APPENDIX D

GRADING AND DRAINAGE FEASIBILITY ANALYSIS

GRADING AND DRAINAGE FEASIBILITY ANALYSIS

FOR CHUMASH CAMP 4 PROPERTY FEE-TO-TRUST APPLICATION ENVIRONMENTAL ASSESSMENT

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Job Number: 1113-0001
April 27, 2012

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CHAPTER 1

INTRODUCTION

The Santa Ynez Band of Chumash Indians (Tribe) proposes a project to develop approximately 1,433 acres of land as part of a trust land acquisition. This grading and drainage technical feasibility study is in support of the Environmental Assessment (EA) prepared in support of the Tribe's application for the Bureau of Indian Affairs (BIA) to take the 1,433 acre Project site into Trust. The EA is being prepared by Analytical Environmental Services (AES), Sacramento, California. The project alternatives evaluated in this EA consist of:

Alternative A (Proposed Project) – 1,433± acre trust land acquisition and development of 143 five-acre residential lots for Tribal members. The remaining land uses would entail 300 acres of vineyards (existing), 206 acres of open space/recreational, 131 acres of riparian corridor and oak woodland conservation, and 3 acres of Special Purpose Zone- Utilities;

Alternative B (Reduced Development Intensity Alternative) – Identical trust land acquisition and development of 143 one-acre residential lots for Tribal members. The remaining land uses would entail 775 acres of open space/recreational, 30 acres of Tribal Government/Development (including 80,000 square feet of Tribal facilities), and the same acreages of vineyard, riparian corridor and oak woodland conservation, and utilities land uses as proposed under Alternative A; and

Alternative C (No Action Alternative) – No federal action or proposed development. The "No Action" alternative is not discussed further in this report, as no technical evaluation is warranted for this alternative.

A summary of project components under the two development alternatives (A and B) is provided in Table 1-1. Full details of the Project Descriptions and alternatives can be found in the EA prepared by AES for this Project.

ALTERNATIVE A – PROPOSED PROJECT

Alternative A consists of two main components: (1) the placement of 5 parcels totaling approximately 1,433± acres into Federal trust status for the Tribe; and (2) the development of 143 five-acre residential plots with the remaining acreage dedicated to agriculture, open space/recreational, conservation of riparian corridors and oak woodland, and development of utilities. Development of the site would include domestic water connections, a wastewater treatment plant (WWTP), and supporting roads and infrastructure. Alternative A is described in more detail in the following sections.

TABLE 1-1. SUMMARY OF PROJECT DEVELOPMENT ALTERNATIVES[a]

Project Components	Alternative	
	A	B
Land Taken into Trust	1,433± acres	1,433± acres
Residential Development	143 five-acre lots	143 one-acre lots
Designated Tribal Land Uses	300 acres of Agriculture (existing), 206 acres of Open Space/Recreational – General/Trails, 98 acres of Resource Management Zone – Riparian Corridors, 33 acres of Resource Management Zone – Oak Woodland, and 3 acres of Special Purpose Zone- Utilities	300 acres of Agriculture (existing), 755 acres of Open Space/Recreational – General/Trails, and 30 acres of Special Purpose Zone -Tribal Government/Development 98 acres of Resource Management Zone – Riparian Corridors, 33 acres of Resource Management Zone – Oak Woodland, and 3 acres of Special Purpose Zone- Utilities
Water Source	Groundwater	Groundwater
Wastewater Treatment	Onsite WWTP	Onsite WWTP

[a]Source: AES, 2012

Proposed Residential Development

Under Alternative A, the Tribe would develop residential plots on Parcels 2, 3 and 4 of the project site. The proposed housing would consist of up to 143 five-acre residential plots with construction of single-family detached houses of varying sizes ranging from 3,000 to 5,000 square feet. Development on each five-acre plot would include approximately 0.35 acres of disturbance for building pad development, driveway construction, utility installations, and landscaping. Additionally, new domestic water connections, improved access roads, driveways, a new wastewater treatment plant, and utilities would also be constructed to support the residences. A site plan identifying the proposed residential plots is shown in Figure 1-1.

Designated Tribal Land Uses

In addition to the proposed residential development, the Tribe would designate the following land uses on the subject property:

Agricultural

The Tribe would continue operating an existing 240-acre vineyard located on Parcel 1 and a portion of Parcel 2 (refer to Figure 1-1). An additional 60 acres would be designated for agricultural use on Parcel 2 to allow for expansion of the existing vineyard operation. The vineyard is currently in operation and includes a storage reservoir,

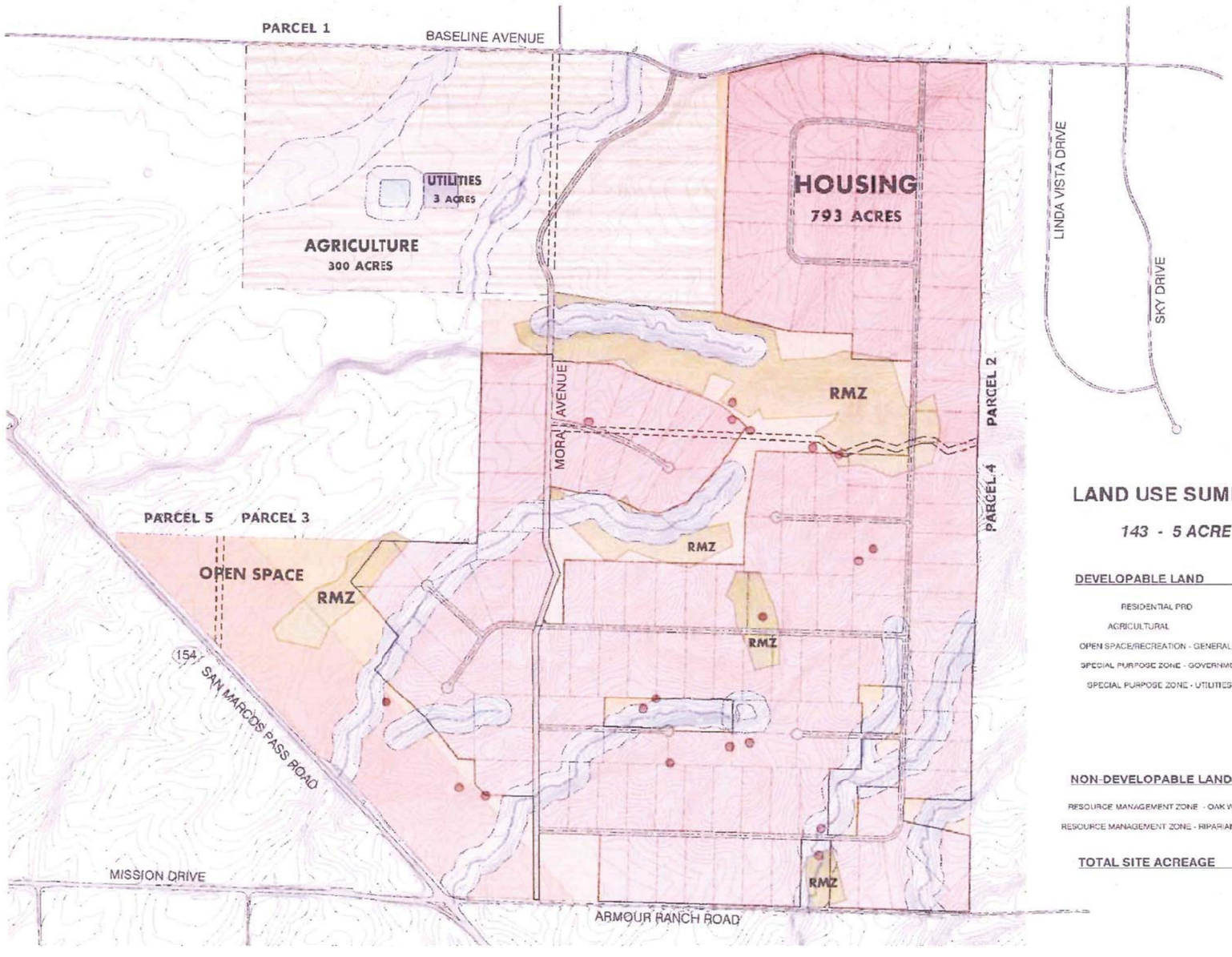
existing access roadways, and a processing/shipping area. No winemaking facilities are currently located on the project site, and there are no plans to develop a winery on the project site. Various structures are located within the agricultural lands including an old abandoned house and operational horse stables.

