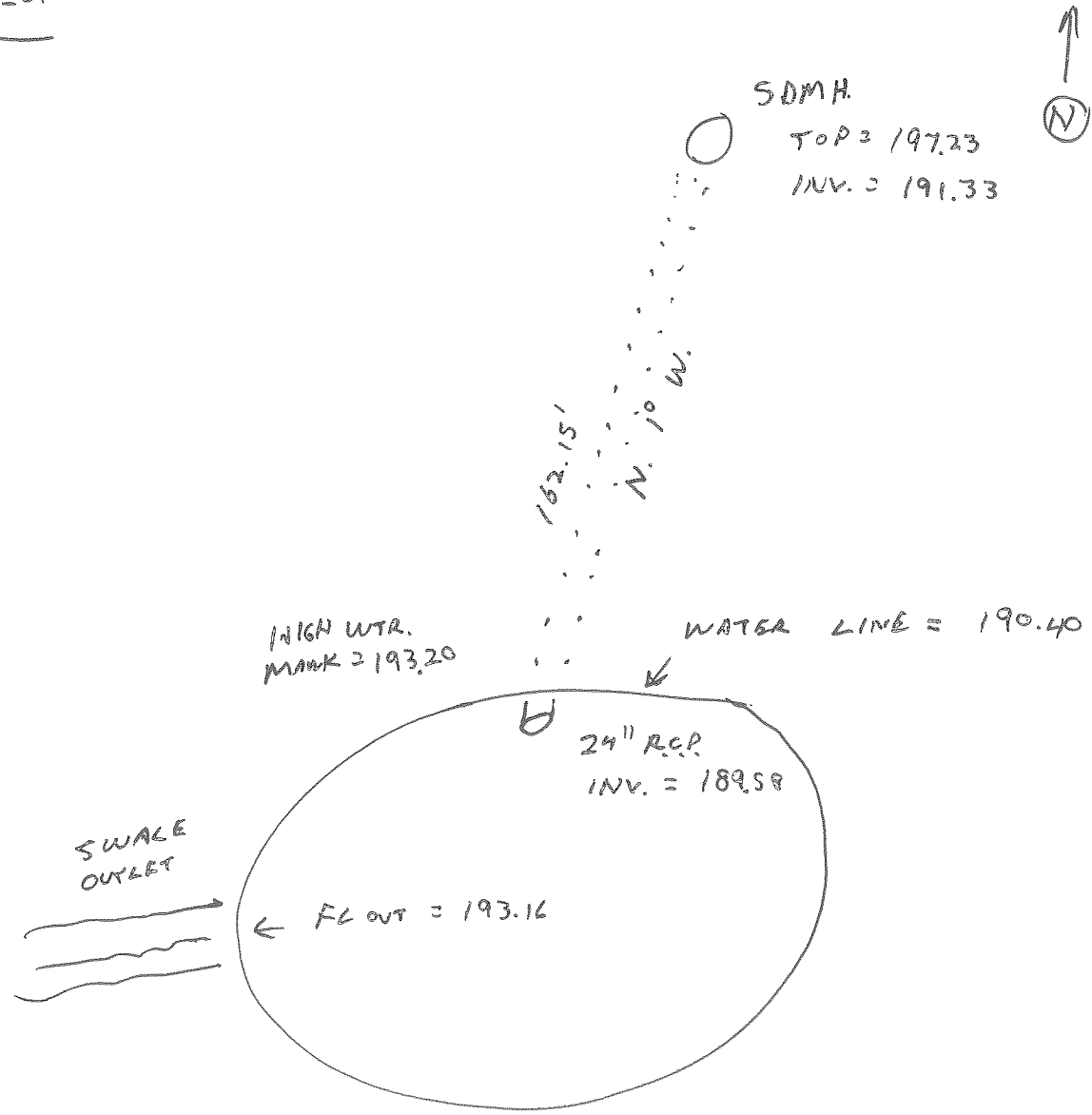
MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0503 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TW DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

19-B-01



BASIN ID / PT. # RANGE: 21-B-01

PROJECT# 2888.00

10846 -10902

SURVEY DATE: 2013-02-27

LOCATION: NORTH OF HWY 68

SURVEY PARTY: TOM HANNAH

AT RYAN RANCH

BASIN ON LINE OR OFF LINE: ON

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: 143.38 (WEIR)

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \*

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \*

ELEV. HIGH WATER MARKS: 142.11

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \*

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \*

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \*

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \*

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: \* SEE SKETCH

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY CALIFORNIA

#### CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET  
**1**  
OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

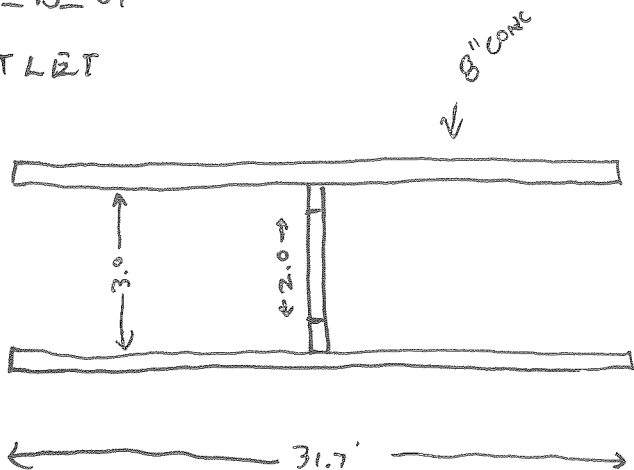
MONTEREY

LOS ANGELES

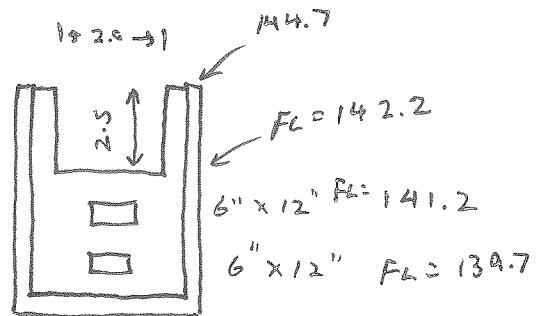
SANTA CRUZ

21-B-01

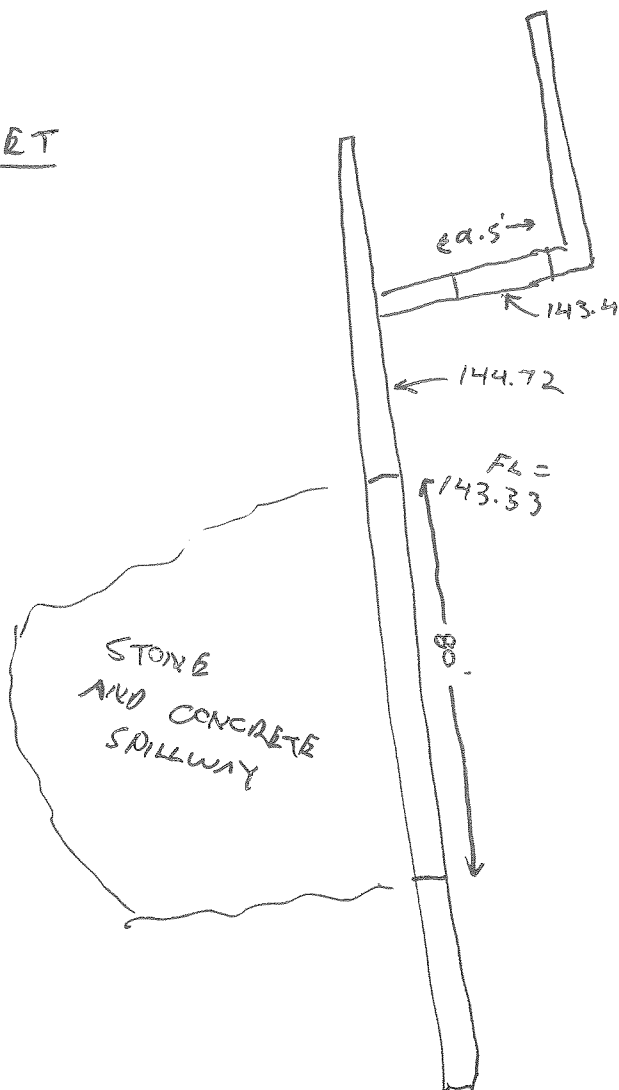
OUTLET



PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-05-03 SHEET No. 2 of 2  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



21-B-01 INLET





# WHITSON ENGINEERS

MONTEREY

LOS ANGELES

SANTA CRUZ

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

PROJECT CANYON DEL REY JOB No. 2888.00

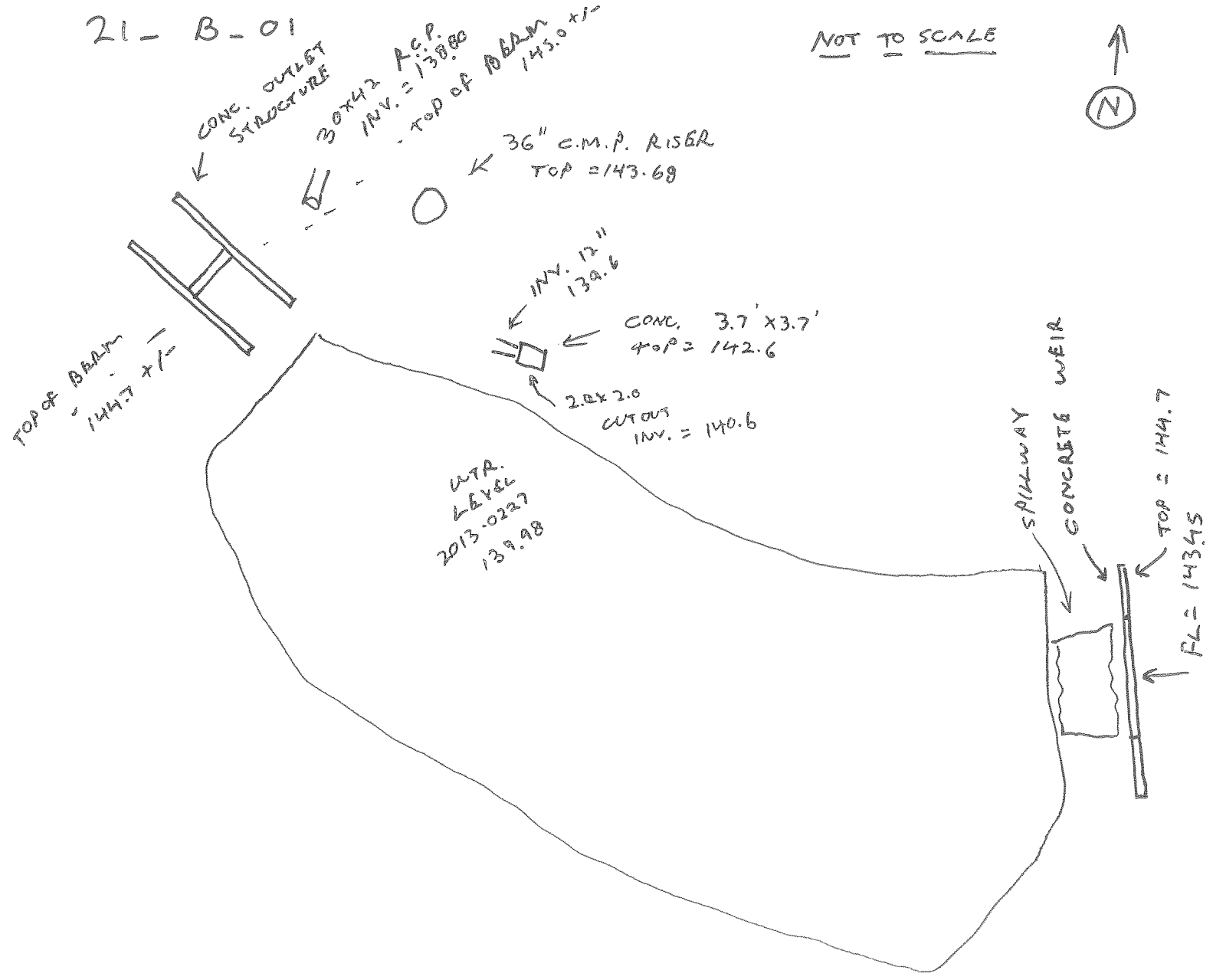
DATE 2013-05-03 SHEET No. 1 of 2

CALCULATED BY FH DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

21-B-01

NOT TO SCALE




CULVERT ID:	<u>21_C_01</u>	PROJECT#	<u>2888.00</u>
1977 ID (IF ANY)	<u>29</u>	SURVEY DATE:	<u>2013-0228</u>
GENERAL LOCATION:	<u>CROSSING UNDER</u> <u>HWY 68 APPROX.</u> <u>1800' WEST OF YORK RD.</u>	SURVEY PARTY:	<u>TOM HANNAN</u> <u>EVIN MURPHY</u>
SURVEY POINT #'s:	<u>10953-10974</u>		

INVERT (UPSTREAM) ELEVATION: <u>164.16</u>	DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION <u>MINIMAL</u>
INVERT (DOWNSTREAM) ELEVATION: <u>163.26</u>	UPSTREAM DEBRIS DESCRIPTION <u>VEGETATION</u>
LENGTH <u>65.26</u> SHAPE <u>OVAL</u>	DOWNSTREAM DEBRIS DESCRIPTION <u>TIRES AND TRASH, VEGETATION</u>
NUMBER OF BARRELS <u>3</u>	PHYSICAL CONDITION: <u>(SOUND)</u> / CRACKED / COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED
DIMENSIONS (DIAMETER / W X H): <u>28" W. 24" H.</u>	TRASH RACK? <u>Y</u> <input checked="" type="radio"/> IF YES, DESCRIPTION:
CULVERT MATERIAL TYPE: <u>EMA *</u>	ANGLE (FROM NORTH) <u>N. 7° E.</u>
HIGH WATER (UPSTREAM) ELEVATION: <u>165.10</u>	-SEE SKETCHES ATTACHED-
HIGH WATER (DOWNSTREAM) ELEVATION: <u>164.07</u>	
SPILL CREST ABOVE CULVERT: <u>169.0</u>	
UPSTREAM SEDIMENT ELEVATION/DESCRIPTION <u>MINIMAL</u>	



COMMENTS: \* PIPE APPEARS TO BE MADE FROM  
A SYNTHETIC FIBERGLASS TYPE MATERIAL

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET _____ OF _____
		SCALE:	
	DRAWN:		
	CHECKED:		
CANYON DEL REY WATERSHED		PROJECT No.:	
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg			





# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.06

DATE 2013-0514 SHEET No. of

CALCULATED BY DATE

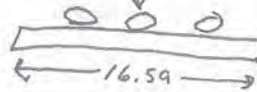
CHECKED BY DATE

21\_C\_01

NOT TO SCALE

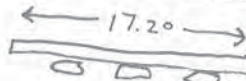


FL = 164.16 (INV. IN.) 28" x 24" ELLIPTICAL (3)  
SYNTHETIC (FIBERGLASS?) MATERIAL



10" CONC. HEADWALL

HWY. 68



INV. OUT:

163.40  
163.26  
163.10

BASIN ID / PT. # RANGE: 22-B-01

PROJECT# 2888.00

11209-11219

SURVEY DATE: 2013-0326

LOCATION: NORTH OF HWY

SURVEY PARTY: \_\_\_\_\_

68 BELOW RYAN RANCH

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO STRUCTURE

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 1' x 1'

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 137.47

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 2.5 w. x 2.8 d.

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 140.67

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS:

WATER LINE 2013-0326 = 138.63

HIGH WATER MARK = 139.89

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

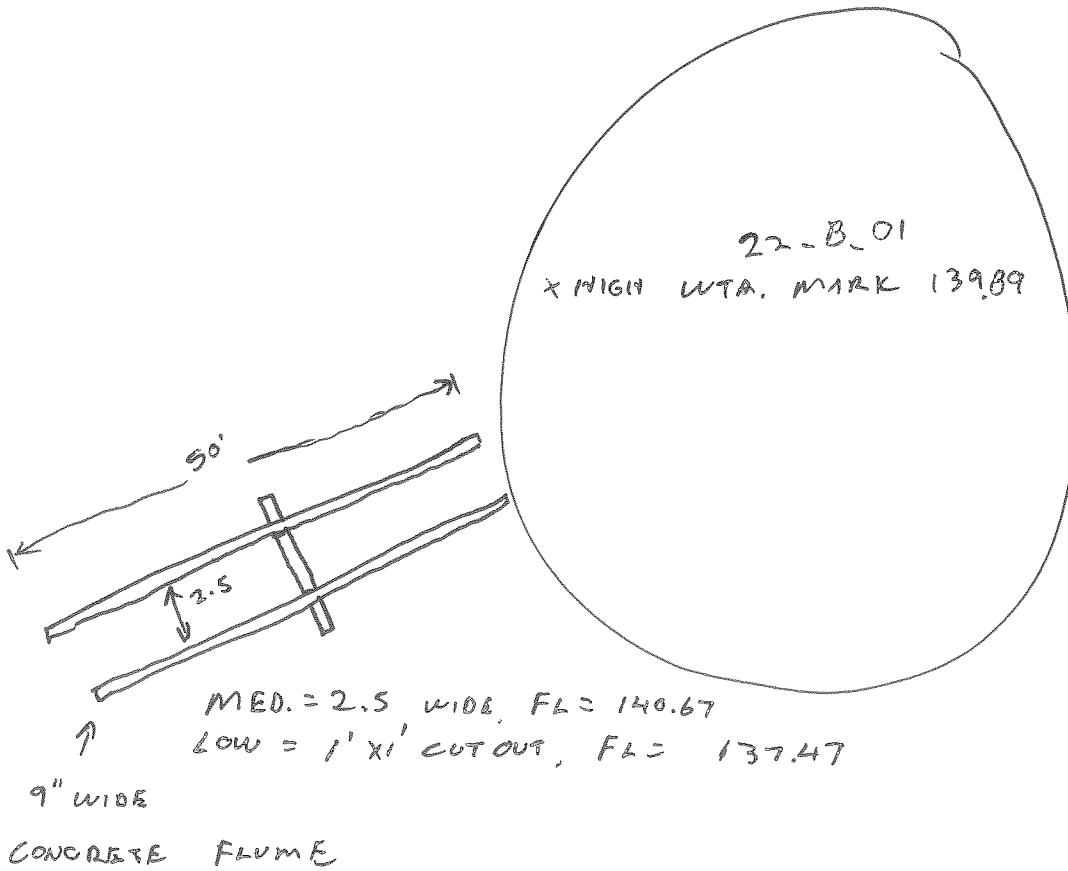
LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0503 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY T.H. DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE

22-B-01



BASIN ID / PT. # RANGE: 24\_B\_01

PROJECT# 2888.00

SURVEY DATE: 2013-0326

LOCATION: AT ENTRANCE TO

SURVEY PARTY: TOM HANNAH

MONTEREA SUBDIVISION

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: \_\_\_\_\_

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 8.5 WIDE SPILLWAY

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 141.90

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

SHEET

1

OF

CULVERT ID: N.A., WITH 24-B-01

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0326

GENERAL LOCATION: AT ENTRANCE

SURVEY PARTY: TOM HANNAH

TO MONTEARRA RANCH

SUBDIVISION

SURVEY POINT #s: 11183, 11192

INVERT (UPSTREAM) ELEVATION: 141.95

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: \_\_\_\_\_

UPSTREAM DEBRIS DESCRIPTION

LENGTH 101.67 SHAPE ROUND

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

DIMENSIONS (DIAMETER / W X H): 36" DIA.

PHYSICAL CONDITION: SOUND / CRACKED / COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: N.A.

TRASH RACK? Y / N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: N.A.

SPILL CREST ABOVE CULVERT: N.A.

ANGLE (FROM NORTH)

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

RISE AT INLET.



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING ■ LAND SURVEYING ■ PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0503 SHEET No. 1 of 1

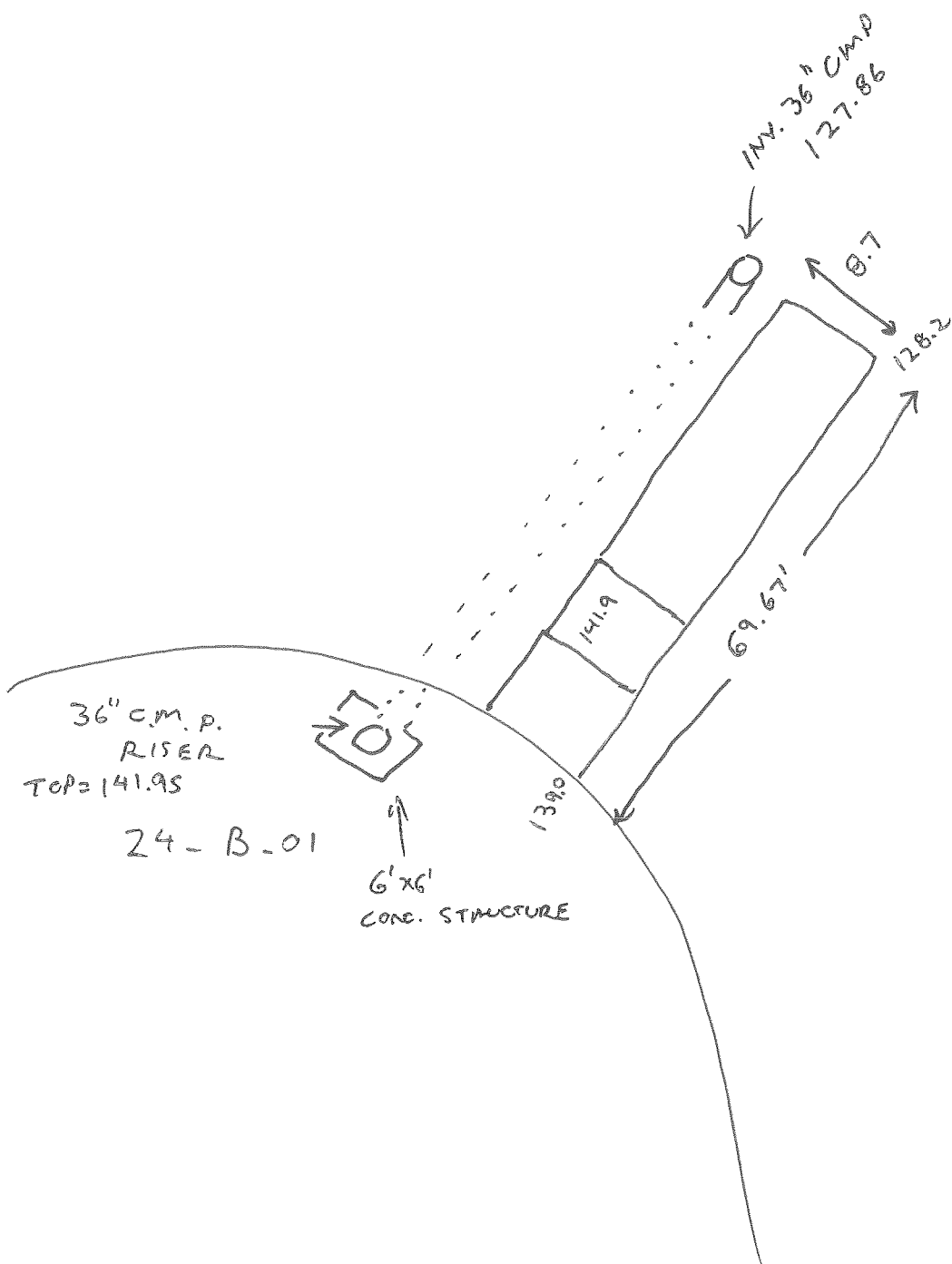
CALCULATED BY TN DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE



24-B-01



BASIN ID / PT. # RANGE: 24-B-02

PROJECT# 2888.00

11193-11202

SURVEY DATE: 2013-0326

LOCATION: ENTRANCE TO

SURVEY PARTY: TOM HANNAH

MONTEARRA RANCH

SUBDIVISION

BASIN ON LINE OR OFF LINE: \_\_\_\_\_

DIMENSIONS OF RISER: \_\_\_\_\_

INVERT (IN) ELEVATION: NO STRUCTURE  
(CSWALE)

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 15" DIA.

DESCRIBE DEBRIS: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 127.25

ELEV. HIGH WATER MARKS: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 15" DIA.

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN  
PHOTOS FOLDER:

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 127.43

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 15" DIA.

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 127.63

CULVERT INLET OR OUTLET? (COMPLETE CULVERT  
FORM) Y (OUTLET)

RISER PRESENT? IF YES, COMPLETE THE CULVERT  
FORM AND NOTE THE FOLLOWING:

WATER LINE 2013-0326 125.97  
HIGH WTR. MARK: 128.97



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET

1

OF

CULVERT ID: N.A., WITH 24-B-02

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-0326

GENERAL LOCATION: ENTRANCE TO

SURVEY PARTY: TOM HANNAH

MONTEREA RANCH

SUBDIVISION

SURVEY POINT #s: 11193-11202

INVERT (UPSTREAM) ELEVATION: 127.63  
127.43  
127.35

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

INVERT (DOWNSTREAM) ELEVATION: 127.25

UPSTREAM DEBRIS DESCRIPTION  
VEGETATION

LENGTH 79.76 SHAPE ROUND

NUMBER OF BARRELS (3)

DOWNSTREAM DEBRIS DESCRIPTION  
VEGETATION

DIMENSIONS (DIAMETER / W X H): 15" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_

TRASH RACK? Y / N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_

SPILL CREST ABOVE CULVERT: 130.53

ANGLE (FROM NORTH) N. 66° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE

-SEE SKETCHES ATTACHED-



COMMENTS: - SEE SKETCH -

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_

PROJECT No.:

SHEET

OF





# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

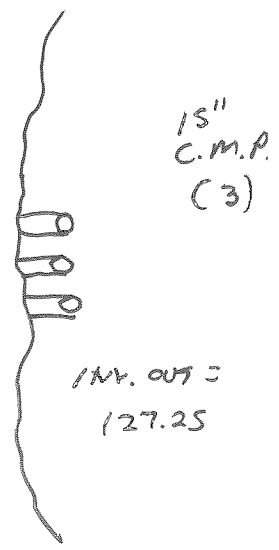
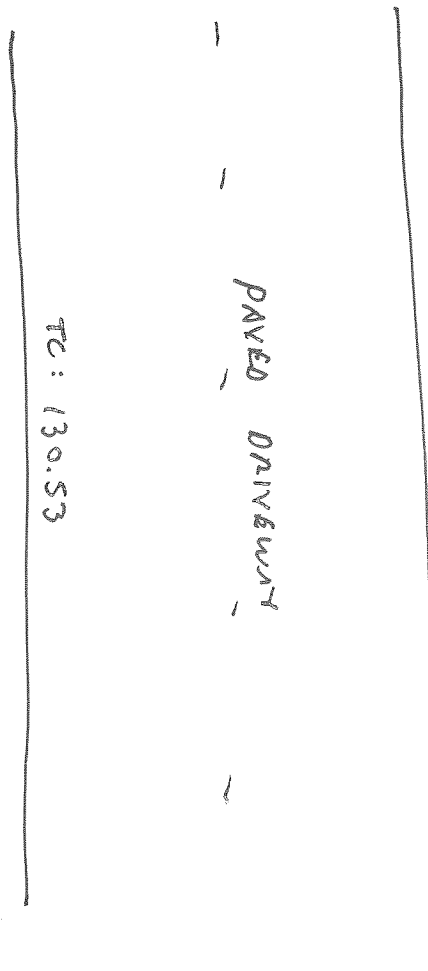
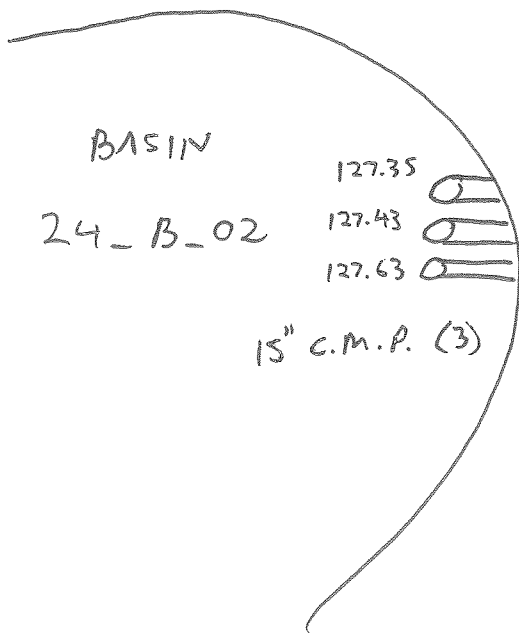
MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0503 SHEET No. 1 of 1  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

NOT TO SCALE




BASIN ID / PT. # RANGE: 25-B-01 PROJECT# 2888.00  
11203-11208 SURVEY DATE: 2013-0326  
 LOCATION: RYAN RANCH SURVEY PARTY: TOM HANNAH  
BUSINESS PARK

BASIN ON LINE OR OFF LINE: \_\_\_\_\_ DIMENSIONS OF RISER: 24" C.M.P. w/ 36" C.M.P. CAP  
 INVERT (IN) ELEVATION: 224.25 (18") ELEVATION OF SEDIMENT, IF ANY: NONE  
224.06 (18")  
 LOW FLOW ORIFICE/OUTLET DIMENSIONS: \* DESCRIBE DEBRIS: NONE  
 LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 220.42 ELEV. HIGH WATER MARKS: NONE  
 MED. FLOW ORIFICE/OUTLET DIMENSIONS: \_\_\_\_\_ PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN  
 PHOTOS FOLDER:  
 MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: \_\_\_\_\_ ATTACHED SKETCHES OF ABOVE  
 HIGH FLOW ORIFICE/OUTLET DIMENSIONS: Top of 36" C.M.P.  
 HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 227.42  
 CULVERT INLET OR OUTLET? (COMPLETE CULVERT  
 FORM)  
 RISER PRESENT? IF YES, COMPLETE THE CULVERT  
 FORM AND NOTE THE FOLLOWING:



COMMENTS: \* PERFORATIONS IN 24" VERTICAL  
C.M.P. (SEE PHOTOS)  
APPROX. HIGH WATER MARK = 224.88  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BASIN SURVEY</b>	DATE:	SHEET  <b>1</b>  OF
	MONTEREY COUNTY CALIFORNIA	SCALE:	
	<b>CANYON DEL REY WATERSHED</b>	DRAWN:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg	CHECKED:	
	PROJECT No.:		

