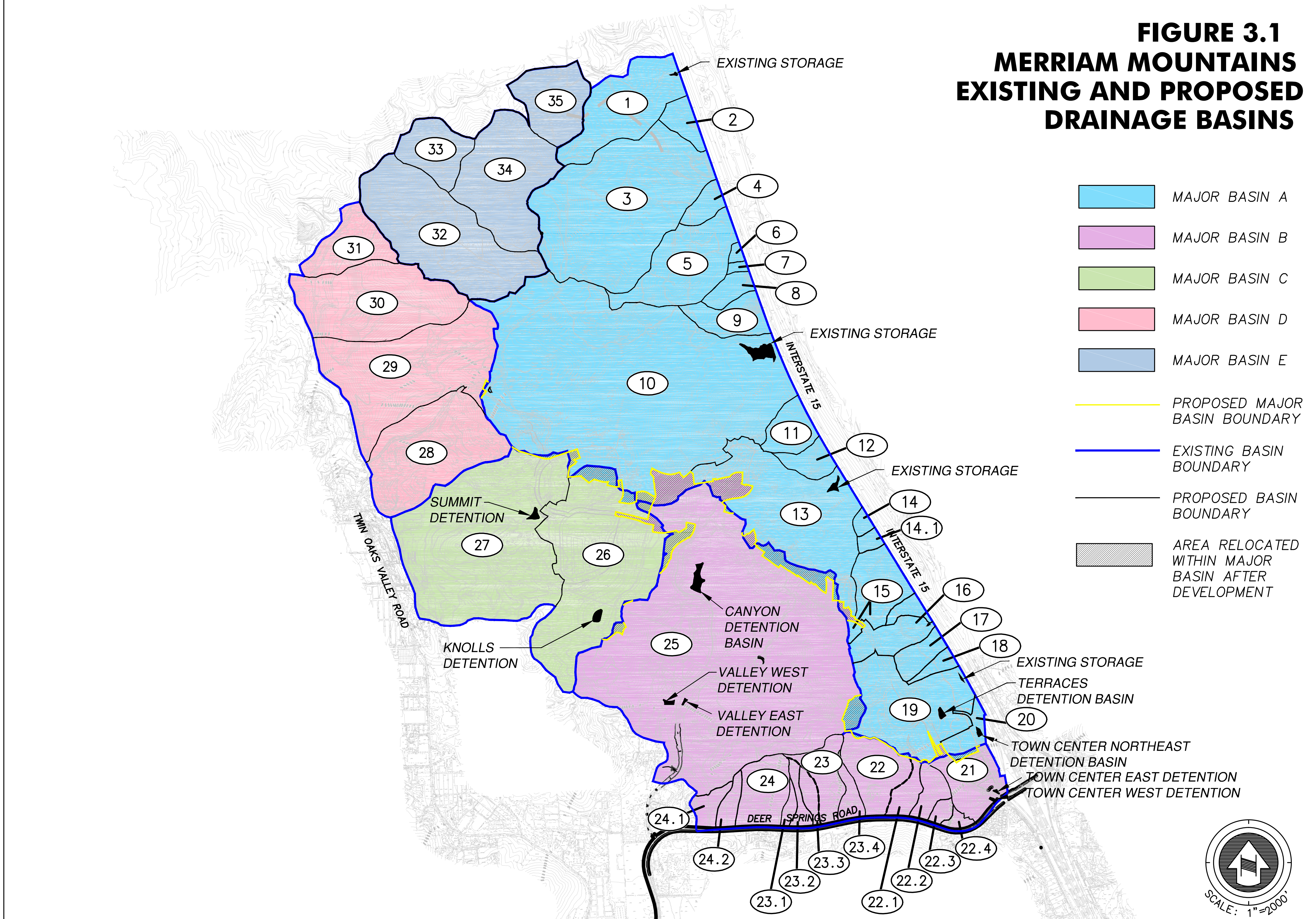
FIGURE 3.1
MERRIAM MOUNTAINS EXISTING AND PROPOSED DRAINAGE BASINS



M:\PROJECTS\2660 NEWLAND COMMUNITIES\002-02 NEWLAND SIERRA\ENG\STORMWATER\DRAINAGE STUDY\MAIN REPORT\FIG 3.2 - EXISTING & PROPOSED Plotted by: kkozlik

Appendix 3

Channel Screening Analysis


LAWRENCE WELK DRIVE
TWIN OAKS VALLEY ROAD
INTERSTATE 15
DEER SPRINGS ROAD
POC 2915
POC 1021
POC 2810
POC 1053
POC 1064
POC 1073
POC 2786
POC 1083
POC 1112
POC 1088
POC 1304
POC 1329
POC 1341
POC 1349
POC 245
POC 2222
POC 2219
POC 2380
POC 1603
POC 2199
POC 1905
POC 2000
POC 2101
POC 2100
SCALE: 1"= 400'
400 200 0 400 800 1200
GRAPHIC SCALE IN FEET
LEGEND
POINT OF COMPLIANCE (POC)
POC ANALYZED IN CHANNEL SCREENING
RECIEVING CHANNELS
FUSCOE
ENGINEERING
full circle thinking
NEWLAND SIERRA
POINT OF COMPLIANCE EXHIBIT