Open Space/Recreational – General/Trails

Approximately 206 acres of the project site would be designated as open space and recreation. Passive trails would be designated for pedestrian use and equestrian trails would be developed to provide recreation for residents and guests in coordination with the horse stables located on the existing agricultural lands. The open space/recreational area adjacent to State Route (SR) 154 would be utilized as a viewshed protection zone. No residential development is planned within the zone adjacent to SR-154 to protect the viewshed of the scenic highway.

Resource Management Zone – Riparian Corridors

In accordance with the Tribe's commitment to conservation, 98 acres of riparian corridors would be protected from development and, where necessary, enhanced in accordance with Tribal ordinances. These riparian corridors would be protected/enhanced to ensure adequate stormwater drainage is provided within the project site and to reduce the potential impact from development of the residential plots. These areas would be protected even where located on a specified residential plot (Figure 1-1). A qualified biologist would develop a Riparian Corridor Improvement Plan (Riparian Plan) for these areas. The Riparian Plan would provide for re-establishment of native vegetation in areas where invasive plant species have overwhelmed native vegetation. Where possible, the Riparian Plan will incorporate planting of California Live Oak trees to stabilize stream banks, provide canopy and shading, and ensure the sustainable future of the California Live Oak on the Reservation.



LAND USE SUMMARY

143 - 5 ACRE LOTS

DEVELOPABLE LAND	**1,302 ACRES**
RESIDENTIAL PRD	793 ACRES
AGRICULTURAL	300 ACRES
OPEN SPACE/RECREATION - GENERAL/TRAILS	206 ACRES
SPECIAL PURPOSE ZONE - GOVERNMENT	00 ACRES
SPECIAL PURPOSE ZONE - UTILITIES	3 ACRES
NON-DEVELOPABLE LAND	**131 ACRES**
RESOURCE MANAGEMENT ZONE - OAK WOODLAND	33 ACRES
RESOURCE MANAGEMENT ZONE - RIPARIAN CORRIDORS	98 ACRES
TOTAL SITE ACREAGE	**1,433 ACRES**

LEGEND

- RESIDENTIAL ZONE — LOW DENSITY PLANNED RESIDENTIAL DEVELOPMENT
- AGRICULTURAL ZONE — AGRICULTURAL 1
- OPEN SPACE / RECREATION ZONE — PASSIVE TRAILS, EQUESTRIAN TRAILS
- RESOURCE MANAGEMENT ZONE (RMZ) — OLD WOODLAND
- RESOURCE MANAGEMENT ZONE (RMZ) — RIPARIAN CORRIDORS
- SPECIAL PURPOSE ZONE — GOVERNMENT CENTER
- SPECIAL PURPOSE ZONE — PUBLIC UTILITIES - WWTP
- ROADS
- VIEW CORRIDOR
- CULTURAL RESOURCES

NORTH

0 1000' 2000'

SOURCE: SUMMIT PROJECT MANAGEMENT, 2011; AES 2011

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CHUMASH CAMP 4 FEE-TO-TRUST

Figure 1-1
Fee-To-Trust Land Use Summary - Alternative A

Resource Management Zone – Oak Woodland

In accordance with Tribal ordinances, approximately 33 acres of oak woodland would be protected from development. Within the oak woodland management zone cutting, trimming, and pruning of the oaks would be monitored and controlled, and ground disturbance would be limited within the dripline of any oak tree within the zone.

Roadways

Existing access roads would be improved and new roads constructed to provide access to the proposed residences and existing agricultural operations. Figure 1-1 shows the internal roadway structure that would be developed to provide access to the proposed residential parcels. The rural roadways would be 24-feet wide two-lane asphalt travel ways, with gravel shoulders that would be constructed using standards comparable to Santa Barbara County requirements. Signage would be provided for the new roadways. Crossing of potential Waters of the U.S. would be limited to the extent feasible; however, span bridges would be utilized where necessary. Access and egress from the project site would be provided from one existing easement onto Armour Ranch Road and two existing easements onto Baseline Avenue.

Grading and Drainage

Construction would involve grading and excavation for building pads and roadways. Cut and fill would be balanced to the extent feasible; however, some structural grade fill may be imported to meet engineering requirements. Stormwater runoff generated from development of the residential units and associated roadways would be conveyed by a combination of open channels, storm drains, and culverts. The drainage plan includes the use of several features designed to reduce surface runoff volumes and filter surface runoff prior to release into the existing on-site natural drainage channels. Runoff from the project site would be directed into vegetated swales, which would serve as energy dissipaters and filtering mechanisms for runoff generated on-site prior to release into the on-site drainage channels. Stormwater would be retained on-site within detention basins prior to discharging off the subject property at rates equivalent to pre-development conditions.

ALTERNATIVE B – REDUCED DEVELOPMENT INTENSITY

Alternative B would involve placing the 1,433-acre Camp 4 site into federal trust status for the benefit of the Tribe; however, under Alternative B, the residential parcel lot sizes would be reduced from 5 acres to 1 acre, decreasing the residential acreage from approximately 793± acres to approximately 194± acres. Development on each one-acre plot would include approximately 0.25 acres of disturbance for building pad development, driveway construction, utility installations, and landscaping. Additionally, new domestic water connections, improved access roads, driveways, a new WWTP, and utilities would also be constructed to support the residences. A site plan identifying the proposed residential plots is shown in Figure 1-2. In addition, approximately 30 acres of the project site would be reserved for approximately 80,000 square feet of Tribal government/ development space. The Tribal facilities would include development of a banquet/exhibition hall designed with an agriculture/equestrian theme, associated administrative spaces, a tribal office complex, and a tribal retreat including ceremony room and gymnasium. A breakdown of the components of the proposed Tribal facilities is displayed in Table 1-2. It is anticipated that the Tribal development would include office space for up to 75 Tribal employees and result in up to 100 events per year being held at the facilities. Approximately 400 parking spaces would be provided for the facilities.

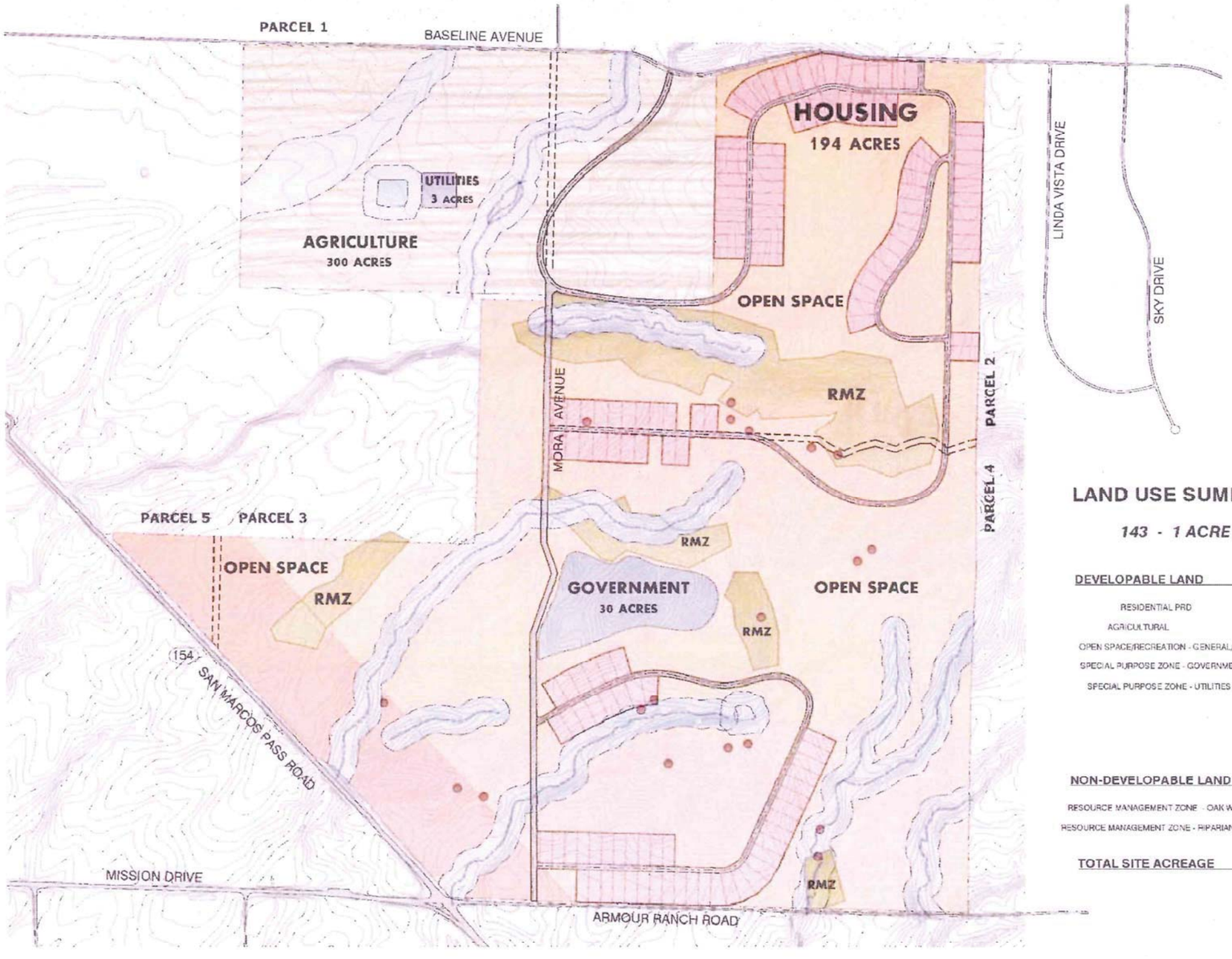
The remaining land uses and project components under Alternative B are identical to that proposed under Alternative A including: the construction of 143 residences ranging from 3,000 to 5,000 square feet, domestic water connections, and a WWTP. Public services, water supply, wastewater treatment and disposal, and roadway improvements would all be provided for Alternative B as described for Alternative A.