CULVERT ID: N.A., FOR 2S\_10\_01

PROJECT# 2888.00

1977 ID (IF ANY) 11203-11208

SURVEY DATE: 2013-0326

GENERAL LOCATION: RYAN RANCH

SURVEY PARTY: TOM HANNAH

BUSINESS PARK

SURVEY POINT #s: 11203-11208

INVERT (UPSTREAM) ELEVATION: UNKNOWN

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: 20 224.25  
224.06

UPSTREAM DEBRIS DESCRIPTION

LENGTH UNKNOWN SHAPE ROUND

NUMBER OF BARRELS 2 (NOT TOGETHER)

DOWNSTREAM DEBRIS DESCRIPTION

DIMENSIONS (DIAMETER / W X H): 18" DIA.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: CMP  
W FLARE

HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_

TRASH RACK? Y / N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_

SPILL CREST ABOVE CULVERT: \_\_\_\_\_

ANGLE (FROM NORTH) S. 60° E. / N. 0° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-



COMMENTS: \* SOME STANDING WATER AT MOUTH  
OF OUTLETS (BOTH PIPES)  
ORIGIN OF PIPES UNKNOWN

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_


CULVERT ID: 25\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0229  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
MONTEREIRA ENTRANCE EVIN MURPHY  
HWY 68 @ 218  
 SURVEY POINT #s: 10787-10815

INVERT (UPSTREAM) ELEVATION: 115.59 (48")  
113.86 (18") DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
110.09 (18") MINIMAL  
 INVERT (DOWNSTREAM) ELEVATION: 112.6 (48") UPSTREAM DEBRIS DESCRIPTION  
 CLEAN  
 LENGTH 130.1 SHAPE ROUND  
 NUMBER OF BARRELS 5 DOWNSTREAM DEBRIS DESCRIPTION  
 STANDING WATER, CATTAILS  
 DIMENSIONS (DIAMETER / W X H): 48" (2) 18" (3) PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: RCP  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK?  YES IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 123.5 ANGLE (FROM NORTH) N. 51° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
 MINIMAL



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	CULVERT SURVEY	DATE:	SHEET
	CANYON DEL REY WATERSHED	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
		OF	



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH

DATE \_\_\_\_\_

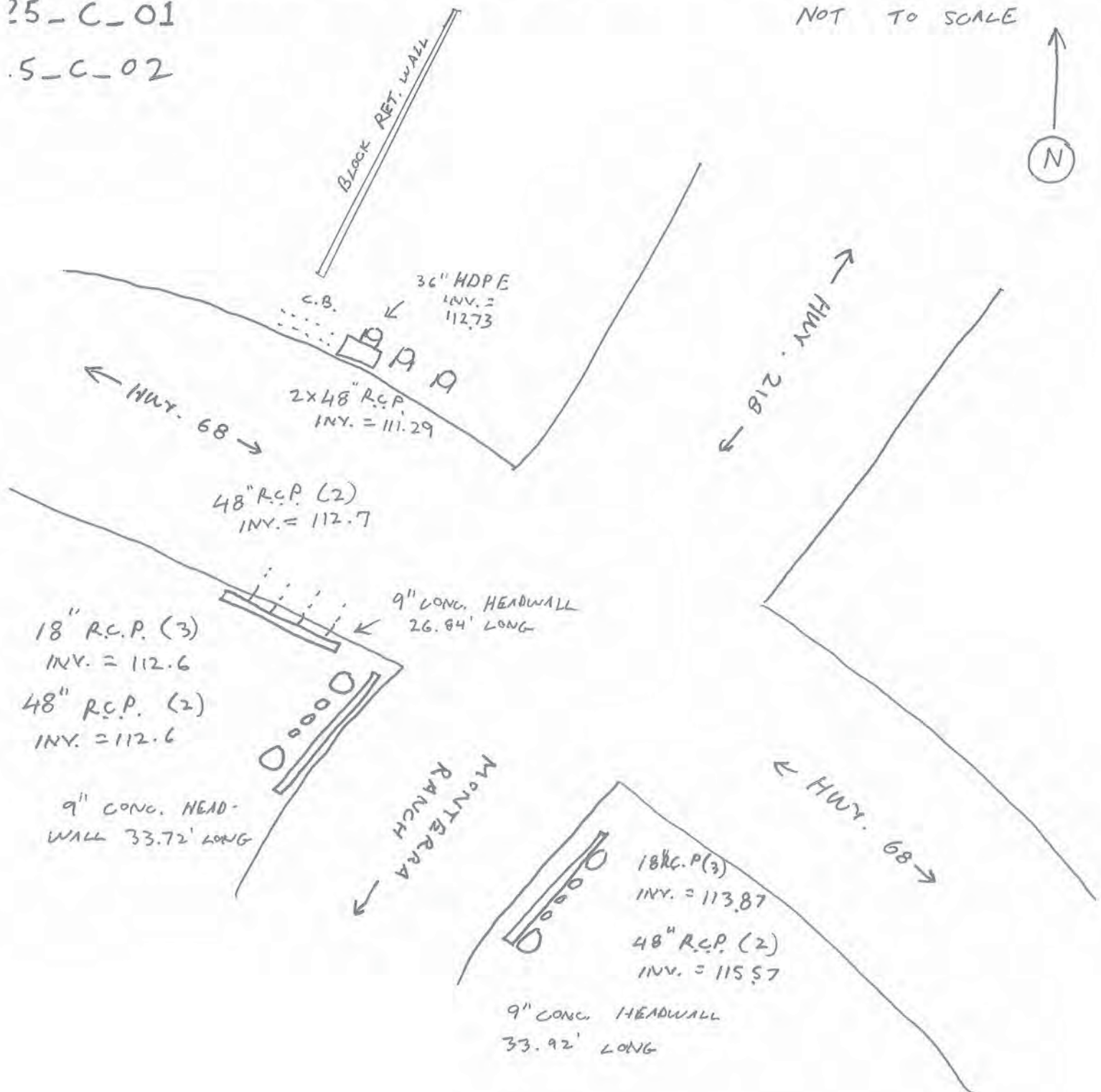
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DATE \_\_\_\_\_

25-C-01

5-C-02

NOT TO SCALE



CULVERT ID: 25\_C-02 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0227  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY 68 JUST WEST  
OF MONTEZUMA ENTRANCE  
 SURVEY POINT #s: 10745-10786

INVERT (UPSTREAM) ELEVATION: 112.73 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
 INVERT (DOWNSTREAM) ELEVATION: 111.31 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 120.34 SHAPE ROUND  
 NUMBER OF BARRELS 2 DOWNSTREAM DEBRIS DESCRIPTION  
 DIMENSIONS (DIAMETER / W X H): 48" I.D. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: R.C.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 118.53 ANGLE (FROM NORTH) N. 32° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-



COMMENTS: AN ADDITIONAL 36" H.D.P.E. C.P.P. FEEDS  
THE CHANNEL AT DOWNSTREAM END.  
THIS PIPE COMES FROM 26\_C-01 STRUCTURE.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
 OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TH

DATE \_\_\_\_\_

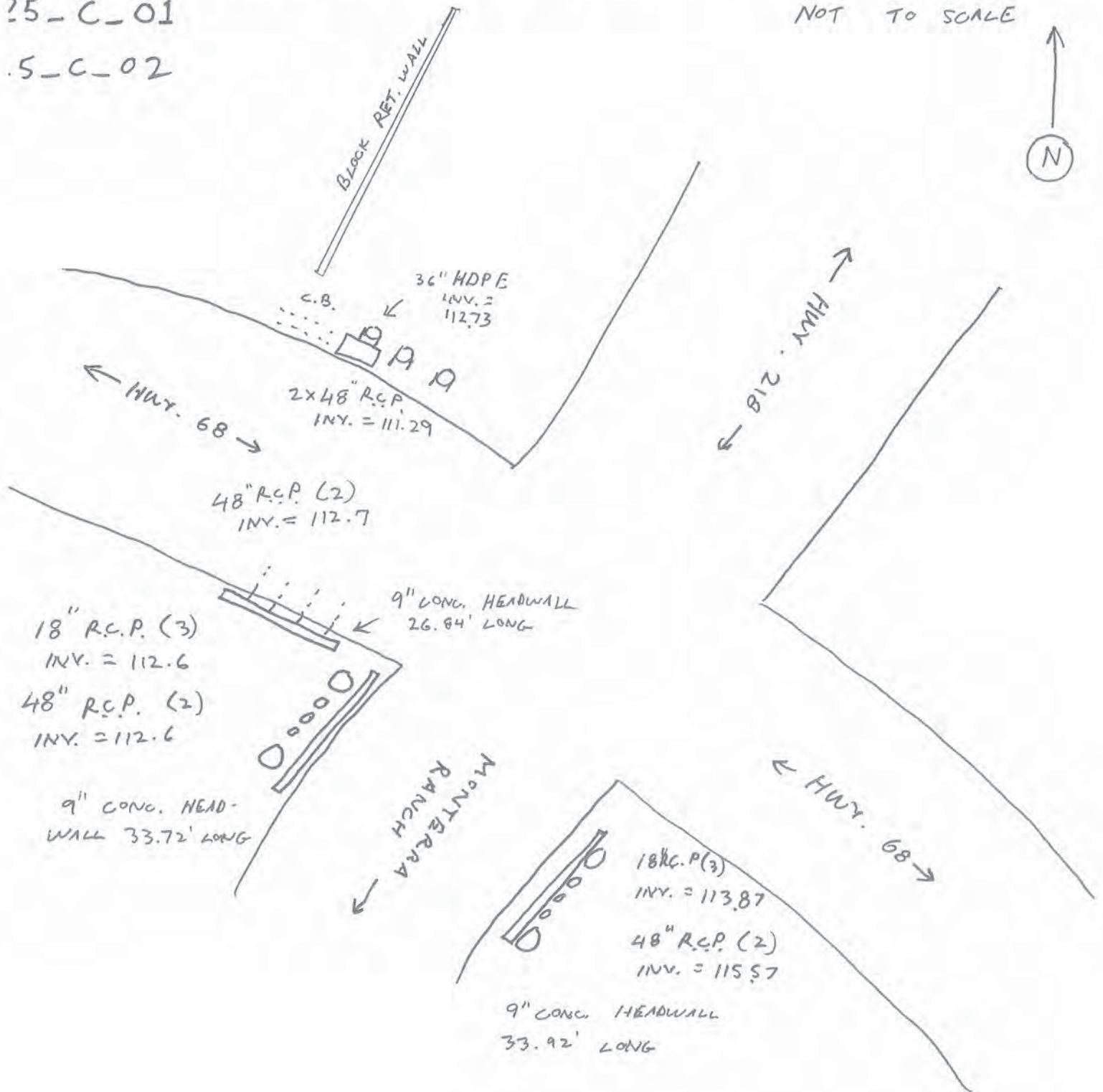
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DATE \_\_\_\_\_

25-C-01

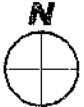
5-C-02

NOT TO SCALE




CULVERT ID: 25\_C-03 PROJECT# 2888.00  
 1977 ID (IF ANY) 32 SURVEY DATE: 2013-0227  
 GENERAL LOCATION: HWY 218, UNDER SURVEY PARTY: TOM HANNAH  
SOUTHEAST ENTRANCE  
TO STONE CREEK  
 SURVEY POINT #s: 10727-10743

INVERT (UPSTREAM) ELEVATION: 110.23 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MINIMAL SEDIMENT  
 INVERT (DOWNSTREAM) ELEVATION: 110.23 UPSTREAM DEBRIS DESCRIPTION  
VEGETATION (CATTAILS, BRAMBLES)  
 LENGTH 59.0' SHAPE Box DOWNSTREAM DEBRIS DESCRIPTION  
VEGETATION (CATTAILS, BRAMBLES)  
 NUMBER OF BARRELS 1 PHYSICAL CONDITION SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 14.0 x 7.7  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y / (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 120.65 ANGLE (FROM NORTH) N. 24° W.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
MINIMAL SEDIMENTS

 TRUE NORTH

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
			OF





# WHITSON ENGINEERS

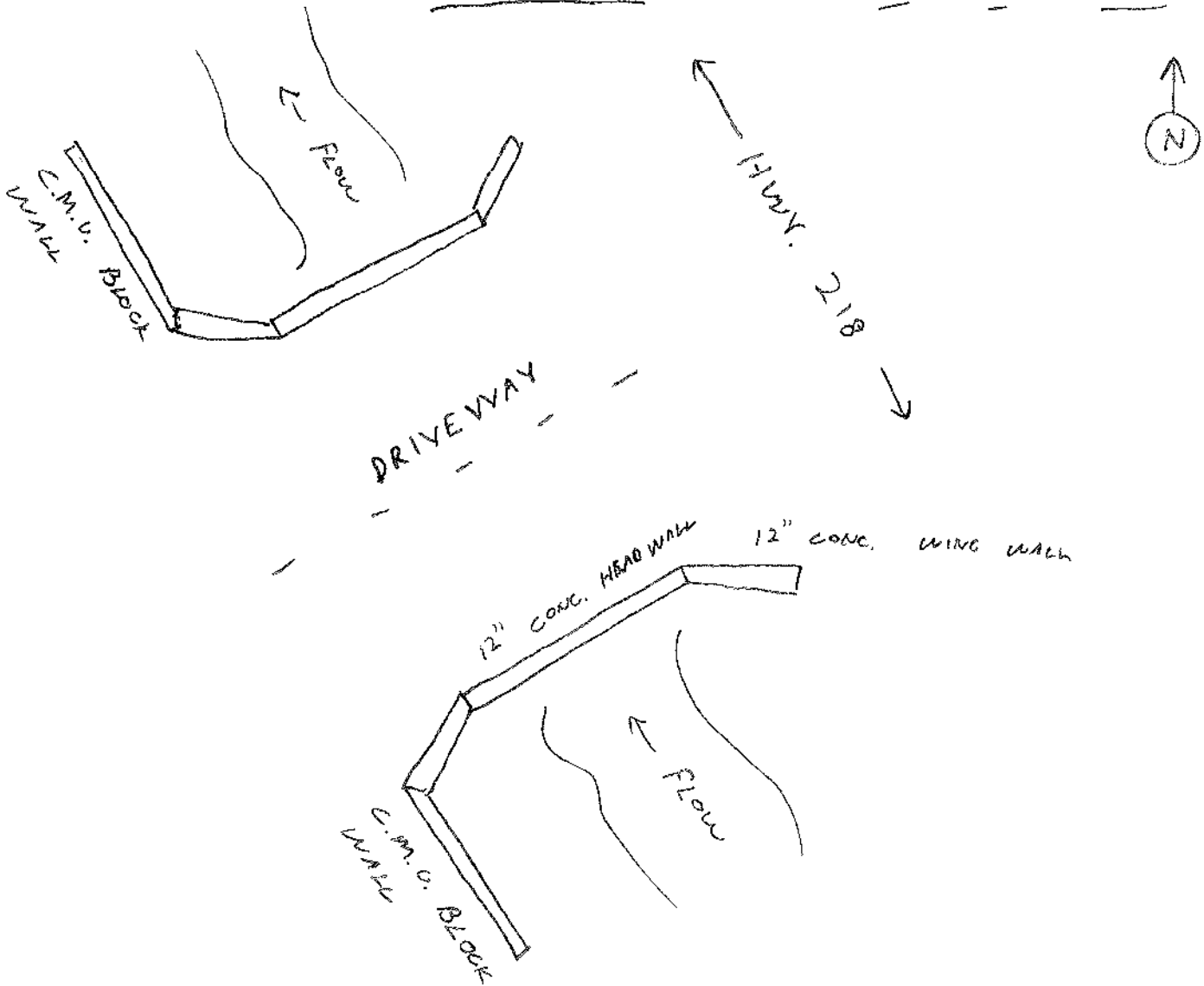
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES SANTA CRUZ

PROJECT: CANYON DEL REY  
NO. 2013-0227  
CALCULATED BY: TH  
CHECKED BY:

DATE: 2-8-88  
SHEET: 1 OF 2  
DATE:  
DATE:

25-C-03

NOT TO SCALE



14' WIDE x 7.7' H. CONCRETE BOX  
CULVERT



WILSON ENGINEERS  
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES      SANTA CRUZ

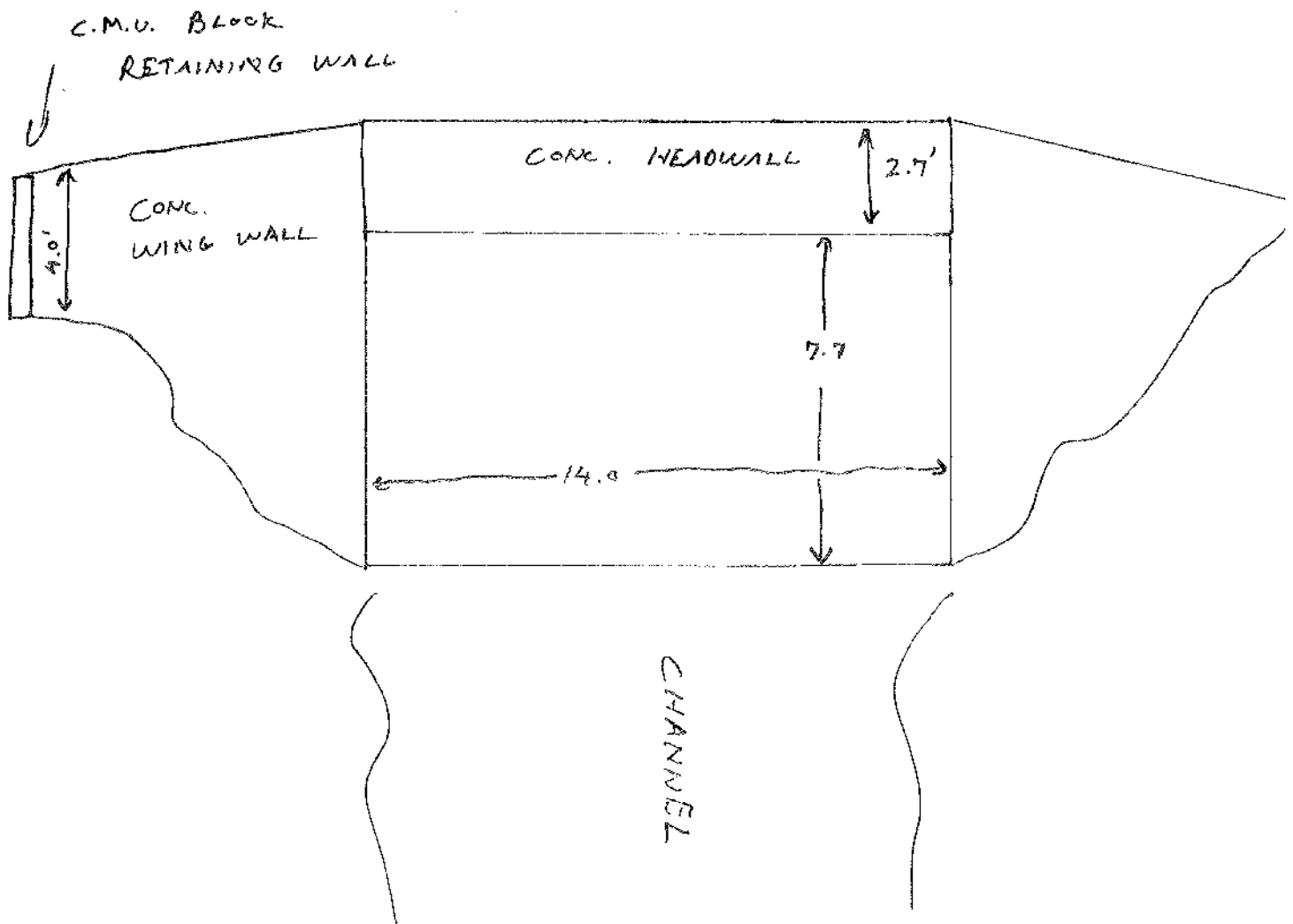
PROJECT CANYON DEL REY      TOTAL 2888.00  
NO. 2013-0227      SHEETS 2 OF 2  
DRAWN BY TH      DATE  
CHECKED BY

NOT TO SCALE

25-C-03

(SOUTH EAST END)

NORTH WEST END SIMILAR, RETAINING WALL TO WEST OF CULVERT.



BASIN ID / PT. # RANGE: 26-B-01  
25-48  
LOCATION: SO. OF NWY 68  
WEST OF 218  
INTERCHANGE

PROJECT# 2888.00  
SURVEY DATE: 2017-04-29  
SURVEY PARTY: TOM HANNAH

BASIN ON LINE OR OFF LINE: \_\_\_\_\_ DIMENSIONS OF RISER: 24" DIA. CMP (3)  
INVERT (IN) ELEVATION: NO STRUCTURE ELEVATION OF SEDIMENT, IF ANY: NONE  
LOW FLOW ORIFICE/OUTLET DIMENSIONS: \* DESCRIBE DEBRIS: NONE  
LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 203.8 ELEV. HIGH WATER MARKS: 203.92  
MED. FLOW ORIFICE/OUTLET DIMENSIONS: 24" O. (3) PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER:  
MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 206.3 ATTACHED SKETCHES OF ABOVE  
HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 12' W.  
HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 210.8  
CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM)  
RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: \* LOW FLOW = MULTIPLE PERFORATIONS  
IN RISERS, APPROX. 3" DIA. ea.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY CALIFORNIA  
CANYON DEL REY WATERSHED  
DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET  
**1**  
OF

CULVERT ID: N.A., WITH 26.B-01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0429  
 GENERAL LOCATION: SO. OF HWY 68 SURVEY PARTY: TOM HANNAH  
WEST OF HWY 218  
INTERCHANGE  
 SURVEY POINT #s: 25-48

INVERT (UPSTREAM) ELEVATION: 202.3 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE  
 INVERT (DOWNSTREAM) ELEVATION: 201.25 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 62' SHAPE ROUND DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 NUMBER OF BARRELS 3 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 24" DIA TRASH RACK?  YES IF YES, DESCRIPTION:  
REBAR GRATE  
 CULVERT MATERIAL TYPE: C.M.P. ANGLE (FROM NORTH) N. 50° E.  
 HIGH WATER (UPSTREAM) ELEVATION: 203.92 -SEE SKETCHES ATTACHED-  
 HIGH WATER (DOWNSTREAM) ELEVATION: N.A.  
 SPILL CREST ABOVE CULVERT: 210.8  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
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			OF



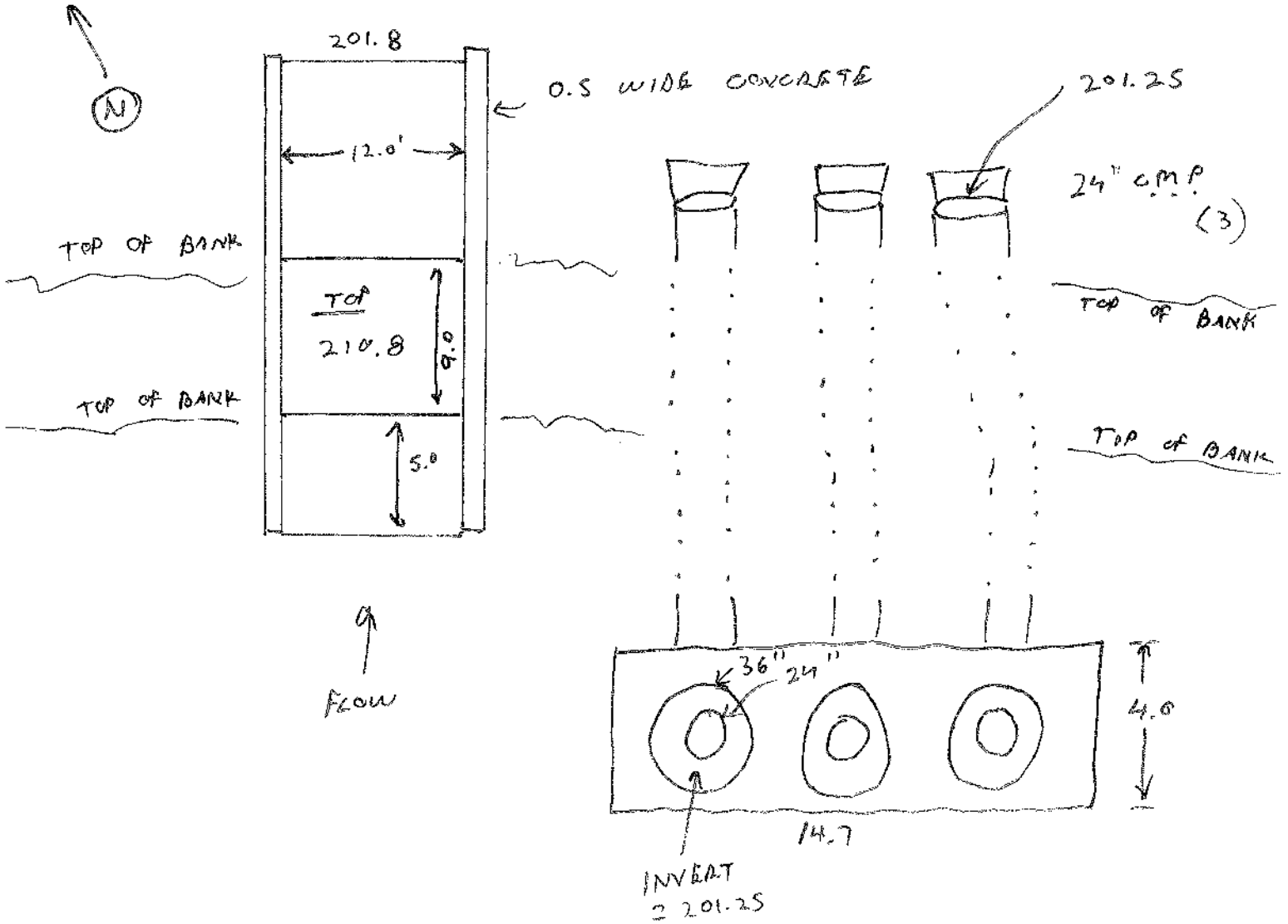
# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES SANTA CRUZ

PROJECT 2888.00  
DATE 2013-04-30  
CALCULATED BY TH  
CHECKED BY

SCALE  
REVISION 1 - 1  
DATE  
DATE

NOT TO SCALE



CULVERT ID: 26\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-02-27  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY. 68 NORTHWEST  
OF HWY. 68 / HWY. 218  
INTERCHANGE  
 SURVEY POINT #s: \_\_\_\_\_

INVERT (UPSTREAM) ELEVATION: 120.87 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE, STANDING WATER IN BOTTOM  
 INVERT (DOWNSTREAM) ELEVATION: 117.5 UPSTREAM DEBRIS DESCRIPTION OF STALL  
NONE CONC. STRUCTURE  
 LENGTH 67.13 SHAPE ROUND  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 DIMENSIONS (DIAMETER / W X H): 36" DIA. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: C.P.P.  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y  IF YES, DESCRIPTION:  
N.A. (Box)  
 HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_  
 SPILL CREST ABOVE CULVERT: 124.63 ANGLE (FROM NORTH) N. 17° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION NONE -SEE SKETCHES ATTACHED-



COMMENTS: 36" Flows to box on N.E. side HWY 218.68  
Box has 18" flowing in from North West,  
and a 36" flowing out to South East.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	
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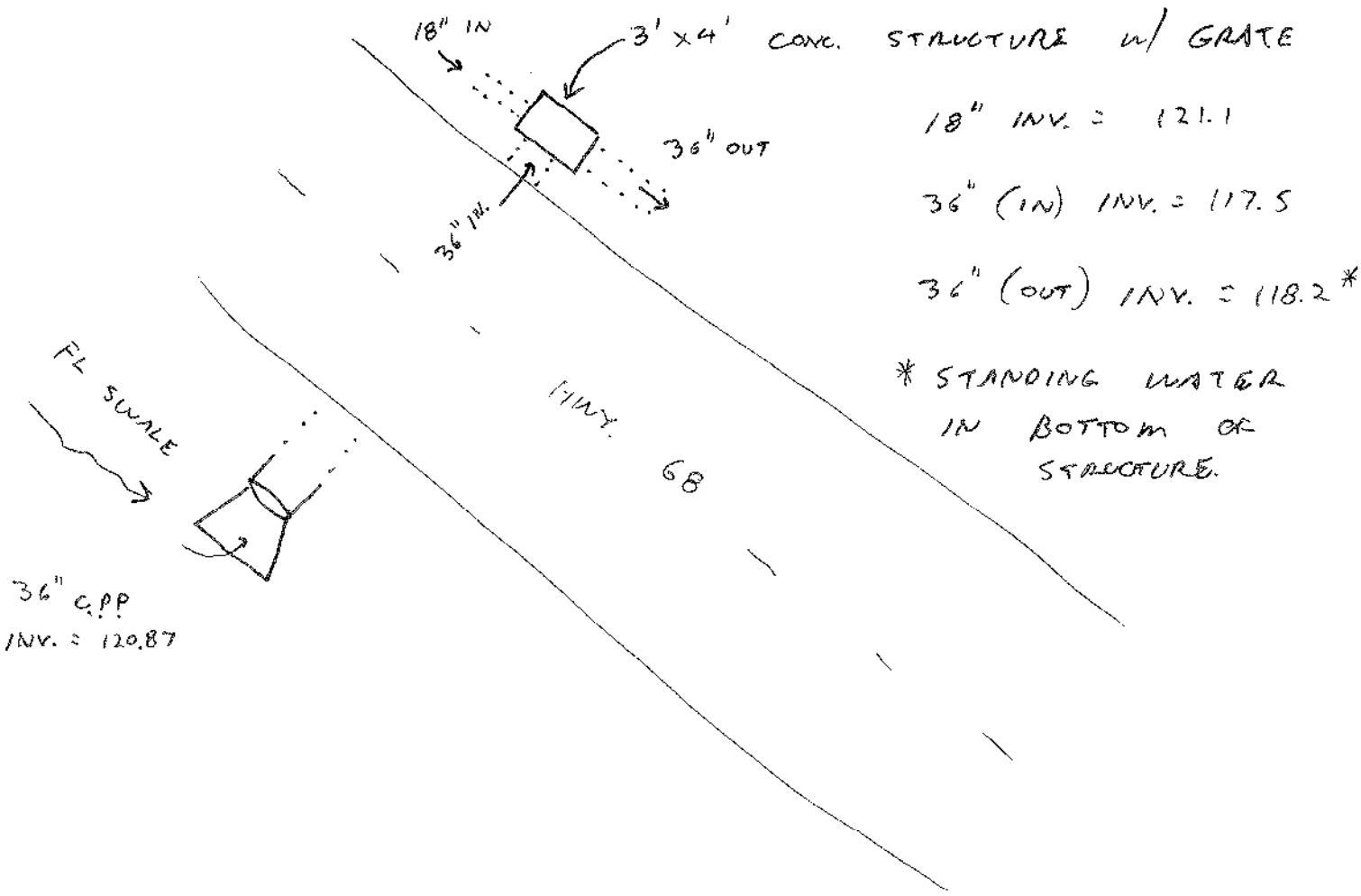
# WHITTON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

CANYON DEL REY 2888.00  
2013-0501  
CALCULATED BY  
CHECKED BY  
REVISION  
DATE  
DATE

26-C-01

NOT TO SCALE



- 18" INV. = 121.1
- 36" (IN) INV. = 117.5
- 36" (OUT) INV. = 118.2\*

\* STANDING WATER  
IN BOTTOM OF  
STRUCTURE.