HYDROMODIFICATION SCREENING

FOR

NEWLAND SIERRA

January 14, 2015

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FOR REVIEW ONLY

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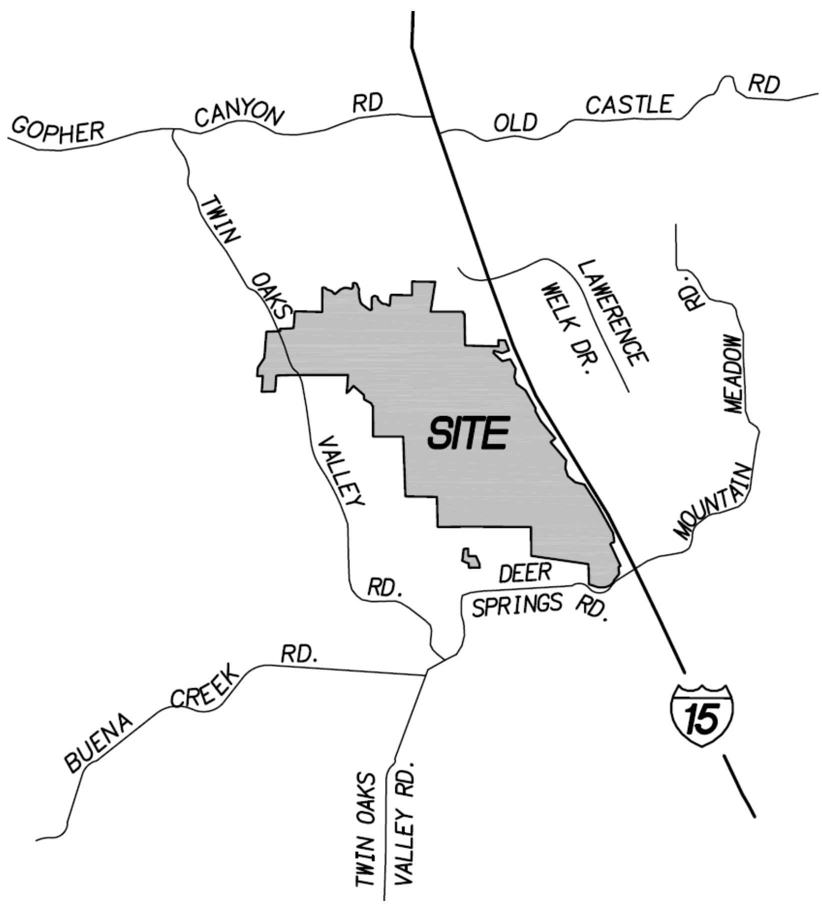
INTRODUCTION

The County of San Diego's March 2011, *Final Hydromodification Management Plan*, and January 8, 2011, *Standard Urban Stormwater Mitigation Plan* (SUSMP) outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility*, developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's BMP Sizing Calculator to establish the appropriate erosion susceptibility threshold of low, medium, or high.



Vicinity Map

This report provides hydromodification screening analyses for the Newland Sierra project for which a tentative map is being prepared by Fuscoe Engineering (Fuscoe). The project site consists of approximately 1,985 acres and is bounded by Interstate 15 on the east, Deer Springs Road on the south, and Twin Oaks Valley Road on the west, with a small portion of the northwestern edge of the site traversed by Twin Oaks Valley Road. Gopher Canyon Road is located approximately 1.5 miles north of the site's northern boundary, and approximately 2.5 miles north of proposed site development (see the Vicinity Map). The developed project will include seven neighborhoods (also referred to as planning areas for planning purposes) with a total of 2,135 single- and multi-family residential units with a variety of housing types as well as parks, a school, and commercial development. The seven planning areas will be designed to promote land stewardship and avoid the most sensitive biological, cultural, and topographical resources.

Under pre-project conditions, the site primarily contains undisturbed natural hillside areas, many portions of which are moderately to steeply sloping. Storm runoff from the undeveloped site primarily occurs as sheet flow on the natural ground surface before entering one of several natural hillside ravines or canyons. The runoff flows down the hillside areas and exits the site at various locations around its boundary. The runoff to the south, west, and southwest ultimately flows to Twin Oaks Valley Creek, the runoff to the northwest ultimately flows to the south fork of Gopher Canyon Creek, and the runoff to the north and east ultimately flows to the south fork of Moosa Canyon Creek.

The proposed project will create a large open space conservation area including approximately 1,200 acres of biological open space restoration. The flow patterns within the open space will be preserved by the project since this natural area is being preserved. In addition, the development footprint will generally maintain the pre-project flow directions in accordance with engineering requirements. The proposed on-site storm drain systems will have several discharge locations into the natural surrounding area. This report provides a downstream channel assessment for six of the discharge locations or points of compliance (labeled POC A through F on the Study Area Exhibit).

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for each POC.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the first point where one of these is reached:

- at least one reach downstream of the first grade control point (preferably second grade control location)
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.). This is also defined as a two-fold increase in drainage area.