Table 1-2. Tribal Community Development – Onsite Facilities

Usage	Square Footage (sf)
Community Center	34,280
Community Center Administrative Support	3,110
Tribal Office Complex	12,025
Tribal Retreat	11,480
Circulation (Misc. at 30%)	18,269
Total Development	**79,164**

Protective Measures and Best Management Practices

Protective measures and best management practices (BMPs) pertinent to this grading and drainage feasibility study have been incorporated into the project design to eliminate or substantially reduce potential environmental impacts from the Proposed Project. These measures and BMPs are discussed below.



LAND USE SUMMARY

143 - 1 ACRE LOTS

DEVELOPABLE LAND	1,302 ACRES
RESIDENTIAL PRD	194 ACRES
AGRICULTURAL	300 ACRES
OPEN SPACE/RECREATION - GENERAL/TRAILS	775 ACRES
SPECIAL PURPOSE ZONE - GOVERNMENT	30 ACRES
SPECIAL PURPOSE ZONE - UTILITIES	3 ACRES

NON-DEVELOPABLE LAND	131 ACRES
RESOURCE MANAGEMENT ZONE - OAK WOODLAND	33 ACRES
RESOURCE MANAGEMENT ZONE - RIPARIAN CORRIDORS	98 ACRES

TOTAL SITE ACREAGE 1,433 ACRES

LEGEND

- **RESIDENTIAL ZONE** — LOW DENSITY PLANNED RESIDENTIAL DEVELOPMENT
- **AGRICULTURAL ZONE** — AGRICULTURAL 1
- **OPEN SPACE / RECREATION ZONE** — PASSIVE TRAILS, EQUESTRIAN TRAILS
- **RESOURCE MANAGEMENT ZONE (RMZ)** — OLD WOODLAND
- **RESOURCE MANAGEMENT ZONE (RMZ)** — RIPARIAN CORRIDORS
- **SPECIAL PURPOSE ZONE** — GOVERNMENT CENTER
- **SPECIAL PURPOSE ZONE** — PUBLIC UTILITIES - WWTP
- **ROADS**
- **VIEW CORRIDOR**
- **CULTURAL RESOURCES**

NORTH

0 1000' 2000'

SOURCE: SUMMIT PROJECT MANAGEMENT, 2011; AES 2011

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Figure 1-2
Fee-To-Trust Land Use Summary - Alternative B

Land Resources

All structures would meet the Tribe's building ordinance, which meets or exceeds Uniform Building Code (UBC) requirements.

Water Resources Related to Stormwater

- Areas outside of buildings and roads would be kept as permeable surfaces to the extent practicable; either as vegetation or high infiltration cover, such as mulch, gravel, or turf block. Pedestrian pathways would use a permeable surface where possible, such as crushed aggregate or stone with sufficient permeable joints (areas between stone or brick if used).
- Existing vegetation would be retained where possible.
- Roof downspouts would be directed to splash blocks and not to underground storm drain systems.
- Runoff from rooftops and other impervious areas would be directed to vegetated areas to help treat and infiltrate stormwater prior to leaving the site.
- Runoff from roadways would filter though rock-lined swales and bio-swales.
- Permanent energy dissipaters would be included for drainage outlets.
- Rock rip-rap energy dissipaters would be installed at the point of release of concentrated flow.

CHAPTER 2

GRADING

This chapter will focus on the Grading for the Chumash Camp 4 Project (Project). Based on an area of disturbance of 0.35 acres (per lot) for Alternative A and 0.25 acres for Alternative B, there will not be extensive grading to create the building pads as compared to the amount of grading that will be required to meet the design criteria for the road network. Contained in this Chapter is an outline of the design criteria implemented for the analysis of the interior road network for the Project, the potential impacts of the grading on the site, locations of crossings, and potential mitigations for limiting the amount of grading required for the Project.

Design Criteria

The layout of the road network for Alternatives A and B are shown in Figures 2-1 and 2-2, respectively. The following design criteria were used:

Design Standards:

- A Policy on Geometric Design of Highways and Streets – 6th Ed (AASHTO 2011)
- Private Road and Driveway Standards Rev 1/25/2010 (Santa Barbara County Fire Department)
- Right of Way Width = 60'
- Total Roadway Width = 36' (2 – 12' paved travel lanes, 2 – 6' Class II aggregate base shoulders)
- Curbs will be utilized for drainage on vertical grades greater than 8%
- Maximum Cut Slope = 2.5:1
- Maximum Fill Slope = 2:1
- Maximum Vertical Grade = 15%
- Minimum Horizontal Curve Radius = 40 feet
- Road Classification: Local Rural Road (Mountainous)
- Average Daily Traffic (ADT) = between 400 and 1500 ADT
- Design Speeds: Mora Avenue = 45mph; Cul-de-Sac (neighborhood) roads = 25 mph; remaining roads = 35 mph

GRADING DESIGN

Figures 2-1 and 2-2 depict the layout of the road network for Alternatives A and B respectively. The individual roads have been designated with a number or letter for the ease of reference throughout this document. Refer to Figures 2-1 and 2-2 for the locations of specific road names. The vertical profiles of the road network were determined using the design criteria above with a goal of minimizing the amount of grading required. However, given the existing topography, there are roads that will require significant cut and fill slopes.

The total amount of cut for Alternative A is 180,000 cubic yards (cy) and the total amount of fill is

190,000 cy. This results in the need for a net import of approximately 10,000 cy of material for Alternative A without considering shrinkage of the fill material once it is compacted. For Alternative B, the amount of cut is 75,000 cy and the total amount of fill is 160,000 cy. Therefore, Alternative B results in a projected net import of 85,000 cy, without considering shrinkage. Both Alternatives will require import, although the import for Alternative A is minimal. The estimated import quantity will be reduced by including the amount of asphalt concrete and aggregate base needed for the 24 foot wide road section and the Class II aggregate base shoulders. If additional import is needed, one source of the import could be the excavated material from the on-site drainage basins. These items can be adjusted to achieve a balanced site, once a preferred alternative is selected and the roadway structural section is finalized.

Table 2-1 presents a summary of the design speed, maximum cut and fill depth and width, and maximum vertical grade for the road network for Alternative A. This summary is based on implementation of the design criteria described earlier in this Chapter.

Table 2-1. Summary of Roadway Grading – Alternative A

Road Name	Design Speed(mph)	Maximum Depth of Cut(C) and Fill(F) (ft) (at centerline of Road)	Maximum Width of Cut(C) and Fill(F) (ft) (beyond the 60' ROW)	Maximum Vertical Grade
Road 1	45	17.5'(C)/17.5'(F)	50'(C)/21'(F)	8%
Road 2	35	21.5'(C)/20'(F)	61'(C)/45'(F)	14.4%
Road 3	25	11.5'(C)/27'(F)	32.5'(C)/46'(F)	14.4%
Road A	25	8.5'(C)/15.5'(F)	12'(C)/18.5'(F)	8%
Road B	25	5'(C)/11'(F)	Min (C)/13.5'(F)	9%
Road C	25	21.5'(C)/11'(F)	51'(C)/14'(F)	13%
Road D	20	8'(C)/23'(F)	Min (C)/40'(F)	14%
Road E	25	9.5'(C)/Min (F)	26'(C)/Min (F)	9.5%
Road F	25	6.5'(C)/9'(F)	18'(C)/5.5'(F)	5.6%

The depths of cut and fill at the centerline of the roads range from a minimum of 5' of cut to maximum of 21.5' of cut and a minimum of less than 5' of fill up to a maximum of 27' of fill. A fill slope of 2:1 was used to minimize the encroachment onto adjacent lots. If a flatter fill slope is utilized, the encroachment onto adjacent lots will be increased. Figure 2-1 depicts the locations of the cut and fill outside the 60 foot right of way limits along the road network for Alternative A.