FL SWALE  
36" C.P.P.  
INV. = 120.87

CULVERT ID: 27\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013-0222  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
N.E. ENTRANCE TO  
STONE CREEK CENTER  
PARALLEL TO HWY 218  
 SURVEY POINT #s: 10460-10476

INVERT (UPSTREAM) ELEVATION: 108.8  
 INVERT (DOWNSTREAM) ELEVATION: 108.45  
 LENGTH 43.4 SHAPE BOX  
 NUMBER OF BARRELS 1  
 DIMENSIONS (DIAMETER / W X H): 14.0 x 8.0  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 111.77  
 HIGH WATER (DOWNSTREAM) ELEVATION: 112.01  
 SPILL CREST ABOVE CULVERT: 120.10  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SILT/SAND, STANDING WATER

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
SILT/SAND, STANDING WATER  
 UPSTREAM DEBRIS DESCRIPTION  
MODERATE VEGETATION  
 DOWNSTREAM DEBRIS DESCRIPTION  
MODERATE VEGETATION  
 PHYSICAL CONDITION: (SOUND) / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 TRASH RACK? Y  IF YES, DESCRIPTION:  
 ANGLE (FROM NORTH) N. 21° 13' W.  
 -SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____  OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
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	PROJECT No.: _____	CHECKED: _____	





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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514

SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.H.

DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_

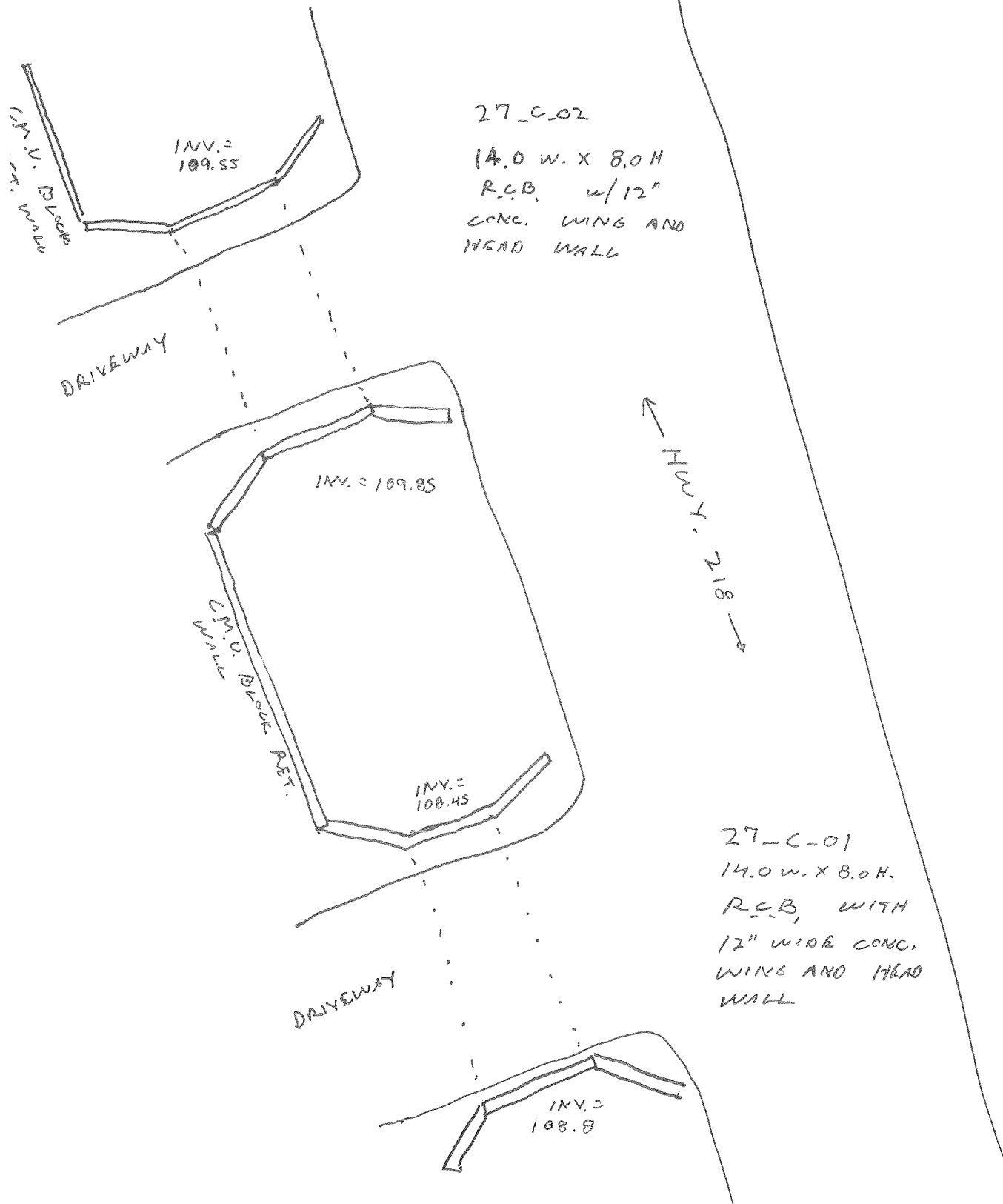
DATE \_\_\_\_\_

27\_C\_01

NOT TO SCALE



27\_C\_02



27\_C\_02

14.0 W. X 8.0 H.  
R.C.B. w/12"  
CONC. WING AND  
HEAD WALL

C.M.U. Block  
WALL

INV. =  
109.55

DRIVEWAY

INV. = 109.85

C.M.U. Block RET.

INV. =  
108.45

HWY. 218

27\_C\_01

14.0 W. X 8.0 H.  
R.C.B. WITH  
12" WIDE CONC.  
WING AND HEAD  
WALL

DRIVEWAY

INV. =  
108.8

CULVERT ID: 27 - C - 02 PROJECT# 2888.00  
 1977 ID (IF ANY) \_\_\_\_\_ SURVEY DATE: 2013.0222  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
SERVICE ENTRANCE TO  
STORAGE LOT, JUST NORTH OF  
STONE CREEK, PARALLEL TO HWY 218  
 SURVEY POINT #s: 10477-10489

INVERT (UPSTREAM) ELEVATION: 109.85  
 INVERT (DOWNSTREAM) ELEVATION: 109.55  
 LENGTH 27.1 SHAPE BOX  
 NUMBER OF BARRELS 1  
 DIMENSIONS (DIAMETER / W X H): 14.0 X 6.7  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 112.01  
 HIGH WATER (DOWNSTREAM) ELEVATION: 110.77  
 SPILL CREST ABOVE CULVERT: 119.4  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
LIGHT SILT  
STANDING WATER IN STRUCTURE.

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
LIGHT SILT AND SOME ~~SOIL~~ SOIL  
DEPOSITS, ~.5' DEEP  
 UPSTREAM DEBRIS DESCRIPTION  
VEGETATION, SIDES AND BOTTOM  
OF CHANNEL  
 DOWNSTREAM DEBRIS DESCRIPTION  
VEGETATION, SIDES + BOTTOM OF CHANNEL  
 PHYSICAL CONDITION: (SOUND) / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 TRASH RACK? Y / (N) IF YES, DESCRIPTION:  
 ANGLE (FROM NORTH) N. 23° 32' W.  
 -SEE SKETCHES ATTACHED-



COMMENTS: THIS IS A RELATIVELY NEW STRUCTURE, CIRCA  
LATE 1990s.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



**CULVERT SURVEY**

**CANYON DEL REY WATERSHED**

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DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
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 CHECKED: \_\_\_\_\_

SHEET \_\_\_\_\_  
 OF \_\_\_\_\_  
 PROJECT No.: \_\_\_\_\_



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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.H. DATE \_\_\_\_\_

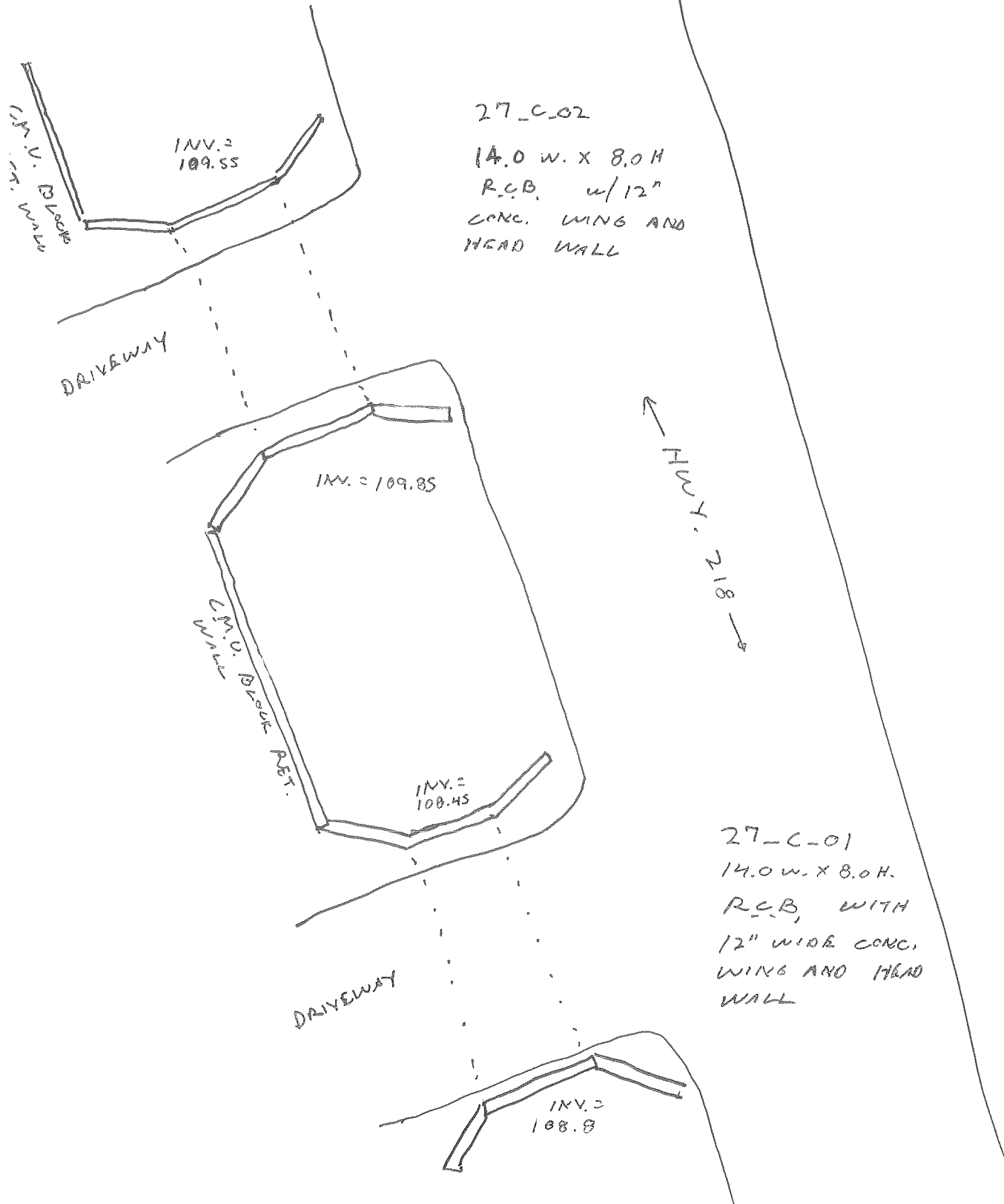
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

27\_C\_01

NOT TO SCALE



27\_C\_02



27\_C\_02

14.0 W. X 8.0 H.  
R.C.B. w/12"  
CONC. WING AND  
HEAD WALL

INV. = 109.55

INV. = 109.85

INV. = 108.45

HWY. 218

27\_C\_01

14.0 W. X 8.0 H.  
R.C.B. WITH  
12" WIDE CONC.  
WING AND HEAD  
WALL

INV. = 108.8

CULVERT ID: 27\_C\_03

PROJECT# 2888.00

1977 ID (IF ANY) 37

SURVEY DATE: 2013-0222

GENERAL LOCATION: PARALLEL TO HWY.  
218 CROSSING UNDER  
DBL RBY GARDENS

SURVEY PARTY: TOM HANNAH

SURVEY POINT #s: 10441-10459

INVERT (UPSTREAM) ELEVATION: 103.6

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
LIGHT VEGETATION, LOOSE RIP-RAP

INVERT (DOWNSTREAM) ELEVATION: 98.3

UPSTREAM DEBRIS DESCRIPTION

LENGTH 379.75' SHAPE ROUND

LIGHT VEGETATION, LOOSE RIP-RAP

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION  
LIGHT VEGETATION, LOOSE RIP-RAP

DIMENSIONS (DIAMETER / W X H): 7.3'

PHYSICAL CONDITION SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: C.M.P.

HIGH WATER (UPSTREAM) ELEVATION: 105.21

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: 99.45

ANGLE (FROM NORTH) N. 21° 09' W.

SPILL CREST ABOVE CULVERT: 111.7

-SEE SKETCHES ATTACHED-

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

LIGHT TO NONE



COMMENTS: END OF PIPE HAVE LIGHT CONCRETE FLARE.

SIDES OF CHANNEL HAVE RIP-RIP SOME

HAS ROLLED TO BOTTOM OF CHANNEL. OVERALL,  
PIPE AND CHANNEL APPEAR RELATIVELY CLEAR.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

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DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
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CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY T.H. DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

27\_C\_03

NOT TO SCALE



INV. OUT = 98.27



DEL REY GARDENS

INV. IN = 103.60

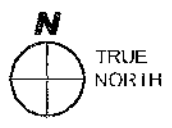


7.3' DIA. C.M.P.

← HWT, 218 →


CULVERT ID: 27\_C..04 PROJECT# 2888.00  
 1977 ID (IF ANY) 38 SURVEY DATE: 2013-02-28  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY. 218 SOUTHEAST OF EVIN MURPHY  
GEN. JIM MOORE BLVD.  
 SURVEY POINT #s: 10975 - 10999

INVERT (UPSTREAM) ELEVATION: 88.32 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MINIMAL  
 INVERT (DOWNSTREAM) ELEVATION: 88.00 UPSTREAM DEBRIS DESCRIPTION  
MINIMAL, VEGETATION, PART OF A  
 LENGTH 41.1' SHAPE BOX FAILING RETAINING WALL (SEE BELOW)  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
VEGETATION (WILLOWS, BRAMBLES)  
 DIMENSIONS (DIAMETER / W X H): 6.0' x 8.0' DEAD WOOD  
 CULVERT MATERIAL TYPE: CONC. PHYSICAL CONDITION: (SOUND)\* / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 98.2 ANGLE (FROM NORTH) N. 74° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION MINIMAL -SEE SKETCHES ATTACHED-



COMMENTS: \* A SIDE RETAINING WALL HOLDING UP  
BANK AT UPSTREAM END IS FAILING.  
(SEE PICTURES)

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE: _____	SHEET _____ OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
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# WITSON ENGINEERS

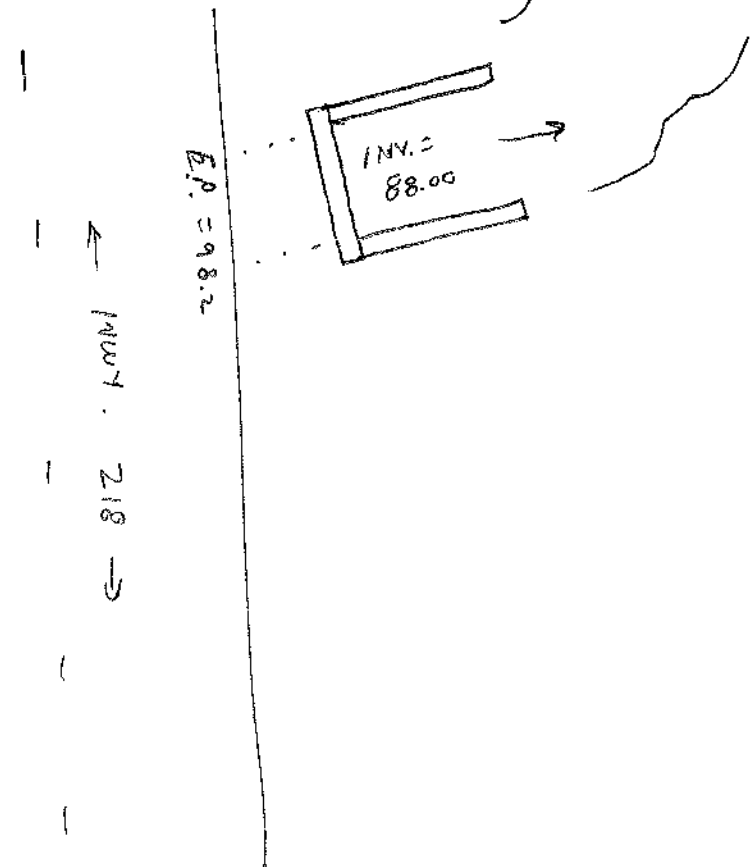
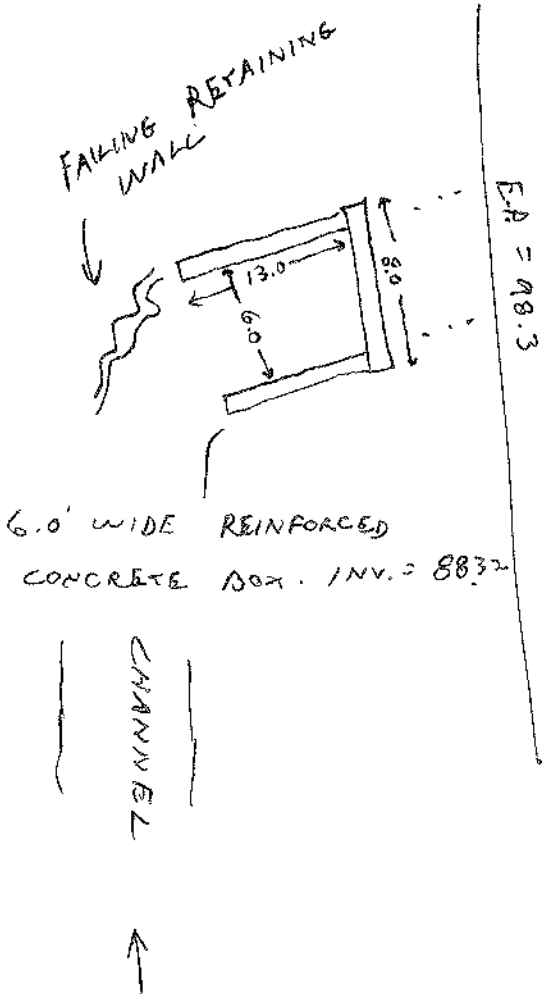
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MONTEREY LOS ANGELES SANTA CRUZ

CANTON DEL REY  
DATE 2013-05-01  
CHECKED BY T. H.  
CHECKED BY

2888.00  
1 of 1  
DATE

27\_C\_04

NOT TO SCALE



CULVERT ID: 28\_C\_01

PROJECT# 2888.00

1977 ID (IF ANY) 39

SURVEY DATE: 2013-0222

GENERAL LOCATION: CROSSING UNDER

SURVEY PARTY: TOM HANNAH

GEN. TIM MOORE

@ HWY 218

SURVEY POINT #s: 10416-10440

INVERT (UPSTREAM) ELEVATION: 81.9

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: 81.4

DIRT, ALGAE, WATER PLANTS

LENGTH 91.5' SHAPE Box

UPSTREAM DEBRIS DESCRIPTION

VEGETATION (SEE PHOTOS)

NUMBER OF BARRELS (1)

DOWNSTREAM DEBRIS DESCRIPTION

VEGETATION (SEE PHOTOS)

DIMENSIONS (DIAMETER / W X H): 9.6 (UP) x 10.6 (DOWN) x 8.0 (UP)  
9.3 (DOWN)

PHYSICAL CONDITION: (SOUND) / CRACKED /

CULVERT MATERIAL TYPE: CONC.

COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: 83.6

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: 84.4

SPILL CREST ABOVE CULVERT: 91.3

ANGLE (FROM NORTH) N. 22° W.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

LIGHT SILT / ALGAE, DIRT,  
WILLOWS + CATTAILS

-SEE SKETCHES ATTACHED-



COMMENTS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

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SHEET

PROJECT No.:

OF





# WHITSON ENGINEERS

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MONTEREY

LOS ANGELES

SANTA CRUZ

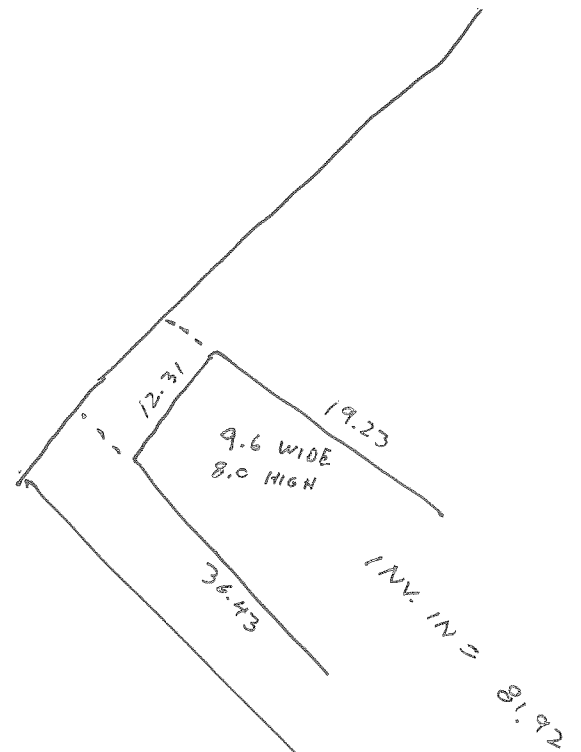
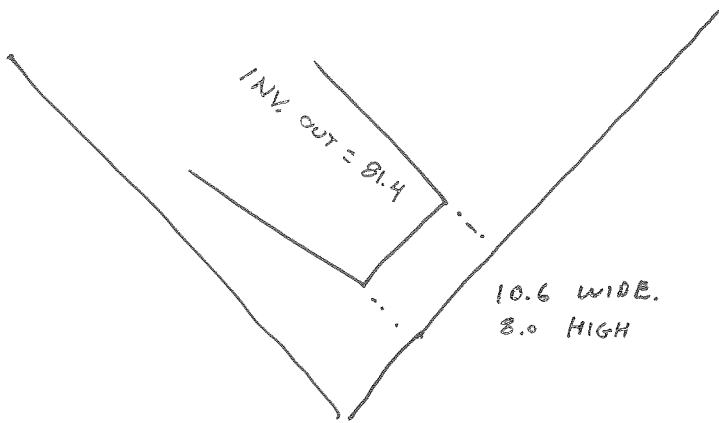
PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

28\_C\_01

NOT TO SCALE



GEN. JIM MOORE



← HWY. 218 →

CULVERT ID: 28-C-02

PROJECT# 2888.00

1977 ID (IF ANY) \_\_\_\_\_

SURVEY DATE: 2013-02-26

GENERAL LOCATION: CROSSING UNDER

SURVEY PARTY: TOM HANNAH

GEN. JIM MOORE,

SIMON LAGUENS

NORTH OF HWY 218

SURVEY POINT #s: 10692-10817

INVERT (UPSTREAM) ELEVATION: 83.46

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
82.45 - MUD AND RIP-RAP

INVERT (DOWNSTREAM) ELEVATION: 79.76

UPSTREAM DEBRIS DESCRIPTION

LENGTH 102.8 SHAPE BOX

~~APPROX. 1' SAND/MUD TO~~  
OPENING PLUGGED

NUMBER OF BARRELS 1

DOWNSTREAM DEBRIS DESCRIPTION

DIMENSIONS (DIAMETER / W X H): 3.0 x 3.0

MINIMAL, EXCEPT PIPE IS PLUGGED

CULVERT MATERIAL TYPE: CONC.

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

HIGH WATER (UPSTREAM) ELEVATION: \_\_\_\_\_

TRASH RACK? Y (N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: \_\_\_\_\_

SPILL CREST ABOVE CULVERT: APPROX. 101

ANGLE (FROM NORTH) N. 80° W.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-

APPROX. 1' SAND/MUD  
IN PIPE.



COMMENTS: DOWNSTREAM OPENING COMPLETELY

BURIED. (SEE PHOTOS)

SMALL FOOTBRIDGE CROSSES CHANNEL DOWN-  
STREAM

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

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PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

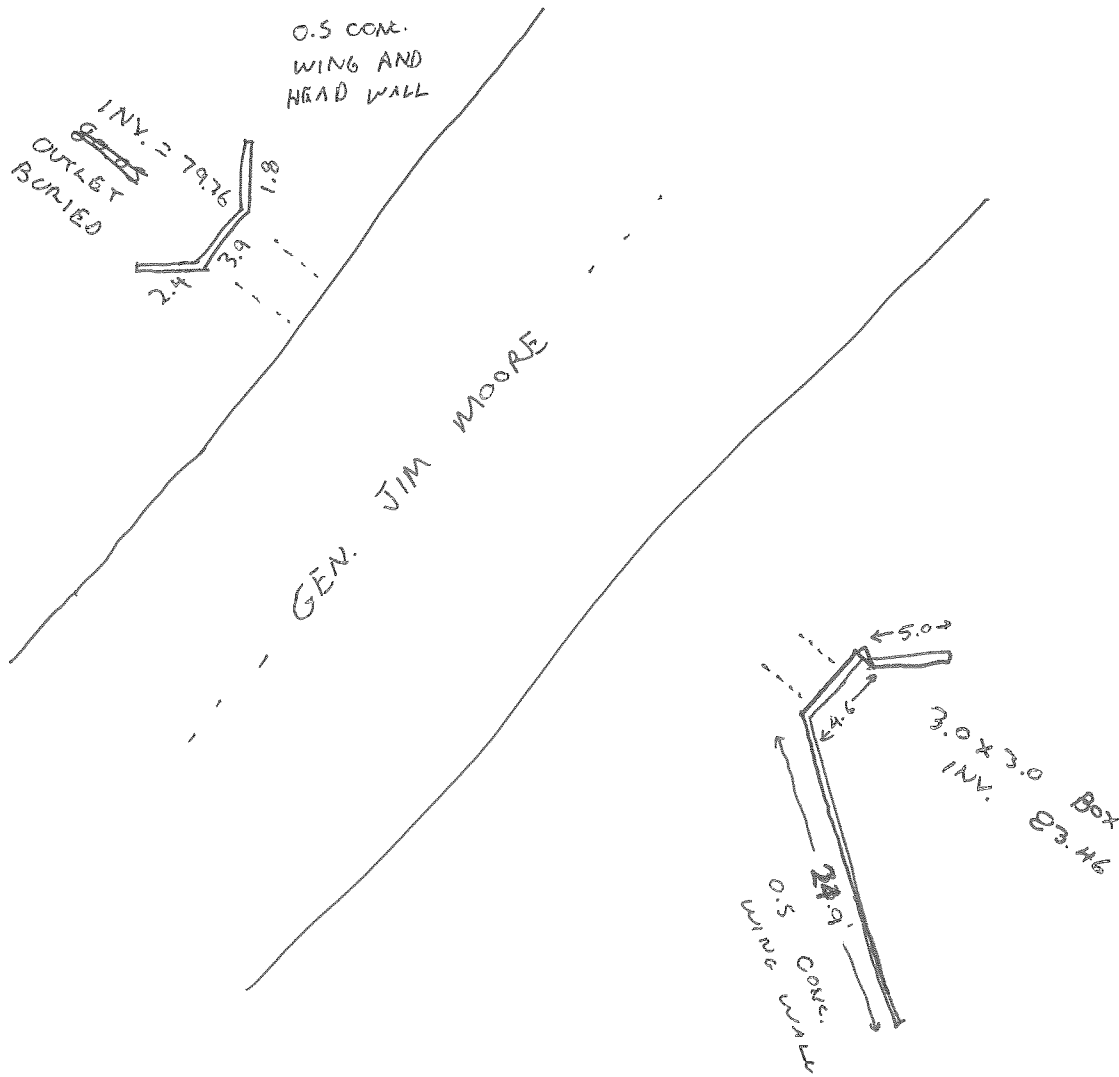
LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

28-C-02

NOT TO SCALE



BASIN ID / PT. # RANGE: 29\_B\_01

PROJECT# 2888.00

10339 - 10349

SURVEY DATE: 2013\_0206

LOCATION: FLOG POND

SURVEY PARTY: TOM HANNAH

DEL REY OAKS

N.E. SIDE

HWY 218

BASIN ON LINE OR OFF LINE: ON

DIMENSIONS OF RISER: N/A

INVERT (IN) ELEVATION: 77.15 \*

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: ~~77.15~~ 76.52

DESCRIBE DEBRIS: NONE

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: N/A

ELEV. HIGH WATER MARKS: 79.52

MED. FLOW ORIFICE/OUTLET DIMENSIONS: N/A

PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: N/A

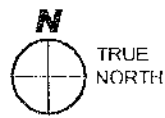
ATTACHED SKETCHES OF ABOVE (SEE 29\_C\_01)

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 6.0' WIDE BOX CULVERT

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 74.52

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) YES 29\_C\_01

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:  
NO RISER



COMMENTS: \* TOP OF WEIR

TOP OF STAFF PLATE = 78.73

WATER LEVEL 2/6/13 3 PM. = 77.18

PHOTO FILE #'S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_

DRAWN: \_\_\_\_\_

CHECKED: \_\_\_\_\_

PROJECT No.: \_\_\_\_\_

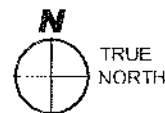
SHEET

1

OF

BASIN ID / PT. # RANGE: 29\_B\_02 PROJECT#: 2888.00  
11145-11182 SURVEY DATE: 2013-03-26  
 LOCATION: NORTH EAST OF SURVEY PARTY: TOM HANNAH  
MONTEREY AIRPORT

BASIN ON LINE OR OFF LINE: \_\_\_\_\_ DIMENSIONS OF RISER: 36" DIA. CONC. w/ GATE  
 INVERT (IN) ELEVATION: \* 4 ELEVATION OF SEDIMENT, IF ANY: NONE  
(SEE BELOW)  
 LOW FLOW ORIFICE/OUTLET DIMENSIONS: 30" DIA. DESCRIBE DEBRIS: VEGETATION RECENTLY  
CLEARED  
 LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 100.78 ELEV. HIGH WATER MARKS: 105.66  
 MED. FLOW ORIFICE/OUTLET DIMENSIONS: 36" DIA. PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN  
 PHOTOS FOLDER:  
 MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 108.73 ATTACHED SKETCHES OF ABOVE  
 HIGH FLOW ORIFICE/OUTLET DIMENSIONS: - SEE SKETCH -  
 HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 109.0  
 CULVERT INLET OR OUTLET? (COMPLETE CULVERT  
 FORM)  
 RISER PRESENT? IF YES, COMPLETE THE CULVERT  
 FORM AND NOTE THE FOLLOWING:



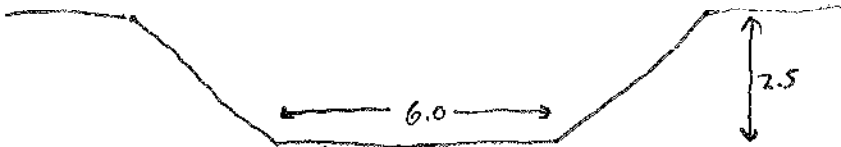
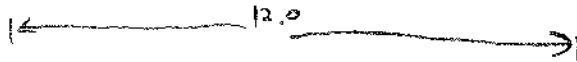
COMMENTS: \* 24" H.D.P.E. 103.07, 15" PVC. 103.07, 48" H.D.P.E 107.04  
30" R.C.P.  
- SEE PHOTOS AND SKETCHES -

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BASIN SURVEY</b>	DATE:	SHEET  <b>1</b>  OF
	MONTEREY COUNTY CALIFORNIA	SCAFF:	
	<b>CANYON DEL REY WATERSHED</b>	DRAWN:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg	CHECKED:	
		PROJECT No.:	

29-B-02

SPILLWAY (OUT FLOW)



SPILLWAY = 109.0

48" R.C.P.  
 WITH FLARE  
 INV. OUT = 99.9



30" R.C.P. WITH FLARE  
 INV. = 100.0

TOP OF BEAM  
 110.9

TOP OF BEAM 110.8

36" DIA.  
 GATE  
 @ 108.73  
 INV. 48" = 100.73



INV. 30" RCP  
 100.79


CULVERT ID: 29\_C\_01 PROJECT# 2888.00  
 1977 ID (IF ANY) 40 SURVEY DATE: 2013-02-06  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
HWY 218 @ FMOG  
POND.  
 SURVEY POINT #s: 10310 - 10342

INVERT (UPSTREAM) ELEVATION: 76.52 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
~~74.52~~ NONE  
 INVERT (DOWNSTREAM) ELEVATION: 75.63 UPSTREAM DEBRIS DESCRIPTION  
NONE  
 LENGTH 67.5' SHAPE BOX DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
NONE  
 DIMENSIONS (DIAMETER / W X H): 6' W, 8' H PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 79.52 TRASH RACK? N IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: 84.25 ANGLE (FROM NORTH) N. 40° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	CULVERT SURVEY	DATE:	SHEET  OF
	CANYON DEL REY WATERSHED	SCAI F:	
	DRAWN:		
	CHECKED:		
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg		PROJECT No.:	



# WILSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
MONTEREY LOS ANGELES SANTA CRUZ

CANYON DEL REY

2013-04-30

CALCULATED BY T.M.