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis

The downstream domain of analysis locations for the study areas covered by this report have been determined by assessing and comparing the four bullet items above. As discussed in the Introduction, the project runoff will be collected by a series of proposed drainage facilities that outlet at several different locations around the site. Fuscoe has identified six specific locations to be analyzed by this report (see the Study Area Exhibit). A downstream domain of analysis has been identified below each of Fuscoe's six points of compliance (POCs A through F on the Study Area Exhibit). Each downstream domain of analysis location was selected as follows.

Per the first bullet item, the first permanent grade control in the natural drainage courses below each of the six POCs was located (see the Study Area Exhibit). For POC A, this occurs at the existing culvert under Deer Springs Road (see Figure 3) just over 230 feet south of POC A. For POC B, a grade control is created by a grouted riprap check dam (see Figure 7) approximately 430 feet below POC B in its downstream drainage course. For POC C, this occurs at a concrete driveway and underlying culverts approximately 520 feet south of POC C (see Figure 12). For POCs D and E, a permanent grade control was not located in the downstream proximity, so this criteria was not used for establishing the downstream domain of analysis location for these two

POCs. For POC F, the first permanent grade control occurs at a private driveway crossing containing a culvert (see Figure 21) approximately 780 feet downstream of the POC.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. Based on review of Google Earth, there is no tidal backwater or lentic waterbody near any of the six POCs. The nearest such waterbody is at Lake San Marcos, which is over 6.4 miles southwest of the site. Therefore, the second bullet item criteria will not govern over the other bullet item criteria for any of the POC's.

The final two bullet items are related to the tributary drainage area. This criteria applies to POC D and E. The other four POC's do not confluence with or accumulate a larger tributary area closer than their permanent grade control locations, so the final two bullet items will not govern for the other four POCs. The drainage area tributary to POC D covers 20.19 acres. The drainage course below POC D accumulates a 100 percent drainage area (i.e., a two-fold increase) approximately 580 feet downstream of POC D as shown on the Study Area Exhibit. In addition, the drainage course tributary to POC E confluences with a larger drainage course approximately 810 feet downstream of POC E. The Study Area Exhibit shows that the area tributary to the POC E drainage course covers 13.55 acres while the larger drainage course has a tributary area of 27.12 acres. Therefore, the equal order tributary criteria is met at the confluence.

From the above information, the downstream domain of analysis locations for the POCs are based on different criteria. For POCs A, B, C, and F, the locations are based on the permanent grade control criteria. For POCs A, C, and F, the associated natural drainage course enters a hardened culvert under a roadway. The culvert and roadway will prevent erosion of the upstream channel bed, so these are considered permanent grade controls. For POC B, the natural drainage course contains a grouted riprap check dam, which is a permanent grade control. The permanent grade control criteria requires that the downstream domain of analysis location extend one reach (20 channel top widths) below the grade control or preferably to the second downstream grade control. For POCs A, B, C, and F, the downstream domain of analysis location was selected at the second grade control. Note that for POC A, its second grade control is the grade control below POC B. For POC B, the second grade control is a short distance downstream of the check dam where the channel bed and banks are lined with large rock (see Figure 8). For POCs C and F, a downstream road crossing forms the second grade control (see Figures 15 and 24, respectively).

For POCs D and E, the closest criteria is met by the last two bullet items. The downstream domain of analysis for POC D is based on achieving a 100 percent (2-fold) increase in drainage area, while POC E is based on a confluence with an equal order tributary.

Upstream Domain of Analysis

The proposed drainage facilities tributary to POCs A, B, C, D, E, and F outlet into the uppermost end of their receiving drainage courses. Since the natural drainage courses do not extend upstream of the drainage facility outlets, the upstream domain of analysis location for these five POC's will be at each POC.

Study Reaches within Domain of Analysis

The entire domain of analysis contains six study reaches (see Study Area Exhibit). A study reach occurs below each POC. The following describes the six study reaches.

Reach 1 (235 feet long) is the study reach below POC A. It extends from the upstream domain of analysis location at POC A to the downstream domain of analysis location at the existing culvert under Deer Springs Road.

Reach 2 (430 feet long) is the study reach below POC B. It extends from the upstream domain of analysis location at POC B to the downstream domain of analysis location at the second grade control below POC B formed by the rock-lined channel.

Reach 3 (992 feet long) is the study reach below POC C. It extends from the upstream domain of analysis location at POC C to the downstream domain of analysis location at the second grade control below POC C at the existing culvert under Country Garden Lane.

Reach 4 (578 feet long) is the study reach below POC D. It extends from the upstream domain of analysis location at POC D to the downstream domain of analysis location where the tributary drainage area below POC D exceeds the tributary drainage area to POC D.

Reach 5 (810 feet long) is the study reach below POC E. It extends from the upstream domain of analysis location at POC E to the downstream domain of analysis location where the drainage course below POC E confluences with a larger drainage course.

Reach 6 (1,298 feet long) is the study reach below POC F. It extends from the upstream domain of analysis location at POC F to the downstream domain of analysis location at the second grade control below POC C F at a private driveway crossing.