Table 2-2 presents a summary of the design speed, maximum cut and fill depth and width, and maximum vertical grade for the road network for Alternative B. This summary is based on implementation of the design criteria described earlier in this Chapter.

Table 2-2. Summary of Roadway Grading – Alternative B

Road Name	Design Speed(mph)	Maximum Depth of Cut(C) and Fill(F) (ft) (at centerline of Road)	Maximum Width of Cut(C) and Fill(F) (ft) (beyond the 60' ROW)	Maximum Vertical Grade
Road 1	45	17.5'(C)/17.5'(F)	51'(C)/21'(F)	8%
Road 2	25	12'(C)/15'(F)	35'(C)/30'(F)	3%
Road 3	35	21'(C)/24'(F)	90'(C)/80'(F)	14.6%
Road 4	25	Min(C)/8'(F)	Min(C)/15'(F)	4%
Road 5	25	5'(C)/23'(F)	Min (C)/35'(F)	9%

The vertical and horizontal alignment of Road 1 does not change between Alternatives A and B. With the current horizontal alignment of Road 3 (Alternative B), it has the largest amounts of cut and fill due to the existing vertical changes in the terrain. Figure 2-2 visually depicts the locations of the cut and fill slopes outside of the 60 foot right of way for Alternative B.

WATER COURSE CROSSINGS

It is anticipated that Alternative A could have approximately 21 water course crossings. See Figure 2-1 for the approximate locations of the water course crossings. The crossings would range from multiple 18" diameter concrete culverts to larger prefabricated arch plate culverts to prefabricated bridge structures. The type and size of the crossing structures is dependent on the roadway geometrics and the hydraulics of the water courses. The crossings for smaller water courses would be designed based on storm runoff flows induced by a 25 year rain event; while the crossings for the larger water courses where an arch plate culvert or bridge structure would be needed would be designed based on storm runoff flows induced by a 100 year rain event with 2' of freeboard (clearance from highest anticipated flood stage level to bottom of structure).

It is anticipated that Alternative B will require approximately 13 crossings. See Figure 2-2 for approximate locations of the water course crossings. The crossing for Alternative B would be designed using the same criteria outlined above for Alternative A.

GRADING RECOMMENDATIONS

The limits of anticipated grading based on the current road network layout and design criteria, are depicted in Figures 2-1 and 2-2. The following recommendations could be considered that would reduce some of the amount of grading.

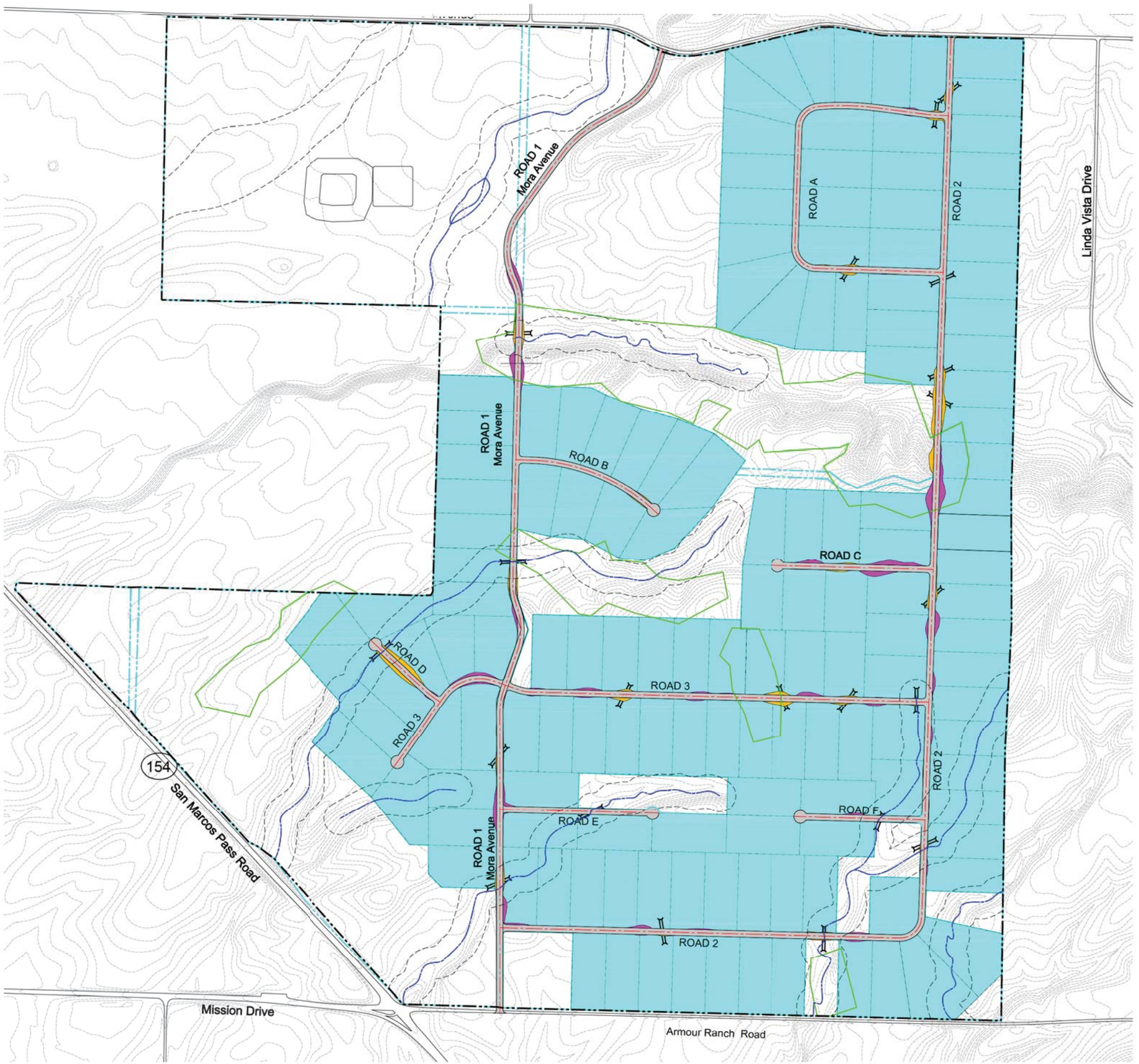
For Roads 2 and 3 of Alternative A, the design speeds could be reduced, thus resulting in a reduced amount of grading to be done. However, the reduction in the grading limits may be minimal. The most likely way to reduce the amount of cut and fill for Alternative A's Roads 2 and 3 would be the installation of retaining walls along with some cut and fill slopes. The goal with the walls would be to minimize the impact of the slopes, but not create a tunnel atmosphere. Architectural treatments could be added to the walls or the walls could be stepped to minimize the visual impacts. For Alternative A's Road C, the grading impacts could be lessened by realigning the road to follow the existing terrain.

The alignment for Road 1 does not change between Alternatives A and B. In order to reduce the amount of cut and fill along Road 1, one option for Alternative A would be to add traffic calming devices such as bulb outs or chacanes in the southern most portion of Road 1, from Armour Ranch Road to Road 3, as it is adjacent to residential lots. This could reduce the speeds on the roadway and therefore would reduce the grading impacts slightly. The largest amount of fill along Road 1 is between Baseline Ave and Road B for Alternative A. This fill could be minimized by spanning the drainage area with a bridge and/or realigning Road 1 to minimize the amount of fill. A bridge still may be required, but the span could be shorter.

One recommendation would be to realign Road 3 to more closely follow the existing terrain. This would not completely eliminate the need for large cut and fill slopes, but it could reduce the amount of grading needed. The horizontal alignment of Road 2 could be revised to follow the natural terrain more closely to reduce the amount of cut needed along this road. A combination of retaining walls and grading could also be used to minimize the grading impacts as well.

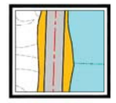
The recommendations for Road 1 for Alternative B are similar to those identified above for Alternative A's Road 1. Traffic calming devices could be installed along Road 1 from Armour Ranch Road to the Government Center. This could reduce the speeds on the roadway and therefore would reduce the grading impacts slightly. The largest amount of fill required for Road 1 in Alternative B is between Baseline Ave and Road 3 for Alternative B (See Figure 2-2). This amount of fill could be reduced by spanning the drainage area with a bridge and/or realigning Road 1 to minimize the amount of fill. A bridge still may be required, but the span could be shorter.