CHECKED BY

2888.0

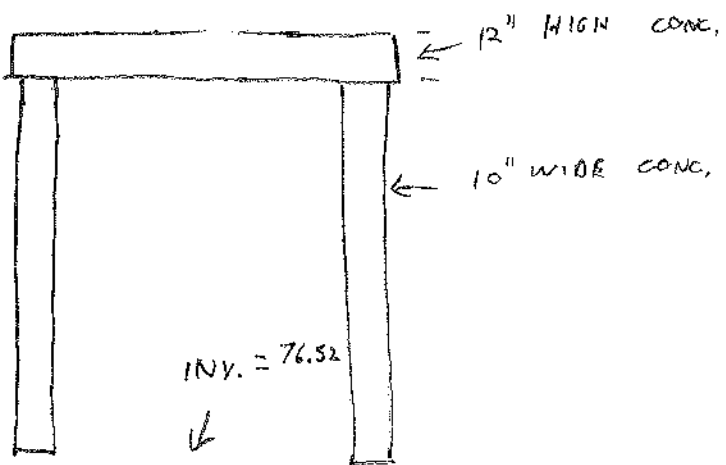
DATE

DATE

DATE

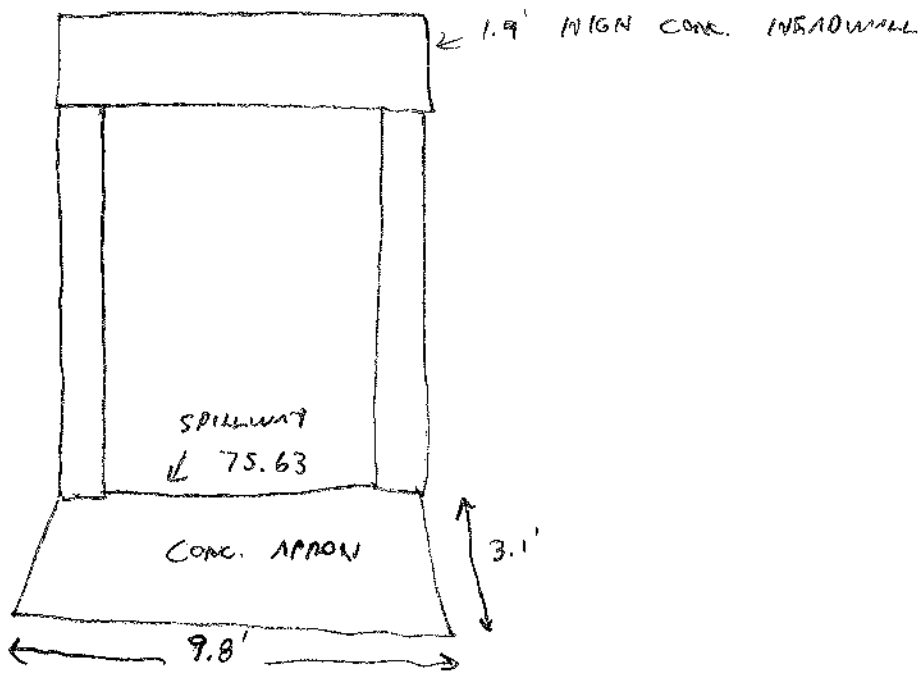
29\_C\_01

N.E. END



29\_C\_01

S.W. END



- SEE PHOTOS -





# WHITSON ENGINEERS

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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

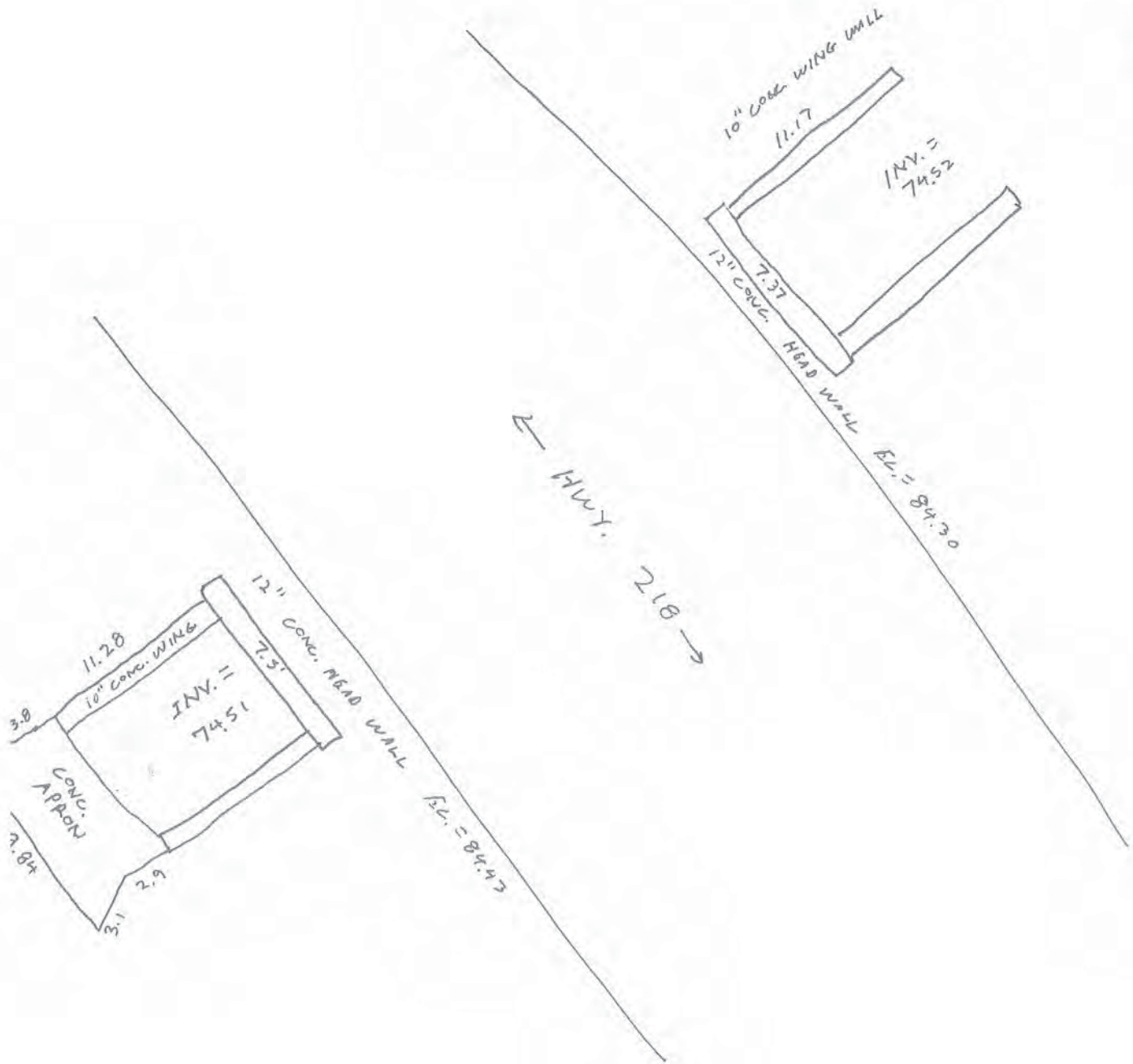
DATE 2013-0514 SHEET No. of

CALCULATED BY T.H. DATE

CHECKED BY DATE

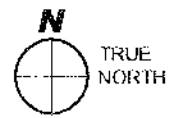
29\_C\_01

NOT TO SCALE



BRIDGE ID: 29-C-02 PROJECT# 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: 2013-02-22  
 GENERAL LOCATION: 942 ANGELUS AVE. SURVEY PARTY: TOM HANNAH  
DEL REY OAKS  
 \_\_\_\_\_  
 SURVEY POINT #s: NA.

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT ELEVATION OF FLOW LINE: \_\_\_\_\_  
 DIMENSIONS (L X W): \_\_\_\_\_ ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_  
 CONSTRUCTION TYPE/MATERIAL: \_\_\_\_\_ DESCRIBE DEBRIS: \_\_\_\_\_  
 DEPTH (THICKNESS) OF DECK: \_\_\_\_\_  
 RAILING HEIGHT FROM DECK: \_\_\_\_\_ ELEVATION OF HIGH WATER MARKS: \_\_\_\_\_  
 ABUTMENT TYPE: \_\_\_\_\_  
 SPAN BETWEEN ABUTMENT: \_\_\_\_\_ PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 INTERMEDIATE PIERS (SIZE/TYPE): \_\_\_\_\_ PHOTOS FOLDER:  
 ATTACHED SKETCHES OF ABOVE




COMMENTS: THIS BRIDGE NOT A DRIVEWAY. IT IS A WOOD  
DECK, ATTACHED TO PRIVATE RESIDENCE.  
FENCED, W/ BEWARE OF DOG. -SEE PHOTOS-

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BRIDGE SURVEY</b>	DATE: _____	SHEET _____  OF _____
	<b>CANYON DEL REY WATERSHED</b>	SCALE: _____	
DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Bridge Survey Form.dwg	DRAWN: _____		
PROJECT No.: _____	CHECKED: _____		


BRIDGE ID: 29-C-03 PROJECT#: 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: 2013-0222  
 GENERAL LOCATION: 938 / 934 SURVEY PARTY: TOM HANNAH  
ANGELUS ST.  
DRIVEWAY  
 SURVEY POINT #s: 10393 - 10409

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT ELEVATION OF FLOW LINE: ~~61.8~~ 62.87/60.60  
 DIMENSIONS (L X W): 17.8 x 14.0 ELEVATION OF SEDIMENT, IF ANY: N/A  
 CONSTRUCTION TYPE/MATERIAL: \_\_\_\_\_ DESCRIBE DEBRIS: NONE  
 DEPTH (THICKNESS) OF DECK: 1.3'  
 RAILING HEIGHT FROM DECK: 3.5' ELEVATION OF HIGH WATER MARKS: \_\_\_\_\_  
 ABUTMENT TYPE: CONC. 64.9 (UPSTREAM) 63.4 (DOWNSTREAM)  
 SPAN BETWEEN ABUTMENT: 15.7 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
29-C-03  
 INTERMEDIATE PIERS (SIZE/TYPE): NONE PHOTOS FOLDER: 29 2013-0222 16-18  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: BRIDGE WAS RE-BUILT IN 1998,  
PER HOMEOWNER AT 938 ANGELUS.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BRIDGE SURVEY</b>	DATE:	SHEET  OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Bridge Survey Form.dwg	DRAWN:	
	PROJECT No.:		



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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

CALCULATED BY TN DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

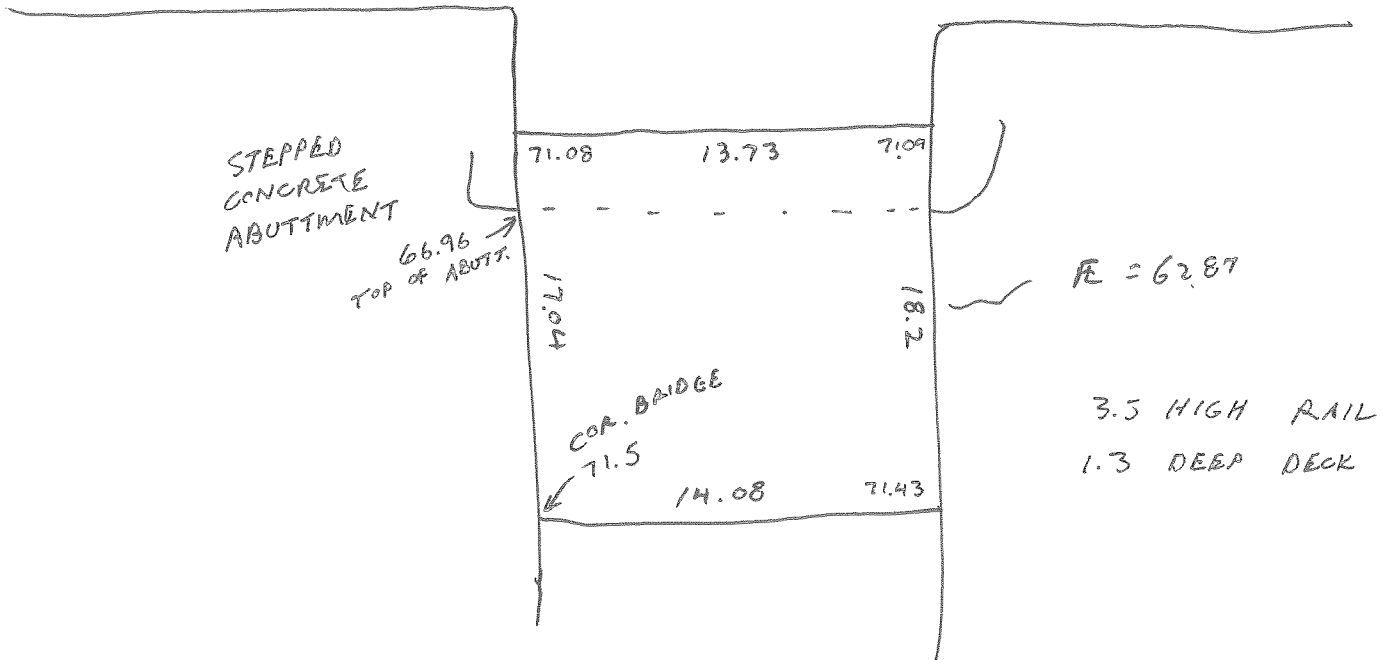
29\_C\_03

NOT TO SCALE



934/938 ANGELUS WAY

ANGELUS WAY



BRIDGE ID: 29\_C\_04 PROJECT# 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: 2013-0222 AND 0226  
 GENERAL LOCATION: 930 AND 926 SURVEY PARTY: TOM HANNAH  
ANGELUS WAY SIMON LABURNIS  
DEL REY OAKS  
 SURVEY POINT #s: 10410-10415, 10563-10605

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT ELEVATION OF FLOW LINE: 59.66 (UP) 58.44 (DOWN)  
 DIMENSIONS (L X W): 17.0 12.0 ELEVATION OF SEDIMENT, IF ANY: NA  
 CONSTRUCTION TYPE/MATERIAL: WOOD/CONC. DESCRIBE DEBRIS: MINIMAL  
 DEPTH (THICKNESS) OF DECK: 2.0  
 RAILING HEIGHT FROM DECK: 4.0 ELEVATION OF HIGH WATER MARKS: NOT  
 ABUTMENT TYPE: CONC. VISIBLE  
 SPAN BETWEEN ABUTMENT: 12.4 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 INTERMEDIATE PIERS (SIZE/TYPE): NONE PHOTOS FOLDER:  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: RELATIVELY NEW CONSTRUCTION. GOOD  
CONDITION. WIRE GABIONS EMPLOYED  
DOWNSTREAM TO STABILISE BANK

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



**BRIDGE SURVEY**

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Bridge Survey Form.dwg

DATE:  
SCALE:  
DRAWN:  
CHECKED:  
PROJECT No.:

SHEET  
OF



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SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY T.H. DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

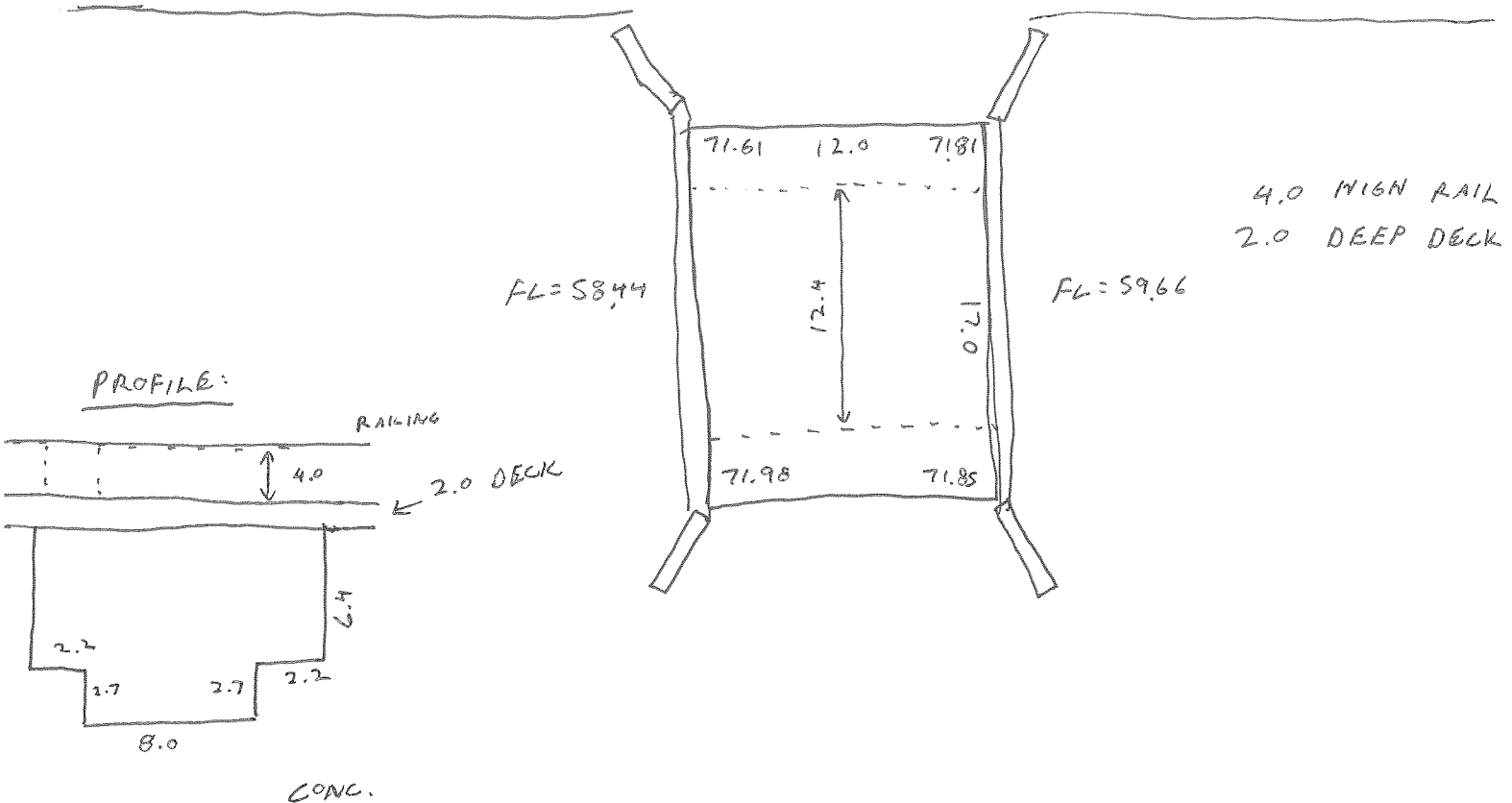
NOT TO SCALE



29\_C\_04

930/926 ANGELUS WAY

ANGELUS WAY



BRIDGE ID:	<u>29_C_05</u>	PROJECT#	<u>2888.00</u>
1977 I.D. (IF ANY):	_____	SURVEY DATE:	<u>2013-0226</u>
GENERAL LOCATION:	<u>ANGELUS WAY</u> <u>DEL REY OAKS</u>	SURVEY PARTY:	<u>TOM HANNAN</u> <u>SIMON LABUENS</u>
SURVEY POINT #s:	<u>10607-10651</u>		

SHAPE OF BRIDGE (FLAT/ARCHED)	<u>FLAT</u>	ELEVATION OF FLOW LINE:	<u>51.27 (UP) 51.05 (DOWN)</u>
DIMENSIONS (L X W):	<u>32.3 10.0</u>	ELEVATION OF SEDIMENT, IF ANY:	<u>NA</u>
CONSTRUCTION TYPE/MATERIAL:	<u>CONC./STEEL/ WOOD</u>	DESCRIBE DEBRIS:	<u>SOME VEGETATION</u>
DEPTH (THICKNESS) OF DECK:	_____		
RAILING HEIGHT FROM DECK:	<u>NONE</u>	ELEVATION OF HIGH WATER MARKS:	<u>52.29</u>
ABUTMENT TYPE:	<u>CONC.</u>		
SPAN BETWEEN ABUTMENT:	<u>13.0</u>	PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN	
INTERMEDIATE PIERS (SIZE/TYPE):	<u>NA.</u>	PHOTOS FOLDER:	
		ATTACHED SKETCHES OF ABOVE	



COMMENTS: UTILITIES RUN UNDER BRIDGE DECK.  
48" CMP ENCASED IN CONC. UNDER BRIDGE  
GABIONS EMPLOYED TO STABILISE BANK UP + DOWN  
STREAM.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BRIDGE SURVEY</b>	DATE:	SHEET  OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Bridge Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	



# WHITSON ENGINEERS

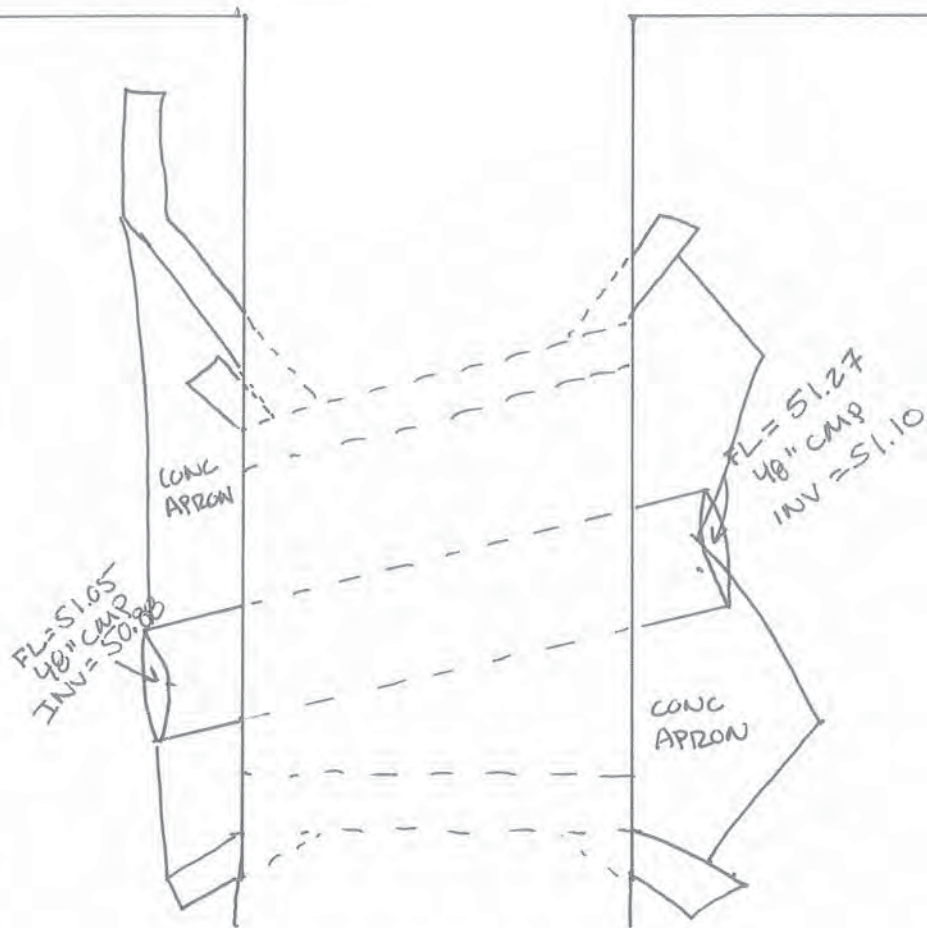
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT  
LOS ANGELES SANTA CRUZ

PROJECT Canyon Del Rey JOB No. 2888.00  
DATE 2013-05-14 SHEET No. 1 of 2  
CALCULATED BY THIEM DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



NTS.

- - - - - Angelus Way - - - - -






BRIDGE ID: 29\_C\_05 PROJECT#: 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: 2013-0226  
 GENERAL LOCATION: ANGELUS WAY SURVEY PARTY: TOM HANIRAN  
DEL REY OAKS SIMON LABUENS  
 SURVEY POINT #s: 10607-10651

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT ELEVATION OF FLOW LINE: 51.27 (UP) 51.03 (DOWN)  
 DIMENSIONS (L X W): 32.3 10.0 ELEVATION OF SEDIMENT, IF ANY: NA  
 CONSTRUCTION TYPE/MATERIAL: CONC./STEEL/ DESCRIBE DEBRIS: SOME VEGETATION  
WOOD  
 DEPTH (THICKNESS) OF DECK: \_\_\_\_\_  
 RAILING HEIGHT FROM DECK: NONE ELEVATION OF HIGH WATER MARKS: 52.29  
 ABUTMENT TYPE: CONC.  
 SPAN BETWEEN ABUTMENT: 13.0 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 INTERMEDIATE PIERS (SIZE/TYPE): NA. PHOTOS FOLDER:  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: UTILITIES RUN UNDER BRIDGE DECK,  
48" CMP ENCASED IN CONC. UNDER BRIDGE  
GABIONS EMPLOYED TO STABILISE BANK UP + DOWN  
STREAM.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BRIDGE SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Bridge Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
			OF

BASIN ID / PT. # RANGE: 09-B-01

PROJECT# 2888.00

11001 - 11054

SURVEY DATE: 2013-0313

LOCATION: BOOTS ROAD

SURVEY PARTY: TOM HANNAH

AT WHIP ROAD

EVIN MURPHY

BASIN ON LINE OR OFF LINE: OFF  
370.7 (18")

DIMENSIONS OF RISER: N/A

INVERT (IN) ELEVATION: 368.4 (F.L. SWALE)

ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_

LOW FLOW ORIFICE/OUTLET DIMENSIONS: 367.36

DESCRIBE DEBRIS: NO SIGNIFICANT DEBRIS

LOW FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 12" x 12" ELEV. HIGH WATER MARKS: 368.9

MED. FLOW ORIFICE/OUTLET DIMENSIONS: 12" x 12" PHOTOS (INCLUDING SPILL CREST) NUMBER I.D. IN PHOTOS FOLDER: \_\_\_\_\_

MED. FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 369.36

ATTACHED SKETCHES OF ABOVE

HIGH FLOW ORIFICE/OUTLET DIMENSIONS: 16.1 x 3.0

HIGH FLOW ORIFICE/OUTLET FLOWLINE ELEV.: 372.20

CULVERT INLET OR OUTLET? (COMPLETE CULVERT FORM) YES 18" HDPE (IN)  
40" HDPE OUT (09-C-01)

RISER PRESENT? IF YES, COMPLETE THE CULVERT FORM AND NOTE THE FOLLOWING:



COMMENTS: WATER LEVEL 3/13/13 36736 AT 3 P.M.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### BASIN SURVEY

MONTEREY COUNTY

CALIFORNIA

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Basin Survey Form.dwg

DATE:
SCALE:
DRAWN:
CHECKED:
PROJECT No.:

SHEET

1

OF

BRIDGE ID: 29\_C\_05  
 1977 I.D. (IF ANY): \_\_\_\_\_  
 GENERAL LOCATION: ANGELUS WAY  
DEL REY OAKS  
 \_\_\_\_\_  
 SURVEY POINT #s: 10607-10651


PROJECT# 2888.00  
 SURVEY DATE: 2013-0226  
 SURVEY PARTY: TOM HANIRAH  
SIMON LABUENS  
 \_\_\_\_\_

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT  
 DIMENSIONS (L X W): 32.3 10.0  
 CONSTRUCTION TYPE/MATERIAL: CONC./STEEL/  
WOOD  
 DEPTH (THICKNESS) OF DECK: \_\_\_\_\_  
 RAILING HEIGHT FROM DECK: NONE  
 ABUTMENT TYPE: CONC.  
 SPAN BETWEEN ABUTMENT: 13.0  
 INTERMEDIATE PIERS (SIZE/TYPE): NA.