Reaches 3, 5, and 6 are greater than the 656 foot (200 meters) maximum reach length described by SCCWRP. Review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and longitudinal slope), vegetative, hydraulic, and soil conditions within each of these three reaches are relatively uniform. Subdividing the reaches into smaller subreaches of less than 656 feet will not yield varying conclusions within a reach. Although the screening tool was applied across the entire length of each of these reaches, the results will be identical for shorter subreaches within each reach.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an “initial desktop analysis” that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed areas, valley slopes, and valley widths. The NED data is similar to USGS mapping. For the project the following topographic mapping sources were used. Fuscoe provided their grading plans and 5-foot contour interval topographic mapping for the project site and adjacent areas. This mapping is more detailed that NED data, so will provide more accurate results. Fuscoe also provided their proposed condition drainage basin boundaries. There are two off-site locations (southeast and northwest) where the Fuscoe mapping did not extend far enough to cover the watershed areas. In these locations, USGS mapping was used. The mapping sources and watershed delineations are included on the Study Area Exhibit in the map pocket.

The mean annual precipitation was obtained from the rain gages closest to the site. These are the Western Regional Climate Center's Vista 1 NE and Valley Center 2 NNE gages (see Appendix A). The average annual rainfall measured at these gages for their periods of record are 13.1 and 17.5 inches, respectively. The "Rain Gages Nearest to Study Area" exhibit in Appendix A shows that the ratio of distances from the site to the Vista and Valley Center gages are approximately 1/3 and 2/3, respectively. The average annual rainfall values at each gage were interpolated based on the distance ratios to calculate an average annual rainfall at the site of 14.6 inches.

The valley slope and valley width were determined for each study reach from the 5-foot contour interval flown topographic mapping. NED data was not used because it is not very accurate for these parameters. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within a study reach by the length of the flow line. The valley width is the valley bottom width dictated by breaks in the hillslope. The valley slope and valley width within each reach along with the area are included in Table 1.

Reach	Tributary Drainage Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	0.0244	0.1021	3.7
2	0.2436	0.0419	3.0
3	0.7626	0.0202	6.1
4	0.0636	0.1003	5.5
5	0.0212	0.3630	5.5
6	0.2049	0.0901	8.5

Table 1. Summary of Drainage Area, Valley Slope, and Valley Width

These values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., $d_{50} < 16$ mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 31. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Figures 25 through 30 contain photographs of the bed material along each of the six study reaches. A gravelometer is included in the photographs for reference. Each square on the gravelometer indicates grain size in millimeters (the squares range from 2 mm to 180 mm). Based on the photographs and site investigation, the bed material and resistance is generally within the transitional/intermediate bed category in all reaches. There was no evidence of a threshold bed condition. However, some bed areas contained smaller grain sizes found in a labile bed and some areas contained large boulders. A pebble count was performed that determined the median (d_{50}) bed material sizes for Reaches 1 through 6 varies from 11 to 180 millimeters (see Appendix B). Figure 6-4 in the County HMP indicates that a d_{50} of 16 mm or greater is within the transitional/intermediate bed category. Dr. Eric Stein from SCCWRP, who co-authored the *Hydromodification Screening Tools: Field Manual* in the *Final Hydromodification Management Plan* (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. This requires the most rigorous steps and will generate the appropriate results for the size range.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The channel bed along Reaches 1, 2, 3, 4, and 6 are within Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential due to a surface veneer such as vegetation. Figures 1, 2, 9, 10, 11, and 13 show that Reaches 1 and 3 contain a fair to moderate cover of grasses, weeds, smaller brush, and scattered trees. The soil was probed and penetration was relatively difficult through the underlying layer. Figures 4, 5, 6, 16, 17, 20, 22, 23, and 24 show that Reaches 2, 4, and 6 contain a dense, uniform cover of mature vegetation including grasses, large brush, and large trees.

The channel bed along Reach 5 is within Category A on Checklist 1. The site visit and review of aerial photographs reveals that this area contains large, closely grouped rock outcroppings, which are evident in Figures 18 and 19. The rock results in a broad armor layer along the ground surface.

Checklist 2 determines grade control characteristics of the channel bed. SCCWRP states that grade controls can be natural. Examples are vegetation or confluences with a larger waterbody. Reach 1 does not contain natural nor manmade grade controls, so is in Category C. As verified with photographs and during a site investigation, Reaches 2, 4, 5, and 6 contain a dense, uniform cover of mature vegetation (see Figures 4 through 6, 16 through 20, and 22 through 24). The plants and their roots serve as effective natural grade controls. The spacing of the plants along the streams is less than a meter. Evidence of the effectiveness of the natural grade controls is the absence of headcutting and mass wasting (large vertical erosion of a channel bank) throughout the natural drainage courses in these reaches. Consequently, the dense vegetation acts as grade controls. Since the underlying resistance is uncertain, Reaches 4 and 6 are within Category B on Checklist 2. In addition to the dense vegetation, Reaches 2 and 5 also contain large rocks and boulders closely spaced and scattered throughout their channel beds. Therefore, Reaches 2 and 5 are in Category A on Checklist 2.

Reach 3 contains a grade control (roadway with culvert) approximately 520 feet from its upstream domain of analysis location and another grade control approximately 460 feet below the first grade control. The $4/S_V$ value for Reach 3 is 651 feet ($4 \div 0.0419 = 198$ meters or 651 feet). The grade controls are spaced closer than 651 feet, so Reach 3 is in Category B on Checklist 2.