The current proposed road network of both Alternative A and B will require extensive cut and fill slopes to meet general road design criteria. With some realignments of roads, the addition of retaining walls, and the reduction of speeds through the installation of traffic calming devices, the grading impacts could be reduced.

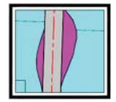


Legend:

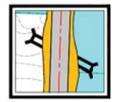
Project Boundary



Limits of Fill Slope beyond the Proposed Road 60' Right / Way



Limits of Cut Slope beyond the Proposed Road 60' Right / Way



Location of Proposed Crossing

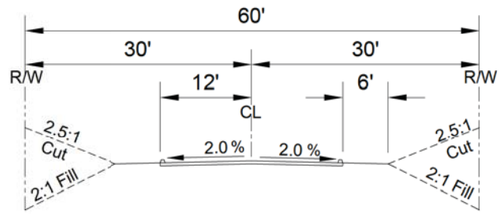
N

GRAPHIC SCALE

0 500 1000 2000

(IN FEET)

1 IN = 1000 FT



TYP ROAD SECTION

Scale: NTS

Provide curb with grades greater than 8%

Refer to Figure 1-1 for Land Use Designations

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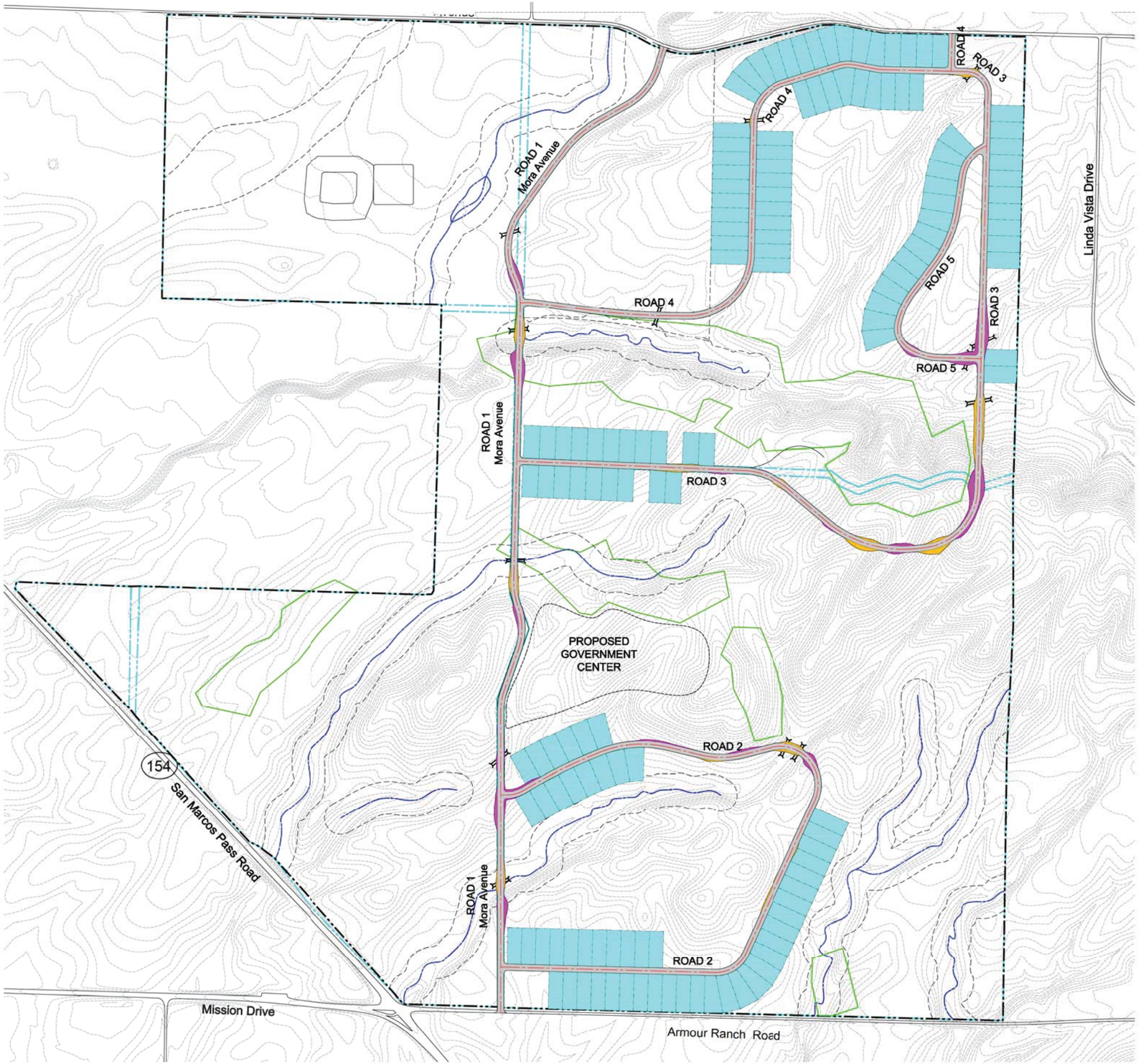
Chumash Camp 4

Figure 2-1
Alternative A - Road Grading Limits



Legend:

- Project Boundary
- Limits of Fill Slope beyond the Proposed Road 60' Right / Way
- Limits of Cut Slope beyond the Proposed Road 60' Right / Way
- Location of Proposed Crossing

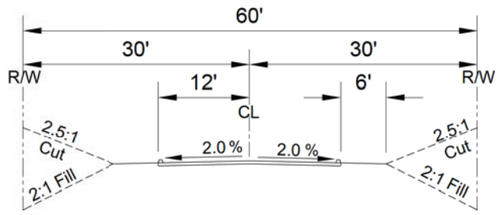
N

GRAPHIC SCALE

0 500 1000 2000

(IN FEET)

1 IN = 1000 FT



TYP ROAD SECTION

Scale: NTS

Provide curb with grades greater than 8%

Refer to Figure 1-2 for Land Use Designations

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Figure 2-2
Alternative B - Road Grading Limits

CHAPTER 3

DRAINAGE

This chapter describes the existing hydrology and hydraulics for the Chumash Camp 4 Project (Project) as well as hydrology and hydraulics for Alternatives A and B. The hydrologic analysis forms the basis for assessing drainage features, Low Impact Development (LID) features, as well as overall drainage constraints.

WATERSHED

The terrain of the Chumash Camp 4 Project is generally comprised of rolling hills with average channel slopes ranging from 1% to 4.5%. The project site is largely unimproved, and includes approximately 256 acres of vineyard. The topography delineates characteristics of concentrated flows from watersheds less than 300 acres in size. The flows form tributaries to the east fork of Sanja de Cota Creek. The soils in 95% of the project area are mapped as SCS type D soils. Type D soils are identified as having very slow infiltration rates and high runoff potential. The remaining 5% of the project has been mapped as SCS soil type B. Type B soils have moderate infiltration rates, and are found in the area of the vineyards. Approximately 60% of the site has a K factor of 0.32, indicating erodible soils. The cut of the existing channels are indicative of the erodability of the soils.

The project has been divided into seven sub-watersheds, as shown in Figure 3-1. Based on this exhibit, the total watershed contributory to the project is 5,924 acres (9.25 square miles). Watersheds A and B have large upstream areas that contribute runoff to the site. Watershed A only affects the vineyard, whereas Watershed B also affects the northern portion of the development project. Both watersheds A and B discharge onto adjacent private properties to the north/northwest of the Project area. Sub-area C flows towards a culvert under San Marcos Pass Road. Sub-areas D, E and F drain towards culverts under Armour Ranch Road. Post construction conditions should match pre-construction conditions at all points of off-site discharge to not adversely affect adjacent private property owners or public right of way.

FLOOD ZONES

The Federal Emergency Management Agency (FEMA) has mapped flood zones within the project site. The applicable Flood Insurance Rate Maps (FIRM) are Community Panel Numbers 06083C0814F, 06083C0820F and 06083C1085F dated September 30, 2005. Portions of the site are shown to be situated within a mapped Zone A flood hazard area, as shown in figure 3-2. The flood zone is within the 256 acre vineyard area. FEMA does not have a detailed study of the area.

The new waste water treatment plant (WWTP) is planned for an area between two forks of the flood zone. During final design, the WWTP would be developed outside of the 100 year flood, or above the flood elevation. Road 1 in both Alternatives intersects the flood zone. With the current alignment, Road 1 will be developed above the floodplain with drainage improvements to prevent altering flood elevations or drainage pathways.