ELEVATION OF FLOW LINE: 51.27 (UP) 51.03 (DOWN)  
 ELEVATION OF SEDIMENT, IF ANY: NA  
 DESCRIBE DEBRIS: SOME VEGETATION  
 \_\_\_\_\_  
 ELEVATION OF HIGH WATER MARKS: 52.29  
 \_\_\_\_\_  
 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 PHOTOS FOLDER:  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: UTILITIES RUN UNDER BRIDGE DECK,  
48" CMP ENCASED IN CONC. UNDER BRIDGE  
GABIONS EMPLOYED TO STABILISE BANK UP + DOWN  
STREAM.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_


	<b>BRIDGE SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Bridge Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
			OF

BRIDGE ID: 29-c-06 PROJECT# 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: 2013-0226  
 GENERAL LOCATION: ANGELUS WAY SURVEY PARTY: TOM HANNAH  
DEL REY OAKS SIMON LAGUENS  
 SURVEY POINT #s: 10653-10690

SHAPE OF BRIDGE (FLAT/ARCHED) FLAT ELEVATION OF FLOW LINE: 45.8 (UP) 45.6 (DOWN)  
 DIMENSIONS (L X W): 24.8 15.25 ELEVATION OF SEDIMENT, IF ANY: N/A  
 CONSTRUCTION TYPE/MATERIAL: CONC. DESCRIBE DEBRIS: NONE  
 DEPTH (THICKNESS) OF DECK: \_\_\_\_\_  
 RAILING HEIGHT FROM DECK: NONE ELEVATION OF HIGH WATER MARKS: NOT  
 ABUTMENT TYPE: CONC. VISIBLE  
 SPAN BETWEEN ABUTMENT: 12.6 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 INTERMEDIATE PIERS (SIZE/TYPE): NONE PHOTOS FOLDER:  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: NEW STRUCTURE, SOUND (CONC.)  
CONSTRUCTION. STREAM CHANNEL CLEAN  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>BRIDGE SURVEY</b>	DATE:	SHEET
		SCALE:	
		DRAWN:	
		CHECKED:	
	<b>CANYON DEL REY WATERSHED</b>	PROJECT No.:	OF
DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Bridge Survey Form.dwg			



# WHITSON ENGINEERS

CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

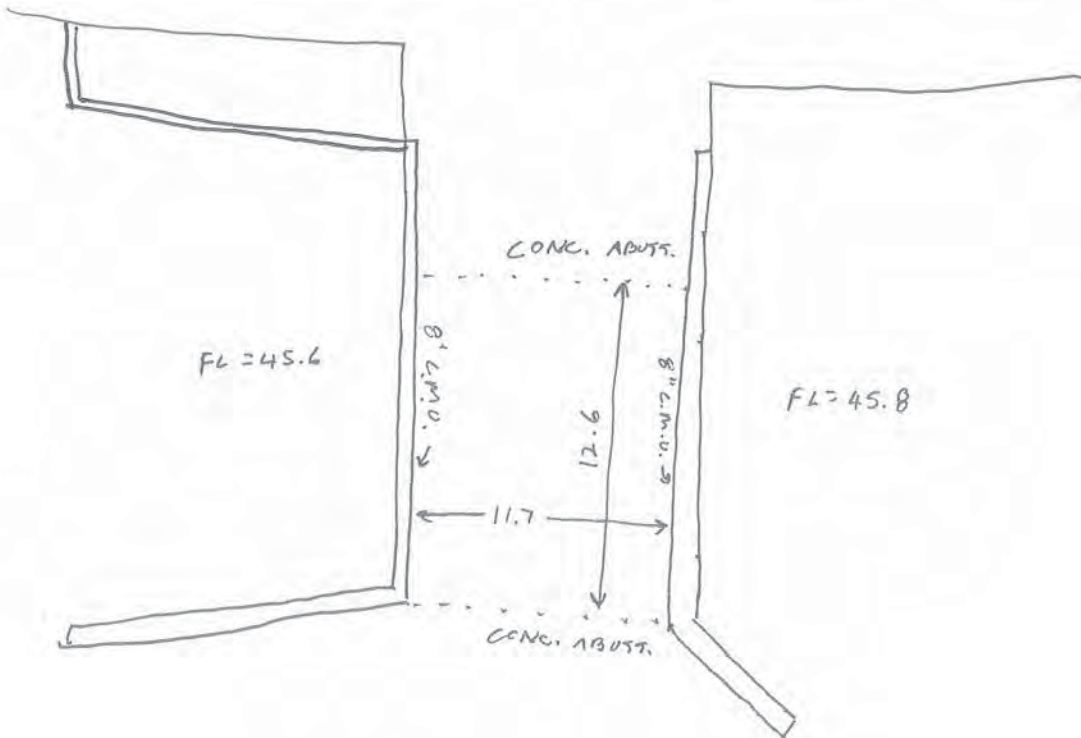
DATE 2013-0514 SHEET No.      of     

CALCULATED BY TH DATE     

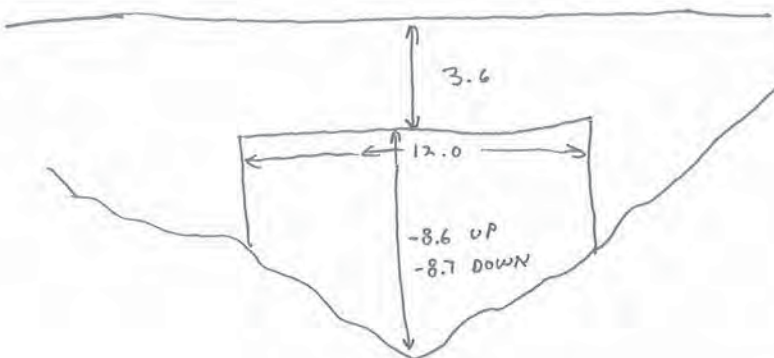
CHECKED BY      DATE     

29-C-06

ANGELUS WAY



PROFILE:



CULVERT ID: 29\_C\_07

PROJECT# 2888.00

1977 ID (IF ANY) 41

SURVEY DATE: 2013-0206

GENERAL LOCATION: CROSSING UNDER  
ROSITA AVE. SOUTH  
OF HIGHWAY 218  
DEL REY OAKS

SURVEY PARTY: TOM HANNAH

SURVEY POINT #s: 10257 - 10309

INVERT (UPSTREAM) ELEVATION: 42.29\*  
40.77

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

INVERT (DOWNSTREAM) ELEVATION: 40.1

UPSTREAM DEBRIS DESCRIPTION  
MODERATE VEGETATION (WILLOWS,  
BRAMBLES)

LENGTH 40.66 SHAPE BOX

DOWNSTREAM DEBRIS DESCRIPTION  
MODERATE VEGETATION (WILLOWS, BRAMBLES)

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 6.0' x 8.25'

PHYSICAL CONDITION: SOUND / CRACKED /  
COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: CONC.

HIGH WATER (UPSTREAM) ELEVATION: NOT VISIBLE

TRASH RACK? Y(N) IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE

SPILL CREST ABOVE CULVERT: 51.0

ANGLE (FROM NORTH) N. 81° E.

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

-SEE SKETCHES ATTACHED-



COMMENTS: \* 1.5' HIGH CONC. "LIP" AT ENTRY TO  
CULVERT.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



### CULVERT SURVEY

CANYON DEL REY WATERSHED

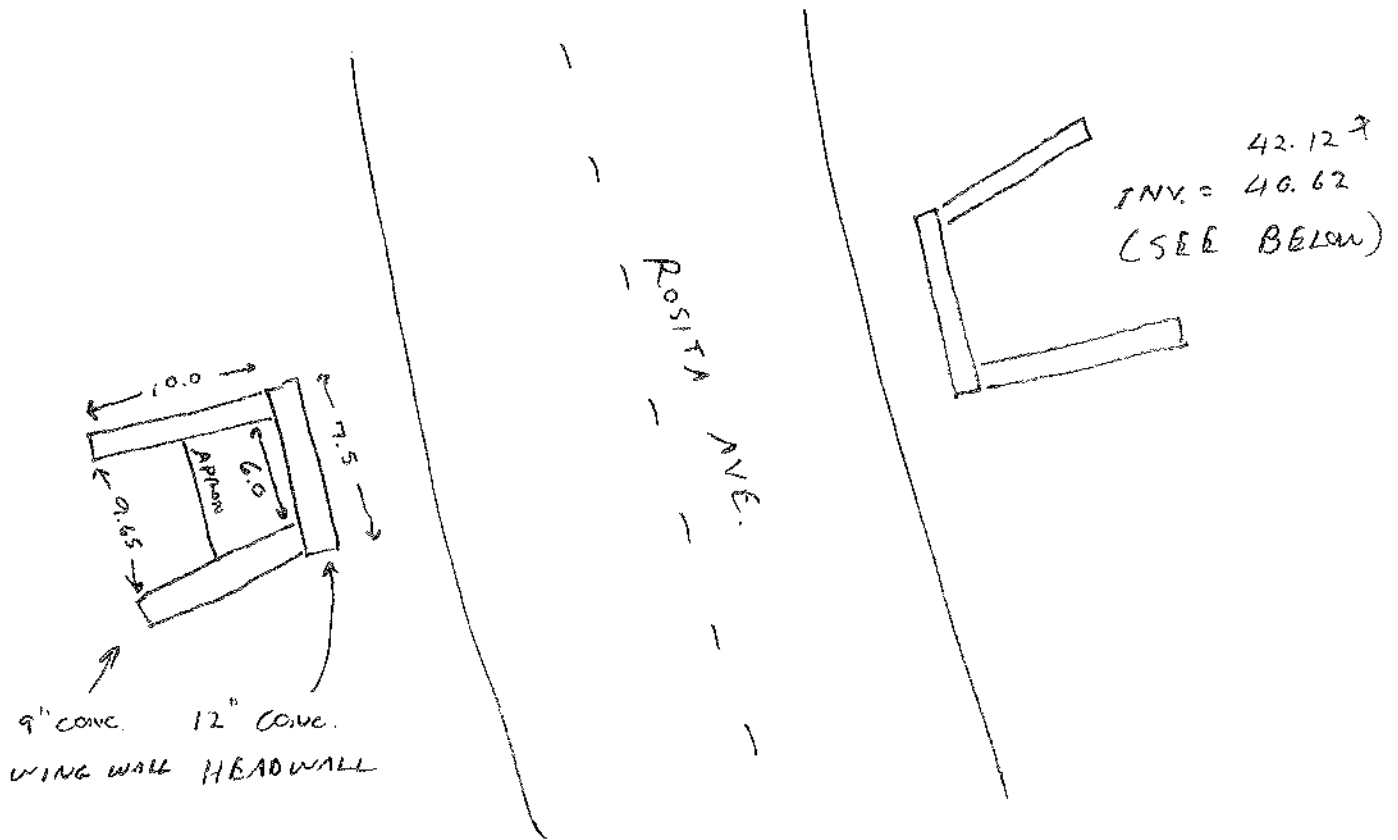
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DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
DRAWN: \_\_\_\_\_  
CHECKED: \_\_\_\_\_  
PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
OF \_\_\_\_\_

29\_C\_07

NOT TO SCALE

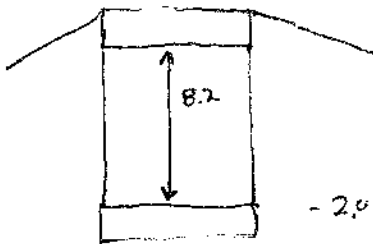


9" CONC. 12" CONC.  
 WING WALL HEADWALL

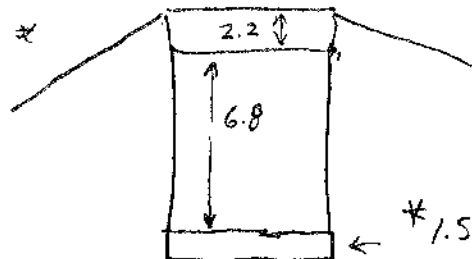
42.12  
 INV. = 40.62  
 (SEE BELOW)

DETAIL, WEST (DOWNSTREAM)

DETAIL, EAST (UPSTREAM)



-2.0 FROM APRON  
 TO FL CREEK



\*1.5' CONC. LIP

NORTH AND SOUTH

CULVERT ID: 29\_C-08 PROJECT# 2888.00  
 1977 ID (IF ANY) 42 SURVEY DATE: 2013-0206 AND 2013-0226  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: TOM HANNAH  
FREMONT BLYD. SIMON LAGUENS  
 SURVEY POINT #s: 10244-10256, 10545-10561

INVERT (UPSTREAM) ELEVATION: 16.54 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
12.79 APPROX. 2.0' SILT  
 INVERT (DOWNSTREAM) ELEVATION: 16.54 UPSTREAM DEBRIS DESCRIPTION  
 LENGTH 706.3' SHAPE Box SOME VEGETATION IN CHANNEL  
 NUMBER OF BARRELS 1 DOWNSTREAM DEBRIS DESCRIPTION  
 DIMENSIONS (DIAMETER / W X H): 8' x 8' CLEAR  
 CULVERT MATERIAL TYPE: CONC. PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 HIGH WATER (UPSTREAM) ELEVATION: COULD NOT SEE TRASH RACK? (Y) / N IF YES, DESCRIPTION:  
COULD NOT SEE METAL BARS, UPSTREAM ONLY  
 SPILL CREST ABOVE CULVERT: \_\_\_\_\_ ANGLE (FROM NORTH) N. 47° 57' W  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
APPROX. 2' SAND / MUD  
IN FRONT OF STRUCTURE



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	
			OF





# WHITSON ENGINEERS

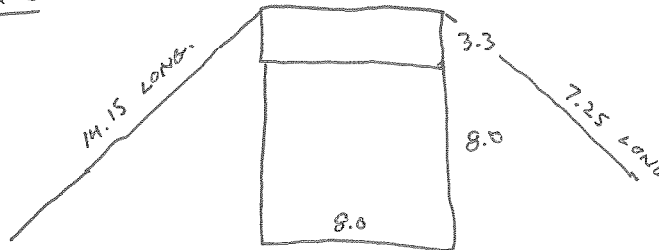
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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No.      of       
CALCULATED BY TH DATE       
CHECKED BY      DATE     

29\_C\_08

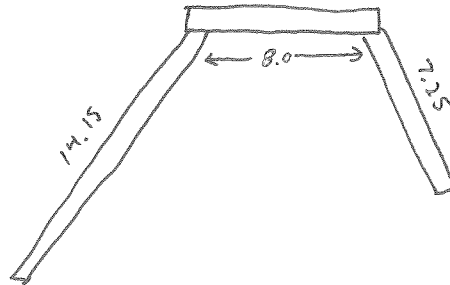
## PROFILE

SOUTHEAST TERMINUS

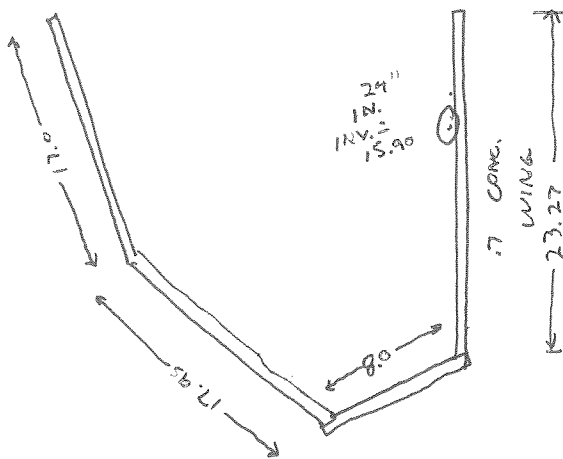


NOT SHOWN:  
REBAR TRASH GRATE

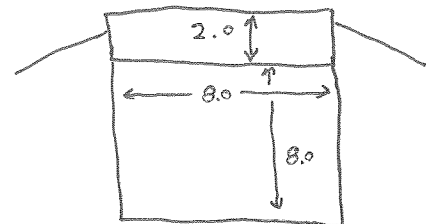
## TOP



NORTHWEST TERMINUS



## PROFILE



CULVERT ID: 30-C-01

PROJECT# 2888.00

1977 ID (IF ANY) 43

SURVEY DATE: 2013-0226

GENERAL LOCATION: SOUTH EAST END

SURVEY PARTY: TOM HANNAH

OF LAGUNA

SIMON LAGUENS

GRANDE PARK

SURVEY POINT #s: 10490-10561

INVERT (UPSTREAM) ELEVATION: ~~9.04~~ 10.77

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
APPROXIMATELY 3.0' SILT/MUD IN STRUCTURE

INVERT (DOWNSTREAM) ELEVATION: 10.43

UPSTREAM DEBRIS DESCRIPTION  
DENSE VEGETATION, TRASH

LENGTH 136.9' SHAPE BOX

DOWNSTREAM DEBRIS DESCRIPTION  
VEGETATION, SILT

NUMBER OF BARRELS 1

DIMENSIONS (DIAMETER / W X H): 6'x6'

PHYSICAL CONDITION: (SOUND) / CRACKED / COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: CONC.

HIGH WATER (UPSTREAM) ELEVATION: 17.0

TRASH RACK?  Y /  N IF YES, DESCRIPTION:  
RAIL ROAD TRACKS IN CONC., 6" X 6" HORIZONTAL OVER INLET AND OUTLET ANGLE (FROM NORTH) N. 27° 28' W.

HIGH WATER (DOWNSTREAM) ELEVATION: 17.84

SPILL CREST ABOVE CULVERT: 46.12

-SEE SKETCHES ATTACHED-

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

APPROX. 2.0' SILT IN BOTTOM OF STRUCTURE



COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
SCALE: \_\_\_\_\_  
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CHECKED: \_\_\_\_\_

PROJECT No.:

SHEET

OF



# WHITSON ENGINEERS

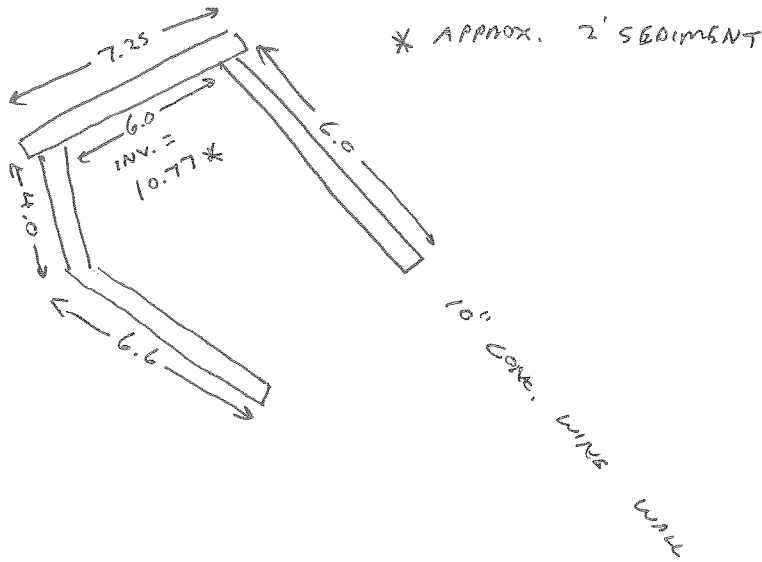
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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30-C-01  
SOUTH EAST  
(UPSTREAM)

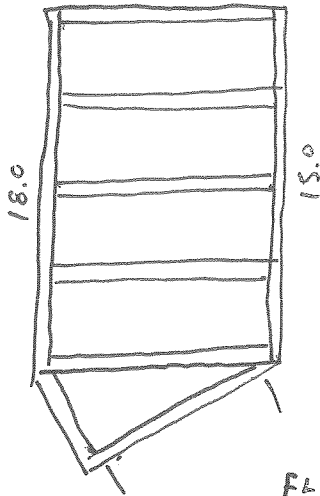
6.0 x 6.0 R.C.B.

NOT TO SCALE ↑



NORTH WEST  
(DOWNSTREAM)

6.0 x 6.0 R.C.B.



FL OUT = 10.43  
APPROX. 3' SEDIMENT

BRIDGE ID: 30-C-02 PROJECT# 2888.00  
 1977 I.D. (IF ANY): \_\_\_\_\_ SURVEY DATE: \_\_\_\_\_  
 GENERAL LOCATION: LAGUNA GRANDE SURVEY PARTY: \_\_\_\_\_  
PARK  
 SURVEY POINT #s: 10224-10243

SHAPE OF BRIDGE (FLAT/ARCHED) ARCHED  
 DIMENSIONS (L X W): 148' X 10.75', WITH  
INTERMEDIATE OBSERVATION PLATFORM  
 CONSTRUCTION TYPE/MATERIAL: WOOD  
 DEPTH (THICKNESS) OF DECK: 0.9'  
 RAILING HEIGHT FROM DECK: 4.5'  
 ABUTMENT TYPE: CONC.  
 SPAN BETWEEN ABUTMENT: 146'  
 INTERMEDIATE PIERS (SIZE/TYPE): WOOD  
PILINGS, APPROX. 12" DIA.  
IN PAIRS (LEFT/RIGHT)  
AT 24' +/- INTERVALS.

WATERLINE = 10.83'  
 ELEVATION OF FLOW LINE: \_\_\_\_\_  
 ELEVATION OF SEDIMENT, IF ANY: \_\_\_\_\_  
 DESCRIBE DEBRIS: NONE VISIBLE  
 ELEVATION OF HIGH WATER MARKS: \_\_\_\_\_  
NONE VISIBLE  
 PHOTOS (INCLUDING RELEASE POINT) NUMBER I.D. IN  
 PHOTOS FOLDER: 30-C-02  
 ATTACHED SKETCHES OF ABOVE



COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



**BRIDGE SURVEY**

**CANYON DEL REY WATERSHED**

DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Bridge Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_  
 PROJECT No.: \_\_\_\_\_

SHEET \_\_\_\_\_  
 OF \_\_\_\_\_



# WHITSON ENGINEERS

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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00

DATE 2013-0514 SHEET No. \_\_\_\_\_ of \_\_\_\_\_

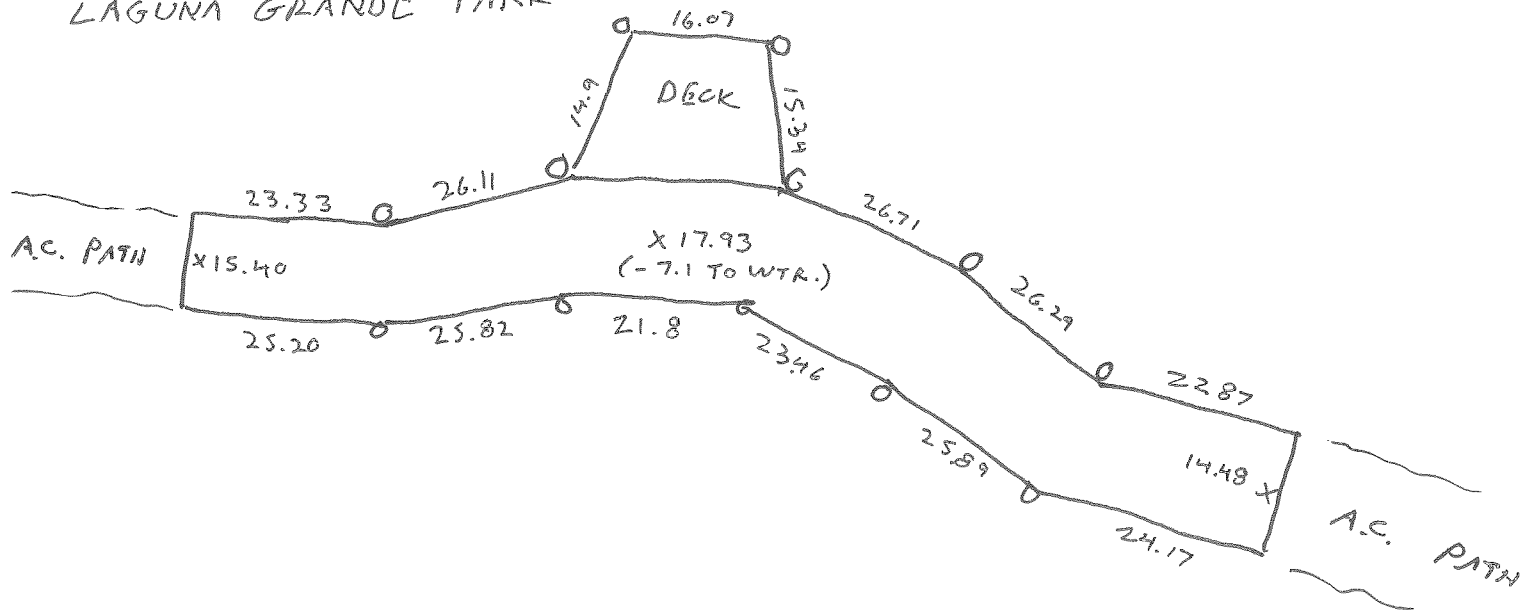
CALCULATED BY TH DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30\_c\_02

FOOT BRIDGE

LAGUNA GRANDE PARK



CULVERT ID: 30-C-03 PROJECT# 2888.00  
 1977 ID (IF ANY) 44 SURVEY DATE: 2013-0206, 2013-0222  
 GENERAL LOCATION: CROSSING UNDER SURVEY PARTY: SIMON LAGUENS  
DEL MONTE AVE. TOM HAINNAH

SURVEY POINT #s: 15093-15170, 10352-258 (2013-0222)

INVERT (UPSTREAM) ELEVATION: 6.20

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION

APPROX. 12" SILT

INVERT (DOWNSTREAM) ELEVATION: 6.47

UPSTREAM DEBRIS DESCRIPTION

CLEAR

LENGTH 91' SHAPE BOX

NUMBER OF BARRELS 2

DOWNSTREAM DEBRIS DESCRIPTION

CLEAR

DIMENSIONS (DIAMETER / W X H): 16'x7' (2)

PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED

CULVERT MATERIAL TYPE: CONC.

HIGH WATER (UPSTREAM) ELEVATION: 10.9

TRASH RACK? Y/ N IF YES, DESCRIPTION:

HIGH WATER (DOWNSTREAM) ELEVATION: 10.93

ANGLE (FROM NORTH) N. 35° W.

SPILL CREST ABOVE CULVERT: 15.3

-SEE SKETCHES ATTACHED-

UPSTREAM SEDIMENT ELEVATION/DESCRIPTION

APPROX. 12" SILT



COMMENTS:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_



# CULVERT SURVEY

CANYON DEL REY WATERSHED

DRAWING PATH: T:\Monterey Projects\2888\Survey\Worksheets\Culvert Survey Form.dwg

DATE: \_\_\_\_\_  
 SCALE: \_\_\_\_\_  
 DRAWN: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_

SHEET

PROJECT No.:

OF



# WHITSON ENGINEERS

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MONTEREY

LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-05-14 SHEET No. 1 of 3  
 CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30-C-03

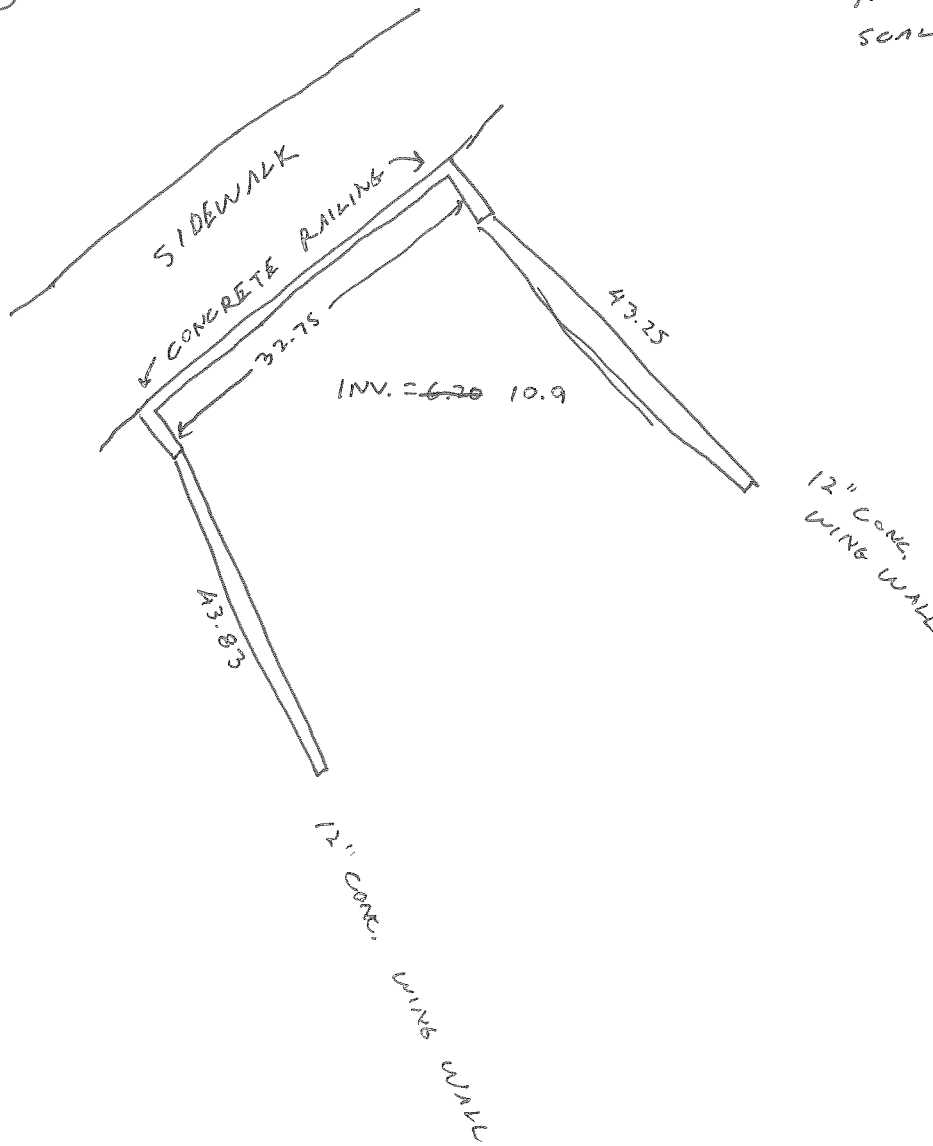
NOT TO SCALE



SOUTH EAST

16.0x7.0 (2)

R.C.B.