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the Screening Index determined in the initial desktop analysis (see Appendix A). d_{50} is derived from a pebble count in which a minimum of 100 particles is obtained along transects at the site. A pebble count was performed for each of the six study reaches. The spacing of each sample location within a reach was estimated by dividing the total length of a representative reach by 100. This distance was paced off in the field and a sample taken. SCCRWP states that if fines less than ½-inch thick are at a sample point, it is appropriate to sample the coarser buried substrate.

The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The pebble count results for each study reach is included in Appendix B and summarized in Table 2. The screening index values (INDEX) for the reaches are tabulated on Form 1 in Appendix A and also included in Table 2. The Screening Index Threshold diagram in Appendix B provides 50% Risk values for various d_{50} values. These values are included in the last column of Table 2. If the INDEX value is less than the 50% Risk value, the reach has less than 50 percent probability of incising and falls within Category A. Table 2 shows that this is the case for all six study reaches.

Reach	D_{50}, mm	INDEX	50% Risk	Difference[1]
1	16	0.041	0.049	0.008
2	32	0.046	0.070	0.024
3	11	0.036	0.038	0.002
4	64	0.061	0.101	0.040
5	180	0.137	0.165	0.028
6	64	0.091	0.101	0.010

[1]Positive Value Reflects Less Than 50% Probability of Incision

Table 2. Summary of Pebble Count, Screening Index, Risk of Incision

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Mobility Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$

Table 3 summarizes the checklist 1, 2, and 3 values for each reach as well as their vertical rating.

Reach	Checklist 1	Checklist 2	Checklist 3	Vertical Rating
1	6	9	3	4.7
2	6	3	3	3.6
3	6	6	3	4.2
4	6	6	3	4.2
5	3	3	3	3.0
6	6	6	3	4.2

Table 3. Overall Vertical Rating

The vertical rating for Reaches 2 through 6 is less than 4.5, so these reaches have a low threshold for vertical susceptibility. The vertical rating for Reach 1 is between 4.5 and 7, so this reach has a medium threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 32) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within any of the reaches during a field investigation. As seen in the figures, the banks are either densely vegetated confirming that mass wasting and extensive fluvial erosion has not occurred, or are gently to moderately sloping with no erosion.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe and/or the banks were densely vegetated as seen in the figures. In addition, the banks showed no evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the topographic mapping and site investigation, the average bank angles in all six reaches are equal to or flatter than 2:1 (26.6 degrees). Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26.6 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For the six study reaches the vertical rating is low or medium, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculations in the spreadsheet in Appendix A show that the VWI for all six reaches is less than 2.

From the above steps, the lateral susceptibility rating is low for Reaches 1 through 6 (colored circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree sheets in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for a portion of the Newland Sierra tentative map by Fuscoe Engineering. The project's storm runoff will be collected by proposed on-site drainage systems and conveyed to various outfalls. Fuscoe selected six of the outfalls (POC A through F) for this report. A downstream channel assessment for each POC was performed based on office analyses and field work. The results indicate a low threshold for vertical susceptibility for Reaches 2 through 6. A medium threshold for vertical susceptibility was returned for Reach 1. The results also indicate a low threshold for lateral susceptibility for Reaches 1 through 6. The County of San Diego requires that the worst case of the vertical and lateral susceptibilities be assumed. Therefore, a low overall threshold is applicable to Reaches 2 through 6, while a medium threshold is applicable to Reach 1. Although only six outfalls were analyzed, it is anticipated that similar results would occur for the remaining proposed outfalls if they are analyzed in the future.

The HMP requires that these results be compared with the critical stress calculator results. The Critical Flow Calculator (spreadsheet provided by the County of San Diego) results are included in Appendix B for each of the six study reaches. The channel dimensions were estimated from the topographic mapping and site visit, while the additional input parameters are from Form 1 in Appendix A. The spreadsheet rounds off some values, but all the values were entered to the significant digits on Form 1. The critical stress results returned a low threshold for each reach. Therefore, the SCCWRP analyses will govern and demonstrate that a low overall threshold is applicable to Reach 2 through 6 (i.e., $0.5Q_2$), while a medium threshold is applicable to Reach 1 (i.e., $0.3Q_2$).

Figure 1. Looking Downstream towards Reach 1 from Upper End near POC A

Figure 2. Looking Upstream towards Reach 1 from Lower End at Deer Springs Road

Figure 3. Culvert under Deer Springs Road at Lower End of Reach 1

Figure 4. Looking Downstream towards Reach 2 from Upper End


Figure 5. Middle of Reach 2


Figure 6. Looking Upstream at Reach 2 from near Lower End

Figure 7. Grouted Riprap Check Dam near Lower End of Reach 2

Figure 8. Large Rock on Channel Bed and Banks at Lower End of Reach 2

Figure 9. Looking Downstream at Reach 3 from Upper End

Figure 10. Upper Middle Portion of Reach 3

Figure 11. Middle Portion of Reach 3

Figure 12. Culverts and Driveway at Middle Portion of Reach 3

Figure 13. Lower Middle Portion of Reach 3

Figure 14. Looking Upstream from Country Garden Lane at Lower End of Reach 3

Figure 15. Culvert and Country Garden Lane Roadway at Lower End of Reach 3

Figure 16. Upstream End of Reach 4

Figure 17. Looking Downstream at Reach 4 from Upper End

Figure 18. Looking Downstream at Reach 5 from Upper End

Figure 19. Looking Upstream at Reach 5 from Lower End

Figure 20. Looking Upstream towards Upper End of Reach 6 from First Grade Control