HYDROLOGIC METHODOLOGY

The peak flows were calculated for the development and upstream watersheds. Peak flows are necessary to size detention basins and road crossings. A hydrograph analysis using HydroCAD (version 9.10) was used to calculate peak flows and to determine pre and post- development runoff quantities for the project boundary. Input parameters are discussed in the following

paragraphs.

LAND USE COEFFICIENTS

Rational coefficients and SCS curve numbers were weighted by percentage of land use tributary to the point of calculation. The SCS curve numbers are based on the soil type and land use identified from National Resource Conservation Service (NRCS) soil maps within the tributary area and developed from Table 2-2 of the SCS/NRCS TR-55 publication used by the HydroCAD program. An NRCS soil map for the project areas is provided in Figure 3-3. The NRCS soil groups exhibit the following general runoff characteristics:

- Group A – Low runoff potential when thoroughly wet
- Group B – Moderately low runoff potential when thoroughly wet
- Group C – Moderately high runoff potential when thoroughly wet
- Group D - High runoff potential when thoroughly wet

SCS Curve Numbers range from 80 to 98 for the studied watersheds during a storm event.

TIME OF CONCENTRATION

The time of concentration was determined by the nomograph provided in Figure 3 of the Santa Barbara County Flood Control and Water Conservation District, Standard Condition of Project Plan Approval, effective January , 2011. Discharge was calculated using the Districts "Program Rational-XL". Velocities were established using the Los Angeles County Flood Control District (LACFCD) Velocity-Discharge-Slope nomograph for natural mountain channels.

UNIT HYDROGRAPH METHOD

The HydroCAD program evaluates pre and post development flows, combines them when necessary and models the total volume of flow through the various drainage features to the point of discharge. Common input parameters were set similar to the Santa Barbara County Public Works Department Flood Control Water Agency memorandum dated January, 2011, with adjustments made to account for the large project size and existing watersheds. The parameters are:

- Runoff Method: SBUH
- Rainfall Distribution: SCS 24-Hr, Type 1 distribution
- Antecedent Moisture Conditions AMC 2
- Hydrograph ordinate time increment: 0.02 hour
- Rainfall Amounts, 24-hour totals: See table 3-2 below

Table 3-2. Rainfall Amount, Inches

Area	Storm Recurrence Interval (Years)		
	10-Year	25-Year	100-Year
Buellton/ Santa Ynez	4.93	5.97	7.45

Source: Santa Barbara County Flood Control and Water Conservation District, Standard Conditions of Project Plan Approval, Effective January, 2011.

PRE-DEVELOPMENT CONDITIONS

The site currently accepts offsite run-off from seven sub-watersheds. Watershed B is the largest offsite watershed at 3623.3 acres; the other watersheds are significantly smaller as shown in Figure 3-1. There are 8 points of discharge under existing conditions. The discharge locations and characteristics in the pre-development conditions should be duplicated in the post-development conditions. The peak run-off flows from offsite are shown in Table 3-3. Peak discharge flows are a combination of off-site flow and onsite flows at the point of discharge shown on figure 3-1. The discharge peak flows are shown in table 3-4.

Table 3-3. Run-Off Peak Flows – Pre-Development Conditions

Location	Storm Event Peak Flows (CFS)[1]		
	10-Year	25-Year	100-Year
A1	476	635	867
B1	2298	3234	4638
B3-OS	198	262	356
B5	124	167	230
D	264	358	495
E	25	34	46
F	96	130	179
G	107	144	197

1. Cubic feet per second

Table 3-4. Discharge Peak Flows – Pre-Development Conditions

Location	Sub-watersheds included	Storm Event Peak Flows (CFS)[1]		
		10-Year	25-Year	100-Year
A2	A1 & A2	672	899	1229
B2	B1 & B2	2594	3632	5184
B3	B3-OS & B3	674	866	1185
B4	B4	47	63	86
B5	B5	124	167	230
C	C	276	374	517
D	D-OS & D	264	358	495
E	E-OS & E	245	329	451
F	F-OS & F	137	185	255
G	G-OS & G	115	154	211

1. Cubic feet per second

POST DEVELOPMENT CONDITIONS

Alternative A is comprised of 143 - 5-acre lots, 24 feet wide roads, with unpaved shoulders. Newly introduced impervious areas would total approximately 3% of the total site. Run-off would be received into Alternative A in the same manner as pre-development conditions.

The project site has been divided into the same seven sub-watersheds with minimal change, as shown in Figure 3-4. Drainage would surface flow, passing through a total of 21 road crossings prior to being discharged from the project site. Approximately seven of the crossings occur in blue line channels, and may require permits from the Army Corps of Engineers, and the US Department of Fish and Wildlife. Underground storm drain pipe will be minimized by using surface swales. The location of the 9 discharge points would remain unchanged. Table 3-5 summarizes the 100 year event prior to the installation of any mitigation measures to reduce discharge.

Table 3-5. Alternative A – Peak Flows

Location	100 Year Storm Event Peak Flows (CFS)[1]		
	Existing	Proposed	Difference
A2	1229	1229	>1
B2	5184	5187	3
B3	1185	1194	9
B4	86	87	1
B5	230	230	>1
C	517	523	6
D	495	502	7
E	451	458	7
F	255	251	1
G	211	211	>1

1. Cubic feet per second

Alternative B is comprised of 143 - 1-acre lots, a 30 acre government center, and 24 feet wide roads with unpaved shoulders. Newly introduced impervious areas would total approximately 4% of the total project site.

The project site has been divided into the same seven sub-watersheds with minimal change, as shown in Figure 3-5. Run-off from the site is primarily surface flow, passing through a total of 13 road crossings prior to being discharged from the project site. Approximately three of the crossings occur in blue line channels, and may require permits from the Army Corps of Engineers, and the US Department of Fish and Wildlife. The use of underground storm drain pipe will be minimized by using surface swales. The location of the 9 discharge points would remain unchanged. Table 3-6 summarizes the 100 year event prior to the installation of any mitigation measures to reduce discharge.

Table 3-6. Alternative B – Peak Flows

Location	100 Year Storm Event Peak Flows (CFS)[1]		
	Existing	Proposed	Difference
A2	1229	1229	0
B2	5184	5192	8
B3	1185	1198	13
B4	86	87	1
B5	230	230	>1
C	517	529	12
D	495	509	14
E	451	455	3
F	255	255	0
G	211	211	0

1. Cubic feet per second

PEAK FLOWS

The design storm events used for design purposes would be consistent with Santa Barbara County Standards and engineering practices. Culvert crossings would be designed for the 25 year storm with overland escape paths for the 100 year storm. Bridge crossings, basins and crossings designed in sump conditions would be designed for the 100 year storm.

DETENTION BASINS

Detention basins would be designed in a manner consistent with the Santa Barbara County Flood Control and Water Conservation District Standards. Basins shall be designed to be free draining.

For Alternative A, 7 detention basins would be required in the project area to discharge run-off at the same rate as in pre-rain conditions for the 2 to 100 year storms. Proposed locations of the basins are shown in Figure 3-4. The basin in sub-watershed B3 would be designed to compensate for an increase in discharge from B4 (1 cfs). The basins for sub-watersheds B2 and B3 would be located in the existing vineyard or in the rear portion of the lots. The basins in sub-watersheds C, D and E would be located in areas designated as Open Space, or Resource Management Zones.

For Alternative B, seven detention basins would be required in the project area to discharge run-off at the same rate as in pre-rain conditions. Proposed locations of the basins are shown in Figure 3-5. The basins would be smaller than the basins proposed for Alternative A, with the exception of the basin associated with the Government Center. The basins would fit into areas

designated as open space.

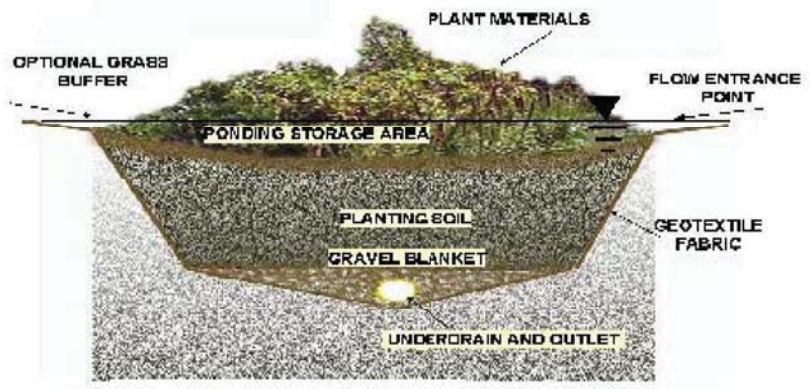
A general drainage basin would be 100 feet by 400 feet, with depths up to 15 feet. Basins would be shaped and designed to match the terrain and the flow requirements.

LOW IMPACT DEVELOPMENT (LID)

Low Impact Development (LID) features would be incorporated into the final lot design for both alternatives to enhance storm water quality. The site provides multiple opportunities for LID design features. Roads are proposed to be of minimal paved widths, lessening the impermeable area. By not designing the roads with curb and gutter, runoff will be slowed, and corresponding Tc values will increase thus allowing for additional infiltration.

Vegetative swales should be designed alongside the unpaved shoulders, helping to further reduce the velocity of the runoff and allow for sediment to drop out of the flow prior to entering existing channels. Swales can be used in areas where the roads are sloped at less than 5%. If the roads are sloped between 5% and 8%, swales can be reinforced with rip rap, or other approved methods, to prevent erosion. Swales also assist in directing drainage to the detention basins, further minimizing the need for underground storm drain pipe. Roads with slopes greater than 8% should have curb or AC dike to prevent erosion which could undercut the pavement.

Biofiltration planters can be incorporated into the open spaces. Rain water harvesting techniques can be used if the planters are revegetated with native plants. Soil in this area is classified as having slow infiltration rates. The final design can account for the infiltration rate by adding perforated pipe at the planter bottom. An example of a typical Biofiltation Planter is shown below.



Example rain garden (or bioretention) with perforated underdrain for poorly draining soils. Source: Prince George's County

Alternative B provides all of the same opportunities for Low Impact Development (LID) as Alternative A. Additional LID features can be incorporated into the final design of the Government Center. This can include permeable pavement in the parking stalls. Landscape strips within parking lots also make for ideal biofiltration planters which promote stormwater

quality and are visually pleasing. A photo of a typical biofiltration planter in a landscape strip can be seen below.

DRAINAGE RECOMMENDATIONS

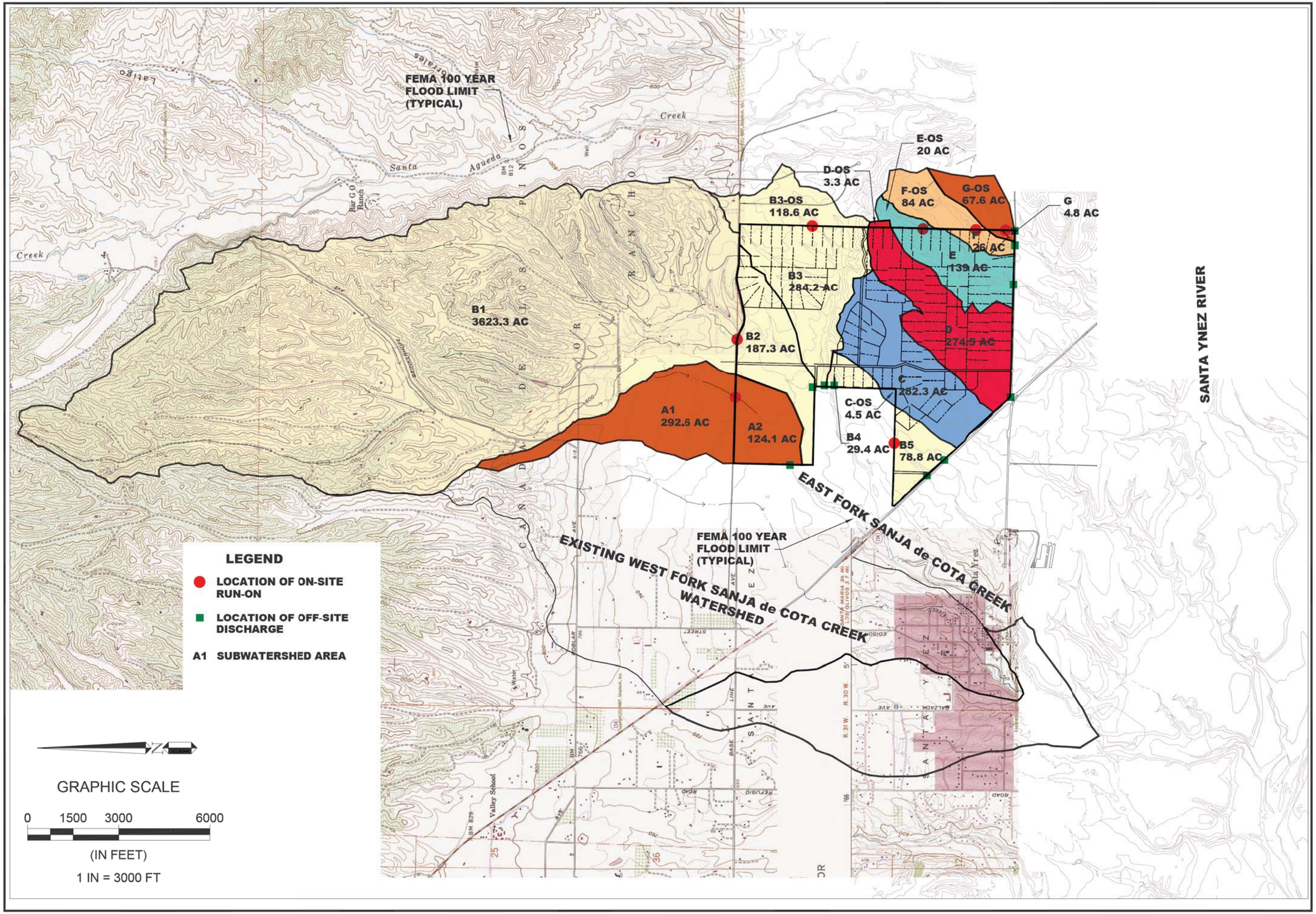
The drainage impacts of the project have been minimized by having a low density project with minimal increase in impervious area. As described in the preceding sections and the project description, the project intends to utilize Low Impact Development practices to reduce erosion, improve storm water quality, lessen the amount of required irrigation, and eliminate any increase in total discharge from the project area.

For Alternative A, additional open space should be incorporated into the site layout to accommodate the drainage basin, particularly in the case of the basins in sub-watersheds B2 and B3. The basins would be located in the rear of the residential yards.

Additionally, as described in Chapter 2 of this report, we recommend that the road alignment be modified to better match the existing terrain. This could reduce the total crossing and amount of grading within the existing drainage channels.

Alternative B appears to have sufficient open space designated around the channels to accommodate detention basin and LID features required to make the site feasible in terms of drainage. The government center should also have open space incorporated in and around it to accommodate the biofiltration swales and detention basin as required during the detailed project design.

The roads in Alternative B will require detailed design that directs drainage away from adjacent sub-watersheds. We also recommend that the road alignment be modified to better match the existing terrain. This could reduce the total crossing and amount of grading within the existing drainage channels.



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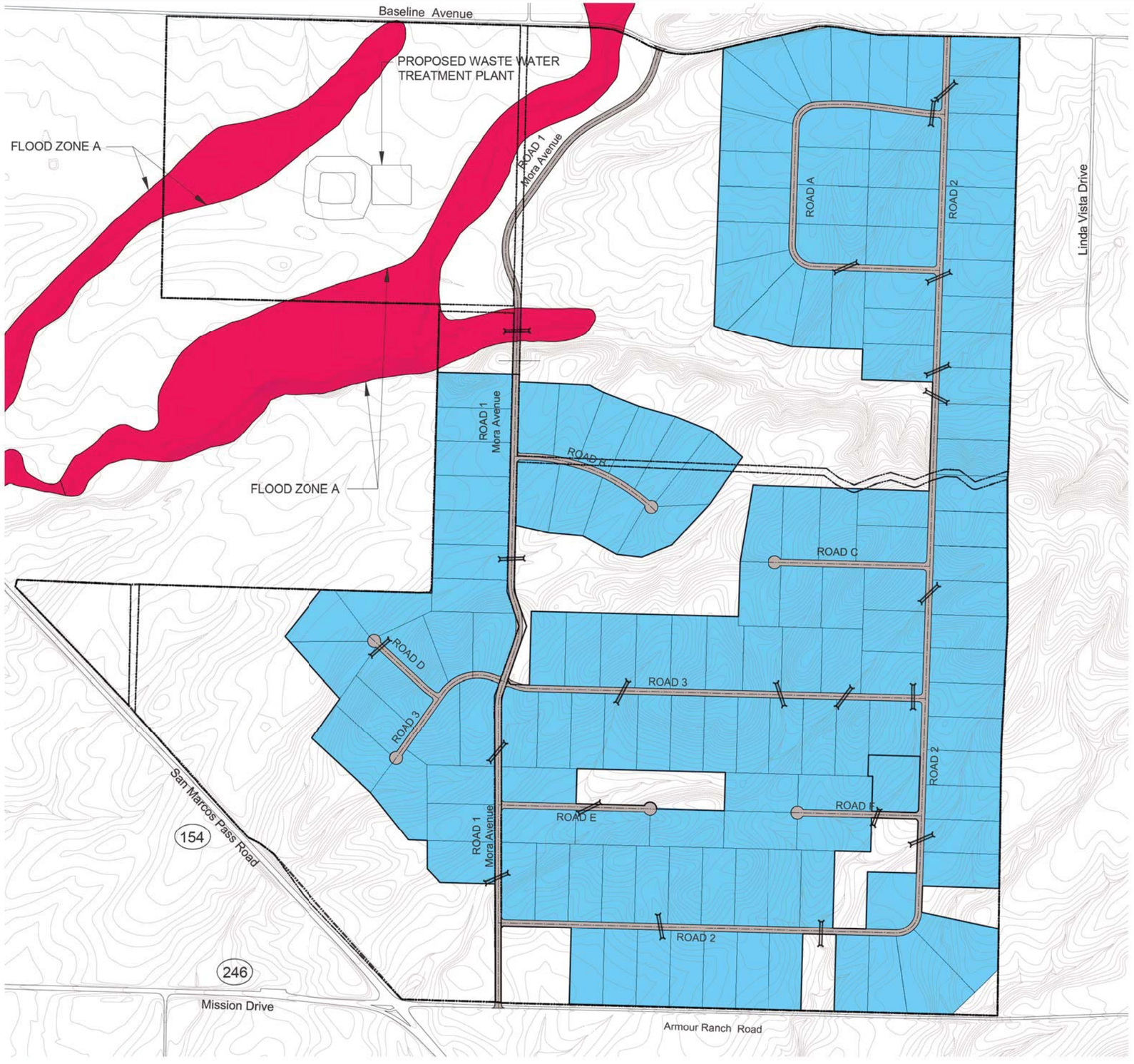
CHUMASH - CAMP 4

FIGURE 3-1
EXISTING WATERSHED AREA MAP



Legend:

Project Boundary

GRAPHIC SCALE

0 500 1000 2000

(IN FEET)

1 IN = 1000 FT

ALTERNATIVE A SHOWN FOR REFERENCE PURPOSES ONLY

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Figure 3-2
FLOOD HAZARD AREA MAP

Hydrologic Soil Group—Northern Santa Barbara Area, California

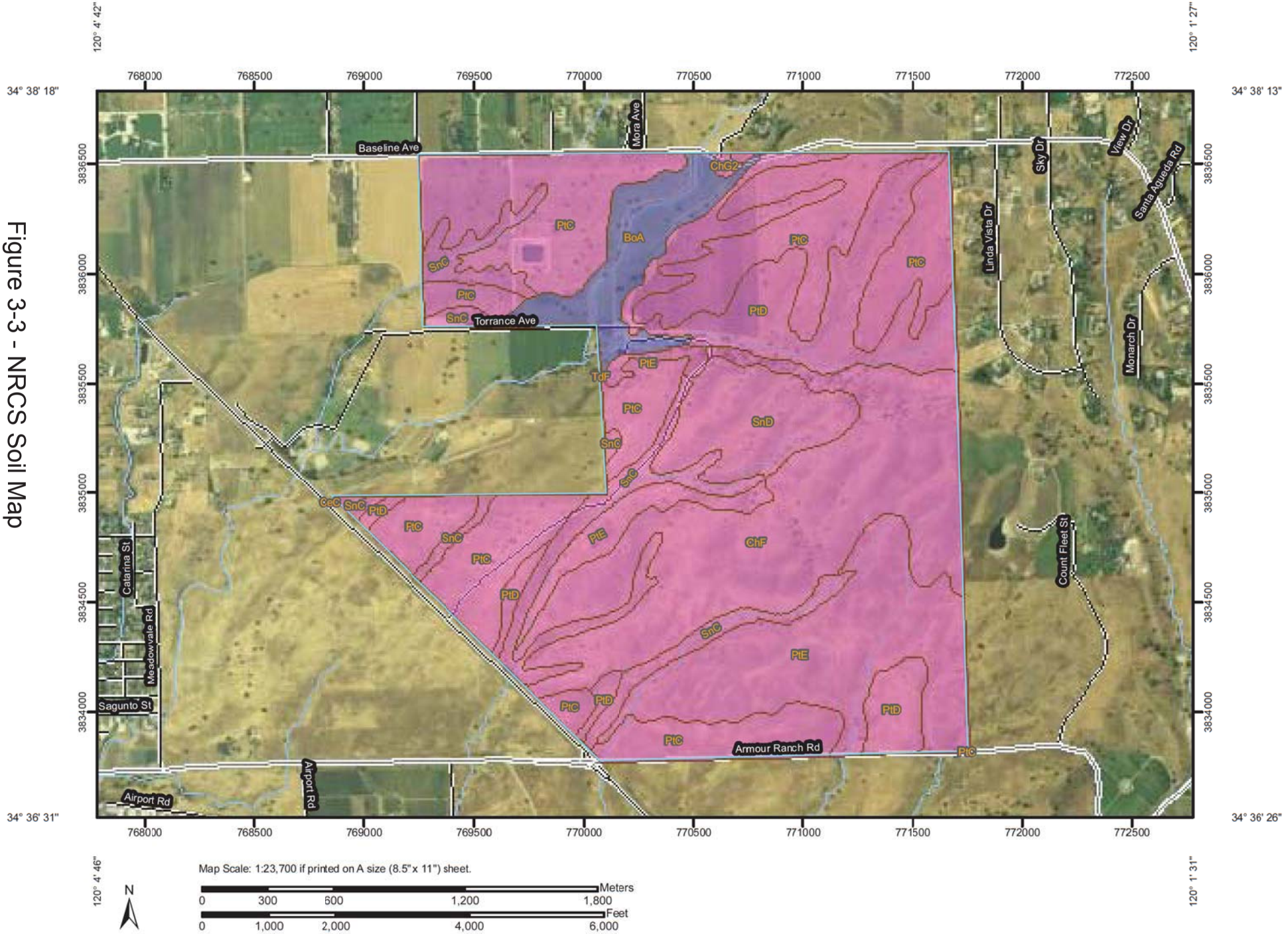

Figure 3-3 - NRCS Soil Map

LEGEND

A1 **SUBWATERSHED AREA**

BASIN **PROPOSED BASIN LOCATION**

N

GRAPHIC SCALE

0 500 1000 2000

(IN FEET)

1 IN = 1000 FT

A1
292.6 AC

A2
124 .1 AC

Baseline Avenue

B1
3623.3 AC

B2
187.3 AC

ROAD 1
Mora Avenue

BASIN

ROAD A

B3
283.7 AC

ROAD 2

BASIN

B3-OS
118.7 AC

Linda Vista Drive

B4
29.4 AC

ROAD B

C-OS
4.5 AC

ROAD 1
Mora Avenue

BASIN

C
282.3 AC

ROAD C

D-OS
3.3 AC

E-OS
20 AC

F-OS
84 AC

B5
78.8 AC

ROAD D

ROAD 3

ROAD 3

D
274.5 AC

BASIN

ROAD E

ROAD 1
Mora Avenue

San Marcos Pass Road

154

BASIN

ROAD F

ROAD 2

E
139 AC

BASIN

F
26 AC

G-OS
67.6 AC

G
4.8 AC

ROAD 2

246

BASIN

Mission Drive

Armour Ranch Road

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CHUMASH - CAMP 4: ALTERNATIVE A

FIGURE 3-4
WATERSHED AREA MAP

LEGEND

A1 **SUBWATERSHED AREA**

BASIN **PROPOSED BASIN LOCATION**

N

GRAPHIC SCALE

0 500 1000 2000

(IN FEET)

1 IN = 1000 FT

A1
2259.4 AC

A2
124.1 AC

B1
1655.1 AC

B2
187.3 AC

B3
283.7 AC

B3-OS
118.6 AC

B4
29.4 AC

B5
78.8 AC

C-OS
4.5 AC

C
282.3 AC

D
274.5 AC

D-OS
3.3 AC

E
139 AC

E-OS
20 AC

F
26 AC

F-OS
84 AC

G
4.8 AC

G-OS
67.6 AC

BASIN

Baseline Avenue

ROAD 1
Mora Avenue

ROAD 2

ROAD 3

ROAD 4

RD 4

ROAD 5

Linda Vista Drive

PROPOSED
GOVERNMENT CENTER

San Marcos Pass Road

154

246

Mission Drive

Armour Ranch Road

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CHUMASH - CAMP 4: ALTERNATIVE B

FIGURE 3-5
WATERSHED AREA MAP