# WHITSON ENGINEERS

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MONTEREY

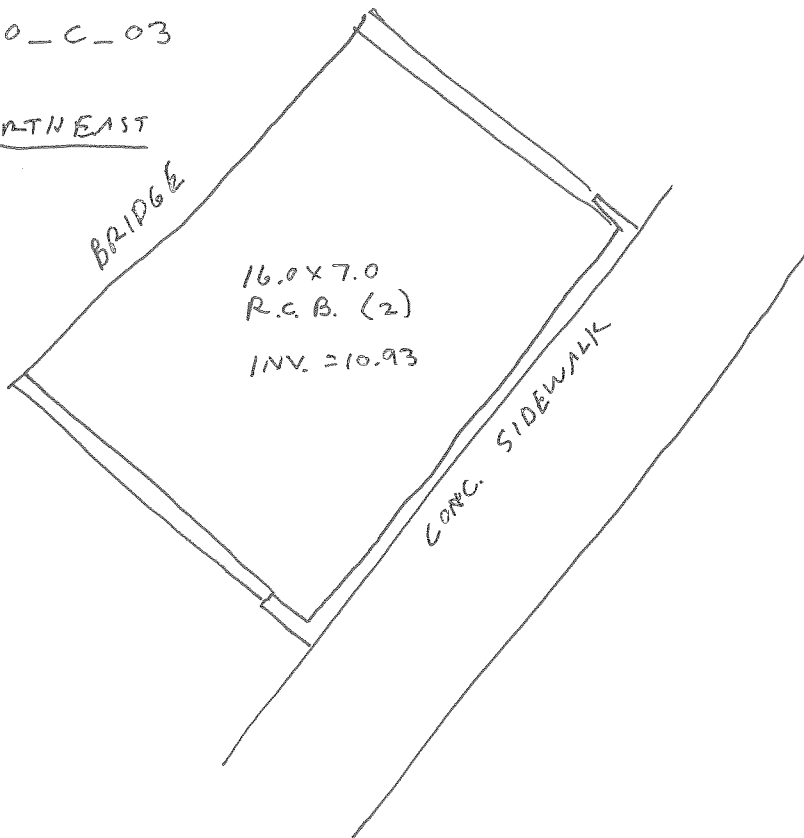
LOS ANGELES

SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
 DATE 2013-08-14 SHEET No. 2 of 3  
 CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30-C-03

NORTH EAST



NOT TO  
SCALE







# WHITSON ENGINEERS

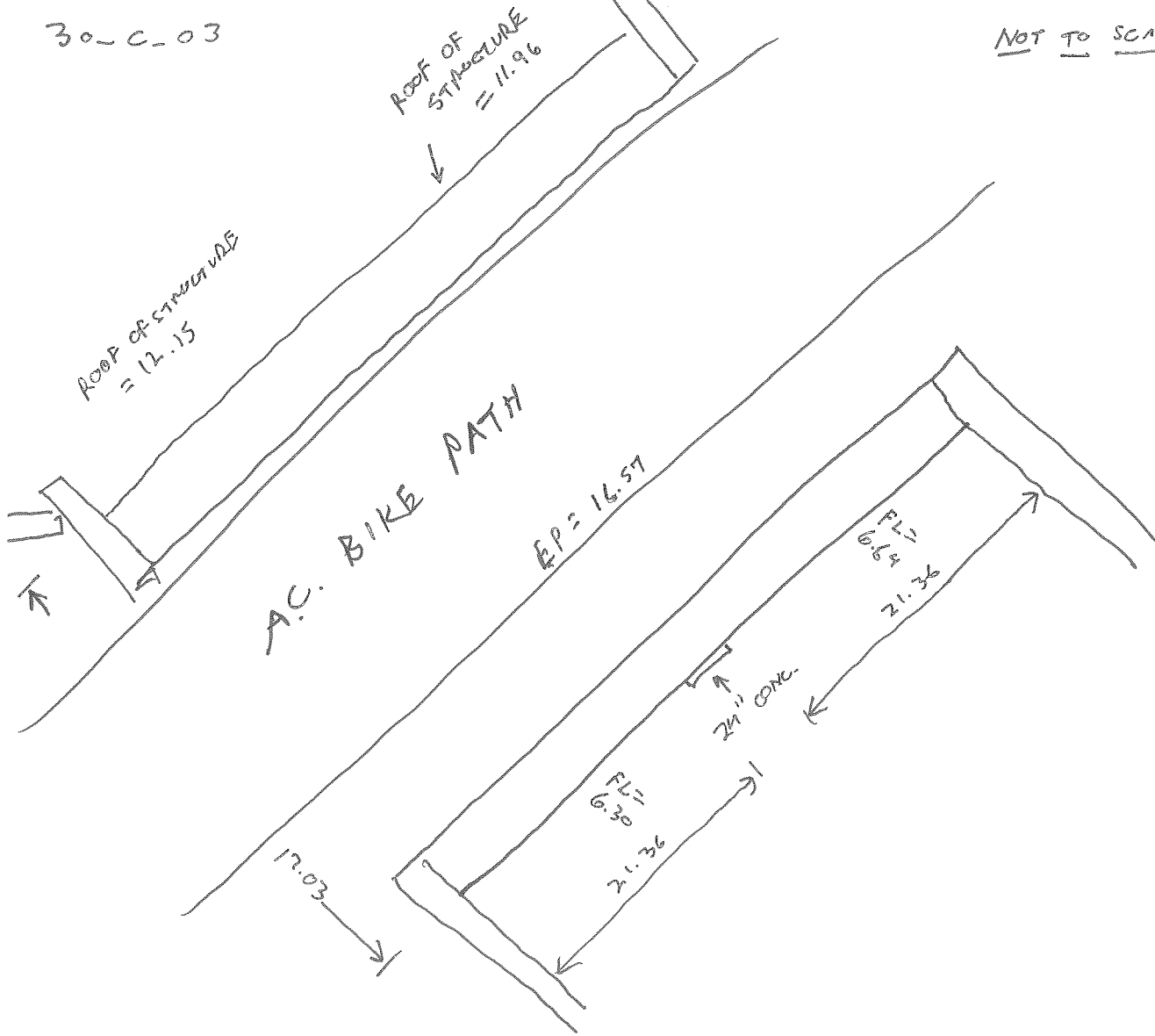
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LOS ANGELES                      SANTA CRUZ

MONTEREY

PROJECT CANYON DEL REY      JOB No. 2888.00  
DATE 2013-0514                      SHEET No. 3 of 3  
CALCULATED BY \_\_\_\_\_              DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_                      DATE \_\_\_\_\_

30-c-03

NOT TO SCALE



CULVERT ID: 30\_C\_04 PROJECT# 2888.00  
 1977 ID (IF ANY) 45 SURVEY DATE: 2013-0206  
 GENERAL LOCATION: FROM ROBERTS SURVEY PARTY: SIMON LAGUENS  
LAKE, CROSSING UNDER  
ROBERTS AVE.  
 SURVEY POINT #s: 15005-15092

INVERT (UPSTREAM) ELEVATION: 9.3  
 INVERT (DOWNSTREAM) ELEVATION: 9.0  
 LENGTH 51.3 SHAPE BOX (DOUBLE)  
 NUMBER OF BARRELS 2  
 DIMENSIONS (DIAMETER / W X H): 8' x 6' (2)  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 12.34  
 HIGH WATER (DOWNSTREAM) ELEVATION: 11.06  
 SPILL CREST ABOVE CULVERT: 16.4  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE VISIBLE

DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE VISIBLE  
 UPSTREAM DEBRIS DESCRIPTION  
NONE VISIBLE  
 DOWNSTREAM DEBRIS DESCRIPTION  
NONE VISIBLE  
 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 TRASH RACK? Y / N IF YES, DESCRIPTION:  
 ANGLE (FROM NORTH) N 30° W  
 -SEE SKETCHES ATTACHED-



COMMENTS: 2 24" GATE VALVES W/ UPSTREAM INVERT  
OF 9.6. CONC. WEIR SITS BETWEEN  
W/ ELEV. (TOP OF WEIR) 10.9.

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
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# WHITSON ENGINEERS

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MONTEREY

LOS ANGELES

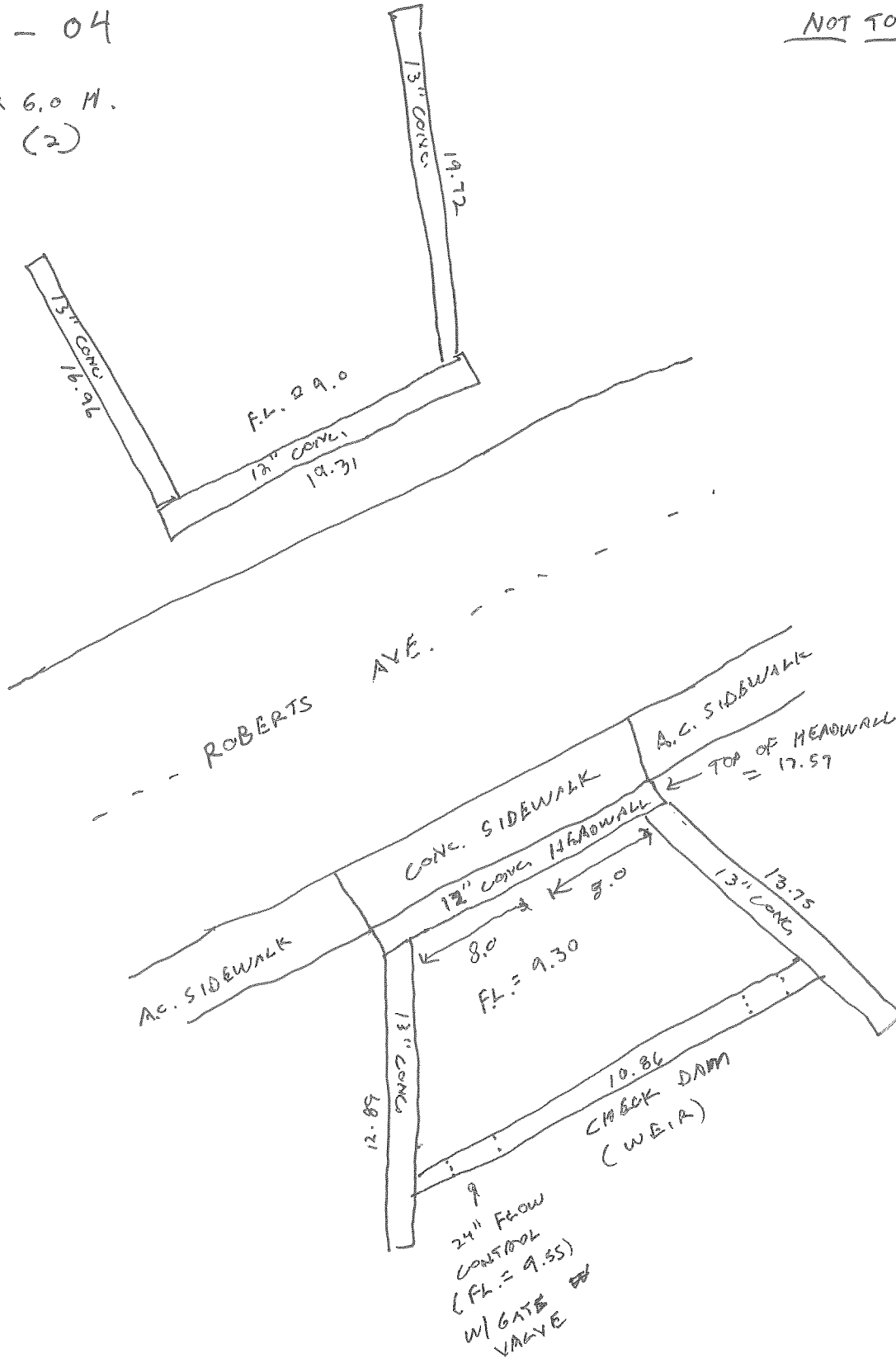
SANTA CRUZ

PROJECT CANYON DEL RE JOB No. 2888.00  
 DATE 2013-0515 SHEET No. \_\_\_\_\_ of \_\_\_\_\_  
 CALCULATED BY TH DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30-C-04

8.0 W. x 6.0 H.  
R.C.B. (2)

NOT TO SCALE ↑  
N



CULVERT ID: 30-C-05 NORTH  
TERMINUS PROJECT# 2888.00  
 1977 ID (IF ANY) 47 SURVEY DATE: 2013-0206  
 GENERAL LOCATION: WATERSHED SURVEY PARTY: TOM HANNAH  
TERMINUS AT  
BEACH HOTEL  
 SURVEY POINT #s: 10018-10022

INVERT (UPSTREAM) ELEVATION: -SHT. 2- DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MOSTLY BEACH SAND  
 INVERT (DOWNSTREAM) ELEVATION: 7.30 UPSTREAM DEBRIS DESCRIPTION  
-SHT. 2-  
 LENGTH 768.9' SHAPE RECTANGLE  
(BOX) DOWNSTREAM DEBRIS DESCRIPTION  
SAND, KELP, DRIFTWOOD  
 NUMBER OF BARRELS 4 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 6' x 5' \* EAST BARREL PLUGGED WITH SAND.  
 CULVERT MATERIAL TYPE: CONC. CONCRETE DETRIORATION, SOME EX-  
 HIGH WATER (UPSTREAM) ELEVATION: -SHT. 2- TRASH RACK? Y IF YES, DESCRIPTION: POSED  
REBAR  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: N.A. (BEACH) ANGLE (FROM NORTH) N. 1° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
-SHT. 2-



COMMENTS: ALL 4 BARRELS CONTAIN SAND.  
MOST EASTERLY BARREL PLUGGED.  
\* INVERT OBTAINED BY DIGGING / PROBING WEST  
BARREL. NO OTHER BARRELS EXCAVATED.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET <u>1</u>  <u>2</u> OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
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	PROJECT No.:	CHECKED:	



# WHITSON ENGINEERS

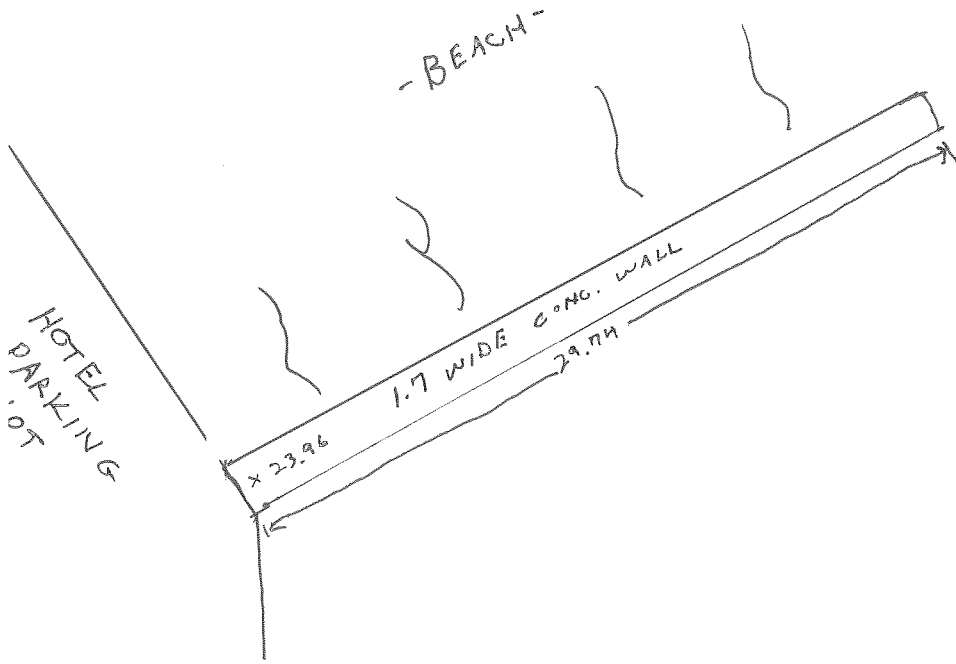
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PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-05-15 SHEET No. 2 of 2  
CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

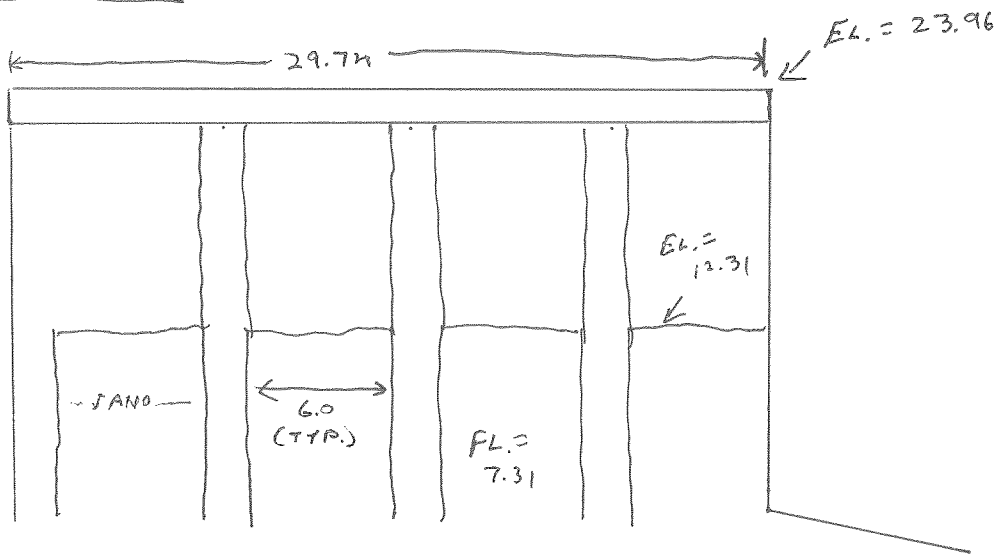
30-C-05

NORTH (DOWNSTREAM)

NOT TO SCALE



## PROFILE



← E W →

\* EAST BARREL  
ALMOST COMPLETELY  
FILLED W/ SAND  
OTHER BARRELS  
2.0' +/- SAND


CULVERT ID: 30-C-05 SOUTH PROJECT# 2888.00  
 1977 ID (IF ANY) 47 SURVEY DATE: 2013-0206  
 GENERAL LOCATION: CANYON DEL REY SURVEY PARTY: SIMON LAGUENS  
@ NORTH BOUND  
EXIT HWY 1.  
 SURVEY POINT #s: 15065 - 15090

INVERT (UPSTREAM) ELEVATION: 8.66 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
- SHT 1 -  
 INVERT (DOWNSTREAM) ELEVATION: - SHT 1 - UPSTREAM DEBRIS DESCRIPTION  
NONE VISIBLE  
 LENGTH 768.9 SHAPE BOX (QUAD) DOWNSTREAM DEBRIS DESCRIPTION  
SHT 1  
 NUMBER OF BARRELS 4 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 6' x 6' (4)  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 11.4' +/- TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: - SHT. 1 -  
 SPILL CREST ABOVE CULVERT: 17.1 ANGLE (FROM NORTH) N. 1° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE VISIBLE -SEE SKETCHES ATTACHED-



COMMENTS: HIGH WATER ELEVATION BASED ON  
OBSERVED CONCRETE DISCOLORATION

PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<h2>CULVERT SURVEY</h2>	DATE:	SHEET <u>2</u>  OF <u>2</u>
	<h3>CANYON DEL REY WATERSHED</h3>	SCALE:	
		DRAWN:	
		CHECKED:	
DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg		PROJECT No.:	



# WHITSON ENGINEERS

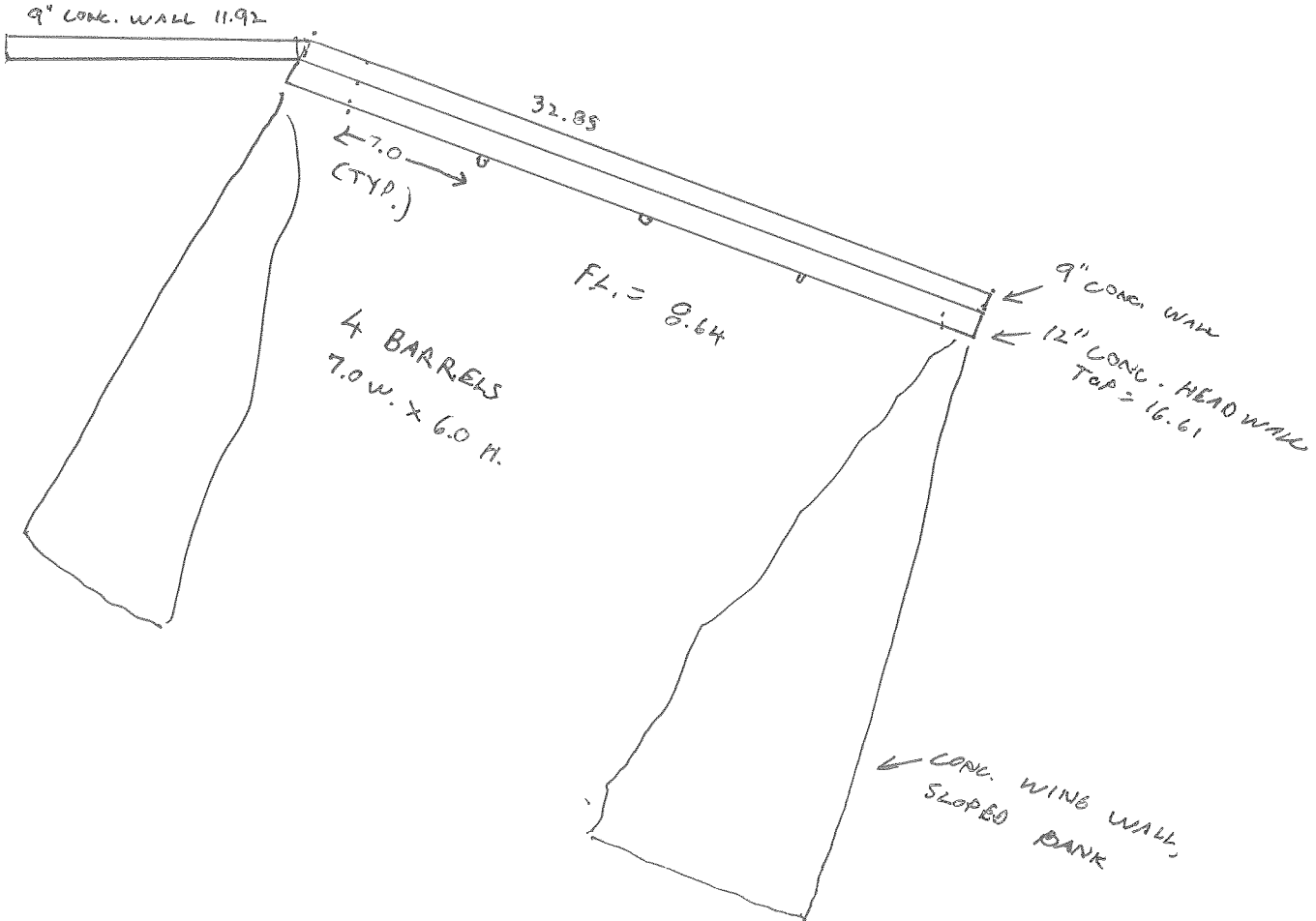
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MONTEREY LOS ANGELES SANTA CRUZ

PROJECT CANYON DEL REY JOB No. 2888.00  
DATE 2013-0515 SHEET No. 1 of 2  
CALCULATED BY TH DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

30-C-05

SOUTH (UPSTREAM)

NOT TO SCALE



CULVERT ID: 30-C-05 NORTH TERMINUS PROJECT# 2888.00  
 1977 ID (IF ANY) 47 SURVEY DATE: 2013-0206  
 GENERAL LOCATION: WATERSHED SURVEY PARTY: TOM HANNAH  
TERMINUS AT  
BEACH HOTEL  
 SURVEY POINT #s: 10018-10022

INVERT (UPSTREAM) ELEVATION: -SHT. 2- DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
MOSTLY BEACH SAND  
 INVERT (DOWNSTREAM) ELEVATION: 7.30 UPSTREAM DEBRIS DESCRIPTION  
-SHT. 2-  
 LENGTH 768.9' SHAPE RECTANGLE  
(BOX) DOWNSTREAM DEBRIS DESCRIPTION  
SAND, KELP, DRIFTWOOD  
 NUMBER OF BARRELS 4 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 6' x 5' \* EAST BARREL PLUGGED WITH SAND.  
 CULVERT MATERIAL TYPE: CONC. CONCRETE DETERIORATION, SOME EX-  
 HIGH WATER (UPSTREAM) ELEVATION: -SHT. 2- TRASH RACK? Y IF YES, DESCRIPTION: POSED  
REBAR  
 HIGH WATER (DOWNSTREAM) ELEVATION: NOT VISIBLE  
 SPILL CREST ABOVE CULVERT: N.A. (BEACH) ANGLE (FROM NORTH) N. 1° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION -SEE SKETCHES ATTACHED-  
-SHT. 2-



COMMENTS: ALL 4 BARRELS CONTAIN SAND.  
MOST EASTERLY BARREL PLUGGED.  
\* INVERT OBTAINED BY DIGGING / PROBING WEST  
BARREL. NO OTHER BARRELS EXCAVATED.  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET <u>1</u>  <u>2</u> OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	



CULVERT ID: 30-C-05 SOUTH PROJECT# 2888.00  
 1977 ID (IF ANY) 47 SURVEY DATE: 2013-0206  
 GENERAL LOCATION: CANYON DEL REY SURVEY PARTY: SIMON LAGUENS  
@ NORTH BOUND  
EXIT HWY 1.  
 SURVEY POINT #s: 15065 - 15090

INVERT (UPSTREAM) ELEVATION: 8.66 DOWNSTREAM SEDIMENT ELEVATION/DESCRIPTION  
- SHT 1 -  
 INVERT (DOWNSTREAM) ELEVATION: - SHT 1 - UPSTREAM DEBRIS DESCRIPTION  
NONE VISIBLE  
 LENGTH 768.9 SHAPE BOX (QUAD) DOWNSTREAM DEBRIS DESCRIPTION  
SHT 1  
 NUMBER OF BARRELS 4 PHYSICAL CONDITION: SOUND / CRACKED /  
 COLLAPSED / REBAR EXPOSED / FAILING / PLUGGED  
 DIMENSIONS (DIAMETER / W X H): 6' x 6' (4)  
 CULVERT MATERIAL TYPE: CONC.  
 HIGH WATER (UPSTREAM) ELEVATION: 11.4' +/- TRASH RACK? Y (N) IF YES, DESCRIPTION:  
 HIGH WATER (DOWNSTREAM) ELEVATION: - SHT. 1 -  
 SPILL CREST ABOVE CULVERT: 17.1 ANGLE (FROM NORTH) N. 1° E.  
 UPSTREAM SEDIMENT ELEVATION/DESCRIPTION  
NONE VISIBLE -SEE SKETCHES ATTACHED-



COMMENTS: HIGH WATER ELEVATION BASED ON  
OBSERVED CONCRETE DISCOLORATION  
 PHOTO FILE #S: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_

	<b>CULVERT SURVEY</b>	DATE:	SHEET <b>2</b>  <b>2</b> OF
	<b>CANYON DEL REY WATERSHED</b>	SCALE:	
	DRAWING PATH: T:\Monterey Projects\2888\SURVEY\Worksheets\Culvert Survey Form.dwg	DRAWN:	
	PROJECT No.:	CHECKED:	

**APPENDIX C**  
**SELECTED FACILITY PHOTOGRAPHS**

# APPENDIX C: Facility Inspection Photographs

LS\_B\_01 Basin and Outlet



LS\_C\_01 Entrance grating



01\_C\_01 Inlet



01\_C\_02 Outlet



01\_C\_03 - Outlet



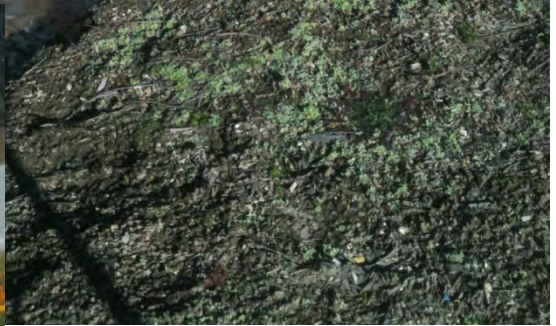
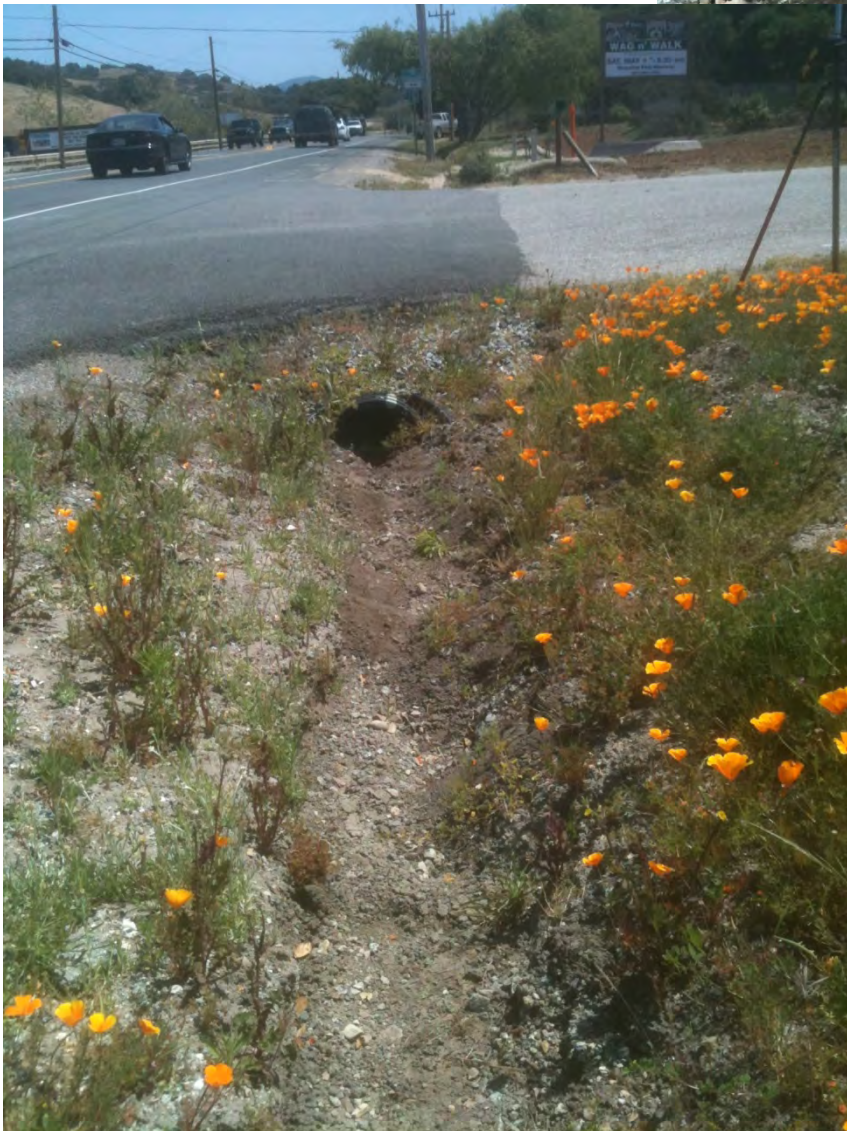
02\_C\_01 - Outlet