Figure 21. Culvert under Driveway near Middle of Reach 6 (First Grade Control)

Figure 22. Looking at Upper and Middle Portion of Reach 6

Figure 23. Looking at Lower Portion of Reach 6

Figure 24. Driveway at Lower Portion of Reach 6
(Surrounded by Densely Vegetated Channel)

Figure 25. Gravelometer within Reach 1

Figure 26. Gravelometer within Reach 2

Figure 27. Gravelometer within Reach 3

Figure 28. Gravelometer within Reach 4

Figure 29. Gravelometer within Reach 5

Figure 30. Gravelometer within Reach 6

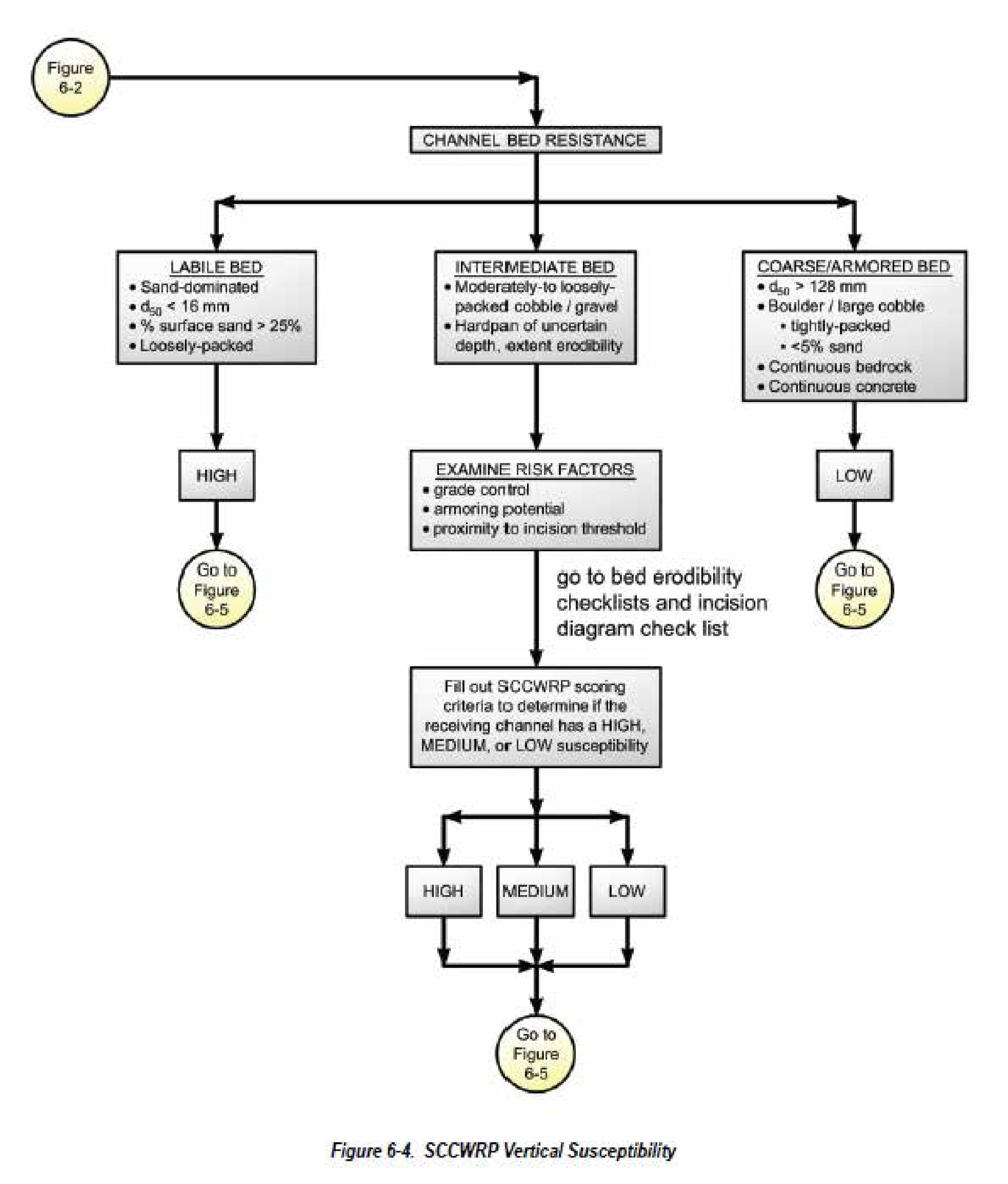


Figure 31. SCCWRP Vertical Channel Susceptibility Matrix

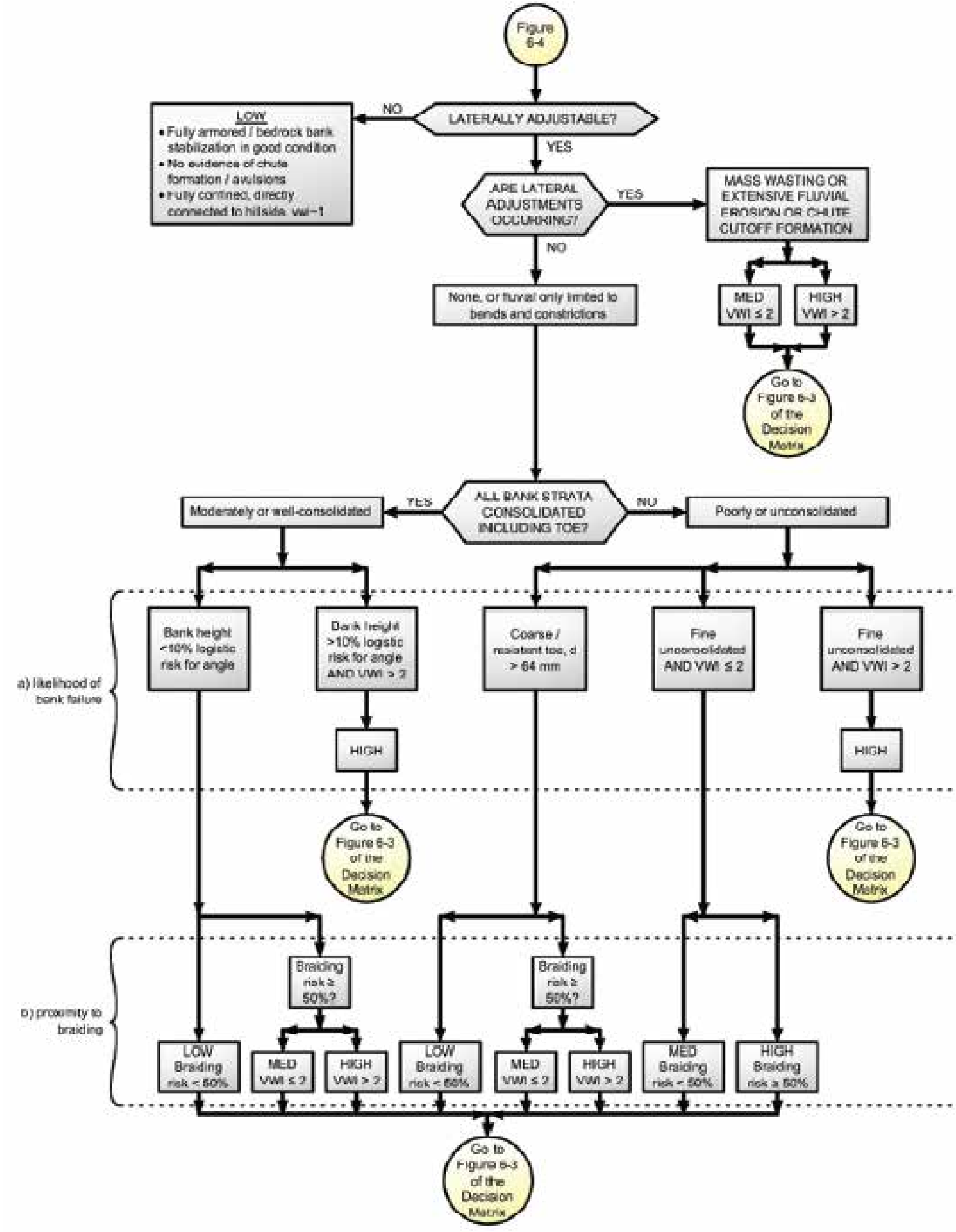


Figure 6-5. Lateral Channel Susceptibility

Figure 32. SCCWRP Lateral Channel Susceptibility Matrix

APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 33.2060 Longitude: -117.1393

Description (river name, crossing streets, etc.): Newland Sierra

North of Deer Springs Road and West of Interstate 15

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	**A**	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	See attached Form 1 table on next page for calculated values for each reach.
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	
Site properties (SI units)	**S_v**	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	See attached Form 1 table on next page for calculated values for each reach.
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	