02\_C\_02 - Inlet



02\_C\_03 - Inlet



03\_C\_01 - Inlet



03\_C\_02 - Inlet

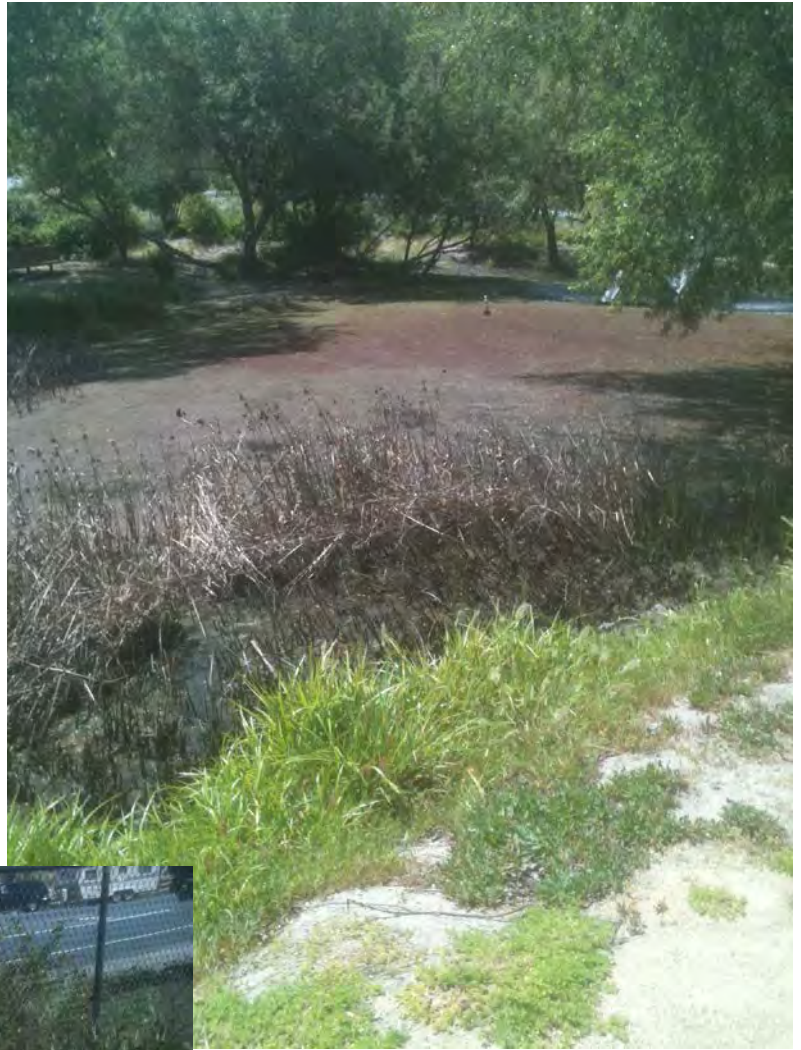


04\_B\_01 – Pond and Overflow Weir

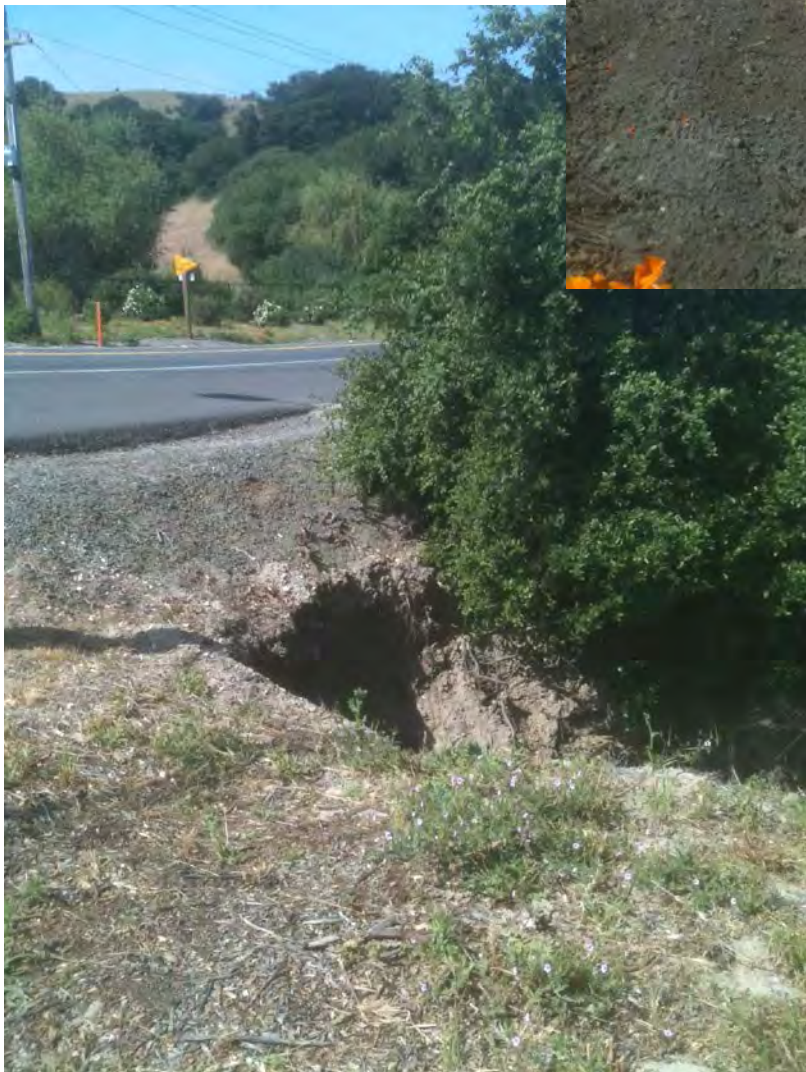




04\_B\_02 – Pond and Outflow  
swale



04\_C\_01 – Inlet and Outlet



04\_C\_02 – Inlet and Outlet



05\_B\_01 – Inlet and Outlet



05\_C\_01 – Inlet and Outlet



06\_C\_01 – Inlet and Outlet



07\_C\_01 – Inlet and Outlet



08\_B\_01 – Basin and Inlet





08\_B\_02 – No photos

08\_C\_01 –Inlet Gate from 08\_B\_01 and Outlet



08\_C\_02 – Inlet and Outlet



09\_B\_01 – Basin and Outlet Structures



09\_C\_01 – Outlet Structure and Manhole



10\_B\_01 – Basin and Inlet



10\_B\_02 Outlet



10\_B\_03 – Basin and Outlet



10\_B\_04 – Basin and Outlet



10\_C\_01 Inlet and Outlet



10\_C\_02 Inlet



10\_C\_02 Inlet





11\_B\_01 Basin and Inlet



11\_B\_02 Basin



12\_B\_01 Basin, Outlet and Overflow swale

12\_B\_02 Basin, Outlet



12\_C\_01 Inlet and Outlet



14\_C\_01 Inlet and Outlet



15\_C\_01 Inlet and Outlet



16\_C\_01 Inlet and Outlet



17\_C\_01 Inlet and Outlet



18\_C\_01 Inlet and Outlet





19\_B\_01 Pond and Outlet



21\_B\_01 Pond and Inlet Weir



21\_B\_01 Outlet Weir and Pond



21\_C\_01 Inlet and Outlet



22\_B\_01 Basin and Outlet



24\_B\_01 Basin and Outlet Riser

24\_B\_01 Outlet Spillway



24\_B\_02 Basin and Outlet



25\_B\_01 Basin



25\_B\_01 Two Outlets



25\_C\_01 Inlet and Outlet





25\_C\_02 Inlet and Outlet



25\_C\_03 Inlet



25\_C\_03 Inlet

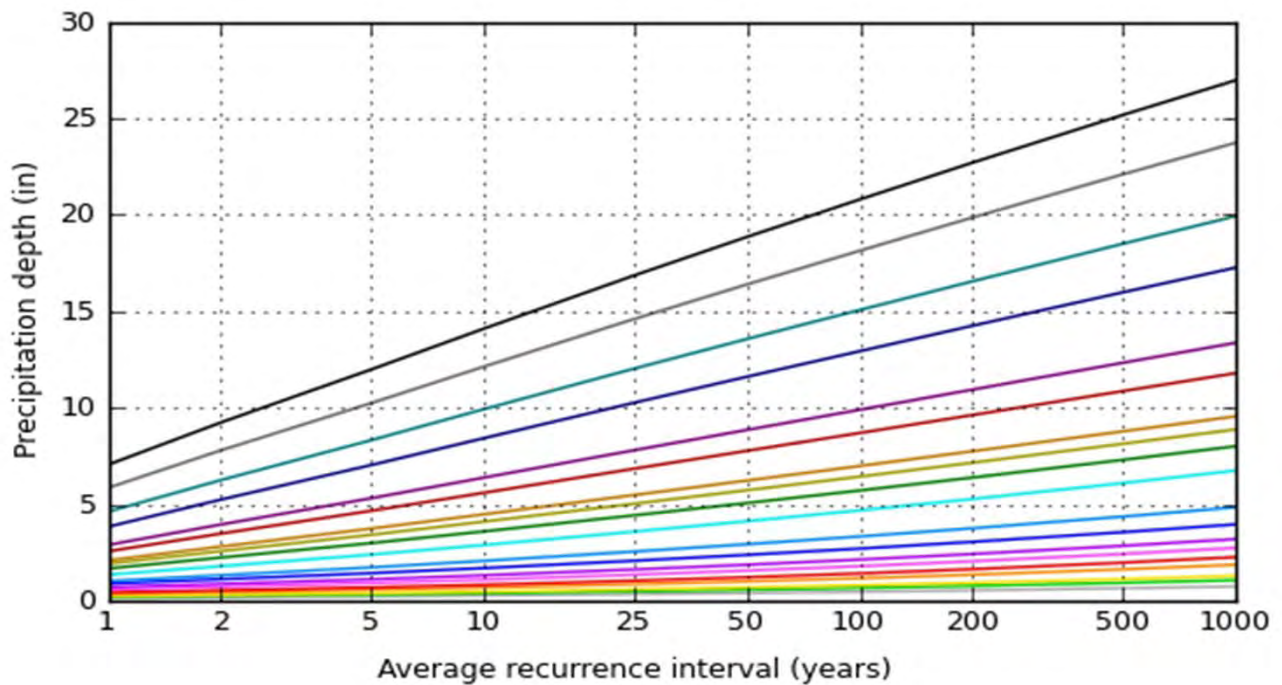
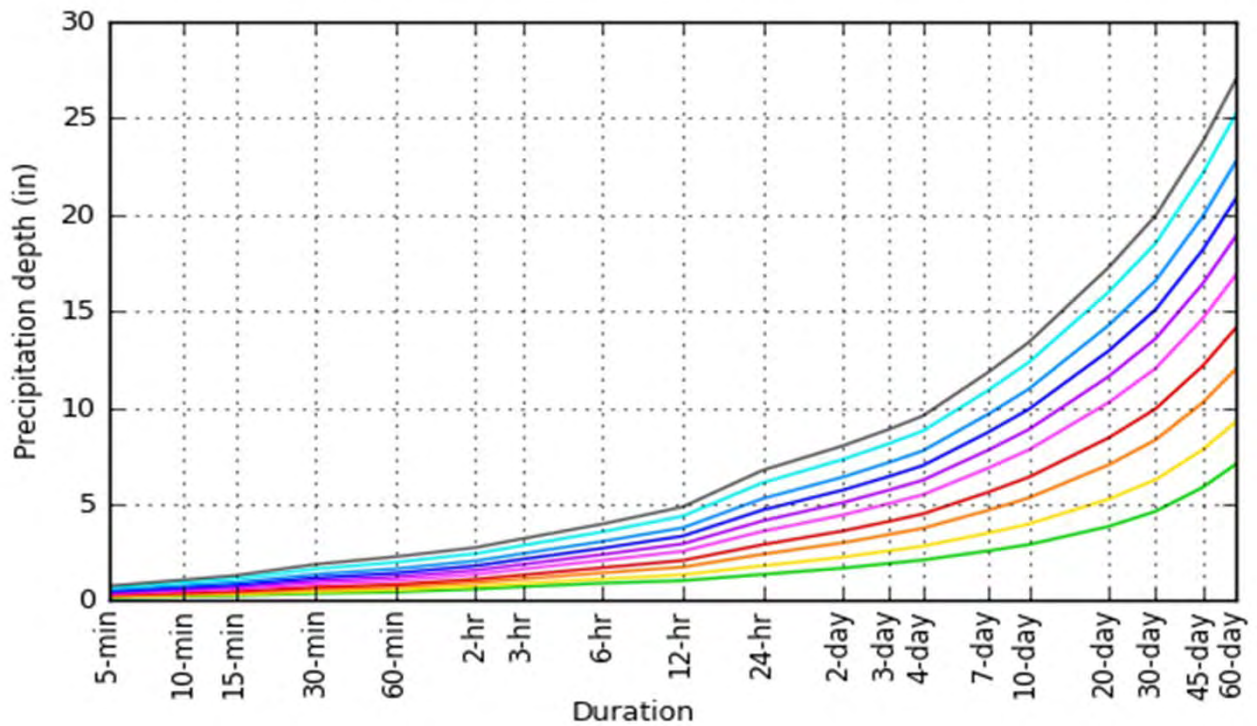
**APPENDIX D**

**DEPTH-DURATION-FREQUENCY ESTIMATES FROM NOAA  
ATLAS 14**

**PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)**

Location	Latitude, Longitude	Duration	2	10	25	50	100	500
Regional Airport	36.5921N, 121.8403W	60-min	<b>0.553</b> (0.485-0.636)	<b>0.845</b> (0.732-0.984)	<b>1.05</b> (0.877-1.27)	<b>1.23</b> (1.00-1.52)	<b>1.42</b> (1.13-1.82)	<b>1.97</b> (1.44-2.73)
		6-hr	<b>1.18</b> (1.04-1.36)	<b>1.78</b> (1.54-2.07)	<b>2.17</b> (1.81-2.63)	<b>2.49</b> (2.03-3.09)	<b>2.83</b> (2.24-3.62)	<b>3.72</b> (2.72-5.14)
		12-hr	<b>1.42</b> (1.24-1.63)	<b>2.19</b> (1.90-2.56)	<b>2.7</b> (2.25-3.27)	<b>3.1</b> (2.53-3.85)	<b>3.53</b> (2.79-4.51)	<b>4.64</b> (3.39-6.41)
		24-hr	<b>1.91</b> (1.75-2.13)	<b>3.04</b> (2.76-3.43)	<b>3.77</b> (3.32-4.36)	<b>4.34</b> (3.76-5.12)	<b>4.95</b> (4.20-5.95)	<b>6.48</b> (5.19-8.27)
		7-day	<b>3.75</b> (3.43-4.18)	<b>5.96</b> (5.40-6.70)	<b>7.27</b> (6.41-8.41)	<b>8.27</b> (7.16-9.74)	<b>9.27</b> (7.87-11.1)	<b>11.7</b> (9.33-14.9)
Junction Roberts Lake/Laguna	36.6059N, 121.8571W	60-min	<b>0.54</b> (0.471-0.627)	<b>0.831</b> (0.715-0.976)	<b>1.04</b> (0.861-1.27)	<b>1.22</b> (0.984-1.52)	<b>1.42</b> (1.11-1.82)	<b>1.97</b> (1.44-2.74)
		6-hr	<b>1.12</b> (0.975-1.30)	<b>1.69</b> (1.46-1.99)	<b>2.07</b> (1.72-2.53)	<b>2.38</b> (1.92-2.97)	<b>2.7</b> (2.13-3.47)	<b>3.55</b> (2.58-4.94)
		12-hr	<b>1.32</b> (1.15-1.53)	<b>2.07</b> (1.78-2.43)	<b>2.55</b> (2.11-3.11)	<b>2.93</b> (2.37-3.66)	<b>3.33</b> (2.62-4.28)	<b>4.36</b> (3.17-6.06)
		24-hr	<b>1.79</b> (1.64-2.00)	<b>2.89</b> (2.61-3.26)	<b>3.58</b> (3.15-4.15)	<b>4.12</b> (3.56-4.87)	<b>4.68</b> (3.97-5.65)	<b>6.1</b> (4.87-7.79)
		7-day	<b>3.48</b> (3.18-3.90)	<b>5.6</b> (5.06-6.32)	<b>6.84</b> (6.01-7.93)	<b>7.77</b> (6.71-9.17)	<b>8.7</b> (7.36-10.5)	<b>10.9</b> (8.67-13.9)
Hwy 68 at Laureles Grade Rd	36.5695N, 121.7555W	60-min	<b>0.545</b> (0.493-0.609)	<b>0.805</b> (0.717-0.912)	<b>0.986</b> (0.841-1.17)	<b>1.14</b> (0.946-1.39)	<b>1.31</b> (1.05-1.65)	<b>1.79</b> (1.32-2.46)
		6-hr	<b>1.35</b> (1.22-1.51)	<b>1.99</b> (1.77-2.25)	<b>2.4</b> (2.05-2.85)	<b>2.74</b> (2.28-3.34)	<b>3.11</b> (2.50-3.90)	<b>4.08</b> (3.00-5.60)
		12-hr	<b>1.74</b> (1.57-1.95)	<b>2.59</b> (2.31-2.94)	<b>3.16</b> (2.69-3.74)	<b>3.62</b> (3.00-4.41)	<b>4.12</b> (3.31-5.17)	<b>5.44</b> (4.00-7.46)
		24-hr	<b>2.32</b> (2.14-2.56)	<b>3.51</b> (3.21-3.92)	<b>4.31</b> (3.83-4.94)	<b>4.95</b> (4.33-5.78)	<b>5.65</b> (4.83-6.73)	<b>7.49</b> (6.04-9.48)
		7-day	<b>4.59</b> (4.24-5.07)	<b>6.92</b> (6.34-7.72)	<b>8.38</b> (7.45-9.61)	<b>9.52</b> (8.32-11.1)	<b>10.7</b> (9.16-12.8)	<b>13.7</b> (11.0-17.3)
South central watershed boundary	36.5535N, 121.7850W	60-min	<b>0.56</b> (0.507-0.624)	<b>0.829</b> (0.741-0.938)	<b>1.02</b> (0.870-1.20)	<b>1.18</b> (0.979-1.42)	<b>1.35</b> (1.09-1.69)	<b>1.84</b> (1.36-2.50)
		6-hr	<b>1.37</b> (1.24-1.53)	<b>2.02</b> (1.80-2.28)	<b>2.44</b> (2.09-2.88)	<b>2.79</b> (2.32-3.38)	<b>3.15</b> (2.55-3.94)	<b>4.12</b> (3.05-5.62)
		12-hr	<b>1.76</b> (1.59-1.96)	<b>2.63</b> (2.35-2.98)	<b>3.21</b> (2.75-3.79)	<b>3.67</b> (3.06-4.45)	<b>4.17</b> (3.37-5.22)	<b>5.49</b> (4.07-7.49)
		24-hr	<b>2.34</b> (2.17-2.59)	<b>3.58</b> (3.27-3.99)	<b>4.39</b> (3.91-5.04)	<b>5.05</b> (4.42-5.90)	<b>5.76</b> (4.93-6.86)	<b>7.62</b> (6.15-9.64)
		7-day	<b>4.64</b> (4.29-5.13)	<b>7.07</b> (6.47-7.88)	<b>8.57</b> (7.63-9.83)	<b>9.75</b> (8.52-11.4)	<b>11</b> (9.38-13.1)	<b>14</b> (11.3-17.7)
Laguna Seca Raceway	36.5819N, 121.7666W	60-min	<b>0.543</b> (0.486-0.612)	<b>0.805</b> (0.711-0.921)	<b>0.989</b> (0.838-1.18)	<b>1.15</b> (0.945-1.40)	<b>1.32</b> (1.05-1.67)	<b>1.81</b> (1.33-2.50)
		6-hr	<b>1.32</b> (1.19-1.49)	<b>1.95</b> (1.72-2.23)	<b>2.37</b> (2.00-2.82)	<b>2.7</b> (2.23-3.31)	<b>3.07</b> (2.45-3.88)	<b>4.04</b> (2.96-5.57)
		12-hr	<b>1.69</b> (1.52-1.91)	<b>2.53</b> (2.24-2.90)	<b>3.09</b> (2.62-3.69)	<b>3.55</b> (2.92-4.34)	<b>4.03</b> (3.23-5.10)	<b>5.34</b> (3.92-7.37)
		24-hr	<b>2.26</b> (2.08-2.50)	<b>3.44</b> (3.14-3.84)	<b>4.22</b> (3.74-4.85)	<b>4.86</b> (4.23-5.68)	<b>5.54</b> (4.73-6.62)	<b>7.36</b> (5.92-9.32)
		7-day	<b>4.47</b> (4.12-4.95)	<b>6.76</b> (6.17-7.56)	<b>8.19</b> (7.27-9.41)	<b>9.3</b> (8.12-10.9)	<b>10.5</b> (8.94-12.5)	<b>13.4</b> (10.8-16.9)
Watershed 28, Fort Ord	36.5858N, 121.8077W	60-min	<b>0.555</b> (0.493-0.632)	<b>0.837</b> (0.733-0.964)	<b>1.03</b> (0.871-1.24)	<b>1.2</b> (0.987-1.48)	<b>1.39</b> (1.11-1.76)	<b>1.91</b> (1.40-2.63)
		6-hr	<b>1.27</b> (1.12-1.44)	<b>1.89</b> (1.65-2.17)	<b>2.3</b> (1.93-2.76)	<b>2.63</b> (2.16-3.24)	<b>2.98</b> (2.38-3.78)	<b>3.92</b> (2.88-5.40)
		12-hr	<b>1.57</b> (1.39-1.78)	<b>2.39</b> (2.09-2.75)	<b>2.92</b> (2.46-3.51)	<b>3.36</b> (2.76-4.14)	<b>3.82</b> (3.05-4.85)	<b>5.05</b> (3.70-6.95)
		24-hr	<b>2.1</b> (1.93-2.34)	<b>3.27</b> (2.98-3.67)	<b>4.04</b> (3.58-4.66)	<b>4.66</b> (4.05-5.46)	<b>5.31</b> (4.52-6.36)	<b>7.01</b> (5.63-8.91)
		4-day	<b>3.37</b> (3.10-3.74)	<b>5.24</b> (4.76-5.87)	<b>6.39</b> (5.66-7.37)	<b>7.29</b> (6.34-8.55)	<b>8.21</b> (7.00-9.84)	<b>10.5</b> (8.44-13.3)
		7-day	<b>4.15</b> (3.81-4.61)	<b>6.45</b> (5.87-7.23)	<b>7.84</b> (6.94-9.04)	<b>8.92</b> (7.76-10.5)	<b>10</b> (8.54-12.0)	<b>12.7</b> (10.2-16.2)
Hwy 68 at York Road	36.5717N, 121.8085W	60-min	<b>0.558</b> (0.498-0.632)	<b>0.839</b> (0.739-0.963)	<b>1.04</b> (0.876-1.24)	<b>1.2</b> (0.992-1.48)	<b>1.39</b> (1.11-1.75)	<b>1.91</b> (1.40-2.62)
		6-hr	<b>1.28</b> (1.15-1.45)	<b>1.91</b> (1.68-2.19)	<b>2.33</b> (1.97-2.78)	<b>2.66</b> (2.19-3.26)	<b>3.02</b> (2.41-3.81)	<b>3.96</b> (2.92-5.44)
		12-hr	<b>1.6</b> (1.42-1.81)	<b>2.43</b> (2.13-2.78)	<b>2.97</b> (2.51-3.55)	<b>3.41</b> (2.81-4.19)	<b>3.88</b> (3.11-4.91)	<b>5.13</b> (3.77-7.04)
		24-hr	<b>2.14</b> (1.97-2.37)	<b>3.32</b> (3.03-3.72)	<b>4.1</b> (3.63-4.72)	<b>4.72</b> (4.11-5.53)	<b>5.38</b> (4.59-6.44)	<b>7.12</b> (5.72-9.04)
		7-day	<b>4.23</b> (3.89-4.69)	<b>6.56</b> (5.97-7.34)	<b>7.97</b> (7.07-9.18)	<b>9.07</b> (7.90-10.6)	<b>10.2</b> (8.69-12.2)	<b>12.9</b> (10.4-16.4)

PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 36.6059°, Longitude: -121.8576°

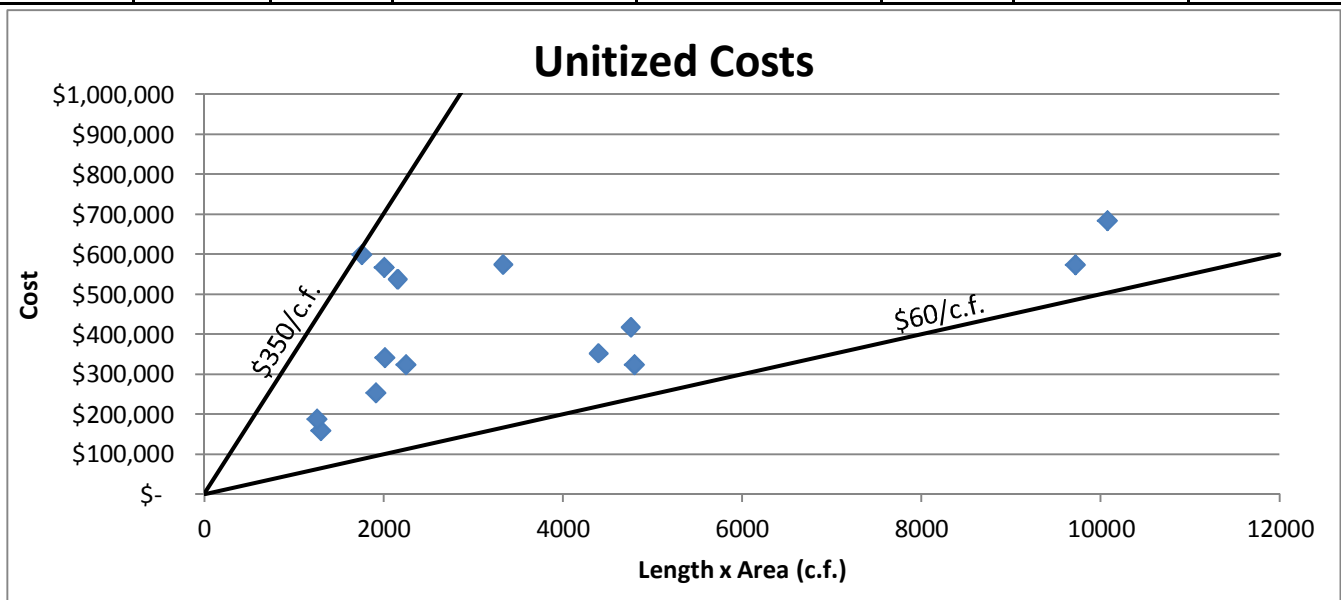


**APPENDIX E**

**PRELIMINARY COST ESTIMATE DETAILS FOR PROPOSED  
FACILITY UPGRADES**

## Canyon del Rey Crossing Modifications - Cost Estimate Summary

Crossing ID	Crossing Length	RCP	RCB		Bridge (Private)		Units L x A	Cost	Unitized
		Dia.	Width	Height	Span	Height			Cost / c.f.
01-C02	130		5	2			1300	\$ 158,000	\$ 122
02-C01	110		8	2			1760	\$ 599,000	\$ 340
03-C01	70		6	3			1260	\$ 187,000	\$ 148
03-C02	80		6	4			1920	\$ 253,000	\$ 132
10-C01	170	5					3338	\$ 574,000	\$ 172
12-C01	110	5					2160	\$ 537,000	\$ 249
14-C01	160	4					2011	\$ 566,000	\$ 282
15-C01	110		8	5			4400	\$ 352,000	\$ 80
21-C01	68		14	5			4760	\$ 417,000	\$ 88
25-C01	135		12	6			9720	\$ 573,000	\$ 59
25-C02	120		12	7			10080	\$ 683,000	\$ 68
27-C03	380		12	7.5			34200	\$ 1,645,000	\$ 48
27-C04	42		6	8			2016	\$ 341,000	\$ 169
29-C01	47		6	8			2256	\$ 324,000	\$ 144
29-C03	12				24	6		\$ 139,000	
29-C07	50		12	8			4800	\$ 324,000	\$ 68





### Unit Cost Summary

Code	Description	Unit	Price	Notes
-	Temporary Environmental Controls	LS	LS	\$10,000 minimum; \$20,000 for work within major watercourses. Includes SWPPP, temporary stormwater BMPs, and ESHA protections
-	Temporary Traffic Controls	LS	LS	\$1,000 to \$5,000 for work outside right of way or on city streets; \$10,000 for work in highway shoulder; \$50,000 for work requiring detours / staged construction on highway
-	Temporary Access Road	LS	LS	
-	Temporary Creek Diversion	LS	LS	\$1,000 up to \$10,000 (for 27-C-02)
151573	Reconstruct Guardrail	LF	\$ 50.00	
260201	Class 2 Aggregate Base	CY	\$ 100.00	
377501	Slurry Seal	TON	\$ 3,000.00	Type 2 applied at 15 LB/SQYD
390132	Hot Mix Asphalt (Type A)	TON	\$ 300.00	for small quantities (<200 tons)
510060	Structural Concrete, Retaining Wall	CY	\$ 1,200.00	
510090	Structural Concrete, Box Culvert	CY	\$ 1,200.00	Structure excavation and backfill are included
520103	Bar Reinforcing Steel (Retaining Wall)	LB	\$ 1.75	
520107	Bar Reinforcing Steel (Box Culvert)	LB	\$ 1.25	
720121	Rock Slope Protection (1/2T, Method A)	CY	\$ 150.00	minimum thickness = 4.5 ft; place on Facing
721017	Rock Slope Protection (Facing, Method B)	CY	\$ 300.00	minimum thickness = 2 ft
729011	Rock Slope Protection Fabric (Class 8)	SOYD	\$ 10.00	
731505	Minor Concrete (Curb and Sidewalk)	CY	\$ 500.00	equates to \$13/LF for 6"VC and \$6/SF for SW
832003	Metal Beam Guard Railing (Wood Post)	LF	\$ 50.00	used for salvage and re-installation
-	Highway Planting	LS	LS	\$3,000 to \$5,000, depending on project area
-	Creek/Riparian Restoration and Planting	LS	LS	\$10,000 to \$50,000, depending on anticipated project area and complexity of restoration

### Reference unit costs (not used in estimates)

Code	Description	Unit	Price	Notes
16095	[36" RCP] Pipe Jacking	LF	\$ 1,800.00	see bid results for 05-0J1904
26710	48" RCP Pipe Jacking	LF	\$ 1,100.00	see bid results for 05-1A0904

### General Cost Estimate Notes

1. Prices and costs are in 2014 dollars. Adjust prices for use in later years.
2. See attached Caltrans Cost Data for lines with Item Code shown
3. Preliminary estimate totals include minor items, supplemental work and contingencies.
4. Estimates do not include "soft costs" which include design, environmental, permitting, fees, testing, or inspections.
5. "Minor items" includes individual low-cost items not otherwise included, such as: culvert markers; RSP fabric; overside drains; and utility cover adjustments.
6. "Temporary Environmental Controls" includes temporary water pollution control work and ESHA protection.
7. Utility relocations are not included, except where specifically noted.

## Preliminary Estimate of Probable Construction Cost

<b>Agency:</b>	Monterey Peninsula Water Management District		
<b>Project Name:</b>	Canyon del Rey Drainage Master Plan		
<b>Project Location:</b>	01-C-02 - Highway 68 at PM 11.22 (Laureles Grade intersection)		
<b>Description:</b>	Remove two (2) existing 18" CMP culverts located in north shoulder of and running parallel to Highway 68 at Laureles Grade. Construct 5'W x 2'H x 130'L RCB, and install RSP inlet and outlet protection. Includes traffic signal conduit relocation and reconstruction of existing bus stop.		
<b>Date of Estimate:</b>	March 26, 2014	Caltrans 2010 Specs	
<b>Prepared by:</b>	Whitson Engineers	by: ndm	checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Traffic Controls	LS	1	\$10,000.00	\$ 10,000
3	150808	Remove Culvert	LS	1	\$ 1,000.00	\$ 1,000
4	260203	Class 2 Aggregate Base	CY	30	\$ 100.00	\$ 3,000
5	390132	Hot Mix Asphalt (Type A)	TON	11	\$ 300.00	\$ 3,300
6	510090	Structural Concrete (Box Culvert)	CY	46	\$ 1,200.00	\$ 55,200
7	520107	Bar Reinforcing Steel (Box Culvert)	LB	7,500	\$ 1.25	\$ 9,375
8	721017	Rock Slope Protection (Facing, Method B)	CY	15	\$ 300.00	\$ 4,500
9	729011	Rock Slope Protection Fabric	SQYD	25	\$ 10.00	\$ 250
10	-	Highway Planting	LS	1	\$ 2,000.00	\$ 2,000
11	-	Traffic Signal and Lighting	LS	1	\$ 3,000.00	\$ 3,000
		Sub-Total				\$ 101,625
		Mobilization			10%	\$ 10,162.50
		Minor Items and Supplemental Work			15%	\$ 15,243.75
		Contingencies			30%	\$ 30,487.50

**TOTAL: \$ 157,519**  
**TOTAL, ROUNDED: \$ 158,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 02-C-01 - Highway 68 at PM 11.15 (400' west of Laureles Grade intersection)

**Description:** Remove existing double 20"x28" CMP culvert which crosses Highway 68 just west of Laureles Grade. Construct 2'H x 8'W x 110'L RCB, and install RSP inlet and outlet protection. Existing culverts are shallow and existing utility crossings are anticipated to require similarly shallow RCB. Staged construction.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Traffic Controls (Stage Construction)	LS	1	\$50,000.00	\$ 50,000
3	150808	Remove Culvert	LS	1	\$ 2,000.00	\$ 2,000
4	260203	Class 2 Aggregate Base	CY	56	\$ 100.00	\$ 5,600
5	377501	Slurry Seal	TON	5	\$ 3,000.00	\$ 15,000
6	390132	Hot Mix Asphalt (Type A)	TON	86	\$ 300.00	\$ 25,800
7	510060	Structural Concrete (Retaining Wall)	CY	24	\$ 1,200.00	\$ 28,800
8	510090	Structural Concrete (Box Culvert)	CY	140	\$ 1,200.00	\$ 168,000
9	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,300	\$ 1.75	\$ 2,275
10	520107	Bar Reinforcing Steel (Box Culvert)	LB	36,700	\$ 1.25	\$ 45,875
11	721017	Rock Slope Protection (Facing, Method B)	CY	78	\$ 300.00	\$ 23,400
12	729011	Rock Slope Protection Fabric	SQYD	160	\$ 10.00	\$ 1,600
13	-	Highway Planting	LS	1	\$ 3,000.00	\$ 3,000
14	-	Pavement Delineation	LS	1	\$ 2,000.00	\$ 2,000
15	-	Traffic Signal and Lighting	LS	1	\$ 3,000.00	\$ 3,000
		Sub-Total				\$ 386,350
		Mobilization			10%	\$ 38,635.00
		Minor Items and Supplemental Work			15%	\$ 57,952.50
		Contingencies			30%	\$ 115,905.00

**TOTAL: \$ 598,843**  
**TOTAL, ROUNDED: \$ 599,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 03-C-01 - north of Highway 68 at PM 11.02 (800' east of Laguna Seca entrance)

**Description:** Remove existing 30"x48" CMP culvert which crosses under secondary Laguna Seca Recreation Area access road. Construct 3'H x 6'W x 70'L RCB, and install RSP inlet and outlet protection.

**Date of Estimate:** March 26, 2014

Caltrans 2010 Specs

**Prepared by:** Whitson Engineers

by: ndm

checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Creek Diversion	LS	1	\$ 1,000.00	\$ 1,000
3	-	Temporary Traffic Controls	LS	1	\$ 2,000.00	\$ 2,000
4	150808	Remove Culvert	LS	1	\$ 1,500.00	\$ 1,500
5	260203	Class 2 Aggregate Base	CY	38	\$ 100.00	\$ 3,800
6	390132	Hot Mix Asphalt (Type A)	TON	24	\$ 300.00	\$ 7,200
7	510060	Structural Concrete (Retaining Wall)	CY	24	\$ 1,200.00	\$ 28,800
8	510090	Structural Concrete (Box Culvert)	CY	34	\$ 1,200.00	\$ 40,800
9	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,400	\$ 1.75	\$ 2,450
10	520107	Bar Reinforcing Steel (Box Culvert)	LB	5,400	\$ 1.25	\$ 6,750
11	721017	Rock Slope Protection (Facing, Method B)	CY	44	\$ 300.00	\$ 13,200
12	729011	Rock Slope Protection Fabric	SQYD	100	\$ 10.00	\$ 1,000
13	-	Highway Planting	LS	1	\$ 2,000.00	\$ 2,000
		Sub-Total				\$ 120,500
		Mobilization			10%	\$ 12,050.00
		Minor Items and Supplemental Work			15%	\$ 18,075.00
		Contingencies			30%	\$ 36,150.00

**TOTAL: \$ 186,775**  
**TOTAL, ROUNDED: \$ 187,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 03-C-02 - north of Highway 68 at PM 10.88 (Laguna Seca entrance)

**Description:** Remove existing 40" HDPE culvert which crosses under Laguna Seca Recreation Area entrance road. Construct 4'H x 6'W x 80'L RCB, construct concrete wing walls and grade control apron on inlet side, and install RSP outlet protection.

**Date of Estimate:** March 26, 2014

Caltrans 2010 Specs

**Prepared by:** Whitson Engineers

by: ndm

checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Creek Diversion	LS	1	\$ 1,000.00	\$ 1,000
3	-	Temporary Traffic Controls	LS	1	\$ 2,000.00	\$ 2,000
4	150808	Remove Culvert and Headwalls	LS	1	\$ 5,000.00	\$ 5,000
5	151573	Reconstruct Guardrail	LF	50	\$ 50.00	\$ 2,500
6	260203	Class 2 Aggregate Base	CY	55	\$ 100.00	\$ 5,500
7	390132	Hot Mix Asphalt (Type A)	TON	50	\$ 300.00	\$ 15,000
8	510060	Structural Concrete (Retaining Wall)	CY	31	\$ 1,200.00	\$ 37,200
9	510090	Structural Concrete (Box Culvert)	CY	42	\$ 1,200.00	\$ 50,400
10	520103	Bar Reinforcing Steel (Retaining Wall)	LB	2,000	\$ 1.25	\$ 2,500
11	520107	Bar Reinforcing Steel (Box Culvert)	LB	7,700	\$ 1.75	\$ 13,475
12	721017	Rock Slope Protection (Facing, Method B)	CY	30	\$ 300.00	\$ 9,000
13	729011	Rock Slope Protection Fabric	SQYD	53	\$ 10.00	\$ 530
14	-	Pavement Delineation	LS	1	\$ 2,000.00	\$ 2,000
15	-	Highway Planting	LS	1	\$ 2,000.00	\$ 2,000
16	-	Reconstruct Wood Fence	LF	50	\$ 100.00	\$ 5,000
		Sub-Total				\$ 163,105
		Mobilization			10%	\$ 16,310.50
		Minor Items and Supplemental Work			15%	\$ 24,465.75
		Contingencies			30%	\$ 48,931.50

**TOTAL: \$ 252,813**  
**TOTAL, ROUNDED: \$ 253,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 10-C-01 - Highway 68 at PM 10.08 (900' east of Pasadera Drive)

**Description:** Jack 48" dia x 170'L RCP culvert parallel to existing 36" CMP culvert which crosses Highway 68. Construct concrete head walls and RSP inlet and outlet protection. Perform creek restoration and planting.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$ 5,000.00	\$ 5,000
3	-	Temporary Access Road	LS	1	\$10,000.00	\$ 10,000
4	510060	Structural Concrete (Retaining Wall)	CY	64	\$ 1,200.00	\$ 76,800
5	520103	Bar Reinforcing Steel (Retaining Wall)	LB	6,500	\$ 1.75	\$ 11,375
6	720121	Rock Slope Protection (1/2T, Method A)	CY	100	\$ 150.00	\$ 15,000
7	721523	Rock Slope Protection (Facing, Method B)	CY	50	\$ 300.00	\$ 15,000
8	-	Jack Pipe, 48 inch RCP	LF	170	\$ 1,100.00	\$ 187,000
9	-	Creek/Riparian Restoration and Planting	LS	1	\$30,000.00	\$ 30,000
		Sub-Total				\$ 370,175
		Mobilization			10%	\$ 37,017.50
		Minor Items and Supplemental Work			15%	\$ 55,526.25
		Contingencies			30%	\$ 111,052.50

**TOTAL: \$ 573,771**  
**TOTAL, ROUNDED: \$ 574,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 12-C-01 - Highway 68 at PM 9.46 (2,400' west of Pasadera Drive)

**Description:** Construct temporary roads to access construction areas. Jack 60" dia x 110'L RCP culvert parallel to existing 48" CMP culvert which crosses Highway 68. Construct concrete head walls and RSP inlet and outlet protection. Perform creek restoration and planting.

**Date of Estimate:** March 26, 2014

Caltrans 2010 Specs

**Prepared by:** Whitson Engineers

by: ndm

checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$ 5,000.00	\$ 5,000
3	-	Temporary Access Road	LS	1	\$10,000.00	\$ 10,000
4	510060	Structural Concrete (Retaining Wall)	CY	46	\$ 1,200.00	\$ 55,200
5	520103	Bar Reinforcing Steel (Retaining Wall)	LB	4,692	\$ 1.75	\$ 8,211
6	720121	Rock Slope Protection (1/2T, Method A)	CY	66	\$ 300.00	\$ 19,800
7	-	Jack Pipe, 60 inch RCP	LF	110	\$ 1,800.00	\$ 198,000
8	-	Creek/Riparian Restoration and Planting	LS	1	\$30,000.00	\$ 30,000
		Sub-Total				\$ 346,211
		Mobilization			10%	\$ 34,621.10
		Minor Items and Supplemental Work			15%	\$ 51,931.65
		Contingencies			30%	\$ 103,863.30

**TOTAL: \$ 536,627**  
**TOTAL, ROUNDED: \$ 537,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 14-C-01 - Highway 68 at PM 9.04 (4,600' east of York Road / 4,500' west of Pasadera Drive)

**Description:** Construct temporary roads to access construction areas. Jack 48" dia x 160'L RCP culvert parallel to existing 48" CMP culvert which crosses Highway 68. Construct concrete head wall at inlet and RSP outlet protection. Perform creek restoration and planting.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$ 20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$ 5,000.00	\$ 5,000
3	-	Temporary Access Road	LS	1	\$ 15,000.00	\$ 15,000
4	510060	Structural Concrete (Retaining Wall)	CY	16	\$ 1,200.00	\$ 19,200
5	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,620	\$ 1.75	\$ 2,835
6	720121	Rock Slope Protection (1/2T, Method A)	CY	44	\$ 300.00	\$ 13,200
7	-	Jack Pipe, 48 inch RCP	LF	160	\$ 1,500.00	\$ 240,000
8	-	Creek/Riparian Restoration and Planting	LS	1	\$ 50,000.00	\$ 50,000
		Sub-Total				\$ 365,235
		Mobilization			10%	\$ 36,523.50
		Minor Items and Supplemental Work			15%	\$ 54,785.25
		Contingencies			30%	\$ 109,570.50

**TOTAL: \$ 566,114**  
**TOTAL, ROUNDED: \$ 566,000**



## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 15-C-01 - north of Highway 68 at PM 8.53 (off Blue Larkspur Lane)

**Description:** Remove existing 48" CMP culvert which crosses under emergency access road located off Blue Larkspur Lane. Construct 5'H x 8'W x 110'L RCB, construct concrete wing walls on inlet side, and install RSP outlet protection.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Creek Diversion	LS	1	\$ 1,000.00	\$ 1,000
3	-	Temporary Traffic Controls	LS	1	\$ 1,000.00	\$ 1,000
4	150808	Remove Culvert and Headwall	LS	1	\$ 5,000.00	\$ 5,000
5	260203	Class 2 Aggregate Base	CY	40	\$ 100.00	\$ 4,000
6	390132	Hot Mix Asphalt (Type A)	TON	30	\$ 300.00	\$ 9,000
7	510060	Structural Concrete (Retaining Wall)	CY	48	\$ 1,200.00	\$ 57,600
8	510090	Structural Concrete (Box Culvert)	CY	77	\$ 1,200.00	\$ 92,400
9	520103	Bar Reinforcing Steel (Retaining Wall)	LB	3,560	\$ 1.75	\$ 6,230
10	520107	Bar Reinforcing Steel (Box Culvert)	LB	17,160	\$ 1.25	\$ 21,450
11	721017	Rock Slope Protection (Facing, Method B)	CY	30	\$ 300.00	\$ 9,000
12	729011	Rock Slope Protection Fabric	SQYD	53	\$ 10.00	\$ 530
13	-	Reconstruct Wood Fence	LF	70	\$ 100.00	\$ 7,000
13	-	Highway Planting	LS	1	\$ 3,000.00	\$ 3,000
		Sub-Total				\$ 227,210
		Mobilization			10%	\$ 22,721.00
		Minor Items and Supplemental Work			15%	\$ 34,081.50
		Contingencies			30%	\$ 68,163.00

**TOTAL: \$ 352,176**  
**TOTAL, ROUNDED: \$ 352,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 21-C-01 - Highway 68 at PM 7.76 (2,000' west of York Road)

**Description:** Remove existing double 24"x28" culvert which crosses Highway 68. Construct double 5'H x 7'W x 68'L RCB, head walls, and RSP inlet and outlet protection. Staged construction.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$10,000.00	\$ 10,000
2	-	Temporary Traffic Controls (Staged Construction)	LS	1	\$50,000.00	\$ 50,000
3	-	Temporary Creek Diversion	LS	1	\$ 5,000.00	\$ 5,000
4	150808	Remove Culvert	LS	1	\$10,000.00	\$ 10,000
5	260203	Class 2 Aggregate Base	CY	28	\$ 100.00	\$ 2,800
6	390132	Hot Mix Asphalt (Type A)	TON	68	\$ 300.00	\$ 20,400
7	510060	Structural Concrete (Retaining Wall)	CY	16	\$ 1,200.00	\$ 19,200
8	510090	Structural Concrete (Box Culvert)	CY	84	\$ 1,200.00	\$ 100,800
9	520103	Bar Reinforcing Steel (Retaining Wall)	LB	2,490	\$ 1.75	\$ 4,358
10	520107	Bar Reinforcing Steel (Box Culvert)	LB	18,224	\$ 1.25	\$ 22,780
11	721017	Rock Slope Protection (Facing, Method B)	CY	56	\$ 300.00	\$ 16,800
12	729011	Rock Slope Protection Fabric	SQYD	100	\$ 10.00	\$ 1,000
13	-	Pavement Delineation	LS	1	\$ 3,000.00	\$ 3,000
14	-	Highway Planting	LS	1	\$ 3,000.00	\$ 3,000
		Sub-Total				\$ 269,138
		Mobilization			10%	\$ 26,913.75
		Minor Items and Supplemental Work			15%	\$ 40,370.63
		Contingencies			30%	\$ 80,741.25

**TOTAL: \$ 417,163**  
**TOTAL, ROUNDED: \$ 417,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 25-C-01 - south of Highway 68 at PM 6.84 (Monterra Ranch Road)

**Description:** Remove existing 2-48" and 3-18" culverts which cross under Monterra Ranch entrance road. Construct 6'H x 12'W x 135'L RCB, construct inlet control structure, and install RSP outlet protection.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$ 5,000.00	\$ 5,000
3	-	Temporary Creek Diversion	LS	1	\$ 2,000.00	\$ 2,000
4	150808	Remove Culvert	LS	1	\$10,000.00	\$ 10,000
5	260203	Class 2 Aggregate Base	CY	68	\$ 100.00	\$ 6,800
6	390132	Hot Mix Asphalt (Type A)	TON	61	\$ 300.00	\$ 18,300
7	510060	Structural Concrete (Retaining Wall)	CY	10	\$ 1,200.00	\$ 12,000
8	510090	Structural Concrete (Box Culvert)	CY	166	\$ 1,200.00	\$ 199,200
9	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,200	\$ 1.75	\$ 2,100
10	520107	Bar Reinforcing Steel (Box Culvert)	LB	43,470	\$ 1.25	\$ 54,338
11	721017	Rock Slope Protection (Facing, Method B)	CY	46	\$ 300.00	\$ 13,800
12	729011	Rock Slope Protection Fabric	SQYD	83	\$ 10.00	\$ 830
13	731505	Minor Concrete (Curb and Sidewalk)	CY	4	\$ 500.00	\$ 2,000
14	-	Reconstruct Landscape Wall	LF	60	\$ 300.00	\$ 18,000
15	-	Highway Planting	LS	1	\$ 5,000.00	\$ 5,000
		Sub-Total				\$ 369,368
		Mobilization			10%	\$ 36,936.75
		Minor Items and Supplemental Work			15%	\$ 55,405.13
		Contingencies			30%	\$ 110,810.25

**TOTAL: \$ 572,520**  
**TOTAL, ROUNDED: \$ 573,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 25-C-02 - Highway 68 at PM 6.83 (100' west of Highway 218)

**Description:** Remove existing double 48" RCP culvert which crosses Highway 68 just west of the Highway 218 intersection. Construct 7'H x 12'W x 120'L RCB, head walls, and RSP outlet protection. Staged construction.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls (Staged Construction)	LS	1	\$50,000.00	\$ 50,000
3	150808	Remove Culvert and Headwalls	LS	1	\$10,000.00	\$ 10,000
4	260203	Class 2 Aggregate Base	CY	65	\$ 100.00	\$ 6,500
5	390132	Hot Mix Asphalt (Type A)	TON	221	\$ 300.00	\$ 66,300
6	510060	Structural Concrete (Retaining Wall)	CY	27	\$ 1,200.00	\$ 32,400
7	510090	Structural Concrete (Box Culvert)	CY	155	\$ 1,200.00	\$ 186,000
8	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,756	\$ 1.75	\$ 3,073
9	520107	Bar Reinforcing Steel (Box Culvert)	LB	45,480	\$ 1.25	\$ 56,850
10	721017	Rock Slope Protection (Facing, Method B)	CY	30	\$ 300.00	\$ 9,000
11	729011	Rock Slope Protection Fabric	SQYD	53	\$ 10.00	\$ 530
12	731505	Minor Concrete (Curb and Sidewalk)	CY	3	\$ 500.00	\$ 1,500
13	-	Reconstruct Chain Link Fence	LF	50	\$ 50.00	\$ 2,500
14	-	Highway Planting	LS	1	\$ 5,000.00	\$ 5,000
		Sub-Total				\$ 440,653
		Mobilization			10%	\$ 44,065.30
		Minor Items and Supplemental Work			15%	\$ 66,097.95
		Contingencies			30%	\$ 132,195.90

**TOTAL: \$ 683,012**  
**TOTAL, ROUNDED: \$ 683,000**

## Preliminary Estimate of Probable Construction Cost

<b>Agency:</b>	Monterey Peninsula Water Management District		
<b>Project Name:</b>	Canyon del Rey Drainage Master Plan		
<b>Project Location:</b>	27-C-03 - Highway 218 at PM 1.55 (at Del Rey Gardens Drive)		
<b>Description:</b>	Remove existing 88" CMP culvert located in the west shoulder of and running parallel to Highway 218 at the entrance to Del Rey Gardens Drive. Provide temporary shoring and creek diversion and construct 7.5'H x 12'W x 380'L RCB, head walls, and RSP inlet and outlet protection.		
<b>Date of Estimate:</b>	March 26, 2014	Caltrans 2010 Specs	
<b>Prepared by:</b>	Whitson Engineers	by: ndm	checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$30,000.00	\$ 30,000
3	-	Temporary Creek Diversion	LS	1	\$10,000.00	\$ 10,000
4	-	Temporary Shoring	LS	1	\$40,000.00	\$ 40,000
5	150808	Remove Culvert	LS	1	\$10,000.00	\$ 10,000
6	260203	Class 2 Aggregate Base	CY	75	\$ 100.00	\$ 7,500
7	390132	Hot Mix Asphalt (Type A)	TON	89	\$ 300.00	\$ 26,700
8	510060	Structural Concrete (Retaining Wall)	CY	48	\$ 1,200.00	\$ 57,600
9	510090	Structural Concrete (Box Culvert)	CY	521	\$ 1,200.00	\$ 625,200
10	520103	Bar Reinforcing Steel (Retaining Wall)	LB	4,412	\$ 1.75	\$ 7,721
11	520107	Bar Reinforcing Steel (Box Culvert)	LB	148,200	\$ 1.25	\$ 185,250
12	721017	Rock Slope Protection (Facing, Method B)	CY	60	\$ 300.00	\$ 18,000
13	729011	Rock Slope Protection Fabric	SQYD	53	\$ 10.00	\$ 530
14	832003	Metal Beam Guard Railing (Wood Post)	LF	50	\$ 50.00	\$ 2,500
15	-	Creek/Riparian Restoration and Planting	LS	1	\$20,000.00	\$ 20,000
		Sub-Total				\$ 1,061,001
		Mobilization			10%	\$ 106,100.10
		Minor Items and Supplemental Work			15%	\$ 159,150.15
		Contingencies			30%	\$ 318,300.30

**TOTAL: \$ 1,644,552**  
**TOTAL, ROUNDED: \$ 1,645,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 27-C-04 - Highway 218 at PM 1.445 (750' north of Del Rey Gardens Drive)

**Description:** Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Highway 218 and provide RSP inlet protection. Staged construction.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls (Staged Construction)	LS	1	\$50,000.00	\$ 50,000
3	260203	Class 2 Aggregate Base	CY	30	\$ 100.00	\$ 3,000
4	390132	Hot Mix Asphalt (Type A)	TON	30	\$ 300.00	\$ 9,000
5	510060	Structural Concrete (Retaining Wall)	CY	38	\$ 1,200.00	\$ 45,600
6	510090	Structural Concrete (Box Culvert)	CY	36	\$ 1,200.00	\$ 43,200
7	520103	Bar Reinforcing Steel (Retaining Wall)	LB	3,888	\$ 1.75	\$ 6,804
8	520107	Bar Reinforcing Steel (Box Culvert)	LB	8,648	\$ 1.25	\$ 10,810
9	721017	Rock Slope Protection (Facing, Method B)	CY	67	\$ 300.00	\$ 20,100
10	729011	Rock Slope Protection Fabric	SQYD	130	\$ 10.00	\$ 1,300
11	-	Creek/Riparian Restoration and Planting	LS	1	\$10,000.00	\$ 10,000
		Sub-Total				\$ 219,814
		Mobilization			10%	\$ 21,981.40
		Minor Items and Supplemental Work			15%	\$ 32,972.10
		Contingencies			30%	\$ 65,944.20

**TOTAL: \$ 340,712**  
**TOTAL, ROUNDED: \$ 341,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 29-C-01 - Highway 218 at PM 1.02 (near Via Verde Drive)

**Description:** Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Highway 218 and provide RSP outlet protection. Staged construction.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls (Staged Construction)	LS	1	\$50,000.00	\$ 50,000
3	260203	Class 2 Aggregate Base	CY	30	\$ 100.00	\$ 3,000
4	390132	Hot Mix Asphalt (Type A)	TON	30	\$ 300.00	\$ 9,000
5	510060	Structural Concrete (Retaining Wall)	CY	38	\$ 1,200.00	\$ 45,600
6	510090	Structural Concrete (Box Culvert)	CY	36	\$ 1,200.00	\$ 43,200
7	520103	Bar Reinforcing Steel (Retaining Wall)	LB	3,888	\$ 1.75	\$ 6,804
8	520107	Bar Reinforcing Steel (Box Culvert)	LB	8,648	\$ 1.25	\$ 10,810
9	721017	Rock Slope Protection (Facing, Method B)	CY	17	\$ 300.00	\$ 5,100
10	729011	Rock Slope Protection Fabric	SQYD	33	\$ 10.00	\$ 330
11	-	Reconstruct Wood Fence	LF	50	\$ 100.00	\$ 5,000
12	-	Creek/Riparian Restoration and Planting	LS	1	\$10,000.00	\$ 10,000
		Sub-Total				\$ 208,844
		Mobilization			10%	\$ 20,884.40
		Minor Items and Supplemental Work			15%	\$ 31,326.60
		Contingencies			30%	\$ 62,653.20

**TOTAL: \$ 323,708**  
**TOTAL, ROUNDED: \$ 324,000**

## Preliminary Estimate of Probable Construction Cost

**Agency:** Monterey Peninsula Water Management District

**Project Name:** Canyon del Rey Drainage Master Plan

**Project Location:** 29-C-03 - Angelus Way near Adair Place, Del Rey Oaks

**Description:** Remove existing privately owned 18' span wood deck bridge and concrete abutments. Construct new abutments and 24' span wood deck bridge and concrete abutments and relocate associated private utilities.

**Date of Estimate:** March 26, 2014 Caltrans 2010 Specs

**Prepared by:** Whitson Engineers by: ndm checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
2	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 30,000
1	-	Temporary Traffic Controls	LS	1	\$ 1,000.00	\$ 1,000
3	-	Earthwork	LS	1	\$ 5,000.00	\$ 5,000
4	-	Permeable Material	CY	2	\$ 500.00	\$ 1,000
5	510060	Structural Concrete (Retaining Wall)	CY	20	\$ 1,200.00	\$ 24,000
6	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,000	\$ 1.75	\$ 1,750
7	-	Premanufactured Wood Bridge 12'x24'	SQFT	288	\$ 100.00	\$ 28,800
8	-	Minor Concrete (Driveway)	CY	8	\$ 500.00	\$ 4,000
9	-	Board Fence / Railing	LF	90	\$ 100.00	\$ 9,000
10	-	Private Utility Relocations	LS	1	\$ 5,000.00	\$ 5,000
11	-	Creek/Riparian Restoration and Planting	LS	1	\$10,000.00	\$ 10,000
		Sub-Total				\$ 89,550
		Mobilization			10%	\$ 8,955.00
		Minor Items and Supplemental Work			15%	\$ 13,432.50
		Contingencies			30%	\$ 26,865.00

**TOTAL: \$ 138,803**  
**TOTAL, ROUNDED: \$ 139,000**



## Preliminary Estimate of Probable Construction Cost

<b>Agency:</b>	Monterey Peninsula Water Management District		
<b>Project Name:</b>	Canyon del Rey Drainage Master Plan		
<b>Project Location:</b>	29-C-07 - Rosita Road near Angelus Way, Del Rey Oaks		
<b>Description:</b>	Construct 8'H x 6'W x 42'L RCB culvert parallel to existing 8'H x 6'W x 42'L RCB culvert which crosses Rosita Road and provide RSP outlet protection.		
<b>Date of Estimate:</b>	March 14, 2014	Caltrans 2010 Specs	
<b>Prepared by:</b>	Whitson Engineers	by: ndm	checked: rpw

Item No.	Item Code	Item	UOM	Quantity	Unit Cost	Total
1	-	Temporary Environmental Controls	LS	1	\$20,000.00	\$ 20,000
2	-	Temporary Traffic Controls	LS	1	\$ 5,000.00	\$ 5,000
3	-	Modify Existing Culvert	LS	1	\$10,000.00	\$ 10,000
4	260203	Class 2 Aggregate Base	CY	32	\$ 100.00	\$ 3,200
5	390132	Hot Mix Asphalt (Type A)	TON	38	\$ 300.00	\$ 11,400
6	510060	Structural Concrete (Retaining Wall)	CY	17	\$ 1,200.00	\$ 20,400
7	510090	Structural Concrete (Box Culvert)	CY	32	\$ 1,200.00	\$ 38,400
8	520103	Bar Reinforcing Steel (Retaining Wall)	LB	1,420	\$ 1.75	\$ 2,485
9	520107	Bar Reinforcing Steel (Box Culvert)	LB	7,730	\$ 1.25	\$ 9,663
10	721017	Rock Slope Protection (Facing, Method B)	CY	45	\$ 300.00	\$ 13,500
11	729011	Rock Slope Protection Fabric	SQYD	50	\$ 10.00	\$ 500
12	-	Wood Safety Railing	LF	60	\$ 100.00	\$ 6,000
13	-	Creek/Riparian Restoration and Planting	LS	1	\$10,000.00	\$ 10,000
		Sub-Total				\$ 150,548
		Mobilization			10%	\$ 15,054.75
		Minor Items and Supplemental Work			15%	\$ 22,582.13
		Contingencies			30%	\$ 45,164.25

**TOTAL: \$ 233,349**  
**TOTAL, ROUNDED: \$ 233,000**

3/27/2014

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## **APPENDIX F**

### **DESCRIPTIONS AND LOCATIONS OF ELECTRONIC FORM FIELD AND FACILITY DATA**

**APPENDIX G**  
**SEDIMENTATION RATE CALCULATIONS**

**APPENDIX H**

**SEDIMENT TRANSPORT INVESTIGATION FIELD LOGS**