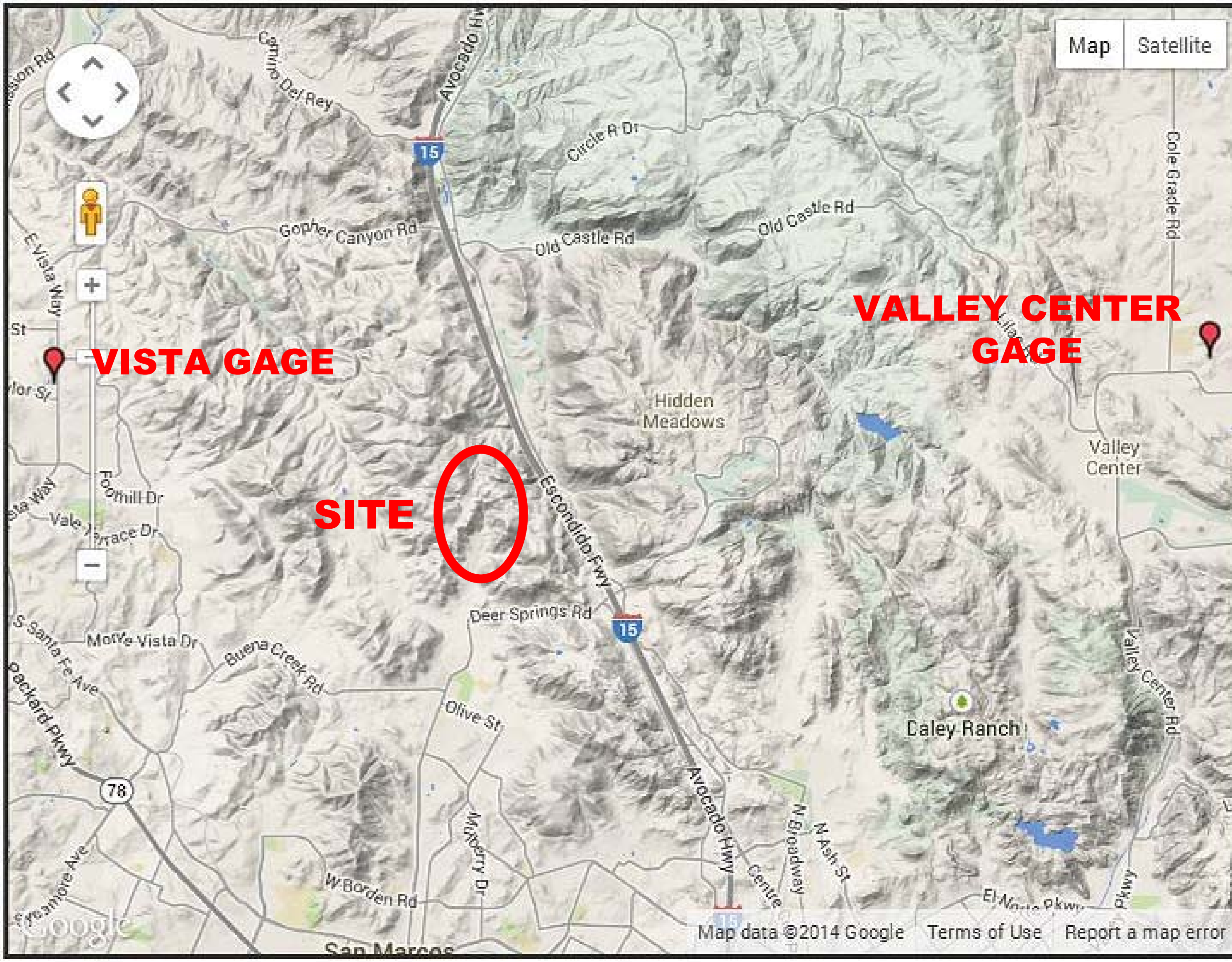
(Sheet 1 of 1)

SCCWRP FORM 1 ANALYSES

Reach	Area A, sq. mi.	Mean Annual Precip. P, inches	Valley Slope Sv, m/m	Valley Width Wv, m	10-Year Flow Q10cfs, cfs	10-Year Flow Q10, cms
1	0.02	14.6	0.1021	3.7	6	0.2
2	0.24	14.6	0.0419	3.0	42	1.2
3	0.76	14.6	0.0202	6.1	113	3.2
4	0.06	14.6	0.1003	5.5	13	0.4
5	0.02	14.6	0.3630	5.5	5	0.1
6	0.20	14.6	0.0901	8.5	36	1.0

Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
1	0.041	3.1	1.17
2	0.046	7.5	0.40
3	0.036	11.6	0.52
4	0.061	4.5	1.21
5	0.137	3.0	1.85
6	0.091	7.1	1.21

US COOP Station Map



RAIN GAGES NEAREST TO STUDY AREA

VISTA 1 NE, CALIFORNIA (049378)

Period of Record Monthly Climate Summary

Period of Record : 8/ 1/1957 to 3/31/2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	67.4	67.8	68.2	70.8	72.9	76.3	81.3	83.0	82.2	77.9	72.3	67.4	74.0
Average Min. Temperature (F)	44.0	45.0	46.3	48.5	53.5	56.6	60.3	61.6	60.0	55.0	48.3	44.0	51.9
Average Total Precipitation (in.)	2.76	2.55	2.24	1.05	0.22	0.11	0.06	0.07	0.25	0.54	1.40	1.83	13.09
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 86.6% Min. Temp.: 87% Precipitation: 87.6% Snowfall: 87.7% Snow Depth: 87.3%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

VALLEY CENTER 2 NNE, CALIFORNIA (049232)

Period of Record Monthly Climate Summary

Period of Record : 1/ 1/1969 to 4/30/1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	Insuff icient Data												
Average Min. Temperature (F)	Insuff icient Data												
Average Total Precipitation (in.)	3.23	3.82	3.93	1.09	0.59	0.09	0.02	0.00	0.51	0.46	1.41	2.30	17.46
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 0.9% Min. Temp.: 0.9% Precipitation: 83.8% Snowfall: 83.8% Snow Depth: 83.8%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu