Summit-Martin Fires

Summit Fire CASCU002548
Martin Fire CACZU005238

State Emergency Assessment Team (SEAT)
Report

Affecting Watersheds in Santa Cruz
and Santa Clara Counties California

	ROUTE DATA	COPY	ATT.
1	**DIRECTOR**	✓	
2	**ASST. DIR. SPEC. SVCS.**	✓	✓
	RECYCLING/SOLID WASTE		
	LANDFILL OPERATIONS		
3	WATER CON/FLOOD CONT.	✓	✓
	STORM WATER MANG.		
	CONSTRUCT. ENG.		
	SANITATION ENG.		
	WATER & WASTEWATER		
4	**ASST. DIR. TRANSPORT.**	✓	✓
5	ROAD OPS. ENG.	✓	✓
	PERMITS/ENCROACH.		
	DRAINAGE OPERATIONS		
	RD. MAINT. OPERATIONS		
	RDA ENG.		
	ROAD DESIGN ENG.		
	SURVEY/DEVELOPMT.		
	TRANSP/RD. PLANNING		
6	**ASST. DIR. ADMIN. SVCS.**	✓	✓
	REAL PROPERTY/FLEET		
7	CSA/PRGM ADMIN.	✓	→ w/ALL
	SAFETY OFFICER/LIVE OAK P.		
	PERSONNEL/MIS		

TABLE OF CONTENTS

DISCLAIMER

The scope of the assessment and the information contained in this report should not be construed to be either comprehensive or conclusive, or to address all possible impacts that might be ascribed to the fire effect. Post fire effects in each area are unique and subject to a variety of physical and climatic factors which cannot be accurately predicted. The information in this report was developed from cursory field examination by licensed resource professionals and should be viewed in conjunction with other relevant sources of information. Neither the State of Californian or any Agency or Department participating as a member of the State Emergency Assessment Team (SEAT) makes any warranty, express or implied, nor assume any legal liability for the information disclosed herein.

EXECUTIVE SUMMARY

Summit Fire and Martin Fire
CA-SCU-002548 and CA-CZU-005238
Affecting watersheds in Santa Cruz and Santa Clara Counties, California

Introduction

An initial assessment conducted by a State Emergency Assessment Team (SEAT) has been completed for the Summit Fire (CALFIRE Incident Number CA-SCU-002548) located in Santa Cruz and Santa Clara Counties, and the Martin Fire (CALFIRE Incident Number CA-SCU-005238) located in Santa Cruz County. The assessment had three key objectives:

- Identify on-site and downstream threats to public health or safety from landslides, mudslides, debris torrents, flooding, road hazards, and other public safety hazards from fire related effects.

- Identify threats to resources at risk, including: excessive erosion; impaired water quality; threats to wildlife, fisheries, botanical values, natural and cultural resources.

- Determine measures that may be used to prevent or mitigate identified threats.

SEAT technical specialists conduct rapid surveys on burned areas and if warranted downstream (outside) of burned areas to determine if emergency rehabilitation treatment is needed to minimize the risk of threats to human life or property, including infrastructure. These surveys also assess if emergency rehabilitation treatment is needed to minimize or prevent deterioration of water quality, minimize loss of soil productivity due to erosion, minimize or prevent degradation of wildlife and botanical habitat, and minimize or prevent degradation of cultural resources. These surveys can be used to facilitate identification of other potential values at risk (for example recreational resources), and determination if emergency rehabilitation treatment is needed. These surveys can be used in conjunction with other relevant, reliable sources of information, e.g. evaluation of a house by a Certified Engineering Geologist to assess if additional emergency rehabilitation treatment is needed to mitigate or prevent threats to human life, loss or damage to property and infrastructure, or damage to the environment beyond those emergency rehabilitation treatments recommended in this report.

Accessible residences and other significant features (e.g. streams) were evaluated in the field. However, numerous residences in the assessment area cannot be seen from public roads and/or lie behind locked gates and were not accessible due to the reluctance of many residents to permit access to their property.

The recommendations (treatments) found in this report fall into one of two broad categories. Those treatments which can be considered temporary measures designed to be quickly and relatively inexpensively implemented; and those treatments designed to provide long-term minimization or prevention of threat to the identified value at risk or to facilitate the recovery of the watershed at an accelerated pace while concurrently minimizing the exposure of the values at risk to the threats identified.

The Summit Fire began on May 22, 2008, and was 100% contained on May 27, 2008. It burned approximately 4,270 acres in portions of the Soquel Creek, Corralitos Creek, Brown's Creek, and Uvas Creek watersheds. Habitat types affected by the fire include Redwood Forest, Mixed Evergreen Forest, Closed-Cone Coniferous Forest, Mixed Hardwood Conifer, Mixed Chaparral, and Riparian Woodland.

The Martin Fire began on June 11, 2008 and was 100% contained on June 28, 2008. It burned approximately 520 acres in portions of the San Vicente Creek and Laguna Creek watersheds. Habitat types affected by the fire include Ponderosa Pine, Redwood Forest, Closed-cone Pine Cypress, Montane Hardwood Conifer, Mixed Chaparral, Coastal Scrub, and Annual Grassland.

The following information summarizes key findings contained in the initial Summit Fire and Martin Fire SEAT assessment. Supplemental SEAT reports will be written if deemed necessary.

Loss of Human Life and Property

The principal concern with the Summit Fire is loss of human life and property due to an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. Residences, campgrounds, and hiking trails near or within stream channels appear to be in positions where they could be affected by significant in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. Specifically, residents that reside within the major gulches are at high risk of debris torrents that would be life threatening. Camp Loma Campground (Santa Cruz County) and the campground located in Uvas Canyon County Park (Santa Clara County), as well as trails within Uvas Canyon County Park are also prone to life threatening debris torrents and flash flooding, particularly along Swanson Canyon creek. Residents that are located directly adjacent to Soquel, Corralitos and Browns creeks that are in high flood risk areas are at increased risk to flooding. Residents in areas near or upstream from the Town of Corralitos could experience flash flooding. Off-site locations along Salsipuedes Creek and the creeks previously mentioned that are in flood zones designated by the Federal Emergency Management Agency (FEMA) are now at a higher risk to flooding. In addition, possible loss of life may result from localized debris sliding, debris flows, and sediment laden floods onto individual homes in and adjacent to the fire area, outside the areas described previously. Highland Way and Eureka Canyon Road in the fire area are at high risk of becoming impassible during and after storms, resulting from flooding and debris flows, which could have an indirect effect on lives if the roads are closed during emergency situations.

The Martin Fire poses no risk to life based on the SEAT evaluation, however, risk to infrastructure (e.g. culverts) is elevated.

Watershed Evaluation

The Summit Fire encroached upon four watersheds as defined by the Calwater 2.2.1 Planning Watershed identification system. These watersheds are Soquel Creek, Corralitos Creek, Browns Creek, and Uvas

Creek. Soquel Creek suffered the greatest amount of high burn severity with 382 acres, or 34% of the watershed located within the fire perimeter. This was followed by Corralitos Creek with 292 acres (15% of the watershed located within the fire perimeter), Browns Creek with 92 acres (11 % of the watershed located within the fire perimeter), and Uvas Creek with 15 acres (5% of the watershed located within the fire perimeter).

The Martin Fire encroached upon two watersheds as defined by the Calwater 2.2.1 Planning watershed identification system. These watersheds are Laguna Creek and San Vicente Creek. Of these watersheds, Laguna Creek suffered the greatest amount of high burn severity with 44 acres, or 9% of the watershed located within the fire perimeter. San Vicente Creek watershed did not suffer any high burn severity.

The principal concern with the Summit Fire is an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The primary mechanisms for this are the loss of mechanical support of hillslope materials that was provided by vegetation and vegetative litter and the increase in runoff resulting from reductions in interception and infiltration, from the simplification of surficial runoff patterns, and from the loss of mechanical support along stream channels where riparian vegetation was burned. Where fires burn moderate to high severity such as in the upper portions of the affected watersheds, the reduction in interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces.

The Martin Fire does not present a significant increased potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows.

Values at Risk

In general, because of the fire and the resultant impact to the processes previously discussed in the section on watershed evaluation, there is an increased risk for storm events to result in flooding, debris torrents, and debris flows on the Summit Fire. As storm intensity or duration rises, there will be an increased elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows.

A. Threats to Human Life, Property, and Infrastructure

As a result of the Summit Fire and the resultant impact to the processes previously discussed in the section on watershed evaluation, houses and the associated human occupancy, other property (e.g. barns, stables, water tanks, etc.) and infrastructure (e.g. roads, bridges, culverts) located within or adjacent to the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. The threat includes the loss of life and property.

The threat is greatest at locations that are within draws, on debris flow fans, at the base of steep slopes, in watercourse canyons, and along low stream banks and flood plains along larger watercourses downstream from the fire area.

B. Threats to Water Quality

As a result of the fires and the resultant impact to the processes previously discussed in the section on watershed evaluation, reservoirs, streams, and other water resources located within or near the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. The risk appears to be greatest to the City of Watsonville water supply. Watsonville maintains water

intakes on Corralitos and Browns Creek. It is assumed there may be domestic water supplies within and downstream of the fire and therefore these are at risk as well.

C. Threats to Recreational Resources

As a result of the fires and the resultant impact to the processes previously discussed in the section on watershed evaluation, recreational resources such as hiking trails and campgrounds are at an increased risk to the threat of flooding, debris torrents, and debris flows. This threat is greatest at Camp Loma (Santa Cruz County) and the "Waterfall Loop" in Uvas Canyon County Park (Santa Clara County).

Additionally, the removal of vegetation due to the fire or the associated suppression activities may result in the creation of new, unofficial trails in the burn areas. These new trails, if not monitored, could result in increased erosion. This risk appears to be greatest on the Bonny Doon Ecological Reserve, and other lands within the fire perimeter where public access is not controlled.

D. Threats to Wildlife, Botanical Values, and Fisheries

As a result of the fires and the resultant impact to the processes previously discussed in the section on watershed evaluation; biological, botanical, and fisheries habitat is at an increased risk to the threat of flooding, debris torrents, and debris flows. Fire suppression activities (e.g. "dozer lines") have also contributed to the current risk to biological, botanical, and fisheries habitat. The risk is greatest for those areas of the Summit and Martin Fires which contain habitat for state and federally listed rare, endangered, or threatened species, state species of special concern, and "covered species" as designated by the California Department of Fish and Game.

E. Threats to Cultural Resources

As a result of the fires and the resultant impact to the processes previously discussed in the section on watershed evaluation, cultural resources are at an increased risk to the threat of flooding, debris torrents, and debris flows. Additionally, there is an increased risk of the exposure of cultural sites as a result of the fire or the associated suppression activities removing protective vegetative cover. Pre-field work assessment and research revealed the Summit and Martin Fires contains known, recorded archeological sites as well as sites discovered during fire suppression efforts. The risk from the fire is greatest to those cultural sites that have been exposed as a result of the fire or the associated suppression activities that could be vandalized or otherwise compromised.

Area Burned

The Summit and Martin Fires encompasses a total of 4,672 acres. Ownership is as follows:

Major Landowners by Fire		
Fire Name	Major Landowners	Total
Martin	Bonny Doon Ecological Reserve	342
	Private - Less Than 100 Acres	151
	City of Santa Cruz	27
Martin Total		520
Summit	Private - Greater Than 100 Acres	985
	Private - less than 100 acres	2,980
	Santa Clara County	144
	Santa Cruz County Youth Activities	72
	United States Government	10
	City of Watsonville	78
Summit Total		4,270
Grand Total		4,790

Soil Burn Severity

Soil Burn Severity is a map of fire caused changes to soil. It is based on an indication of the post-fire vegetation condition as a result of the amount of heat that is released by a fire. It can be used to help predict subsequent effect on other resources. Burn Severity on the Summit and Martin Fires has been determined to be as follows:

Burn Severity of Summit and Martin Fires by Fire			
Fire Name	Burn Severity	Total	
Martin	High Severity	44	9%
	Moderate Severity	274	53%
	Low Severity	116	22%
	Unchanged	86	17%
Martin Total		520	100%
Summit	High Severity	783	18%
	Moderate Severity	1,567	37%
	Low Severity	1,625	38%
	Unchanged	295	7%
Summit Total		4,270	100%
Grand Total		4,790	

Recommendations

The following is a summary of recommendations by discipline.

Geology

General Recommendations:

1. Residents in potentially affected areas should be informed of potential life-threatening hazards this rainy season. They should be informed which areas are at potentially high risk of being impacted by these hazards. Some suggested methods include conducting community information meetings, posting information at commonly visited locations such as Corralitos market in Corralitos, and at other stores, fire stations, schools, and libraries in the area. The information should also be posted on the County OES web site.

2. Residents should be given advanced warning of approaching storms, to allow adequate time to prepare their property for potential impacts, and to allow time to evacuate if necessary. The appropriate County entities (OES, Flood Control, Sheriff, etc) should develop a plan for an early warning system (for example reverse 911 phone calls, or house to house visits by the County Sheriff, Fire Department, or other County Agency).

3. An evacuation plan should be developed by the appropriate local agencies (OES, Flood Control, Sheriff) if one does not already exist, and information shared with residents.

4. Additional study of the high risk locations by the appropriate discipline (Certified Engineering Geologist or Professional Engineer), should be done to better determine the risk level on a site specific basis and to determine more site specific mitigation measures which could be used to reduce the level of potential impact.

5. *All* structures intended to control the flow and direction of water (e.g. waterbars, rolling dips, inside ditches, relief culverts, berms, etc), should be inspected prior to the onset of rain to insure they are clean and functioning properly.

6. Highland Way, Eureka Canyon Road, and Browns Creek Road in the fire area, and for several miles downstream should receive frequent maintenance of drainage structures, and monitoring of conditions (during storms if possible), to keep these vital evacuation routes open.

7. See SEAT Hydrology Technical Report for additional specific recommendations for culverts, bridges, and road maintenance.

Martin Fire

No recommendations.

Specific Recommendations

Summit Fire

a. The residences/locations described in Specific Observations section above, in items 1,2,3,9,and 10 are at the very highest risk, and the residents of these dwellings should be highest priority for early warning and evacuation by the appropriate local entity. These dwellings should absolutely not be occupied during rainstorms this rain season (Oct 2008 – May 2009) unless a Certified Engineering Geologist or Professional Engineer has performed a thorough and detailed evaluation and has determined the dwelling is not at risk.

b. The residences/locations described in the Specific Observations section above in items 4,5,6,7,8, 11 and 12 are also at potentially high risk of impacts to life and property. It is extremely important to provide adequate information for people to understand the danger they could be in during rainstorms this coming rainy season. The appropriate local entity should develop an early warning system and evacuation plans to allow residents to evacuate well in advance of any storm.

Martin Fire

No recommendations.

Hydrology

1. From the Summit Fire Area down to the town of Corralitos, plans for emergency evacuation and informing the affected public that the dangers from the fires are not over needs to be made.

2. Install precipitation gage at upper watershed in the Summit Fire area and tie into the Santa Cruz County alert system. In addition, a detailed study to determine a rainfall threshold value that can cause land slides and subsequent debris torrents should be performed by a licensed professional civil engineer who specializes in soil mechanics and hydrology.

3. Uvas Canyon Park should close during moderate or heavy rainfall events over the next year.

4. Loma Campground should remain closed during the first two winters or until a licensed professional geologist has evaluated the upstream watersheds and has deemed the campground safe from debris torrents.

5. Eureka Canyon Road, Highland Way and Browns Valley Road should be safely monitored during and after rain events.

6. Prior to the first typically expected rainfall all culverts and ditches along Eureka Canyon Road, Highland Way and Browns Valley Road should be cleaned to assure they are completely functional. Culverts should be inspected after moderate rainfall events to insure they continue to be clean and functioning properly. All erosion control structrures designed to control the flow and direction of water (e.g. "waterbars", berms, relief ditch culverts, etc.) within the fire perimeter and downstream of the fire perimeter that could be impacted by rainfall, should be inspected prior to the first typically expected rain to insure they are clean and functioning properly.

7. To further assure that the culverts and bridges are functional, up stream debris should be removed where imminent danger exists. The Santa Cruz County Road Department, in consultation with a fisheries biologist from California Department of Fish and Game should determine if imminent danger exists.

8. Possible undersized culverts on Eureka Canyon Road at mile post markers 7.58 and 8.11 should be evaluated and redesigned, if applicable, by a licensed professional civil engineer.

9. Repair or replace culvert on Eureka Canyon Road at mile post marker 7.91.

10. The off-site culvert on Warren Drive near the Martin Fire should be cleaned prior to the first rain.

Biology/Botany/Fisheries

Summit Fire Burn Area:

1. To control sediment delivery into watercourses, erosion control measures on disturbed and burned slopes draining into watercourses should be conducted where feasible. Erosion control measures recommended include the installation of straw wattles, rice straw or weed-free straw, biodegradable erosion control matting, and mulching with slash in forested areas. If seeding is preferred, the USDA Natural Resources Conservation Service and the Resource Conservation District of Santa Cruz County should be consulted for an appropriate stock and/or seed mix.

2. Existing seasonal roads or new roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

3. To maintain fisheries resources, burned trees within 50 feet of a stream that flows into a fish-bearing stream should be retained for future large woody debris recruitment and to decrease solar radiation of stream waters.

4. In burned forested areas, burned large old trees should be retained. These trees provide habitat for many species, reduce soil erosion, and aid soil formation in a post-fire environment (Karr et al. 2004, Beschta et al. 2004).

5. In burned forested areas, roads and skid tails should be monitored regularly throughout the winter period. Erosion control practices including water bars, applying rice straw or weed-free straw, and slash-packing should be considered.

6. In burned forested areas, invasive non-native plants should be monitored and controlled using hand removal techniques or other means.

7. Structures placed within streams to control sediment (e.g. sediment control basins, check dams, rip rap, artificially placed large wood etc...) are generally not recommended. A fisheries biologist or hydrogeomorphologist should be consulted before any in-stream work is conducted in fish-bearing streams or their tributaries.

8. Culverts in Soquel Creek, Corralitos Creek and Browns Creek watersheds should be monitored throughout the first several post-fire winter periods to ensure that culverts are kept open and sediment, and rocky and woody material pass through the culverts.

9. In-stream woody debris should not be removed unless there is a risk of imminent threat of damage to life and/or property.

10. Prior to work that would affect the bed, bank and/or channel of any stream, the Department of Fish and Game should be contacted and a notification should be made for a Lake and Streambed Alteration Agreement[1] (www.dfg.ca.gov/habcon/1600/)

Martin Fire Burn Area:

1. Immediate action should be taken to repair broken fencing to secure the Bonny Doon Ecological Reserve from disturbance by unauthorized motorized vehicles.

2. Immediate action should be taken to repair the damaged and failing culvert in Reggardio Creek located in the southern portion of the Bonny Doon Ecological Reserve. The culvert should be appropriately sized to pass sediment and woody debris in a 100-year storm.

3. Within the Bonny Doon Ecological Reserve, an invasive non-native plant monitoring (including mapping) and control program is recommended.

4. Existing seasonal roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

5. To minimize the spread of invasive non-native plants, equipment used for fire suppression repair or any other type of repair or management related operation should be hosed off before and after working within the burn area.

6. Seeding and mulching of disturbed areas for erosion control (i.e. fire suppression repair) on the Bonny Doon Ecological Reserve is not recommended without prior approval from the Department of Fish and Game.

7. Within the Bonny Doon Ecological Reserve, the removal of standing burned trees (e.g. hazard trees) and burned downed woody debris should first be evaluated by a qualified biologist, ecologist or botanist to determine if any biological resourses are at risk from tree removal. Consideration should be made to closing certain areas off to the public if they are considered unsafe.

8. The closure of the Bonny Doon Ecological Reserve to the public for an additional period of time to allow sufficient time for recovery of burned sensitive habitats and plants should be considered.

9. Post-fire research and monitoring on the survival and germination of sandhills habitat vegetation communities, including state- and federal-listed plants is recommended.

10. Appropriately-timed surveys for Mount Herman June beetle and Zayante band-winged

[1] Notification with the Department of Fish and Game, or the requirement of a Lake or Streambed Alteration Agreement would not be needed before beginning the following emergency work: 1) immediate emergency work necessary to protect life or property; 2) immediate emergency repairs to public service facilities necessary to maintain service as a result of a disaster in an area in which the Governor has proclaimed a state of emergency; and 3) emergency projects undertaken, carried out, or approved by a state or local governmental agency to maintain, repair, or restore an existing highway, within the existing right of-way of the highway, that has been damaged as a result of fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide, within one year of the damage. Although notification is not required before beginning the emergency work, you must notify the Department in writing within 14 days after beginning the work.

grasshopper should be conducted.

Water Quality

1. Projects that could potentially impact the nearby water bodies (i.e. construction, road maintenance, land-use practices, etc.), either already in progress, planned or in planning stages, in primary and secondary water bodies need to be revised to include components protective of values at risk due to severe modification to the landscape as a result of the fires.

2. The burn greatly reduced vegetative cover, particularly on those areas of moderate and high intensity severity, exposing dump sites throughout the burn area. The debris at these dump sites includes cans, bottles, derelict equipment, plastics, broken glass, metals, and other non-native debris. Due to the reduction of vegetation, materials associated with dump sites exposed by the fire are more prone to enter nearby water bodies. Since this is an additional threat to water quality as a direct result of the fire, the debris should be removed and property disposed of offsite. Additionally, removal of this debris will discourage additional dumping in exposed areas.

3. Recreational trespassing is a widespread problem throughout Santa Cruz County. Trespassing activities such as use of Off Highway Vehicles (OHVs) can damage current road infrastructure and cut new trails, severely altering drainage patterns leading to increased erosion. Considering the landscape's increased susceptibility to erosion in post-fire conditions, trespassing becomes an issue of specific importance. Private landowners and the Santa Cruz County Sheriff's office should work collaboratively to take appropriate steps to discourage and prevent illegal trespass activities.

4. The fires severely reduced the amount of preexisting vegetative cover. Vegetative cover is essential for reducing sediment movement via rainfall interception and root structure. Where appropriate and feasible, revegetation and soil stabilization techniques should be established. Revegetation efforts should be done in consultation with the local NRCS or other post-fire restoration professionals and include components to eliminate the introduction of non-native invasive plant species that include the use of weed free straw and sterilized seed mixes.

5. Many home sites were destroyed by the Summit Fire. These home sites are either in active reconstruction or currently unmanaged. Reconstruction of the home sites should be implemented consistent with the requirements of the Central Coast Regional Water Quality Control Board's (Water Board) Construction General Permit and any applicable Santa Cruz County codes. The Water Board's permit can be viewed via the following link:

   http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

6. Unmanaged home sites destroyed by the fire should be evaluated prior to the winter period to determine the most appropriate way to secure the perimeter and prevent associated materials (including household hazardous waste) from entering the nearby water bodies.

7. A majority, if not all, of the home sites discussed in the previous recommendation have onsite septic systems. Home sites in active reconstruction should install or reinstall septic systems per Santa Cruz County code, California Plumbing code, and Basin Plan requirements for septic systems. Unmanaged sites should be evaluated for abandoned septic systems. Abandoned septic systems have the potential to fail and adversely impact water quality. Such septic systems should be appropriately treated per Santa Cruz County code, California Plumbing code, and Basin Plan requirements to prevent fecal coliform and pathogen contamination of nearby water bodies.

8. Landowners and land-use managers with grading projects in primary or secondary water bodies should consult with the NRCS prior to project implementation to ensure the project is protective of water quality. Construction of new roads and other projects that require soil disturbance should be minimized.

9. Culverts located in primary and secondary water bodies have an increased risk for plugging due to the anticipated increase of sediment loads and debris during upcoming winter storms. Land owners and land use managers with culverts on their property should inspect their infrastructure prior to the rainy season to determine if the installation of "trash racks" is appropriate. Additionally, they should inspect and clean-out culverts during the winter after every significant storm event (two-inches of rain or greater within a twenty-four hour period or any the land use manager determinate appropriate) to prevent the potential for plugging and ultimately catastrophic failure of the crossing.

10. According to Jed Wilson , California Department of Forestry and Fire Protection Fire Captain, who participated in suppression activities on the Summit Fire, fire retardant was utilized as part of the suppression activities. The Pajaro River is listed on the Clean Water Act's 303(d) list as impaired for boron, a substance found in some fire retardants. Additionally, fire retardants have been found to be toxic to fish and other aquatic organisms. A focused evaluation of where fire retardant was dropped during suppression activities should be conducted to determine the risk to the beneficial uses of water. Appropriate follow-up activities should be implemented to minimize damage to beneficial uses.

Additional Recommendations not previously discussed.

Tree Removal

Prior to tree cutting or removal, landowners should consult with a Registered Professional Forester (RPF) or CALFIRE to determine if a local or state Permit may be required. An RPF or CALFIRE, in addition to advising on the potential need for a Permit, can advise the landowner on the health of trees, future mortality of the remaining trees because of the fires, potential hazard trees, and future fire potential, to name a few issues which may be of concern to the landowner. An RPF or CALFIRE can provide possible mitigations designed to minimize or prevent erosion that may result from potential tree removal, and provide assistance in advising of local, state, or federal agencies or other Professionals who may also be able to provide assistance.

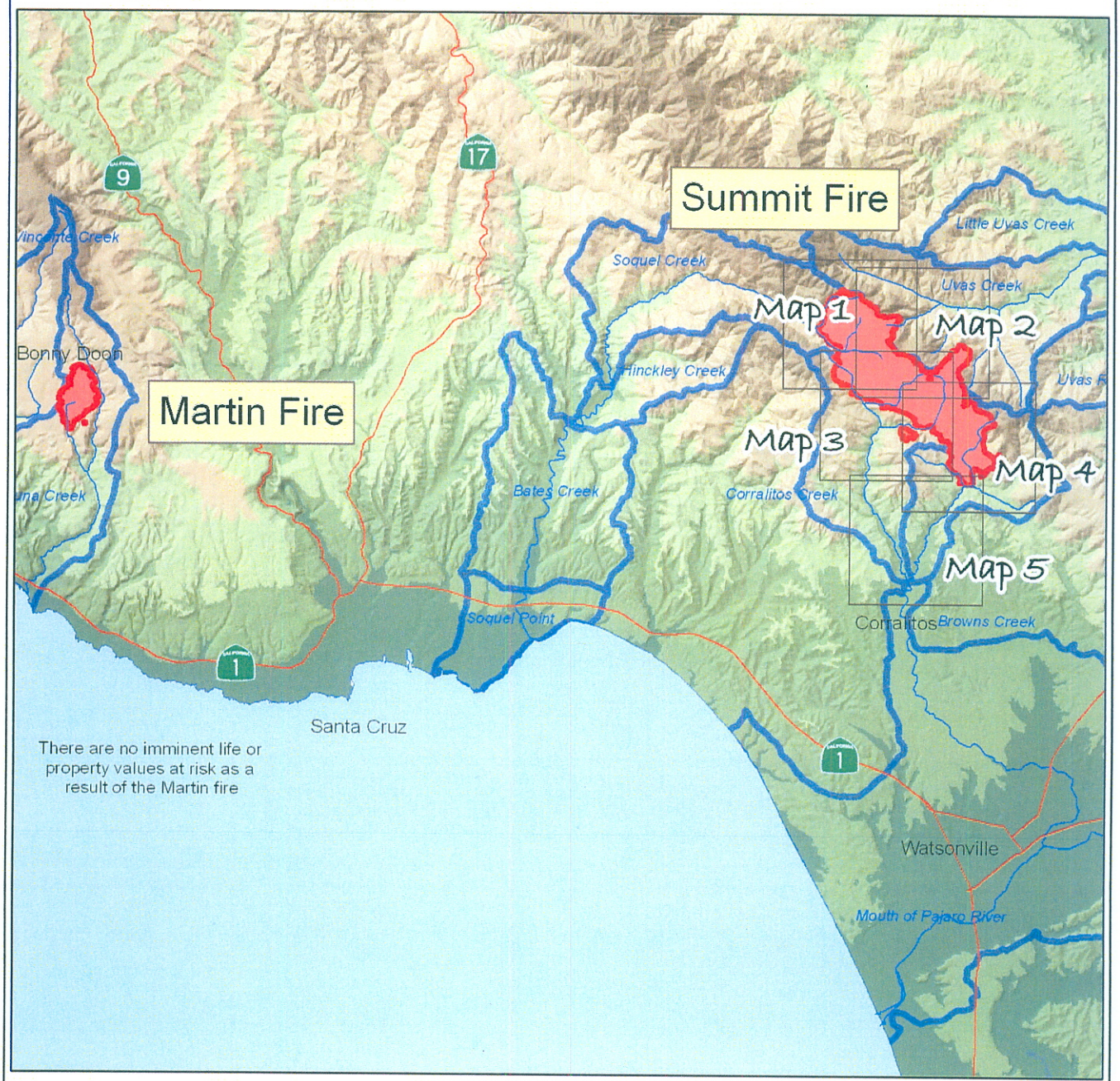
Cultural Resources

Prior to implementing any treatments previously recommended that involves the use of heavy equipment (e.g. "bulldozer") or can otherwise significantly alter the landscape, the landowner should consult with a Professional Archeologist to determine if known or unknown cultural resource sites will be adversely impacted.

Summary

The fire and the resultant impact to the processes previously discussed in the section on watershed evaluation have resulted in an increased risk for storm events to result in flooding, debris torrents, and debris flows. The threat includes the loss of life and property and as storm intensity or duration rises, there will be an increased elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows. All values at risk identified could be adversely affected.

Summit and Martin Fires - SEAT
Burn Site Evaluation Map Index



Legend

- Highway
- Streams
- Map Index Block
- Fire Perimeter
- CalWater221 Planning Watersheds

N
W E
S

Scale

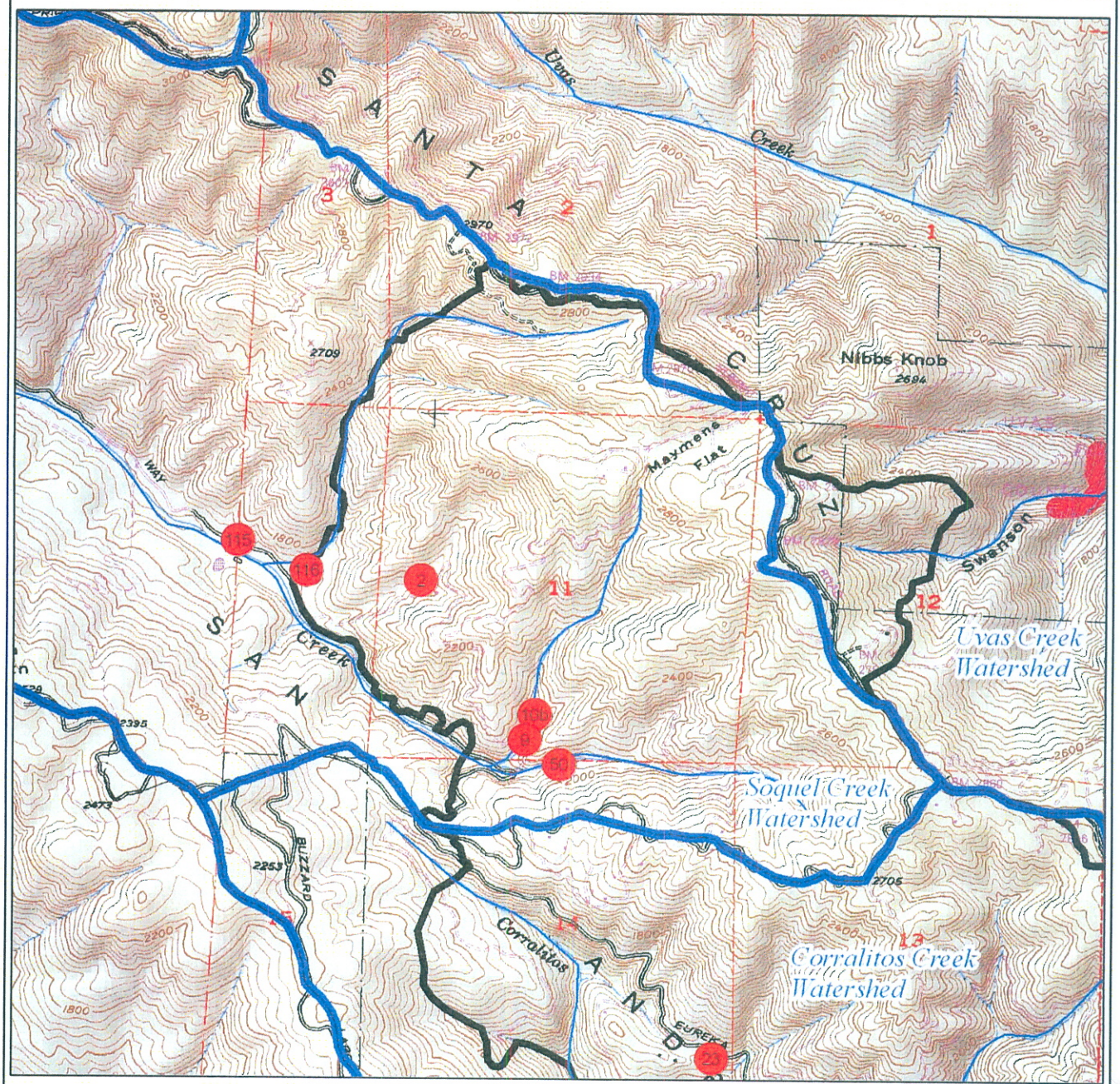
0 2 4 6 8 Miles

0 2 4 6 8 10 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-6

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #1



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

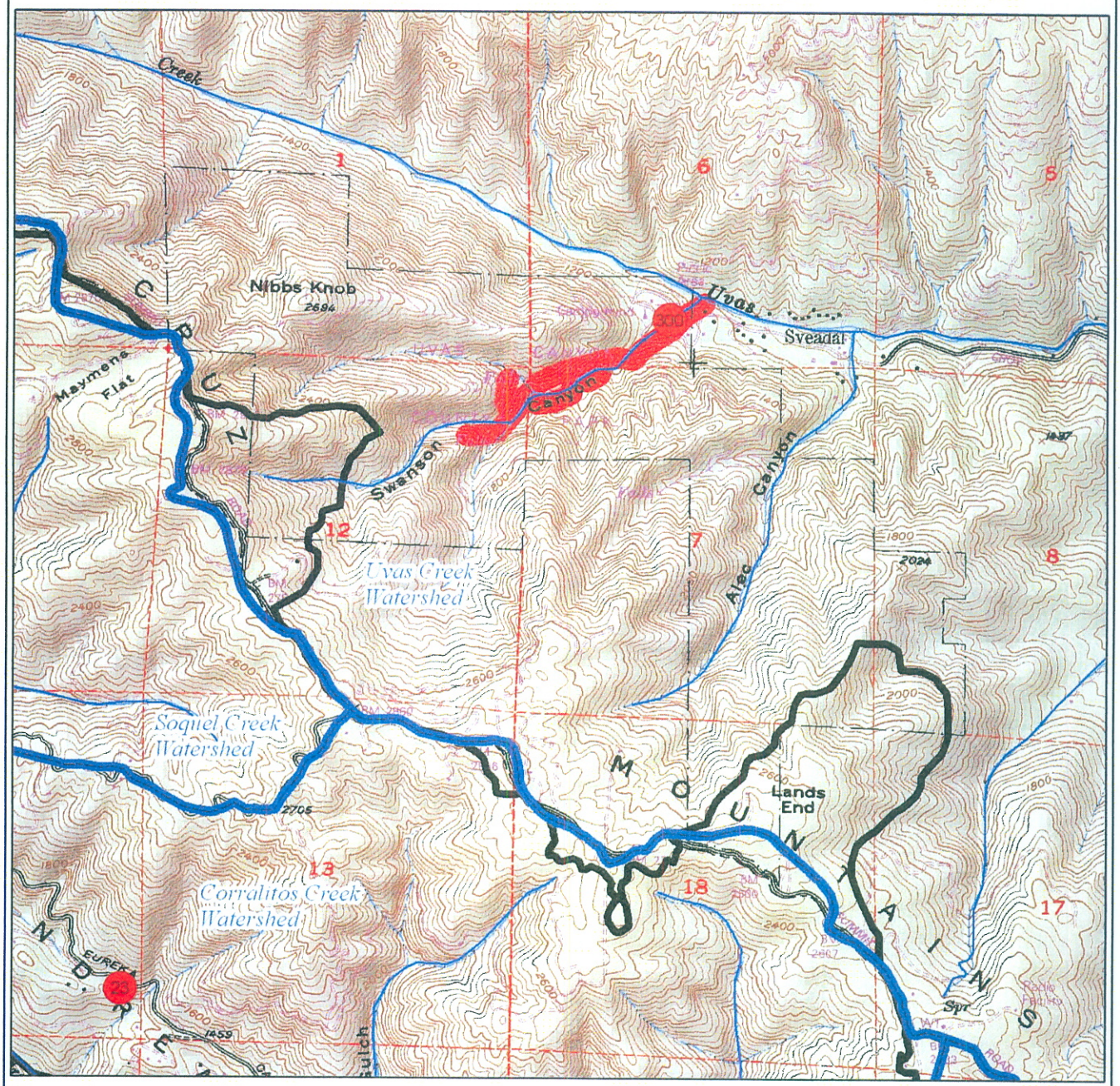
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-7

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #2



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Uvas Canyon County Park
- Fire Perimeter

N
W E
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Scale

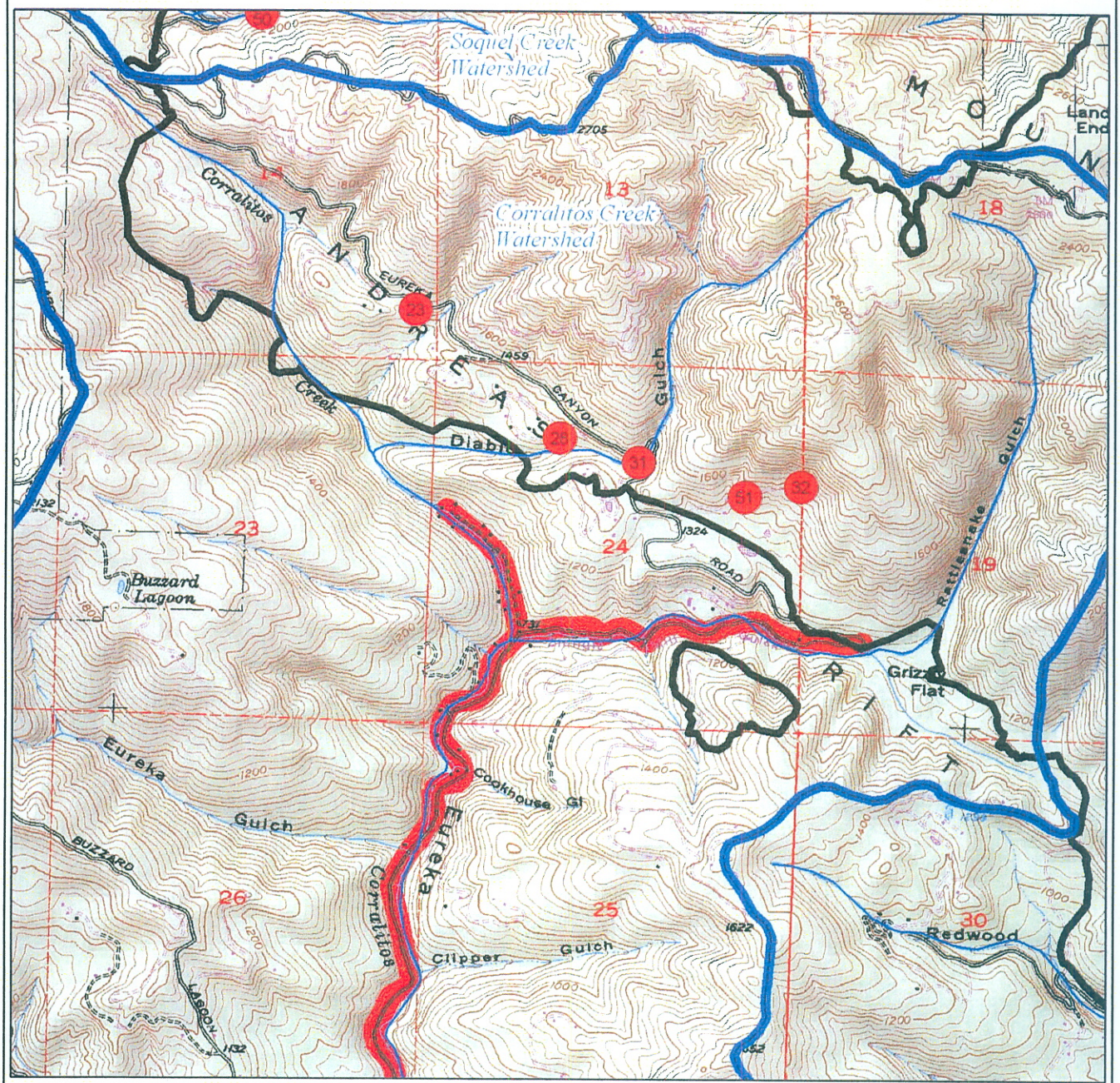
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-8

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #3



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

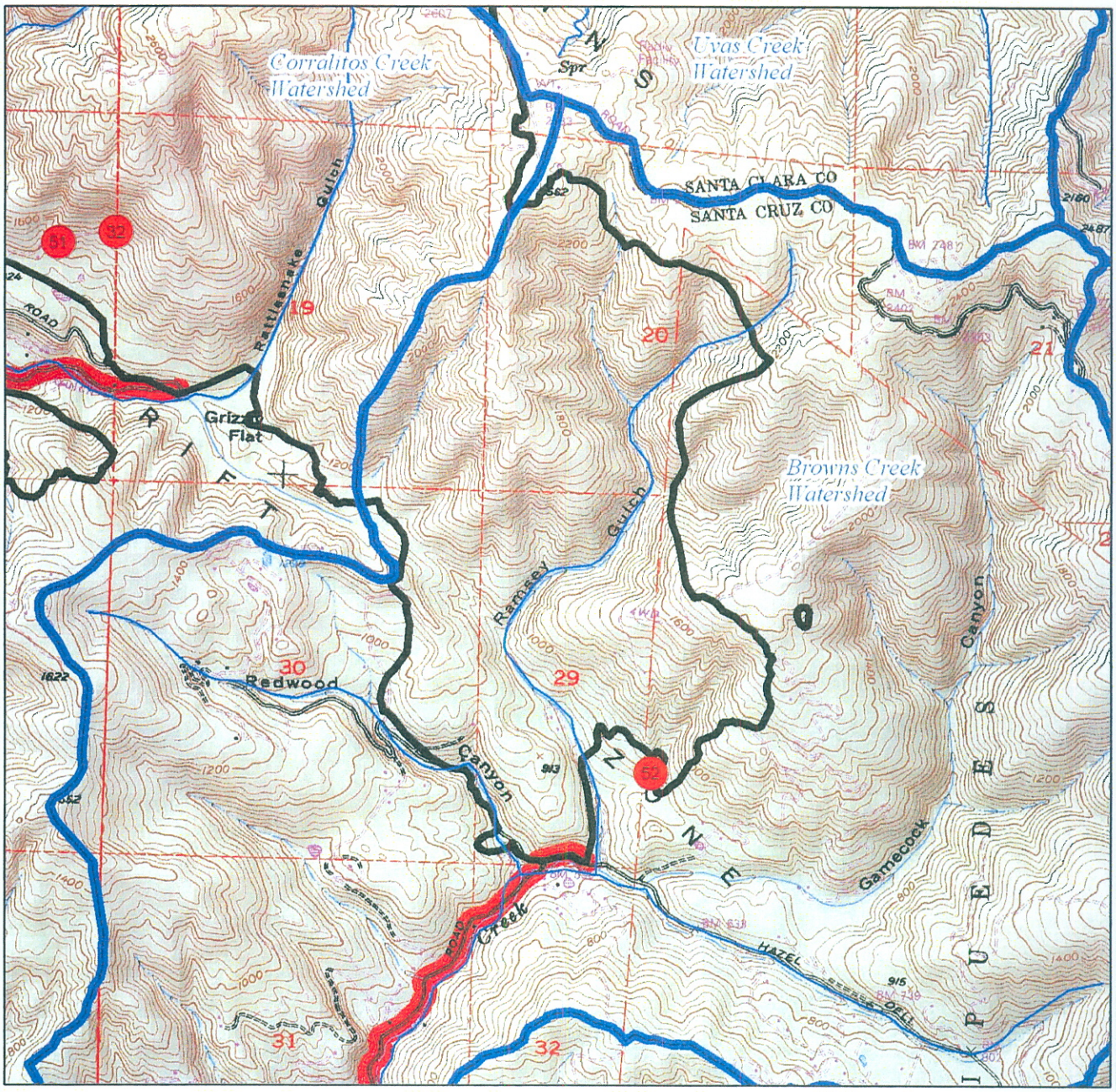
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-9

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #4



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

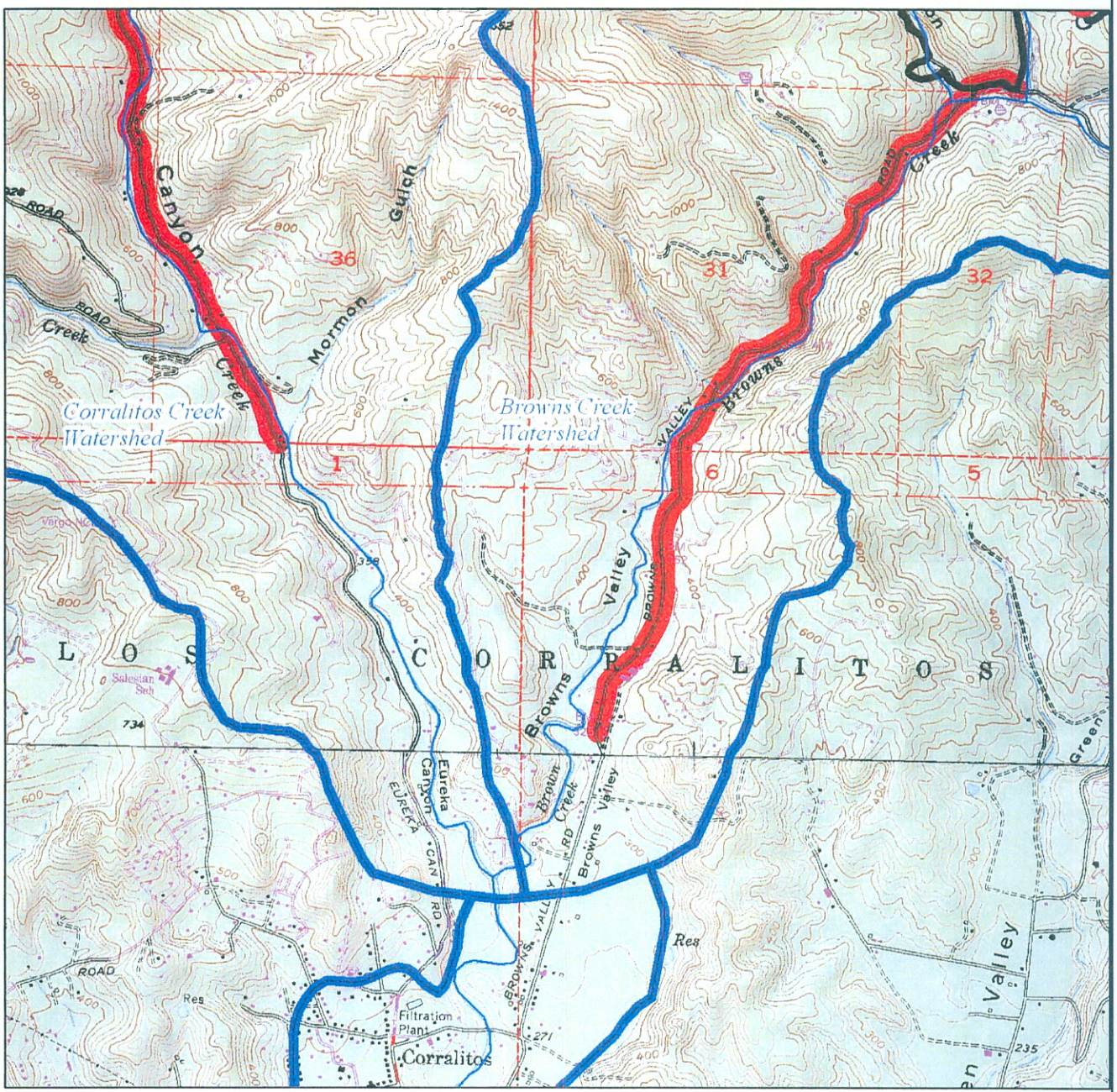
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-10

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #5



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

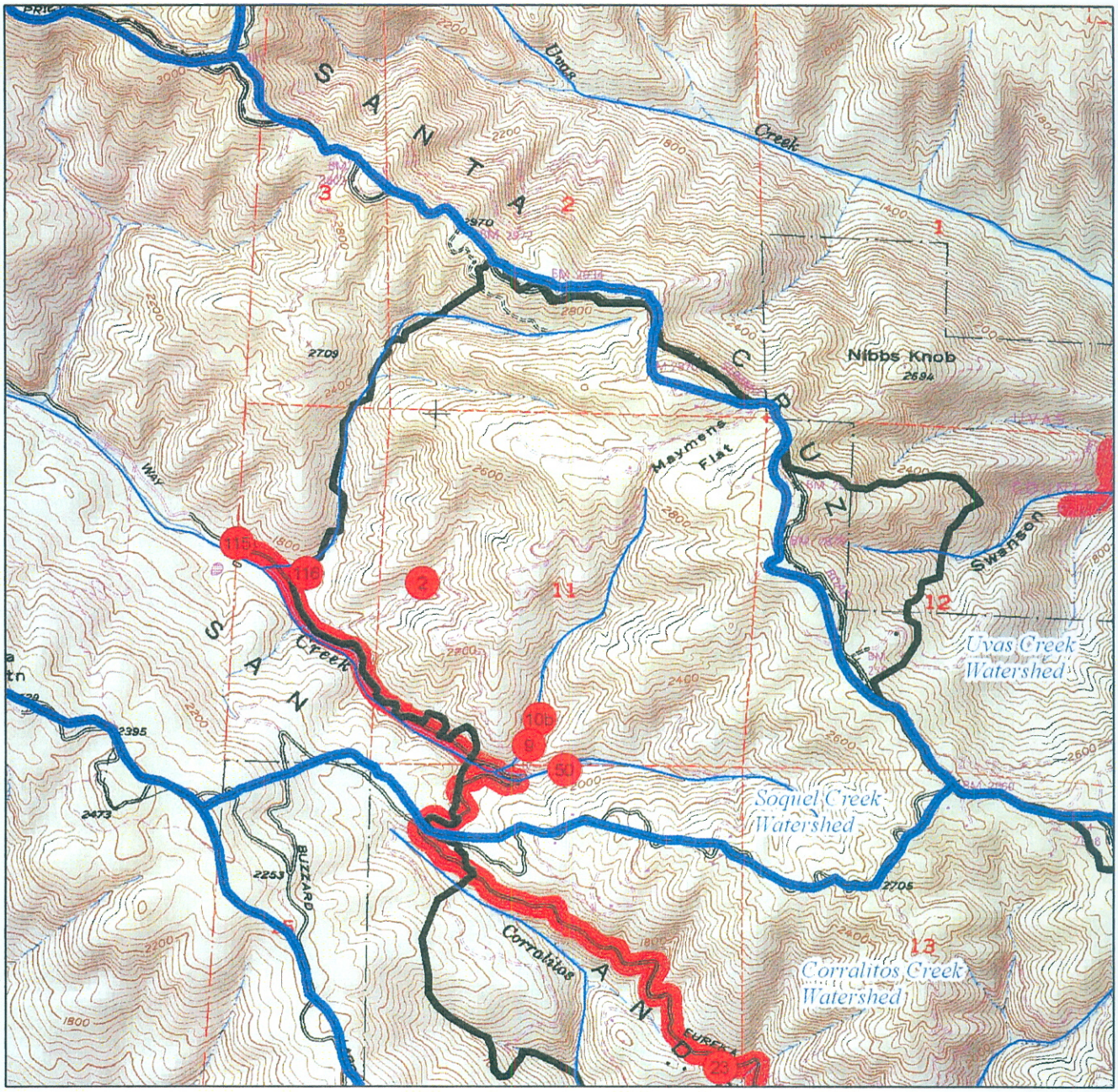
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-11

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #1



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
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Scale

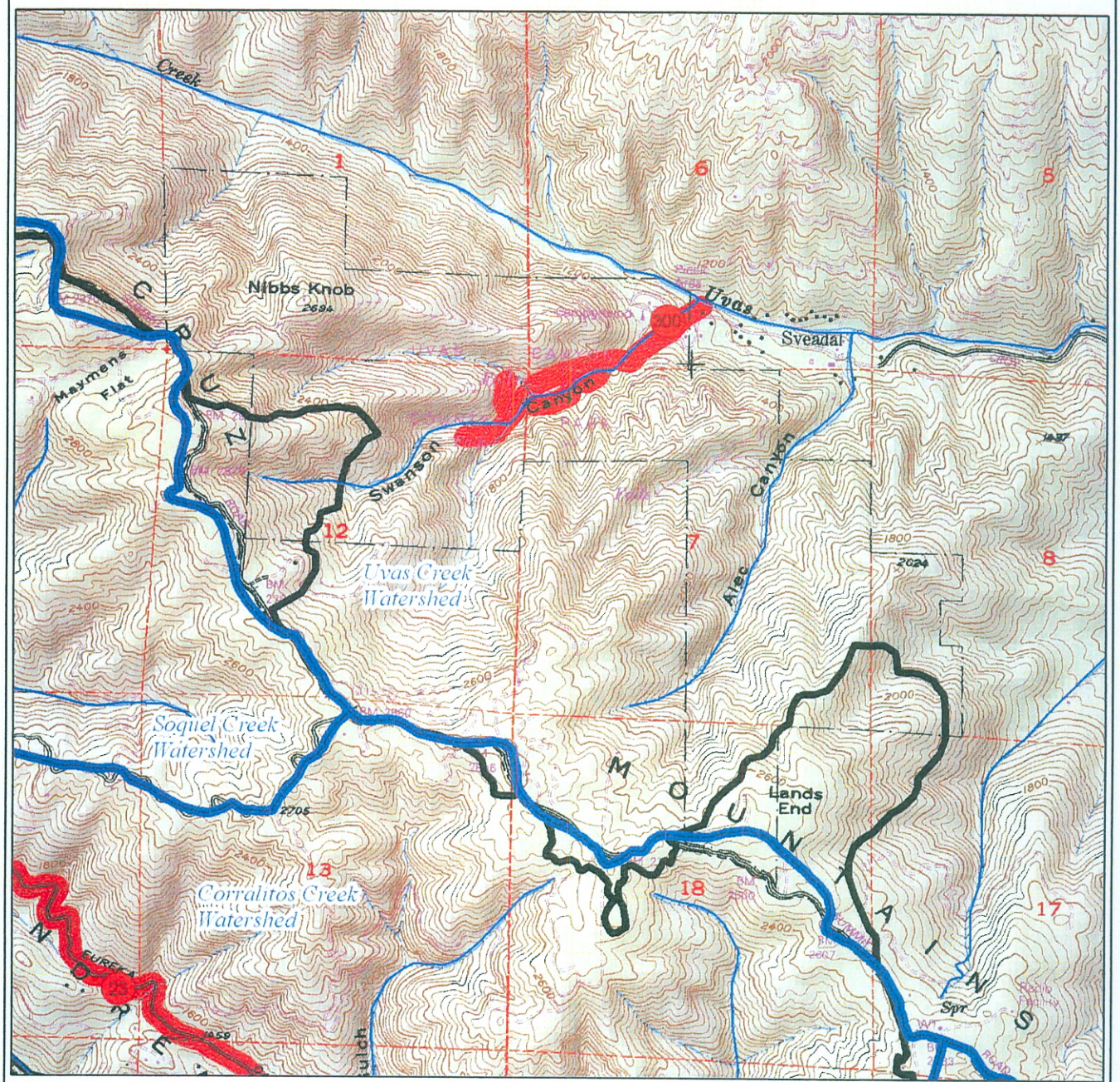
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-12

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #2



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Uvas Canyon County Park
- Fire Perimeter

N
W E
S

Scale

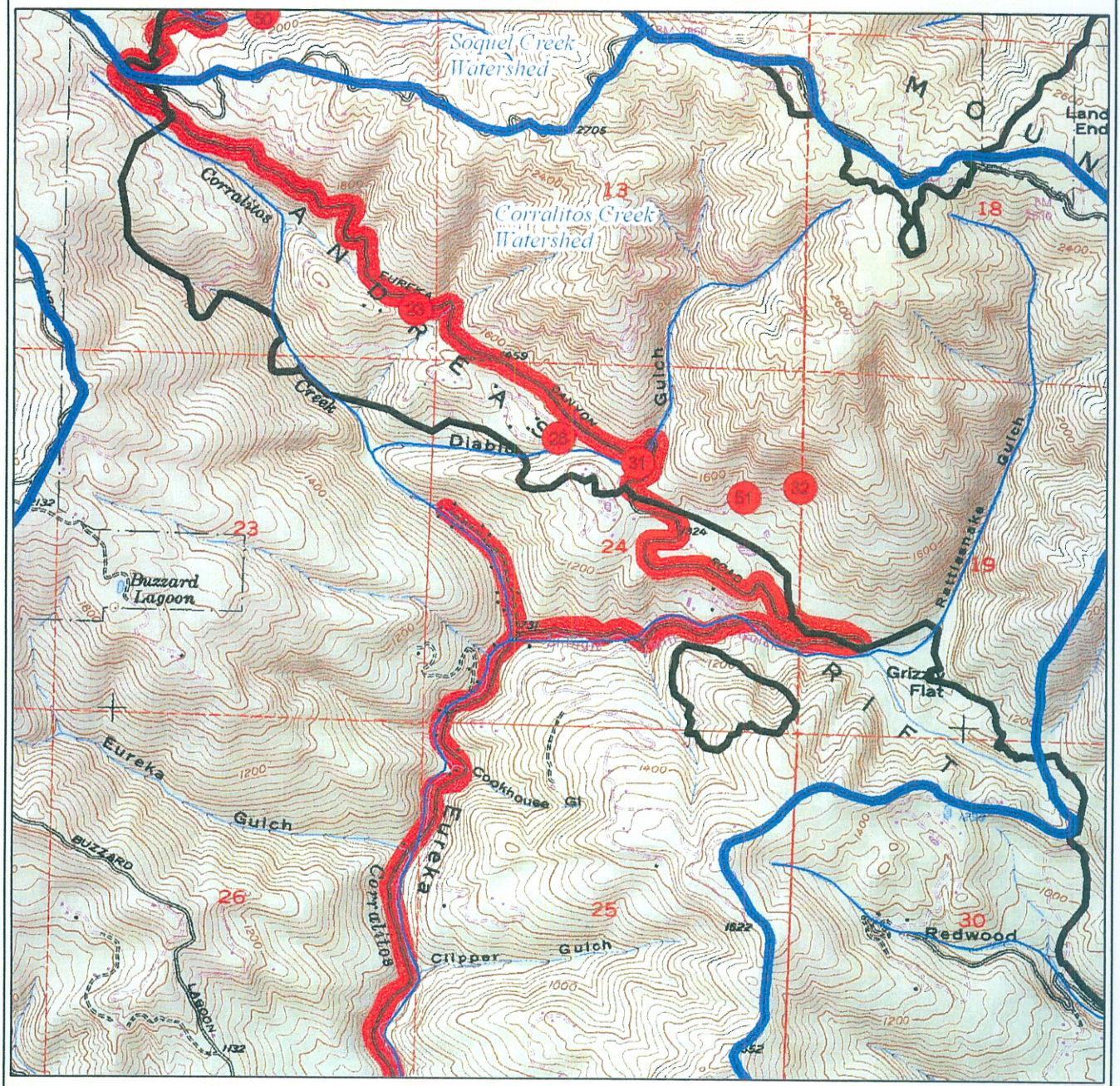
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-13

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #3



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

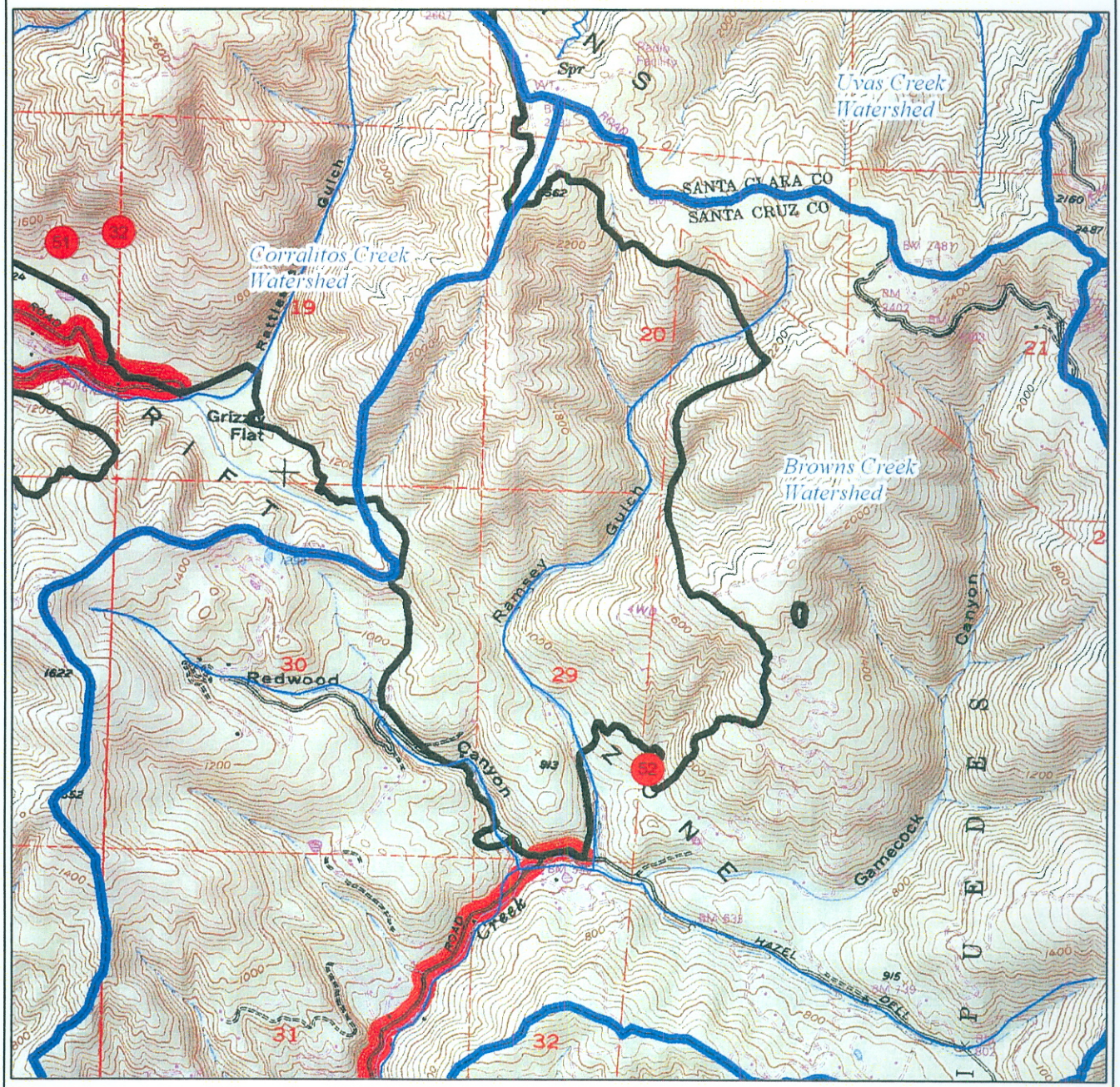
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-14

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #4



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

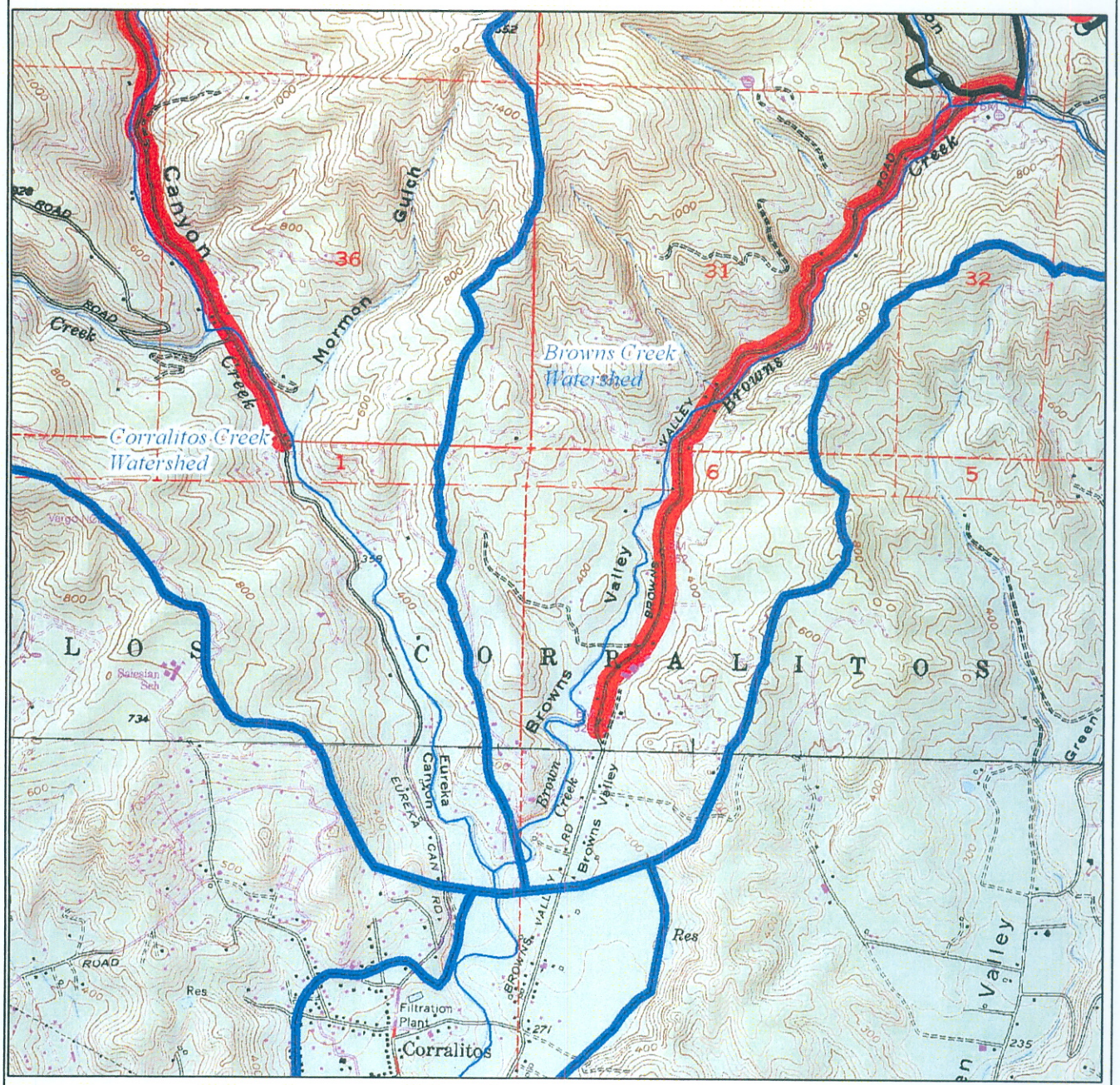
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-15

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #5



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-16

Summit and Martin Fires
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Introduction

An initial assessment conducted by a State Emergency Assessment Team (SEAT) has been completed for the Summit Fire (CALFIRE Incident Number CA-SCU-002548) located in Santa Cruz and Santa Clara Counties, and the Martin Fire (CALFIRE Incident Number CA-SCU-005238) located in Santa Cruz County. The assessment had three key objectives:

- Identify on-site and downstream threats to public health or safety from landslides, mudslides, debris torrents, flooding, road hazards, and other public safety hazards from fire related effects.

- Identify threats to resources at risk, including: excessive erosion; impaired water quality; threats to wildlife, fisheries, botanical values, natural and cultural resources.

- Determine measures that may be used to prevent or mitigate identified threats.

SEAT technical specialists conduct rapid surveys on burned areas and if warranted downstream (outside) of burned areas to determine if emergency rehabilitation treatment is needed to minimize the risk of threats to human life or property, including infrastructure. These surveys also assess if emergency rehabilitation treatment is needed to minimize or prevent deterioration of water quality, minimize loss of soil productivity due to erosion, minimize or prevent degradation of wildlife and botanical habitat, and minimize or prevent degradation of cultural resources. These surveys can be used to facilitate identification of other potential values at risk (for example recreational resources), and determination if emergency rehabilitation treatment is needed. These surveys can be used in conjunction with other relevant, reliable sources of information to assess if additional emergency rehabilitation treatment is needed to mitigate or prevent threats to human life, loss or damage to property and infrastructure, or damage to the environment beyond those emergency rehabilitation treatments recommended in this report.

Accessible residences and other significant features (e.g. streams) were evaluated in the field when possible. However numerous residences and other significant features in the assessment area cannot be seen from public roads and/or lie behind locked gates and were not accessible due to the reluctance of many residents to permit access to their property.

The Summit Fire began on May 22, 2008, and was 100% contained on May 27, 2008. It burned approximately 4,270 acres in portions of the Soquel Creek, Corralitos Creek, Brown's Creek, and Uvas Creek watersheds. Habitat types affected by the fire include Redwood Forest, Mixed Evergreen Forest, Closed-Cone Coniferous Forest, Mixed Hardwood Conifer, Mixed Chaparral, and Riparian Woodland.

The Martin Fire began on June 11, 2008 and was 100% contained on June 28, 2008. It burned approximately 520 acres in portions of the San Vicente Creek and Laguna Creek watersheds. Habitat types affected by the fire include Ponderosa Pine, Redwood Forest, Closed-cone Pine Cypress, Montane Hardwood Conifer, Mixed Chaparral, Coastal Scrub, and Annual Grassland.

Watershed Evaluation

The Summit Fire encroached upon four watersheds as defined by the Calwater 2.2.1 Planning watershed identification system. These watersheds are Soquel Creek, Corralitos Creek, Browns Creek, and Uvas Creek. Of these watersheds, Soquel Creek suffered the greatest amount of high burn severity with 382 acres, or 34% of the watershed located within the fire perimeter. This was followed by Corralitos Creek

with 292 acres (15% of the watershed located within the fire perimeter), Browns Creek with 92 acres (11 % of the watershed located within the fire perimeter), and Uvas Creek with 15 acres (5% of the watershed located within the fire perimeter).

The Martin Fire encroached upon two watersheds as defined by the Calwater 2.2.1 Planning watershed identification system. These watersheds are Laguna Creek and San Vicente Creek. Of these watersheds, Laguna Creek suffered the greatest amount of high burn severity with 44 acres, or 9% of the watershed located within the fire perimeter. San Vicente Creek watershed did not suffer any high burn severity.

The principal concern with the Summit Fire is an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The primary mechanisms for this are the loss of mechanical support of hillslope materials that was provided by vegetation and vegetative litter and the increase in runoff resulting from reductions in interception and infiltration, from the simplification of surficial runoff patterns, and from the loss of mechanical support along stream channels where riparian vegetation was burned. Where fires burn moderate to high, such as in the upper portions of the affected watersheds, the reduction in interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces.

The Martin Fire does not present a significant increased potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows.

Values at Risk

In general, as a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, there is an increased risk for storm events to result in flooding, debris torrents, and debris flows on the Summit Fire. As storm intensity or duration rises, there will be an increased elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows.

A. Threats to Human Life, Property, and Infrastructure

As a result of the Summit Fire and the impact to the processes previously discussed in the section on watershed evaluation, houses and the associated human occupancy, other property (e.g. barns, stables, water tanks, etc.) and infrastructure (e.g. roads, bridges, culverts) located within or adjacent to the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. This threat includes the loss of life and property.

This threat is greatest at locations that are within draws, on debris flow fans, at the base of steep slopes, in watercourse canyons, and along low stream banks and flood plains along larger watercourses downstream from the fire area.

B. Threats to Water Quality

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, reservoirs, streams, and other water resources located within or near the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. The risk appears to be greatest to the City of Watsonville water supply. Watsonvillemaintains water intakes on Corralitos and Browns Creek. It is assumed there may be domestic water supplies within and downstream of the fire and therefore these are at risk as well.

C. Threats to Recreational Resources

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, recreational resources such as hiking trails and campgrounds are at an increased risk to the threat of flooding, debris torrents, and debris flows. This threat is greatest at Camp Loma (Santa Cruz County) and the "Waterfall Loop" in Uvas Canyon County Park (Santa Clara County).

Additionally, the removal of vegetation due to the fire or the associated suppression activities may result in the creation of new, unofficial trails in the burn areas. These new trails, if not monitored, could result in increased erosion. This risk appears to be greatest on the Bonny Doon Ecological Reserve, and other lands within the fire perimeter where public access is not controlled.

D. Threats to Wildlife, Botanical Values, and Fisheries

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, biological, botanical, and fisheries habitat is at an increased risk to the threat of flooding, debris torrents, and debris flows. Suppression activities (e.g. "dozer lines") have also contributed to the current risk to biological, botanical, and fisheries habitat. The risk is greatest for those areas of the Summit and Martin Fires which contain habitat for state and federally listed rare, endangered, or threatened species, state species of special concern, and "covered species" as Designated by the California Department of Fish and Game.

E. Threats to Cultural Resources

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, cultural resources are at an increased risk to the threat of flooding, debris torrents, and debris flows. Additionally, there is an increased risk of the exposure of cultural sites as a result of the fire or the associated suppression activities removing protective vegetative cover. Pre-field work assessment and research revealed the Summit and Martin Fires contains known, recorded archeological sites as well as sites discovered during fire suppression efforts. The risk from the fires is greatest to those cultural sites that have been exposed as a result of the fire or the associated suppression activities that could be vandalized or otherwise compromised.

Area Burned

The Summit and Martin Fires perimeters encompasses a total of 4,672 acres. Ownership is as follows:

Table 1-Major Landowners by Fire

Major Landowners by Fire		
Fire Name	Major Landowners	Total
Martin	Bonny Doon Ecological Reserve	342
	Private - Less Than 100 Acres	151
	Santa Cruz City Of	27
Martin Total		520
Summit	Private - Greater Than 100 Acres	985
	Private - less than 100 acres	2,980
	Santa Clara County	144
	Santa Cruz County Youth Activities	73
	United States Government	10
	Watsonville City Of	78
Summit Total		4,270
Grand Total		4790

Soil Burn Severity

Burn severity is the amount of heat that is released by a fire and how it affects other resources. Burn Severity on the Summit and Martin Fires has been determined to be as follows:

Table 2-Burn Severity by Fire

Burn Severity of Summit and Martin Fires by Fire			
Fire_Name	Burn Severity	Total	
Martin	High Severity	44	9%
	Moderate Severity	274	53%
	Low Severity	116	22%
	Unchanged	86	17%
Martin Total		520	100%
Summit	High Severity	783	18%
	Moderate Severity	1,567	37%
	Low Severity	1,625	38%
	Unchanged	295	7%
Summit Total		4,270	100%
Grand Total		4,790	

Table 3-Burn Severity Fire and Watershed

Burn Severity of Summit and Martin Fires by Calwater 2.21 Planning Watershed				
Fire_Name	CDFPWSNAME	Burn Severity	Total	
Martin	Laguna Creek	High Severity	44	9%
		Moderate Severity	271	53%
		Low Severity	112	22%
		Unchanged	84	16%
	Laguna Creek Total		511	100%
	San Vincente Creek	High Severity	0	0%
		Moderate Severity	3	37%
		Low Severity	4	43%
		Unchanged	2	21%
	San Vincente Creek Total		9	100%
Martin Total			520	
Summit	Browns Creek	High Severity	92	11%
		Moderate Severity	197	23%
		Low Severity	524	62%
		Unchanged	34	4%
	Browns Creek Total		847	100%
	Corralitos Creek	High Severity	292	15%
		Moderate Severity	759	38%
		Low Severity	801	40%
		Unchanged	142	7%
	Corralitos Creek Total		1,994	100%
	Soquel Creek	High Severity	382	34%
		Moderate Severity	487	43%
		Low Severity	227	20%
		Unchanged	34	3%
	Soquel Creek Total		1,130	100%
	Uvas Creek	High Severity	15	5%
		Moderate Severity	123	41%
		Low Severity	74	25%
		Unchanged	87	29%
	Uvas Creek Total		299	100%
Summit Total			4,270	
Grand Total			4,790	

Summary of Technical Specialist Reports and Recommendations

The following discussions summarize the technical specialist reports and provide further detail regarding values at risk.

A. Geology

I. Resource Setting

The Summit Fire burned 4,189 acres in the steep terrain of the Santa Cruz Mountains along the Santa Cruz - Santa Clara county line. The majority of the burned acreage was in Santa Cruz County, but two small tongues of the fire crept down into drainages on the Santa Clara side of Summit Ridge.

The geology in the Summit Fire vicinity consists of sandstone, shale, and mudstone that have been strongly folded and fractured by the San Andreas Fault that trends along the southern boundary of the burn area. Annual rainfall in the mountains is considerably higher than down along the ocean. It is not uncommon for rainstorms in the Santa Cruz Mountains to be of long duration, with intervals of intense rainfall. Due to the geology and weather in the area, the mountains are naturally unstable, and there are numerous landslide deposits and scars in the fire area.

The steep headwater slopes of several large watersheds were burned, including Soquel Creek, Corralitos Creek and Browns Creek on the Santa Cruz side, and Uvas Creek on the Santa Clara side of the mountain.

The Martin Fire burned 483 acres on the top of Ben Lomond Mountain near the community of Bonny Doon, approximately six miles northwest of the city of Santa Cruz. Most of the burn occurred on nearly flat terrain. The only moderate to steep slopes in the vicinity are found in the inner gorge of Laguna creek, which flows just outside the east boundary of the fire, and in the headwaters of Reggiardo Creek in the southwest portion of the burn. The streams converge just south of the burn area. The geology in the vicinity consists of metamorphic bedrock, mostly quartzite and schist, which is covered in the northwest portion of the burn area by the Santa Margarita Sandstone. Deep highly erodible sandy soils have developed in the area underlain by the Santa Margarita Sandstone, and much less erodible loam soils have developed on the metamorphic bedrock.

II. Findings

The Summit and Martin Fires are very different in terms of the potential impacts to life and property. Due to the predominantly gentle slopes, relatively small size, and predominantly low to moderate burn intensity in the Martin Fire area, the risks to life and property from potential flood, sedimentation, or landslides appears to be low.

The situation on and downstream from the Summit Fire is just the opposite. The risk to life and property due to post-fire conditions is high at numerous locations within and downstream from the burn area. There is a significantly increased potential for the occurrence of floods, hyperconcentrated flows, debris flows, debris torrents, debris slides, and rock falls. Locations on the landscape where there is a high risk of being impacted by these hazards are within draws, on debris flow fans, at the base of steep slopes, in watercourse canyons, and along low stream banks and flood plains along larger watercourses downstream from the fire area.

We identified residences (houses, RVs, tents), parks and campgrounds, as well as roads that are located in these high hazard areas. Because of the rugged terrain and the sparsely populated nature of the burn area, there are few roads in the area. If the roads located in high hazard areas become blocked during rainstorms, some residences could be cut off from vehicle access for extended periods of time. During our field assessment, we were frequently prevented from visiting residences. Many remote residences lie behind locked gates, and many residents were reluctant to grant us permission to come on their property to do assessment work. In those instances we relied on information from previous assessments such as the post-fire damage assessment performed by CALFIRE, and other field work performed by California Geological Survey and other agencies.

III. Emergency Determination

a. Values at Risk considered in this assessment.
   - Life
   - Property (houses, RVs, other structures)
   - Infrastructure (roads and drainage structures – particularly roads that provide the only paved access to and from remote residences)
   - Water Supply

We identified five locations containing one or more residences, which are at very high risk to life and property from debris flows, debris slides, rock fall, and hyperconcentrated flows. These residences should not be occupied during storms this coming rainy season (approximately Oct 2008 – May 2009).

We identified six locations containing one or more residences, or which would put people in harms way within parks and campgrounds, that are at potentially high risk to life and property from debris flows, debris slides, rock fall, hyperconcentrated flows, and floods. Some of these locations should probably not be occupied during storms, but others may not be at such a high level of risk. Additional study by appropriate professionals such as Engineering Geologists or Professional Engineers is needed to better determine the risk level on a site-specific basis. In the absence of additional study, it would be prudent for the proper public entity to provide an early warning system and an evacuation plan so that residents could evacuate these locations during storms.

We identified three roads segments that are at potentially high risk for flooding that have residences along the stream banks, and have in-stream drainage structures, which could be impacted. Additional study is needed to identify those residences and structures that are likely to be impacted and to provide a warning and evacuation plan for those residences that could be impacted.

We identified two road segments that are primary transportation routes for local residents that are at high risk of becoming impassible from plugged culverts and debris flows during rain storms.

IV. Treatments/Recommendations

- Residents in potentially affected areas should be informed of potential life-threatening hazards this rainy season. They should be informed which areas are at potentially high risk of being impacted by these hazards. Some suggested methods include posting information at commonly visited locations such as Corralitos market in Corralitos, and at other stores, fire stations, schools, libraries in the area. Community information meetings could be conducted. The information should also be posted on the County OES web site.

- Residents should be given advanced warning of approaching storms, to allow adequate time to prepare their property for potential impacts, and to allow time to evacuate if necessary. The appropriate County entities (OES, Flood Control, Sheriff, etc) should develop a plan for early warning. Some examples of early warning could be in the form of reverse 911 phone calls, or house to house visits by the County Sheriff, Fire Department, or other County Agency.

- An evacuation plan should be developed by the appropriate local agencies (OES, Flood Control, Sheriff), and information shared with residents.

- Additional study of the high risk locations by the appropriate discipline, Certified Engineering Geologist or Professional Engineer, should be done to better determine the risk level on a site specific basis, and to determine if more site specific mitigation measures which could be used to reduce the level of potential impact.

- *All* structures intended to control the flow and direction of water (e.g. waterbars, rolling dips, inside ditches, relief culverts, berms, etc), should be inspected prior to the onset of rain to insure they are clean and functioning properly.

- Highland Way, Eureka Canyon Road, and Browns Creek Road in the fire area, and for several miles downstream should receive frequent maintenance of drainage structures, and monitoring of conditions (during storms if possible), to keep these vital evacuation routes open.

- See SEAT Hydrology Technical Report for additional specific recommendations for culverts, bridges, and road maintenance.

- The residences/locations described in Specific Observations section of the Geology Technical Specialist Report, in items 1,2,3,9,and 10 are at the very highest risk, and the residents of these dwellings should be highest priority for early warning and evacuation by the appropriate local entity. These dwellings should absolutely not be occupied during rainstorms this rain season (Oct 2008 – May 2009).

- The residences/locations described in the Specific Observations section Geology Technical Specialist Report, in items 4,5,6,7,8, 11 and 12 are also at potentially high risk of impacts to life and property. It is extremely important to provide adequate information for people to understand the danger they could be in during rainstorms this coming rainy season. The appropriate local entity should develop an early warning system and evacuation plans to allow residents to evacuate well in advance of any storm.

B. Hydrology

The Summit and Martin fires of 2008 burned approximately 4,189 and 483 acres, respectively. These fires were located in Santa Cruz County, though two small portions of the Summit Fire reached Santa Clara County. Steep to mild slopes are in both areas, though the Martin Fire area is mainly made up of mild slopes. The average annual rainfall from the Summit and Martin fire areas are 46 and 39 inches per year, respectively.

All the areas burned by the Summit Fire drain into the following four watersheds: Corralitos Creek, Browns Creek, Soquel Creek and Uvas Creek watersheds. The type of burn severity at the Summit Fire ranges from low to high. Major gulches typically have low to moderate burn severities, where many of the ridges and their hillsides have moderate to high burn severities.

The Laguna Creek watershed drains the entire burned area caused by the Martin Fire. High burn severity areas have mild slopes, while the steepest slopes have low burn severity and the canopy is intact.

Values at risk were identified by five days of on-the-ground surveys, topographic maps, burned area severity maps and previous assessment reports from the Summit Fire. Approximately 93% of the land within the Summit Fire is private and residents were reluctant to permit access to their private property. Therefore, limited foot surveys were performed at the Summit Fire. Due to the relatively small,

unpopulated and undeveloped area of the Martin Fire, only one day of field survey work was needed to determine the values at risk.

Values at risk from the Summit and Martin fires are those which may be adversely affected by the excessive watershed response caused by the loss of vegetative soil cover. The determined values at risk from the Summit Fire included life, property and infrastructure. Values at risk from the Martin Fire were limited to infrastructure.

Residents in or below the Summit Fire area and are located in gulches or nearby streams are at risk of their lives and properties. The only three paved roads are at risk of flooding and structural failure. Subsequent rainfall and the pattern in which it is delivered will determine the amount of damage due to flooding, hyperconcentrated flows or debris torrents at any specific time. The Martin Fire is at low risk of one road being flooded.

It is crucial for local governments to inform the affected public that the danger due to the Summit Fire is not over. Maintenance on culverts and ditches along with further evaluation is recommended. An effort to stabilize the burned hill slopes and slow down the runoff will reduce the impacts that may occur. Proactive measures are recommended to help prevent or reduce the loss of lives and the amount of damage that can occur if a wet winter prevails.

C. Botanical, Aquatic, Wildlife and Fish, Terrestrial Wildlife

I. Resource Setting

The Martin Fire burn area occurs in the largest and most pristine remaining occurrences of several rare plant communities which are limited to ancient marine sand deposits in Santa Cruz County. Sensitive vegetation communities affected include Maritime Coast Range Ponderosa Pine Forest, Northern Interior Cypress Forest, and Northern Maritime Chaparral. Federal and state-listed plants have been directly impacted. Important drainages affected by the Martin Fire are Reggardio Creek and Laguna Creek.

The Summit Fire burn area includes largely Redwood Forest, Closed-Cone Coniferous Forest, and Mixed Chaparral. These vegetation communities occur on slopes that drain into Soquel Creek, Corralitos Creek, Browns Creek, and Uvas Creek. These drainages support federal-listed amphibians and salmonids.

II. Survey Methods

Field review and non-field research was conducted by a biologist from September 3 to September 9, 2008.

III. Findings of the On-the-Ground Survey

In the Martin Fire burn area, high and moderate intensity burns appeared to have burned and possibly killed a portion of the population of state and federal-listed endangered Santa Cruz cypress. The effects of the fire and suppression activities are currently unknown for the federal-listed endangered Ben Lomond spineflower, the state and federal-listed endangered Santa Cruz wallflower and federal-listed endangered Mount Hermon june beetle and Zayante band-winged grasshopper. A watercourse crossing in Reggardio Creek has been damaged by the fire. Fire effects on riparian habitat in Reggardio Creek could have local adverse impacts to federal-listed

threatened California red-legged frog and downstream effects to habitats of federal-listed threatened steelhead trout in Laguna Creek.

In the Summit Fire burn area, steelhead and rainbow trout and their habitats are at risk from fire, fire suppression activities and post-fire forest management practices. Moderate and high severity fires have burned understory and overstory vegetation on steep slopes directly above known salmonid summering habitat and upstream of salmonid spawning and wintering habitat.. Important watercourses affected include Ramsey Gulch, Shingle Mill Gulch, Rattlesnake Gulch, Diablo Gulch, Soquel Creek, Corralitos Creek, and Browns Creek. Dozer lines have cleared vegetation on steep slopes above resident rainbow trout habitat.

IV. Emergency Determination

In the Martin Fire and Summit Fire burn areas, sensitive native plant resources are at risk from being out-competed by invasive non-native plants that may establish and spread in soils disturbed by fire, fire-fighting, and fire suppression repair. Also at risk is the Bonny Doon Ecological Reserve if immediate action is not taken to secure the area with fencing to exclude trespass by unauthorized motorized vehicles. Bank and channel stability in Reggardio Creek are also at immediate risk if the damaged culvert in the Bonny Doon Ecological Reserve is not replaced prior to the first post-fire winter period.

Salmonid fisheries resources in Soquel Creek, Corralitos Creek, Browns Creek and Uvas Creek watersheds are at risk from sediment mobilization and delivery from steep burned, denuded slopes in these drainages.

V. Recommendations

Martin Fire Burn Area:

1. Immediate action should be taken to repair broken fencing to secure the Bonny Doon Ecological Reserve from disturbance by unauthorized motorized vehicles.

2. Immediate action should be taken to repair the damaged and failing culvert in Reggardio Creek located in the southern portion of the Bonny Doon Ecological Reserve. The culvert should be appropriately sized to pass sediment and woody debris in a 100-year storm.

3. Within the Bonny Doon Ecological Reserve, an invasive non-native plant monitoring (including mapping) and control program is recommended.

4. Existing seasonal roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

5. To minimize the spread of invasive non-native plants, equipment used for fire suppression repair or any other type of repair or management related operation should be hosed off before and after working within the burn area.

6. Seeding and mulching of disturbed areas for erosion control (i.e. fire suppression repair) on the Bonny Doon Ecological Reserve is not recommended without prior approval from the Department of Fish and Game.

7. Within the Bonny Doon Ecological Reserve, the removal of standing burned trees (e.g. hazard trees) and burned downed woody debris should first be evaluated by a qualified biologist, ecologist or botanist to determine if any biological resourses are at risk from tree removal. Consideration should be made to closing certain areas off to the public if they are considered unsafe.

8. The closure of the Bonny Doon Ecological Reserve to the public for an additional period of time to allow sufficient time for recovery of burned sensitive habitats and plants should be considered.

9. Post-fire research and monitoring on the survival and germination of sandhills habitat vegetation communities, including state- and federal-listed plants is recommended.

10. Appropriately-timed surveys for Mount Herman June beetle and Zayante band-winged grasshopper should be conducted.

Summit Fire Burn Area:

1. To control sediment delivery into watercourses, erosion control measures on disturbed and burned slopes draining into watercourses should be conducted where feasible. Erosion control measures recommended include the installation of straw wattles, rice straw or weed-free straw, biodegradable erosion control matting, and mulching with slash in forested areas. If seeding is preferred, the USDA Natural Resources Conservation Service and the Resource Conservation District of Santa Cruz County should be consulted for an appropriate stock and/or seed mix.

2. Existing seasonal roads or new roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

3. To maintain fisheries resources, burned trees within 50 feet of a stream that flows into a fish-bearing stream should be retained for future large woody debris recruitment and to decrease solar radiation of stream waters.

4. In burned forested areas, burned large old trees should be retained. These trees provide habitat for many species, reduce soil erosion, and aid soil formation in a post-fire environment (Karr et al. 2004, Beschta et al. 2004).

5. In burned forested areas, roads and skid tails should be monitored regularly throughout the winter period. Erosion control practices including water bars, applying rice straw or weed-free straw, and slash-packing should be considered.

6. In burned forested areas, invasive non-native plants should be monitored and controlled using hand removal techniques or other means.

7. Structures placed within streams to control sediment (e.g. sediment control basins, check dams, rip rap, artificially placed large wood etc...) are generally not recommended. A fisheries biologist or hydrogeomorphologist should be consulted before any in-stream work is conducted in fish-bearing streams or their tributaries.

8. Culverts in Soquel Creek, Corralitos Creek and Browns Creek watersheds should be monitored throughout the first several post-fire winter periods to ensure that culverts are kept open and sediment, and rocky and woody material pass through the culverts.

9. In-stream woody debris should not be removed unless there is a risk of imminent threat of damage to life and/or property.

10. Prior to work that would affect the bed, bank and/or channel of any stream, the Department of Fish and Game should be contacted and a notification should be made for a Lake and Streambed Alteration Agreement (www.dfg.ca.gov/habcon/1600/)

D. Water Quality

As a direct result of the fires and in anticipation of the associated stream systems accepting much higher than average amount of sedimentation and siltation during upcoming winter storms, cold / warm fresh water habitat, aquatic organism migration, and municipal drinking water supply are at an elevated risk of experiencing negative and potentially catastrophic impacts. Landowners and land-use managers should take all necessary and appropriate steps to stabilize soil, eliminate new soil disturbance projects, and monitor and maintain infrastructure (i.e. roads, road crossings, etc.).

Recommendations

Providing assistance for and implementing the following recommendations has the potential to minimize negative impacts to beneficial uses identified for the primary and secondary water bodies.

1. Projects that could potentially impact the nearby water bodies (i.e. construction, road maintenance, land-use practices, etc.), either already in progress, planned or in planning stages, in primary and secondary water bodies need to be revised to include components protective of values at risk due to severe modification to the landscape as a result of the fires.

2. The burn greatly reduced vegetative cover, particularly on those areas of moderate and high intensity severity, exposing dump sites throughout the burn area. The debris at these dump sites includes cans, bottles, derelict equipment, plastics, broken glass, metals, and other non-native debris. Due to the reduction of vegetation, materials associated with dump sites exposed by the fire are more prone to enter nearby water bodies. Since this is an additional threat to water quality as a direct result of the fire, the debris should be removed and property disposed of offsite. Additionally, removal of this debris will discourage additional dumping in exposed areas.

3. Recreational trespassing is a widespread problem throughout Santa Cruz County. Trespassing activities such as use of Off Highway Vehicles (OHVs) can damage current road infrastructure and cut new trails, severely altering drainage patterns leading to increased erosion. Considering the landscape's increased susceptibility to erosion in post-fire conditions, trespassing becomes an issue of specific importance. Private landowners and the Santa Cruz County Sheriff's office should work collaboratively to take appropriate steps to discourage and prevent illegal trespass activities.

4. The fires severely reduced the amount of preexisting vegetative cover. Vegetative cover is essential for reducing sediment movement via rainfall interception and root structure. Where appropriate and feasible, revegetation and soil stabilization techniques should be established. Revegetation efforts should be done in consultation with the local NRCS or other post-fire

restoration professionals and include components to eliminate the introduction of non-native invasive plant species that include the use of weed free straw and sterilized seed mixes.

5. Many home sites were destroyed by the Summit Fire. These home sites are either in active reconstruction or currently unmanaged. Reconstruction of the home sites should be implemented consistent with the requirements of the Central Coast Regional Water Quality Control Board's (Water Board) Construction General Permit and any applicable Santa Cruz County codes. The Water Board's permit can be viewed via the following link:

   http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

   Unmanaged home sites destroyed by the fire should be evaluated prior to the winter period to determine the most appropriate way to secure the perimeter and prevent associated materials (including household hazardous waste) from entering the nearby water bodies.

6. A majority, if not all, of the home sites discussed in the previous recommendation have onsite septic systems. Home sites in active reconstruction should install or reinstall septic systems per Santa Cruz County code, California Plumbing code, and Basin Plan requirements for septic systems. Unmanaged sites should be evaluated for abandoned septic systems. Abandoned septic systems have the potential to fail and adversely impact water quality. Such septic systems should be appropriately treated per Santa Cruz County code, California Plumbing code, and Basin Plan requirements to prevent fecal coliform and pathogen contamination of nearby water bodies.

7. Landowners and land-use managers with grading projects in primary or secondary water bodies should consult with the NRCS prior to project implementation to ensure the project is protective of water quality. Construction of new roads and other projects that require soil disturbance should be minimized.

8. Culverts located in primary and secondary water bodies have an increased risk for plugging due to the anticipated increase of sediment loads and debris during upcoming winter storms. Land owners and land use managers with culverts on their property should inspect their infrastructure prior to the rainy season to determine if the installation of "trash racks" is appropriate. Additionally, they should inspect and clean-out culverts during the winter after every significant storm event (two-inches of rain or greater within a twenty-four hour period or any the land use manager determinate appropriate) to prevent the potential for plugging and ultimately catastrophic failure of the crossing.

9. According to Jed Wilson , California Department of Forestry and Fire Protection Fire Captain, who participated in suppression activities on the Summit Fire, fire retardant was utilized as part of the suppression activities. The Pajaro River is listed on the Clean Water Act's 303(d) list as impaired for boron, a substance found in some fire retardants. Additionally, fire retardants have been found to be toxic to fish and other aquatic organisms. A focused evaluation of where fire retardant was dropped during suppression activities should be conducted to determine the risk to the beneficial uses of water. Appropriate follow-up activities should be implemented to minimize damage to beneficial uses.

Additional Recommendations not previously discussed.

Tree Removal

- Prior to tree cutting or removal, landowners should consult with a Registered Professional Forester (RPF) or CALFIRE to determine if a local or state Permit may be required. An RPF

or CALFIRE, in addition to advising on the potential need for a Permit, can advise the landowner on the health of trees, future mortality of the remaining trees because of the fires, potential hazard trees, and future fire potential, to name a few issues which may be of concern to the landowner. An RPF or CALFIRE can provide possible mitigations designed to minimize or prevent erosion that may result from potential tree removal, and provide assistance in advising of local, state, or federal agencies or other Professionals who may also be able to provide assistance.

Cultural Resources

- Prior to implementing any treatments previously recommended that involves the use of heavy equipment (e.g. "bulldozer") or can otherwise significantly alter the landscape, the landowner should consult with a Professional Archeologist to determine if known or unknown cultural resource sites will be adversely impacted.

Summary

The fire and the resultant impact to the processes previously discussed in this report has resulted in an increased risk for storm events to result in flooding, debris torrents, and debris flows. As storm intensity or duration rises, there will be a simultaneous elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows. These events could result in the loss of human life and property. All values at risk identified could be adversely affected.

LIST OF APPENDICES

A. Geology Technical Specialist Report
B. Hydrology Technical Specialist Report
C. Biology/Botany/Fisheries Technical Specialist Report
D. Water Quality Technical Specialist Report
E. General Location Map - Figure Appx E-1
F. Burn Severity Maps
    Figure Appx F-2 - Summit Fire
    Figure Appx F-3 - Martin Fire
G. Geologic Maps
    Figure Appx G-4 - Summit Fire
    Figure Appx G-5 - Martin Fire
H. Burn Site Evaluation - Risk to Lives and Property Maps
    Figure Appx H-6 - Index Map
    Figure Appx H-7 - Summit Fire - Risk to Lives Area 1
    Figure Appx H-8 - Summit Fire - Risk to Lives Area 2
    Figure Appx H-9 - Summit Fire - Risk to Lives Area 3
    Figure Appx H-10 - Summit Fire - Risk to Lives Area 4
    Figure Appx H-11 - Summit Fire - Risk to Lives Area 5
    Figure Appx H-12 - Summit Fire - Risk to Property Area 1
    Figure Appx H-13 - Summit Fire - Risk to Property Area 2
    Figure Appx H-14 - Summit Fire - Risk to Property Area 3
    Figure Appx H-15 - Summit Fire - Risk to Property Area 4
    Figure Appx H-16 - Summit Fire - Risk to Property Area 5
I. Watershed Maps
    Figure Appx I-17 - Summit Fire
    Figure Appx I-18 - Martin Fire
J. California Precipitation Map - Figure Appx J-19
K. Ownership - Table 1
L. Soil Burn Severity
    Table 2 - Burn Severity by Fire
    Table 3 - Burn Severity by Fire and Watershed
M. Burn Site Evaluation Summary Table - Table 4
N. FEMA Flood Insurance Rate Maps Table - Table 5

Appendix A
Geology Technical Specialist Report

DRAFT TECHNICAL SPECIALTIST'S REPORT

STATE EMERGENCY ASSESSMENT TEAM (SEAT) Report

Resource: Geology

Fire Name: Summit Fire CA-CZU-005238, and Martin Fire CA-SCU-002548
May/June, 2008

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I. Resource Condition Assessment

A. Resource Setting

Summit Fire

The Summit Fire burned approximately 4,189 acres within the Coast Ranges geomorphic province along the Santa Cruz – Santa Clara county boundary. Bedrock geology within most of the burn area (northeast of the San Andreas fault) consists of marine sandstone, shale and mudstone units with minor fault-bounded altered intrusive diabase, basalt and gabbro; southwest of the fault rift the bedrock consists of sandstone and mudstone units (McLaughlin, et al, 2001). Portions of the fault rift are covered with older and younger alluvium (McLaughlin, et al, 2001). Soils, derived from these geologic parent materials, are primarily sandy loam (SM) with variable amounts of rock fragments and are susceptible to erosion where disturbed or subjected to concentrated runoff flows (Bowman and Estrada, 1980). Deep-seated and shallow-seated landslides, debris flows and stream bank erosion commonly occur within the Summit Fire burn area (Cooper-Clark, 1975; McLaughlin, et al, 2001,). Landslides, whether active or inactive, may be adversely affected as a consequence of the fire removing the tree and chaparral canopy and the loss of the reinforcing effect of roots. Description of the geologic units within the Summit Fire area is included in the legend to the Geologic Map of the Summit Fire Area (Figure Appx F-2).

Topography within the burn area ranges from gentle to very steep, with elevations ranging from approximately 2800 feet above mean sea level along Summit Ridge to approximately 550 feet at the mouth of Ramsey Gulch in the southeast corner of the burn area. Summit Ridge is a prominent northwest trending mountain separating Santa Cruz and Santa Clara Counties. The ridge top itself is gentle to moderately sloping and contains several large flats. The side slopes on the southwest are very steep, extending 1000 to 1400 feet down to the linear trough of the San Andreas fault zone at the base of the slope. Slopes on the northeast side are also very steep and extend approximately 1600 feet down into Uvas Creek canyon. The ridge flanks are deeply incised by numerous small to medium-sized, steep gradient watercourses. The San Andreas fault trough contains very irregular topography including sag ponds, small hillocks, wide flats and short pitches of very steep slope.

The majority of the fire burned along the ridge top and down the steep southwestern flank into the San Andreas fault trough, an area containing the headwaters of Soquel Creek, Corralitos Creek, and Browns Creek. Two small tongues of the fire burned about a half mile or so from the ridge top

down into the headwaters of Swanson Canyon, Alec Canyon, and Croy Creek, on the northeast flank of the mountain. All three creeks drain into Uvas Creek.

Soquel Creek flows northwesterly along the San Andreas fault zone for a couple miles downstream from the fire area before turning southwest to flow through mountainous terrain out onto the coastal plain near the town of Soquel and eventually to the ocean at the town of Capitola. Corralitos and Browns Creeks both flow out of the San Andreas fault zone, through steep-sided canyons down to gentler topography which begins a short distance upstream from the town of Corralitos. The two steams merge and flow through Corralitos and eventually reach the Pajaro River near the town of Watsonville. Uvas Creek flows northeasterly into Uvas Reservoir several miles downstream from the fire area, and eventually into the Parajo River, which in turn flows into the ocean near Watsonville.

Martin Fire

The Martin Fire burn area covers approximately 483 acres on the gently sloping ridgetop of Ben Lomond Mountain near the community of Bonny Doon in Santa Cruz County. The majority of the burn area is within the Boony Doon Ecological Reserve administered by California Dept of Fish and Game. Published geologic mapping indicates the burn area is underlain by bedrock consisting of metasedimentary rocks of Mesozoic and Paleozoic age, mainly pelitic schist and quartzite. The younger Santa Margarita Sandstone of upper Miocene age overlies the bedrock in the northwestern half of the burn area. Soils developed on the portion of the site underlain by Santa Margarita Sandstone consist of silty fine to medium grained sand, similar to beach sand, which is highly erodible on moderate to steep slopes. Soils developed on the metamorphic bedrock is appeared to be a clay loam to silt loam, based on field observations, and appeared to be much less erodible than the sandy soil that covers much of the site. Description of the geologic units within the Martin Fire area is included in the legend to the Geologic Map of the Martin Fire Area (Figure Appx G-3).

The topography of the burn area is nearly flat, with steep inner gorge slopes of Laguna Creek along the eastern boundary of the burn, and with the moderately incised headwaters of Reggiardo Creek located in the southwest portion of the burn.

B. Survey Methods

Summit Fire

Field reconnaissance was conducted between September 4 and 11, 2008 on the assessment area for the Summit Fire, which included the burn area and downstream portions of the streams whose headwater areas were burned. Observations were made from vehicles along roads within the assessment area, and by foot along streams and across hillsides in selected portions of the assessment area. The purpose of the field reconnaissance was to identify areas of high value that were at potential risk due to the effects of the fire. High value areas are defined as locations that are at risk for possible loss of life and property due to in-channel floods, hyperconcentrated floods, debris torrents, debris flows, slope-generated landslides, rock fall, and associated slope movement. Areas that contained houses, RVs used as dwellings, parks, campgrounds, and critical infrastructure received the greatest attention.

The majority of the burn assessment area is private property. Accessible residences were evaluated in the field. However numerous residences in the assessment area cannot be seen from public roads and/or lie behind locked gates and were not accessible due to the reluctance of many residents to permit access to their property. A limited number of foot surveys were performed where possible. Information gathered in earlier damage assessment surveys of the Summit Fire area by CALFIRE,

California Geological Survey (CGS), and other public agencies was used to assist in determining the potential risk for some of the areas where access was restricted during our field reconnaissance (CALFIRE, 2008; CGS, 2008a, CGS, 2008b). Other Information used to assess burn area conditions came from oblique aerial photographs taken from helicopter overflights flown after the fire, from Burn Intensity maps developed during our field work time period, and BARC (Burned Area Reflectance Classification) maps derived from satellite imagery of post-fire vegetation condition.

Martin Fire

Field reconnaissance was conducted on September 4th and 8th, 2008 on the Martin Fire area. Much of the burn perimeter accessible by vehicle was driven and much of the interior of the fire was assessed via foot inspection.

II. Findings of the On-The-Ground Survey

A. General Observations

Summit Fire

The principal concern within the Summit Fire burn, and along streams draining the burn area, is an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows (commonly called mud flows or mud slides). The primary mechanisms for this are:

- Increases in runoff resulting from the loss of live vegetation,
- Reductions in infiltration due to the removal of duff and the dehydration of the soil,
- Development of hydrophobic soils,
- The simplification of surficial runoff patterns, and
- The loss of mechanical support of hillslope materials that was provided by vegetation and vegetative litter along stream channels.

Where fires burn hot, such as in the headwater portions of the Soquel and Corralitos watersheds, and to a lesser extent in the Browns Creek watershed, the reduction in rainfall interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces. Hydrophobic soils were found to have developed in much of the High and Moderate Burn Intensity areas. Hydrophobic soils also developed in a portion of the headwaters of Swanson Canyon, which drains through Uvas Canyon County Park into Uvas Creek. Dry ravel was also observed on some of the steep slopes within the burned headwaters of these streams. Dry ravel is the downslope mobilization of loose bedrock, soils, and other debris that had accumulated in wedges on the upslope side of vegetation, downed logs and branches that were consumed by the fire. Much loose material has been released to move downslope as dry ravel. Loose deposits of burned mineral soil and ash several inches to over a foot thick were observed in many of the hotly burned areas.

During heavy rains the dry ravel deposits and other loose material may become mobilized by overland flow, be concentrated in swales and watercourses, and transform into sediment laden masses that flow downstream as debris flows and debris torrents. These debris flows and debris torrents may occur in isolated small swales and water courses and travel only short distances as relatively small volume masses, or numerous smaller streams may join together into larger channels and travel much longer distances as large volume debris flows. The steep-gradient smaller unnamed watercourses in the burn area, and the steep upper portions of the larger watercourses, such as

Maymen Creek, upper Soquel Creek, upper Diablo Gulch, Rattlesnake Gulch, Ramsey Gulch, and Swanson Canyon in and downstream from the burn area could potentially be affected by these debris flows and hyperconcentrated flood flows. The magnitude of post-fire damage will ultimately be determined by the intensity and duration of storms that impact the burn area, particularly during the winter of 2008-09.

Values at Risk

1) Very High Risk Dwellings and Campsites

There are several residences (houses and "permanent" Recreational Vehicle locations) and part of a campground that are at very high risk of being impacted by hyperconcentrated floods, debris flows or debris torrents, even during light to moderate rains. Most of these residences and the campgrounds are located in or adjacent to a watercourse channel, often one with old debris flow deposits visible nearby in the channel. The watershed upstream is usually large, with steep intensely burned slopes, with little remaining vegetation or ground cover. Runoff from the upslope area can be quick, extreme, and capable of carrying the loose ash and soil off the slopes into watercourse channels. Another house in this very high risk category is located on the toe slope of a high steep severely burned hillside. The area has experienced debris slides in the past, and a large amount of debris has moved downslope to form a debris apron at the toe of the slope. Debris slides and rock falls have a high likelihood of occurring again this winter during even in a moderate rainstorm. Each of these locations was visited either during our field assessment or as part of an earlier field assessment. ***These locations are the highest priority of all the locations in the high risk category that require the use of early warning systems, development of evacuation plans, and other mitigations.*** The landowner should consider additional detailed study by an Engineering Geologist to determine the precise risk level and possible mitigations. However, based on the observed conditions, it is unlikely the risk level would be reduced. These locations are described in the Specific Observations #1, #2, #3, #9, and #10.

2). Other High Risk Residences and Hiking Trails

Numerous residences (houses and RVs) and a popular hiking trail in Uvas Canyon County Park (Santa Clara County) are potentially at high risk of being impacted by hyperconcentrated floods, debris flows or debris torrents, due to their location, but the likelihood of their being impacted is somewhat less than the preceding Very High Risk category. It appears that during light rains these locations may not be impacted, but during moderate to large/intense storm events these locations could be impacted every bit as severely as the Very High Risk locations. Part of the uncertainty about the level of risk and the likely hood of the hazard occurring for specific locations is due to the reconnaissance nature of this assessment. More detailed study by an Engineering Geologist would help determine the site specific risk level and mitigations for each site. Additional study could determine that some locations are not at high risk, or it could identify additional mitigations to reduce impacts on a site specific basis. Some residences in this category were not visited during our assessment due to access problems, but based on previous assessment surveys (CALFIRE, 2008; California Geological Survey, 2008b) they appeared to possibly be in a high risk location. Locations in this category are described in Specific Observations #4, #5, #6, #7, #8, and #11.

3). Residences (houses and RVs) and drainage structures (culverts and bridges) located along larger watercourses downstream from the burn area.

Locations on Corralitos Creek down to the confluence with Browns Creek, locations on Shingle Mill Gulch creek, and locations on Browns Creek from Ramsey Gulch to the confluence with Corralitos

Creek are at elevated risk of flooding due to conditions in the burn area. Structures close to the top of the channel bank, or less than 15 feet in elevation above the streambed are at highest risk of being impacted by flooding. Locations in this category are described in Specific Observations #12.

4.) Eureka Canyon Road and Highland Way in or adjacent to the burn area.

The roads in and adjacent to burn area that are located at the base of steep burned hill slopes are at greatly increased risk of having culverts and other drainage structures plugged or damaged by hyperconcentrated flows, debris flows, debris torrents, and floods. The roadway itself may be buried with debris at crossings if the culverts become plugged, and at locations between crossings by debris sliding down from slopes above the road.

Eureka Canyon Road from Grizzly Flat to Ormsby Cutoff, and Highland Way from Ormsby Cutoff to Camp Loma are subject to these hazards due to the fire. These roads provide the only paved access to and from residences in much of the fire area. Highland Way, a few miles west of Camp Loma, is closed due to a landslide. Ormsby Cutoff is only paved a short distance and the unpaved (dirt) section up to Summit Road travels through burnt terrain. If the unpaved section of Ormsby Cutoff is impacted by flooding or debris flows it may be very difficult to access this road during the winter. Eureka Canyon and Highland Way may provide the only emergency access for numerous residences located along the two roads, and therefore it is important to life and safety that the roads remain open during winter as much as possible.

5.) Water Supply and Watercourse Habitat Conditions.

Water supply and watercourse habitat conditions downstream from the burn area may be at risk from sedimentation. On the Santa Clara side of Summit Ridge, potentially affected areas include Uvas Creek and Uvas Canyon County Park, Sveadal community along Alec Canyon creek, properties along Croy Creek, and potentially Uvas Reservoir, which provides water for the Santa Clara County Water District. On the Santa Cruz side of Summit Ridge potentially affected areas include individual water supplies to properties in and adjacent to the burn area, Corralitos and Browns Creeks, and City of Watsonville water supply intakes on Corralitos and Browns Creeks.

Given that a significant portion of the watershed has been burned in the steep headwaters of these streams, the sediment load in all these creeks may be significantly elevated above pre-fire levels.

Uvas Reservoir is approximately 6 miles downstream from Uvas Canyon County Park. The headwaters of Uvas Creek are approximately 3 miles upstream of the County Park, and were unaffected by the Summit Fire. Three watercourses that were affected to some degree by the Summit Fire flow into Uvas Creek - Swanson Canyon creek which joins Uvas Creek at the County Park, Alec Canyon creek which joins Uvas Creek ½ mile below the County Park in the community of Sveadal, and Croy Creek which joins uvas Creek 1 ½ miles below the County Park.

Based on the amount of high intensity burn on some of the steep slopes in the headwaters of Swanson Canyon creek, there could be significantly increased sediment loads carried down Swanson Canyon in the form of hyperconcentrated flows and debris flows during the 2008-2009 rainy season.

A very small amount of the Alec Creek watershed was burned in the fire, but there were a number of dozer fire lines cleared in the watershed during fire suppression activities. It is our understanding that CALFIRE applied erosion control treatments to the fire lines during post fire suppression repair efforts. It is our understanding that Santa Clara County Parks Department is planning to do additional erosion control work on the dozer fire lines this fall to minimize sediment delivery to the Park via Alec Canyon as well as via Swanson Canyon. Based on the percentage of watershed

burned and disturbed, and the planned erosion control work, the increase in sediment delivery to Uvas Creek from Alec Canyon is expected to be relatively small.

Numerous dozer fires lines were cleared in the Croy Creek watershed and post-fire erosion control treatments were installed on the fire lines by CALFIRE. To our knowledge, no additional erosion control work is planned in this watershed. During our field assessment we observed one recently opened dirt road located to the east of the burn area in the vicinity of Lands End on Summit Mountain which appears to be receiving use by 4-wheel drive vehicles. The road use has degraded and compromised waterbars so that they will probably not be functional this coming rainy season. It appears that follow-up erosion control work should be done to upgrade the waterbars, and that the road should be closed to vehicle traffic in some fashion prior to start of the rainy season. Based on the relatively light to moderate burn intensities in the portion of the watershed that burned, relatively small increases in sediment load are expected in Croy Creek. The increases should be considerably less than the sediment load increases experienced after the Croy Fire of 2002. The Croy Fire burned about half the Croy Creek watershed, and a large area on the north side of Uvas Creek as well. It is expected that the increases in sediment delivery to Uvas Reservoir will be noticeable, but not significant. The increases should be much less that those experienced following the Croy Fire.

The dwellings and facilities in the high-risk locations described above are discussed in more detail in Specific Observations section, below. Because most of the areas discussed above are likely to be inhabited year-round, we believe these areas constitute a *high risk to life that requires immediate action.* We believe that inaction may and can lead to the loss of life in these areas. The magnitude of post-fire damage will be determined by the intensity and duration of storms that impact the area.

Martin Fire

Portions of the area burned hot on the gentle slopes, but the rest of the area had moderate to light burn. Most of the steep slopes leading down to Laguna Creek were not burned at all. However, where it had burned down into the inner gorge, the canopy was left unburned, but much of duff layer had burned. Scorched tan oak leaves had dropped onto the ground so that by the time of our site assessment approximately 80-90% or the ground surface had been covered with leaves.

B. Specific Observations (keyed to Figures Appx H-7 through Appx H-16).

Summit Fire

Houses and other high-value sites within and down stream from burned areas were assessed as well as access permitted, to evaluate potential risks from debris flow, rock fall, floods, and other geologic hazards. Structures (houses, campgrounds, recreational vehicle dwellings) and infrastructure (primarily roads, culverts, and bridges) within or downstream of large watersheds appear to be in positions where they may be affected by significant in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. At risk sites, some with multiple homes, that were identified as having potential risks to lives or property are listed and briefly described below and summarized in Appendix M Burn Site Evaluation Summary Table). The locations of the sites are shown on Figures Appx H-7 through Appx H-16. The Site numbers referenced below are those provided on the SEAT Team Burn Evaluation Summary – Resource Specialty Geologist and Hydrologist (Table 4, Appendix M).

1) Camp Loma, Site numbers: 115 and 116. Future Farmers of America Camp, located along Soquel Creek and Highland Way.

Debris torrents, hyperconcentrated flows, and flood flows are likely to come down all the steep tributary watercourses of Soquel Creek in the burn area. The tent camping area located on the north side of Highland Way is adjacent to a tributary watercourse that forms the western boundary of the burn area. Debris flows could come through the tent camping area. If the debris flows are large enough they could reach the camp caretakers house located between Highland Way and the main stem of Soquel Creek. The house is at high risk of being impacted by flood flows and possibly hyperconcentrated flows coming down Soquel Creek. Other camp buildings on the south side of Soquel Creek could also be impacted by flood flows. During storm periods it is likely that Highland Way to the east of the camp will be blocked by debris coming down the numerous steep watercourses draining the burn area. The only other evacuation route out of the camp is Highland Way to the west but a large landslide currently blocks that. Camp and caretaker's house should not be occupied during storm periods.

House. Site number 2.

This house is located on long driveway behind locked gate that goes north off Highland Way approximately ¼ mile east of Camp Loma. The house is located in a draw that is at very high risk of being impacted by flood, hyperconcentrated flow, and debris torrent. Evacuation route via Highland Way to the east will likely be impassible during storms. The house should not be occupied during storm periods.

2) House and RV pads. Sites numbers 9, 10a, and 10b.

These sites are located along dirt driveway behind locked gate that goes north from Highland Way at hairpin turn approximately ¾ mile east of Camp Loma. One RV was apparently burnt and removed, but pad is located close to large watercourse that is at high risk of impacts from large debris flows during storm events. House is located approximately 40 feet in elevation above channel bottom so should be out of hazard area from debris flows and floods. Another group of RV pads is shown on maps (CALFIRE 2008) to be located a short distance up the draw past the house. We were not able to access that location during our field assessment. If any of the RVs are located close to the watercourse channel they are at high risk of being impacted by flooding and debris flows. All residents in this area are likely to be stranded during storm events since the only evacuation route, Highland Way to the east, is very likely to be blocked by debris coming down from the burn area. Any RV pad located close to the watercourse channel should not be occupied during storm events.

3) Two houses. Site number 50.

Maps (CALFIRE 2008) show the homes located in or close to a large watercourse (the upper part of Soquel Creek) approximately 1/8 mile east of the hairpin turn on Highland Way (MP 0.42). The CALFIRE maps indicate the houses were burnt, and that the site is reached by a dirt driveway off Ormsby Trail. We were not able to access the site during our field assessment. The watercourse channel is at high risk of being impacted by floods, hyperconcentrated floods, and debris flows. If the house sites are close to the watercourse channel they should not be occupied during storm periods. Any residents living off of Ormsby Trail should not count on being able to use either Highland Way to the west or Eureka Canyon Road to the east during storm periods, because of the high potential for these roads being blocked by debris. Evacuation routes would likely have to be accessed by going up Ormsby Trail to Summit Road.

4) House. Site number 23.

This house is located just downslope from Eureka Canyon Road at a point approximately 300 feet west of the culvert at MP 7.58. The back of the house sits very close to the toe of the steep fill slope of Eureka Canyon Road. If debris flows coming down from the steep burned area above Eureka Canyon Road are diverted down the road, they could break through the low berm along the road shoulder and cascade down the steep fill slope into the back of the house. The risk of a debris flow occurring during a storm, coming down to the road, and being diverted along the roadway is high. The risk of the debris flow breaking through the road berm directly upslope from the house appears to be moderate to low. However, if it did break through the road berm above the house, it is highly likely that there would be severe impacts to the house, and the risk of injury or death for anyone who happened to be in the back part of the house at that time would be high. The risk to the house should be evaluated in more detail by an Engineering Geologist, and any recommendations coming from the additional study should be implemented. In the meantime in the absence of additional study it is recommended that the house not be occupied during storm periods

5) Multiple house site containing approximately 15 dwellings. Site number 28.

These are located on Upper Highland Road, accessed via a driveway going downslope from Eureka Canyon Road at a point approximately ¼ mile west of the Diablo Gulch culvert crossing. The slopes above Eureka Canyon Road extending for approximately ¼ mile along the roadway contain numerous small V-shaped linear gullies or ephemeral watercourse channels that appear to be old debris torrent chutes. The topographic maps shows the slope to be rather short and planar with no significant watercourses draining onto it. This is good from the standpoint of lessening the risk of large debris flows developing on the slope, however there is evidence that there have been numerous small debris torrents coming down this slope face in the recent past. Several apparent small debris flow deposits were observed on the slope above Eureka Canyon Road, and at least one probable deposit was observed on the slope below Eureka Canyon Road in the area of the houses. It is likely that the slope will experience some debris flows as a result of the fire. The size and number of debris flows will depend on the severity of storms that occur. Small debris flows may come down to Eureka Canyon Road and be diverted down the road some distance, perhaps all the way to the Diablo Gulch crossing. However, some larger flows appear to have the potential to go across the road and down the slope into the housing community. Once a flow enters the community the specific path it might follow will depend on several variables, so it is difficult to predict which houses (if any) might be impacted by such a debris flow. But if a house were to be impacted by a debris flow it could be severely damaged, and the people inside could be injured or even possibly killed. Anecdotal reports indicate that a log retaining wall on the upper portion of the north bank of Diablo Gulch, which helps support a house on top of the bank, is rotten. Additional study by an Engineering Geologist would help to determine the level of risk of being impacted by a debris flow and other hazards, on a site-specific basis. In the absence of such additional study, residents should be informed of the possibility of a dangerous debris flow impacting their houses, and early warning of approaching storms and evacuation should be made available for those who want it.

6) House. Site number 31.

The house is located along the east side of Diablo Gulch channel, just below the crossing on Eureka Canyon Road. The house is located on a terrace well back from the channel, however sheds and playground equipment are located closer to the channel. Very large boulders are abundant in the stream channel above Eureka Canyon Road and adjacent to the house. It appears that the channel has experience some very large debris torrents in the past. Much of the watershed above the house burned with moderate to high intensity, and numerous steep gradient tributary channels feed into the main watercourse channel. It appears that a small to moderate sized debris flow would likely not impact the house, although it might impact structures closer to the channel. It also appears that a large debris torrent may impact the house. In either case people could be at risk of bodily harm if

they were "in the wrong place" on the property at the time of the debris flow. An engineering geologist should do a more detailed study to better define the level of risk for the property. Recommendations from the study should be implemented. In the meantime the house and property should not be occupied during storm periods.

7) Multiple house site containing approximately 5 dwellings. Site number 51.

The site is near a large flat located on the northeast side of Eureka Canyon Road, approximately ¼ mile east of the Diablo Gulch crossing. The houses are situated along the base of a very steep, high concave slope. It appears that debris slides have been a common occurrence for a long time at this location, and that repeated slides have built up a debris apron along the base of the slope. The houses are situated at various places on the debris apron. The slope above has burned at moderate to high intensity, leaving a bare rocky face. It is anticipated that debris slides, rock fall, and debris torrents could impact the area the houses are built on. The houses are part of a religious retreat, and it is our understanding that the houses are not continuously occupied, but are used by various people for various lengths of time. Additional study by an Engineering Geologist would help to identify the risk and appropriate mitigations for each house on a site-specific basis. In the absence of such a study, the residents of each house should be warned of potentially life threatening conditions that have been created by the fire. A method for early warning of approaching storms, and for timely evacuation of the houses should be instituted. The houses should not be occupied during storm periods unless an engineering geologist has determined that it is safe to do so.

8) House. Site number 32.

This house is at the same location as described in item 8, above. It is the last house at the end of the dirt road leading diagonally upslope from the flat. The house sits near the bank of a watercourse that has high potential for debris torrents and hyperconcentrated flows. The house also is at high risk from debris slide coming from directly upslope. This house should not be occupied during storm periods, and adequate early warning of impending storms should be provided to allow adequate time to vacate the house.

9) House. Site number 52.

This house is located on commercial timberland along a steep tributary watercourse to Ramsey Gulch. The site was not visited during our field assessment. It was brought to our attention by a CGS engineering geologist who did a review of the property as part of a timberland review project (California Geological Survey, 2008a). The house is at high risk of impact due to debris flows, flooding, hyperconcentrated flows from the burned slopes above the site. The house should not be occupied during storm periods, and adequate early warning of impending storms should be provided to allow adequate time to vacate the house.

10) Campground trail. Site number 300.

The Uvas Canyon County Campground is located at the confluence of Swanson Canyon watercourse with Uvas Creek. Most of the campground facilities are situated on higher ground above the deeply incised inner gorge channels of both watercourses. Numerous hiking trails extend upslope from the campground. There are seasonal waterfalls on the three headwater branches of the creek which are reached by trails. Waterfall Loop trail goes along the main channel up to provide access to the other trails to the individual waterfall locations. Reportedly the greatest attraction for visitors is to walk along the waterfall loop trail next to the creek to go see the falls when they are flowing at their highest, which is during and a short time after large storm events. Because of the areas of high and medium intensity burns on steep headwater slopes of Swanson Canyon, there is high potential for hyperconcentrated flows, debris flows, and debris torrents along the channel coming all the way

down to the campground area. The most likely time for these floods and debris flows to occur would be during and shortly after heavy rainfall events – the same time as there would likely be the most visitors at the park on trails close to the watercourse channels. Other portions of the campground have reportedly been impacted by flooding in the early 1980s, but the risk to these areas appears to be considerably lower than to the trails down along the stream channels. The trails close to the watercourse channels should be closed to use during periods of time when the risk of injury or possibly death is high, which is during rainfall events and for at least 24 hours after rainfall has ceased. The trail closures should be in effect for at least the first rainfall season (October 2008 thru May 2009). An Engineering geologist should do additional study to better determine the areas at risk, the risk levels, and the length of time that risk will be elevated due to fire effects.

11) Downstream dwellings and infrastructure including RV/tent sites (No Site Number).

Dwellings, drainage structures (culverts and bridges) and other structures downstream from the immediate vicinity of the burn area including Corralitos Creek down to the confluence with Browns Creek, Shingle Mill Gulch creek, and Browns Creek down to the confluence with Corralitos Creek are at increased risk from increased flows and flooding. The potentially affected roads along these watercourse segments are Eureka Canyon Road from Grizzly Flat to approximately Geronimo Way , Lower Highland Road, and Browns Creek Road from the crossing of Ramsey Gulch to approximately Via del Sol road. These areas are at increased risk from floods due to changed conditions upstream in the burn area. During our field reconnaissance in these areas we observed many dwellings that were situated well back from the stream bank, and well above the stream bed out of harms way, however, some dwellings were close to the stream bank and/or were less than 15 feet in elevation above the adjacent stream bed. These could be impacted by flooding. Also driveways that cross the streams over bridges, culverts, and foot bridges are at increased risk of being washed out. If this were to occur some residents would loose access to and from their dwellings for an unknown period of time.

Martin Fire

A segment of upper Reggiardo Creek approximately 300 feet long within the burn area is moderately incised, with steep (60%) side slopes. In this particular area much of the riparian vegetation on the banks has been burned off, and the side slopes, which are composed, mostly of sand appear to be at moderate risk of eroding into the channel during rainstorms this winter. Sediment input to the creek in this segment will undoubtedly be increased due to the fire. However, just down stream of this segment the stream becomes less incised and side slopes are gentler, and more vegetation has been left unburned. In terms of sedimentation in Reggiardo Creek downstream from the burn area, based on the relatively small percentage of the watershed burned, and the predominantly gentle slopes in the burned area, it appears that impacts from increased sedimentation should be low.

Due to the low percentage of watershed burned in the Laguna creek drainage, and the predominantly gentle slopes that were burned, it appears that impacts from downstream sedimentation will be minimal.

III. Emergency Determination

Summit Fire

The values at risk considered in this assessment include the possible loss of life and property due to landsliding, debris flow, rock fall, debris torrents, and hyperconcentrated flooding from increased surface water runoff. In general, the risk from landslides, debris flows and rock falls are possible where roads, residences or other development are located within and/or adjacent to canyon stream channels or on alluvial fans, colluvial footslopes and debris flow deposits. It should be noted that these hazards are part of the natural processes in this environment, and that these risks were present under pre-fire conditions. Many existing structures in the burn area and downstream of the burn area have been, and will continue to be at risk from these hazards.

The potential for these processes to be exacerbated by fire is primarily dependent upon burn severity and slope steepness, both of which are highly variable in the Summit Fire area. In general, where the burn severity is moderate to high and the slopes are steep, the potential for increased hazard is greatest. The potential for increased hazard from flooding is also present downstream along watercourses that experienced high and moderate burn severity in their headwaters.

In most cases the severity of the risk to life and property is closely dependent on what kind of weather the area receives. If rainfall events are small to moderate this first rainy season, most of the high-risk sites will likely not be severely impacted. However, there are a few locations that appear to be at such high risk that even small to moderate rainfall events could cause severe impacts. If the rainfall events are large and/or intense then many if not most of the sites identified in this assessment as being at high risk could experience severe impacts that could threaten life and property. With this in mind, and using the philosophy of wanting to err on the side of safety, the recommendations below have been formulated. Many of the locations identified have a ***high risk to life that requires immediate action.*** Additional study of site specific conditions by proper specialists (Engineering Geologists, Professional Engineers, etc) could better clarify the level of risk and develop appropriate mitigations on a site-specific basis.

Martin Fire

Based on field assessment, there are no significant risks to life or property from this fire.

IV. General Recommendations:

1. Residents in potentially affected areas should be informed of potential life-threatening hazards this rainy season. They should be informed which areas are at potentially high risk of being impacted by these hazards. Some suggested methods include conducting community information meetings, posting information at commonly visited locations such as Corralitos market in Corralitos, and at other stores, fire stations, schools, and libraries in the area. The information should also be posted on the County OES web site.

2. Residents should be given advanced warning of approaching storms, to allow adequate time to prepare their property for potential impacts, and to allow time to evacuate if necessary. The appropriate County entities (OES, Flood Control, Sheriff, etc) should develop a plan for an early warning system (for example reverse 911 phone calls, or house to house visits by the County Sheriff, Fire Department, or other County Agency).

3. An evacuation plan should be developed by the appropriate local agencies (OES, Flood Control, Sheriff) if one does not already exist, and information shared with residents.

4. Additional study of the high risk locations by the appropriate discipline (Certified Engineering Geologist or Professional Engineer), should be done to better determine the risk level on a site specific basis and to determine more site specific mitigation measures which could be used to reduce the level of potential impact.

5. *All* structures intended to control the flow and direction of water (e.g. waterbars, rolling dips, inside ditches, relief culverts, berms, etc), should be inspected prior to the onset of rain to insure they are clean and functioning properly.

6. Highland Way, Eureka Canyon Road, and Browns Creek Road in the fire area, and for several miles downstream should receive frequent maintenance of drainage structures, and monitoring of conditions (during storms if possible), to keep these vital evacuation routes open.

7. See SEAT Hydrology Technical Report for additional specific recommendations for culverts, bridges, and road maintenance.

Martin Fire

No recommendations.

Specific Recommendations

Summit Fire

8. The residences/locations described in Specific Observations section above, in items 1,2,3,9,and 10 are at the very highest risk, and the residents of these dwellings should be highest priority for early warning and evacuation by the appropriate local entity. These dwellings should absolutely not be occupied during rainstorms this rain season (Oct 2008 – May 2009) unless a Certified

Engineering Geologist or Professional Engineer has performed a thorough and detailed evaluation and has determined the dwelling is not at risk.

9. The residences/locations described in the Specific Observations section above in items 4,5,6,7,8, 11 and 12 are also at potentially high risk of impacts to life and property. It is extremely important to provide adequate information for people to understand the danger they could be in during rainstorms this coming rainy season. The appropriate local entity should develop an early warning system and evacuation plans to allow residents to evacuate well in advance of any storm.

Martin Fire

No recommendations.

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Appendix B
Hydrology Technical Specialist Report

DRAFT TECHNICAL SPECIALIST'S REPORT
State Emergency Assessment Team

Resource: Hydrology

Fire Name: Summit Fire SCU-002548
Martin Fire CZU-005238
May/June 2008

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Resource Condition Assessment

I. Resource Setting

A. Setting

The Summit and Martin fires of 2008 burned approximately 4,189 and 483 acres, respectively. The majority of the Summit Fire was within Santa Cruz County, though portions of this fire crossed over into Santa Clara County. The Martin Fire was completely within Santa Cruz County.

All the areas burned by the Summit Fire drain into four watersheds: Corralitos Creek, Browns Creek, Soquel Creek and Uvas Creek watersheds. Three main gulches within the Summit Fire burn perimeter drain into Corralitos Creek: Diablo Gulch, Shingle Mill Gulch and Rattlesnake Gulch. Only Ramsey Gulch drains into Browns Creek. Corralitos Creek and Browns Creek watersheds combine just above the town of Corralitos. Corralitos Creek continues to meander south where it drains into Salsipuedes Creek and then into the Pajaro River near the town of Watsonville. There are three main drainages in the Summit Fire burn perimeter that contribute to main stem of Soquel Creek: Soquel Creek, Maymens Creek and an unnamed gulch. Soquel Creek then meanders northwest and then south west where it drains into the Pacific Ocean near the city of Capitola. On the Santa Clara County side of the Summit Fire; three main drainages that drain into the main stem of Uvas Creek are effected by the fire: Swanson Canyon Creek, Alec Canyon Creek and Croy Creek. Uvas Creek then meanders west where it drains into Uvas Reservoir. These drainages can be seen on Figure Appx I-17

Taking into account the orographic features of the Summit Fire area, examining nearby precipitation gages that have historic data and examining the United States Geological Service (USGS) California Average Annual Rainfall map, the average annual rain fall is approximately 46 inches per year (WRCC, 2008)(USGS, 2008). The average annual precipitation map used can be seen in Figure Appx J-19. A rain on snow event is unlikely within the burn perimeter of the Summit Fire. Topographical features within the Summit Fire include an elevation range from approximately 500 feet above sea level near the confluence of Ramsey Gulch and Browns Creek to 2,960 feet at the north most portion of the intersection of the burn perimeter and Summit Road. Slopes vary from approximately 25% to 90% within the Summit Fire

The Martin Fire area is drained entirely by the Laguna Creek Watershed. Most of the Martin Fire drainage comes from Reggiardo Creek, though some of the west side of the burned area drains into Laguna Creek. Reggiardo Creek drains into Laguna Creek south of the Martin Fire burn perimeter where Laguna Creek crosses Smith Grade Road. These drainages can be seen on Figure Appx I-18.

Using the same methodology as above to determine the average annual precipitation, the average annual rainfall for the Martin Fire area is approximately 39 inches per year (WRCC, 2008)(USGS, 2008). The average annual precipitation map used can be seen in Figure J-19. A rain on snow event is unlikely within the burn perimeter of the Martin Fire. Elevations within the Martin Fire range from approximately 1,120 feet above sea level at the south end of the burn perimeter to 1,953 feet at Prom Peak. Slopes range from approximately 6% to 70% within the Martin Fire area. Note that the majority of the area within the Martin Fire has mild slopes.

B. Survey Method

To begin to identify the values at risk, a tour was taken of the Summit and Martin fires on September 04, 2008. The Summit Fire tour included traveling Eureka Canyon Road, Highland Way and Summit Road which traverse along or next to the perimeter of the burned area. Ormsby Cutoff and Maymens Flat roads, which traverse into the burned areas, were also traveled. Touring the Martin Fire included driving along Martin Road which traverses along the west side of the burned area. Warren Drive and Smith Grade Road were also traveled to see the southern portion of the burned area and the downstream areas, respectively. Additional on-the-ground surveys were then conducted.

Three additional days of on-the-ground field surveys were spent in or around the burned areas of the Summit Fire to further identify and evaluate possible values at risk. Approximately 93% of the land within the Summit Fire is private of which 25% are parcels less than 100 acres. Due to the majority of the land being private property and the reluctance of many residents to permit access to their property, a limited number of foot surveys were performed. Therefore, the *Summit Fire Damage Assessment Report* by the California Department of Forestry and Fire Protection (California Department of Forestry and Fire Protection, 2008), along with the knowledge from field visits, topographic maps, and burn severity maps, were used to identify possible homes at risk from flooding and debris torrents. Accessible residences were identified in the field. In addition, hydrophobicity tests were performed to determine burn severities in different locations located throughout the fire perimeter. "Burn severity" is a way to describe the effects from a fire on the soil conditions and its hydrologic function, such as the infiltration rate and run-off rate. (Harmoan, 2001).

Due to the relatively small, unpopulated and undeveloped area of the Martin Fire, one additional day was spent examining possible values at risk via a foot survey. This foot survey, topographic maps and burn severity maps were then used to determine the values at risk. During this field visit, hydrophobicity tests were performed to determine burn severities at different locations throughout the fire perimeter.

II. Findings of the On-The-Ground Survey

A. Values At Risk

1. Observations

The type of burn severity at the Summit Fire ranges from low to high. Of the 4,189 acres that burned; 18% has high, 37% has moderate and 38% has low burn severity. Remaining areas are not burnt. Major gulches, as described in the setting section above, typically have low to moderate burn severities. Many of the ridges and their hillsides have moderate to high burn severities. The upper watershed between Ormsby Cutoff Road and the north end burn perimeter along with the areas adjacent to the southwest of Ormsby Cutoff Road has the largest extent of high burn severity. These areas drain into Corralitos and Soquel creeks. Though these soils are completely exposed, new vegetative growth was witnessed during the field surveys. This new growth was common in high burn severity areas and is seen below in Figure 1. Most of the Santa Clara County side of the fire has low to moderate burn severities, though high burn severity exists in some areas that drain into Swanson and Alec canyons.

Figure 1-Looking at south hillside from Maymens Road.

Burn severity at the Martin fire ranges from low to high. Of the 483 acres that burned; 9% has high, 53% has moderate and 22% has low burn severity. Remaining areas are not burnt. High burn severity areas have mild slopes. The steepest slopes within the burned perimeter, which drain into Laguna Creek, have low burn severity and the canopy is intact.

2. Specific observations

Values at risk from the Summit Fire are those which may be adversely affected by the excessive watershed response caused by the loss of vegetative soil cover. Due to the loss of control of water on-site, values at risk are areas on-site or downstream where flooding, debris flows or debris torrents may likely occur. The values at risk for the Summit Fire that were identified in this assessment are listed below.

1. Life
2. Property
    a. On-site
    b. Off-site
3. Infrastructure
    a. Culverts
        i. Eureka Canyon Drive
        ii. Highland Way
        iii. Browns Road
    b. Roads
        i. Eureka Canyon Drive
        ii. Highland Way
        iii. Browns Valley Road
        iv. Off-site in FEMA designated flood zones
    c. Bridges and driveways
        i. Eureka Canyon Drive
        ii. Browns Valley Road
        iii. Lower Highland Way
        iv. Off-site in FEMA designated flood zones
    d. Individual water supplies
4. Recreation
    a. Campgrounds
        i. Camp Loma
        ii. Uvas Canyon County Park
    b. Hiking trails
        i. Uvas Canyon Hiking Trails

It should be noted that lives at risk may be synonymous with property, infrastructure or recreation. For example, Uvas Canyon County Park has scenic waterfalls that are directly downstream of the burned area in Santa Clara County. Visitors of the park are likely to see these waterfalls from hiking trails at times when the trail will be the most at risk of flooding or debris torrents. Therefore, not only will the trails be at risk, human life will be also be at risk. In addition, for many on-site residents Eureka Canyon Road is the only paved access. Highland Way, the other paved access, is currently closed due to a large landside located northwest of Loma Campground. If Eureka Canyon Road has a structural failure due to slides or flooding, someone traveling the road could be at risk of losing their life.

Values at risk from the Martin Fire are those which may be adversely affected by the excessive watershed response caused by the loss of vegetative soil cover. Because most of the area has mild slopes and the areas with steep slopes still have canopy intact with a good amount of ground cover, debris torrents or flooding is not expected. To error on the side of caution, culverts on-site and off-site are listed as a value at risk.

B. Condition of Values At Risk

Road related features, such as culverts and bridges were identified at the Summit Fire, see Table 4, Appendix M. Though many houses were destroyed from the fire; roads, bridges and culverts that were identified were not damaged from the burn. Individual resident water supply lines from springs and creeks were melted, but have since been repaired. Off-site flood zones that are down stream along Soquel, Corralitos, Browns, Salsipuedes and Uvas creeks have been previously mapped by FEMA. Table 5, Appendix N, lists these Flood Insurance Rate Map (FIRM) identification numbers that cover the potential areas of concern.

Culverts below the Martin Fire perimeter were not damaged from the fire, although one culvert within the burned area was damaged. The head wall was burned and the culvert is filled in with sediment. It is the understanding of the State Emergency Assessment Team (SEAT) that this culvert will be repaired by California Department of Fish and Game.

Emergency Determination

Because vegetative soil cover has been reduced by the Summit Fire, increased run-off is expected. Subsequent rainfall and the pattern in which it is delivered will determine the amount of damage due to flooding, hyperconcentrated flows or debris torrents at any specific time. If light rainfall events occur evenly over time, above average run-off will result and therefore increase the average stream flows. Bank erosion would be minimal and some flooding where the flows are constricted by narrow channels, heavily laden channel debris or partially plugged culverts may occur. If above average rainfall events occur evenly over time, widespread debris flows, flooding and debris torrents are likely. If a record rainfall event occurs, debris torrents and hyperconcentrated flooding is expected.

Due to limited access to most of the burned areas and off-site downstream areas, many of the specific values at risk are stated in terms of general areas. These areas are shown on Figures Appx H-7 through H-16. Possible values at risk that were accessible were evaluated and listed in Table 4

As displayed in Figures Appx H-7 through H-11, residents that reside within the major gulches, as described in the setting section above, are at high risk of debris torrents that would be life threatening. Camp Loma Campground is also prone to life threatening debris torrents and flash flooding. Also noted in Figures H-7 through H-11, are residents that are located directly adjacent to Soquel, Corralitos and Browns creeks that are in high flood risk areas. Residents in these areas that are near or upstream from the Town of Corralitos could experience flash flooding. Off-site locations along Salsipuedes Creek and the creeks previously mentioned that are in flood zones designated by FEMA are now at a higher risk to flooding. Uvas Canyon County Park is also at increased risk of flooding and debris torrents, particularly those areas directly down stream of the fire, such as Swanson Canyon.

Partially plugged, damaged or undersized culverts along Highland Way, Eureka Canyon Road and Browns Valley Road could cause run-off or stream flows to overtop the roads or erode structural sections of the roads. This could cause these roads to be washed out. These areas are shown on Figures Appx 12 through H-16. Culverts on Eureka Canyon Road at mile post marker 7.58 and 8.11 appear to be undersized when compared against its corresponding drainage area. A previously damaged culvert on Eureka Canyon Road at mile post marker 7.91 exists. These culverts are listed in Table 4, Appendix M. If Highland Way, Eureka Canyon Road or Browns Valley Road is washed out, no paved access will remain and residents above the damaged section of road may be stranded. Unpaved access may be accessible if erosion has not severely damaged these roads.

Residents along Eureka Canyon Road or Browns Valley Road who reside on the opposite side of an adjacent creek, may become stranded if their driveway/bridge is washed out or flooded.

Individual water supplies from springs or creeks will likely have high turbity levels. These individual water supplies that pass through culverts, gulches or streams may get destroyed by flooding or debris flows.

An off-site culvert on Warren Drive, which is adjacent to the southwest perimeter of the Martin Fire, may become plugged from upstream debris. This may cause this section of road to become inundated with debris flow.

Treatments to Mitigate the Emergency

Public awareness is crucial in preventing loss of life or destruction of property due to flooding, hyperconcentrated flows or debris torrents that can be caused by the aftermath from the Summit Fire. Initially county, city and community organizations need to be identified. In return these entities should notify the potentially effected public of the life threatening values at risk as stated above. Items listed below are some suggested ways that local officials can inform the public that the dangers from the fires are not over.

- Prior to the first typically expected rain, notify residents in the life threatening areas that are designated in this report.
- Prior to the first typically expected rain, post warning notices on the Town of Corralitos kiosk board about flood hazards and possible drinking water contamination in springs and creeks.
- Mail warning/notification letters to residents in the FEMA determined flood zones affected by Corralitos, Browns, Salsipuedes, and Soquel creeks, as well as areas along these creeks that have not yet been determined by FEMA
- Post temporary warning signs, such as, "warning potential flood hazard" on Highland Way, Eureka Canyon and Browns Valley Road during rainfall events.

Local governments are strongly encouraged to develop an evacuation plan, if one is not already in place, for residents that may be stranded due to a possible road failure on Highland Way, Eureka Canyon Road and Browns Valley Road, or where residents' driveways/bridges may be washed out. If time permits, a precipitation gage installed in the upper watershed and tied into Santa Cruz County's alert system is strongly recommended. This new precipitation gage along with a detailed study to determine a rainfall threshold value that can cause land slides and subsequent debris torrents would aid appropriate officials to quickly execute an evacuation plan. This study should be performed by a licensed professional civil engineer who specializes in soil mechanics and hydrology. Uvas Canyon County Park should close during moderate or heavy rainfall events over the next year. Camp Loma should remain closed during the first two winters or until a licensed professional geologist has evaluated the upper watersheds and has deemed the campground safe from debris torrents.

Prior to the first typically expected rainfall, all culverts along Highland Way, Eureka Canyon Road and Browns Valley Road should be inspected, cleaned and "trash racks" installed where notable debris exists. These areas are displayed on Figures Appx H-12 through H-16 and their current conditions noted in Table 5, Appendix M. The possible undersized culverts on Eureka Canyon Road at mile post markers 7.58 and 8.11 should be evaluated and redesigned, if applicable, by a licensed professional civil engineer. Previously damaged culvert on Eureka Canyon Road at mile post marker 7.91 needs to be

repaired or replaced. All culverts should be monitored and cleaned where needed after moderate rainfall events.

Upstream from culverts and bridges along Highland Way, Eureka Canyon Road and Browns Valley Road should have debris removed where imminent danger exists. For example, if large debris that reside upstream from a culvert or bridge that has the potential to be mobilized and is believed to have the possibility of plugging the downstream culvert or bridge and therefore causing flooding or road failure, this debris should be removed. The Santa Cruz County Road Department with consultation with a fisheries biologist of the California Department of Fish and Game should make this type of decision. The roadside drainage ditches along Highland Way, Eureka Canyon Road and Browns Valley Road should be cleaned prior to the first rainfall event.

Local governments are encouraged to work with and aid landowners where suitable in the upper watersheds that have exposed soils to help reduce rainfall run-off. To reduce the increased run-off response from exposed soils, placement of sterile rice straw is recommended. Effective application may be difficult due to the topography. Therefore, the National Resources Conservation Service should be consulted for advice on this and other potential effective erosion control applications.

The off-site culvert near the Martin Fire should be cleaned prior to the first rain. Large debris upstream that pose imminent threat should be removed. The Martin Fire does not pose a risk to life or property.

Discussion/Summary/Recommendations

The character and density of vegetation has a major influence on the way rainfall is disseminated. Due to the Summit Fire, soils have become exposed in the upper watersheds within the perimeter of the fire. Therefore, the lack of vegetation in these areas poses a risk for flooding, hyper-concentrated flows or debris torrents to downstream areas. The possibility and extent of this risk is dependent on rainfall and the pattern in which it is delivered. Therefore, the hydrologic response can vary from slightly increased flows to devastating flooding and debris torrents. The following recommendations are made.

1. From the Summit Fire Area down to the town of Corralitos, plans for emergency evacuation and informing the affected public that the dangers from the fires are not over needs to be made.

2. Install precipitation gage at upper watershed in the Summit Fire area and tie into the Santa Cruz County alert system. In addition, a detailed study to determine a rainfall threshold value that can cause land slides and subsequent debris torrents should be performed by a licensed professional civil engineer who specializes in soil mechanics and hydrology.

3. Uvas Canyon Park should close during moderate or heavy rainfall events over the next year.

4. Loma Campground should remain closed during the first two winters or until a licensed professional geologist has evaluated the upstream watersheds and has deemed the campground safe from debris torrents.

5. Eureka Canyon Road, Highland Way and Browns Valley Road should be safely monitored during and after rain events.

6. Prior to the first typically expected rainfall all culverts and ditches along Eureka Canyon Road, Highland Way and Browns Valley Road should be cleaned to assure they are completely functional. Culverts should be inspected after moderate rainfall events to insure they continue to be clean and functioning properly. All erosion control structrures designed to control the flow and direction of water (e.g. "waterbars", berms, relief ditch culverts, etc.) within the fire perimeter and downstream of the fire perimeter that could be impacted by rainfall, should be inspected prior to the first typically expected rain to insure they are clean and functioning properly.

7. To further assure that the culverts and bridges are functional, up stream debris should be removed where imminent danger exists. The Santa Cruz County Road Department, in consultation with a fisheries biologist from California Department of Fish and Game should determine if imminent danger exists.

8. Possible undersized culverts on Eureka Canyon Road at mile post markers 7.58 and 8.11 should be evaluated and redesigned, if applicable, by a licensed professional civil engineer.

9. Repair or replace culvert on Eureka Canyon Road at mile post marker 7.91.

10. The off-site culvert on Warren Drive near the Martin Fire should be cleaned prior to the first rain.

References

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Geographic Information System
http://gis.co.santa-cruz.ca.us/

Western Regional Climate Center
http://www.wrcc.dri.edu/

United States Geological Society
Water Watch
http://education.usgs.gov/california/maps/california_precipitation2.htm

United States Geological Society
Geography, Geology, Hazards and Natural History Information
http://water.usgs.gov/waterwatch/?m=flood&r=ca&w=map

United States Geological Society
Water Resources of the Unite States, California
http://water.usgs.gov/software/NFF/manual/ca/index.html

Federal Emergency Management Agency
http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1&userType=G

Appendix C
Biology/Botany/Fisheries Technical Specialist Report

DRAFT TECHNICAL SPECIALIST'S REPORT

STATE EMERGENCY ASSESSMENT TEAM (SEAT) REPORT

RESOURCES: **Botanical**
Aquatic Wildlife and Fish
Terrestrial Wildlife

Fire Name: Summit Fire CA-SCU-002548Martin
Fire CA-CZU-005238
May/June 2008

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I. Resource Condition Assessment

This report assesses the effects of the Summit and Martin Fires, firefighting suppression activities, and fire suppression repair on sensitive plants and animals.

A. Setting

Summit Fire

The 4,189-acre Summit Fire burn area covers mostly privately-owned land that supports residential housing in the northwestern section, and residential and commercial timberlands in the southeastern section. Table 3 shows the vegetation communities affected by the Summit Fire.

Table 1. Vegetation communities within the Summit Fire burn area.

California Wildlife Habitat Relationships (WHR) Classification System	**California Natural Diversity Data Base (CNDDB)**
Redwood Forest	----------
Mixed Evergreen Forest	----------
Closed-Cone Coniferous Forest	
Mixed Hardwood Conifer	----------
Mixed Chaparral	. ----------
Riparian Woodland	----------

The burn area drains into four main watersheds: Soquel Creek, Corralitos Creek, Browns Creek and Uvas Creek. Both perennial- and intermittent-flowing streams are present within the burn area. The northwestern portion of the burn area (e.g. northwest of Ormsby Trail) contains un-named tributaries to Soquel Creek. Perennial streams flowing through Devils' Gulch and Rattlesnake Gulch flow into

Corralitos Creek, while flows through Ramsey Gulch empty into Browns Creek. Corralitos Creek and Browns Creek converge near the town of Corralitos before flowing into the Pajaro River near the City of Watsonville. Burn areas and fire fighting activities in the Uvas Creek watershed include Swanson Canyon, Alec Canyon, and Croy Creek. Other aquatic habitats present within the burn area are permanent and seasonal wetlands.

Special-status species known to occur within and downstream of the Summit Fire burn area are described in Table 4.

Table 2 Special-status species found in and near the Summit Fire burn area.

Common Name	Scientific Name	Status	Occurrence
Heartleaf or Santa Cruz (Anderson's) manzanita	*Arctostaphylous andersonii*	CNPS 1B	K, O
Steelhead trout	*Oncorhynchus mykiss*	FT	K, O
California red-legged frog	*(Rana aurora draytonii)*	FT	K, O

Martin Fire

The 483-acre Martin Fire burn area is comprised of both private- and state-owned land. The majority of the burn area includes a large portion of the 552-acre Bonny Doon Ecological Reserve (BDER), which is owned by the California Department of Fish and Game. The BDER contains the largest and most pristine remaining occurrences of several rare plant communities which are limited to ancient marine sand deposits in Santa Cruz County. Table 1 shows the vegetation communities affected by the Martin Fire.

Table 3. Vegetation communities within the Martin Fire burn area.

California Wildlife Habitat Relationships (WHR) Classification System	**California Natural Diversity Data Base (CNDDB)**
Ponderosa Pine	Maritime Coast Range Ponderosa Pine Forest
Redwood Forest	----------
Closed-cone Pine Cypress	Northern Interior Cypress Forest.
Montane Hardwood Conifer	----------
Mixed Chaparral	Northern Maritime Chaparral.
Coastal Scrub	----------
Annual Grassland	----------

The burn area contains the intermittent-flowing Reggardio Creek, which empties into Laguna Creek immediately to the east of Bald Mountain approximately 1.1 mile south of the burn area. Laguna Creek is a perennial-flowing stream that flows through the BDER but outside the burn area to the east.

The Martin Fire burn area and areas downstream contain a high proportion of special-status species that could be affected by fire, fire-fighting activities, and fire suppression repair (Table 2).

Table 4. Special-status species found in and near the Martin Fire burn area.

Common Name	Scientific Name	Status[2]	Occurrence[3]
Santa Cruz cypress	*Cupressus abramsiana*	FE, SE	K
Santa Cruz wallflower	*Erysimum teretifolium*	FE, SE	K
Ben Lomond spineflower	*Chorizanthe pungens var. hartwegiana*	FE	K
Heartleaf or Santa Cruz (Anderson's) manzanita	*Arctostaphylous andersonii*	CNPS 1B	K
Silverleaf or Bonny Doon Manzanita	*A. silvicola*	CNPS 1B	K
Mount Hermon June Beetle	*Polyphylla barbata)*	FE	P
Zayante band-winged grasshopper	*Trimerotropis infantilis*	FE	P
Steelhead trout	*Oncorhynchus mykiss*	FT	O
California red-legged frog	*(Rana aurora draytonii)*	FT	P

B. Survey Methods

Plant and animal survey methods consisted of identifying the locations of the Martin and Summit fires, reviewing burn area topography and watershed features, Burned Area Reflectance Classification (BARC) maps, and the California Natural Diversity Database (CNDDB 2008). Species biology and ecology, especially those species considered sensitive by federal, state and local governments were

[2] FE- Federal Endangered; FT-Federal Threatened, SE- State Endangered, CNPS 1B- Plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California

[3] K- known to occur within the burn area, P- possibly occurs within the burn area, O- occurs outside the burn area but possibly affected by fire and fire suppression activities

reviewed to determine the effects of fire and fire suppression activities on these species. In addition, specific areas of interest (e.g. areas of severe burn and areas supporting sensitive species) within the burn areas were searched on foot and observations were recorded.

II. Findings of the On-The-Ground Survey

A. Potential Biological Values At Risk

Summit Fire

The species listed in Table 4 were identified as biological values at risk because of the Summit Fire and associated fire suppression and suppression repair activities.

Direct impacts of fire on heartleaf manzanita are likely low, however, impacts of dozer lines may be slightly more significant. The path of heavy fire-fighting equipment was aligned directly where heartleaf manzanita populations are known to occur, such as outside of the burn area between Gamecock Canyon and Ramsey Gulch. Dozer lines apparently followed existing seasonal roads resulting in only minimal removal of heartleaf manzanita plants. More long-term adverse effects to heartleaf manzanita could occur if mechanical disturbance of soil facilitates the establishment and spread of invasive non-native plants that could out-compete regenerating manzanita.

Most dozer lines and active vegetation clearing appeared to have occurred in the Uvas Creek drainage in Santa Clara County. Uvas Creek contains resident rainbow trout. Excessive sediment delivery into Uvas Creek could adversely affect rainbow trout habitat by the filling of pools with fine materials. Warm water aquatic resources in Uvas Reservoir as well as steelhead resources downstream of the reservoir are also at risk.

Steelhead and rainbow trout and their habitat in Santa Cruz County are at significant short and medium term risk from fire, fire suppression activities and post-fire forest management practices (Beschta et al. 2004, Karr et al. 2004).
Moderate and high severity fires have burned understory and overstory vegetation on steep slopes directly above known salmonid summering habitat, and upstream of salmonid spawning and wintering habitat. Important drainages that are affected include Ramsey Gulch, Shingle Mill Gulch, Rattlesnake Gulch, Diablo Gulch, Soquel Creek, Corralitos Creek, and Browns Creek.

Large amounts of sediment and woody debris could be immobilized during 2008-09 winter storms, adversely affecting salmonids by possibly altering channel form and structure (although this could also be beneficial), smothering and scouring redds and aquatic invertebrate food sources, and by filling of summer pools. Loss of overhead canopy in Ramsey Gulch and Rattlesnake Gulch could increase solar radiation and consequently increase stream temperatures. Direct effects on adult fish could also occur as sharp-edged fines scrape the bodies of fish allowing fungal infections to take hold which could eventually kill the fish.

Changes to stream channel form could also pose risk to California red-legged frog. Instream pools and backwater areas could be degraded and reduced in size from filling with sediment and woody debris. Permanent and seasonal wetlands that support or potentially support red-legged frog are present within the burn area but appear unaffected by the fire. However, the loss of intervening, vegetated upland habitat between ponds and streams could result in increased adult frog mortality as frogs become more vulnerable to predators as they move between aquatic habitats.

Sensitive terrestrial wildlife species are not known to occur within the Summit Fire burn area. The persistence of terrestrial wildlife species in the burn area does not appear to be at risk from the fire and fire suppression activities since many of these species are common and largely mobile. However, given the large area of the fire and the timing of the fire, which coincides with the birth of many mammals and birds, immobile young such as nestlings and newborns likely were killed by the fire. As with the Martin Fire, taxon such as reptiles, which are not able to flee quickly and fossorial mammals, which rely on underground burrows for cover may not have escaped the fire.

Martin Fire

The species listed in Table 2 were identified as biological values at risk because of the Martin Fire and associated fire suppression and suppression repair activities.

Sensitive plants found within the Martin Fire burn area are characterized as early-successional species (e.g. Santa Cruz wallflower, Ben Lomond spineflower) requiring an open habitat with low vegetative cover (Department of Fish and Game 2003). Ponderosa Pine, Closed-cone Pine Cypress, Mixed Chaparral plant communities, which cover much of the burn area, are considered fire–adapted. Fire may also play an important role in maintaining viable populations of Santa Cruz Cypress, but other mechanisms may also be responsible (U.S. Fish and Wildlife Service 1998a). Although fire in general may have beneficial effects on the sandhills habitat of the Martin Fire burn area, over 60% of the fire burned at moderate and high severities and was ignited at a time of year that could be detrimental to the survival and reproduction of sensitive plant species.

High and moderate intensity burns appeared to have burned and possibly killed a portion of the Santa Cruz cypress population on the BDER. The effects of the fire and suppression activities are currently unknown for the Ben Lomond spineflower and Santa Cruz wallflower. Direct impacts of the fire on both heartleaf and silverleaf manzanitas are likely low, however, post-fire disturbance activities in the burn area (e.g. ground disturbance by recreationists, non-native plant species invasion) could play a greater role in slowing recovery. Also, fire suppression activities may have had harmful effects if non-native invasive plant propagules were carried into the burn area on equipment, and fencing is not repaired to keep motorized vehicles out of the BDER.

Because the fire occurred in June during the flight seasons of the Mount Herman June beetle and the Zayante band-winged grasshopper (U.S. Fish and Wildlife Service 1998b), adults may have been killed by the fire. In areas of high severity burn subterranean beetle larva may have also been killed if excessive heat penetrated into the upper soil layers.

Steelhead trout are not known to occur in Reggardio Creek, however resident rainbow have been recorded in Laguna Creek near the eastern boundary of the burn area (Santa Cruz County 2004). Steelhead occur below a natural barrier approximately two miles downstream of the burn area. Sediment delivery, which may increase slightly due to loss of riparian and within-stream vegetation in Reggardio Creek, could adversely affect rainbow (and steelhead) trout spawning and summering habitat in Laguna Creek. Trout habitat upstream of the Laguna Creek Reggardio Creek confluence may only be minimally affected since steep slopes above Laguna Creek experienced only light under understory burning while the coniferous overstory remains largely unaffected.

The headwaters and upper portion of Reggardio Creek where California red-legged frog may occur are located in the moderate and high severity burn areas. Losses of upland and riparian vegetation as well as damage to the road crossing could adversely affect channel bank stability and reduce pool volumes through deposition of sediment. Changes in hydrogeomorphology of Reggardio Creek and loss of upland movement cover could adversely affect red-legged frog.

Most terrestrial wildlife populations do not appear to be at risk from this relative small-sized fire and fire suppression activities since species known to occur onsite are common and largely mobile. Many individuals likely moved into surrounding un-burned areas for refuge. However, reptiles, which are not able to flee quickly and fossorial mammals, which rely on underground burrows for cover may not have escaped the fast-moving fire.

B. Specific Observations

Summit Fire

Since the most sensitive biological values at risk appear to be salmonids and aquatic habitat, special emphasis was placed on field-reviewing fish-bearing streams and burned areas upslope of fish-bearing streams. As such, riparian and burned areas in the Soquel Creek, Corralitos Creek and Browns Creek watersheds were inspected.

Rainbow trout were observed in small pools at culvert outlets near the headwaters of Soquel Creek (N 37°04.146' W121°49.799') and Maymens Flat Creek. Although overstory and understory vegetation did not appear burned in the vicinity of these occurrences, the Maymens Creek watercourse flows through high severity burn areas. Also, the headwaters area of Maymens Creek flows through chaparral habitat where slopes above the creek have been completely denuded of vegetation by fire. The only streamside vegetation noted was a section of riparian habitat supporting willow (*Salix* sp) and cottonwood (*Populus* sp) located at the top of the slope of Maymens Flat.

Steelhead trout were observed in Rattlesnake Gulch, a tributary to Shingle Mill Gulch and Corralitos Creek. Here approximately four trout, including two that appeared to exceed 12 inches in length, were trapped in a pool measuring approximately eight feet by ten feet and had a depth of three feet. The pool is located at the outlet of a box culvert. The immediate surrounding riparian and upslope areas are on the edge of the burn area and did not appear to have burned. However, steep slopes that drain into Rattlesnake Gulch contain high severity and moderate severity burn areas.

Also in Rattlesnake Gulch, newts (*Taricha* sp.) and small salmonids two to three inches long were observed (N37°02.729' W121°47.678'). Burned coniferous trees are present on the western slopes of a Non-Industrial Timber Management Plan (NTMP) boundary and Rattlesnake Gulch.

Steelhead are also present in Browns Creek near the confluence of Ramsey Gulch (N37°01.562' W121°46.658'). Crayfish (*Pacifastacus leniusculus*) and sculpin (*Cottus* sp.) were observed here also. High severity burned areas occur on very steep southeast-facing slopes that drain into Ramsey Gulch.

One permanent wetland (N37°02.932' W121°48.232') and two seasonal wetlands (N37°02.436' W121°47.510') in the Grizzly Flat area were inspected to assess the affects of the fire on California red-legged frog breeding habitat. The permanent wetland occurs in a flat area and is surrounded by an approximate 300- foot buffer of coyote brush (*Baccharis pilularis*), hardwoods and pine. However, immediately upslope of the pond, vegetation has been almost completely burned. The seasonal wetlands are presently dry. Mature willow and a band of redwood trees surround the ponds. Burned forest that includes low, moderate and high burn severity occur upslope of the ponds on southwest-facing slopes. Low severity burned areas separate the permanent and seasonal wetlands, however riparian forest through Grizzly Flat is unburned.

Burned areas on steep slopes above Ramsey Gulch were examined more closely. A timber harvesting plan is proposed on the Ramsey Gulch slopes but has not yet been operated on. However, an

Emergency Notice for salvage logging of burned trees was underway during the field inspection. Slopes above Ramsey Gulch had high and moderate severity burns and few trees remained. Soils and aquatic substrate in Ramsey Gulch appeared to be covered in white ash. Water was present in Ramsey Gulch and steelhead are known to occur into the moderate and high severity burn areas.

As part of the post-fire emergency logging operations, trees along the banks of an intermittent stream, Big Gulch, were marked for harvest. Although the trees are burned, the stumps are sprouting. The culvert inlet of a watercourse crossing in Big Gulch was observed to be completely buried.

In addition, trees within and beside a spring-fed creek supporting chain fern (*Woodwardia fimbriata*), a wetland indicator plant, had been harvested. An old-growth redwood tree with a re-iterating trunk was blackened by the fire and marked for harvest. Heavy equipment will be used on recently burned forest soils to conduct salvage logging and to conduct the proposed THP, likely in 2009. Erosion control measures that will occur in portions of Ramsey Gulch will likely be fire suppression repair conducted by CALFIRE (e.g. road and dozer line water bars), and the landowner will apply an erosion control seed mix that contains non-invasive plant species.

A number of invasive non-native plant species were observed in the Maymens Flat area and along the upslope portions of the burn area. Yellow star-thistle (*Centaurea solstitialis*), French broom (*Genista monspessulana*), and pampass grass (*Cortaderia jubata*) were observed growing alongside Ormsby Trail and Summit Road, suggesting a non-native invasive plant seed source is already established.

Martin Fire

Many Santa Cruz cypress trees are burned and possibly killed from the fire, however, abundant seed was observed on ash beds just west and southwest of the fire station (Keeler-Wolf et al. 2008). Similarly, many individuals of knobcone pine were burned and likely killed, but some individuals were observed un-burned or lightly charred, especially in the southwest portion of the burn area where burn intensity was low and moderate. Redwood trees located in the southern portion of the burn area are burned but when the outer bark was scraped with a pen knife, only the outer 0.5 inch was blackened. All Douglas-fir trees located in the south-central portion of the burn area are burned and apparently killed, while many of the oak (*Quercus* sp.) trees observed are lightly burned but showing abundant re-sprouting along branches and trunk. Many of the manzanita plants are only partially burned (e.g. leaves present but burned, twigs and branches present) and many burned individuals were re-sprouting. Burned chamise (*Adenostoma fasciculatum*) was also observed re-sprouting. Little vegetative re-sprouting was observed in the high severity burn areas. Post-fire re-growth of bracken fern (*Pteridium aquilinum* var. *pubescens*) was common throughout.

Non-native vegetation observed included French broom and eucalyptus. Acacia and pampass are also known to occur in and on lands adjacent to the BDER.

The watercourse crossing on Reggardio Creek was inspected and observed to be damaged by the fire, failing and in need of immediate repair. An area adjacent to the watercourse crossing that parallels Reggardio Creek showed headcutting that may indicate the culvert was not functioning prior to the fire.

Dozer lines from fire suppression were examined and were found to have followed existing roads. One section of new dozer line approximately 100 feet in length and 50 feet in width located in the southwest portion of the burn area on the BDER did result in the removal of native vegetation. Most of the cleared vegetation appeared to be manzanita.

BDER fencing along Martin Road was found to be damaged, likely from fire-fighting activities. Some large logs were placed along the road as apparent short-term fencing solution to keep vehicles out of the

BDER. Heavy equipment trails were also found along Martin Road, although little vegetation was present due to the extremely sandy soils.

Four, four to six-inch trout, likely rainbow, were observed in Laguna Creek in a pool formed by the Santa Cruz County Waterworks Dam. This is approximately 1.5 stream miles downstream of the burn area and the BDER.

III. EMERGENCY DETERMINATION

Botanical Resources:

The most immediate threat to botanical resources from both the Summit Fire and Martin Fire would appear to be from the invasion of non-native plants. Ground disturbance and native vegetation loss from fire, fire-suppression and fire suppression repair have left expansive opportunities for invasive plants to establish and spread. This is of particular concern since seed sources, although limited, are present within both burn areas.

The recovery of sensitive plants, vegetation communities and invertebrates in the sandhills habitat of the Bonny Doon Ecological Reserve is under moderate threat if measures are not taken immediately to secure the burned portions from additional ground disturbance from unauthorized activities.

Aquatic Wildlife and Fish:

The most immediate threat to aquatic resources includes the degradation and loss of spawning and summering habitat for salmonids in the Soquel Creek, Corralitos Creek, Browns Creek drainages, and to a lesser extent the Uvas Creek drainage. Threats include the delivery of large amounts of sediment from burned, denuded steep slopes draining into fish-bearing streams. The loss of riparian and side slope trees and shrubs on the upper reaches of watercourses may contribute heated water to cool water adapted fish.

Terrestrial Wildlife Resources:

No immediate threats were identified.

IV. RECOMMENDATIONS

Summit Fire Burn Area:

1. To control sediment delivery into watercourses, erosion control measures on disturbed and burned slopes draining into watercourses should be conducted where feasible. Erosion control measures recommended include the installation of straw wattles, rice straw or weed-free straw, biodegradable erosion control matting, and mulching with slash in forested areas. If seeding is preferred, the USDA Natural Resources Conservation Service and the Resource Conservation District of Santa Cruz County should be consulted for an appropriate stock and/or seed mix.

2. Existing seasonal roads or new roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

3. To maintain fisheries resources, burned trees within 50 feet of a stream that flows into a fish-bearing stream should be retained for future large woody debris recruitment and to decrease solar radiation of stream waters.

4. In burned forested areas, burned large old trees should be retained. These trees provide habitat for many species, reduce soil erosion, and aid soil formation in a post-fire environment (Karr et al. 2004, Beschta et al. 2004).

5. In burned forested areas, roads and skid tails should be monitored regularly throughout the winter period. Erosion control practices including water bars, applying rice straw or weed-free straw, and slash-packing should be considered.

6. In burned forested areas, invasive non-native plants should be monitored and controlled using hand removal techniques or other means.

7. Structures placed within streams to control sediment (e.g. sediment control basins, check dams, rip rap, artificially placed large wood etc…) are generally not recommended. A fisheries biologist or hydrogeomorphologist should be consulted before any in-stream work is conducted in fish-bearing streams or their tributaries.

8. Culverts in Soquel Creek, Corralitos Creek and Browns Creek watersheds should be monitored throughout the first several post-fire winter periods to ensure that culverts are kept open and sediment, and rocky and woody material pass through the culverts.

9. In-stream woody debris should not be removed unless there is a risk of imminent threat of damage to life and/or property.

10. Prior to work that would affect the bed, bank and/or channel of any stream, the Department of Fish and Game should be contacted and a notification should be made for a Lake and Streambed Alteration Agreement[4] (www.dfg.ca.gov/habcon/1600/)

Martin Fire Burn Area:

11. Immediate action should be taken to repair broken fencing to secure the Bonny Doon Ecological Reserve from disturbance by unauthorized motorized vehicles.

12. Immediate action should be taken to repair the damaged and failing culvert in Reggardio Creek located in the southern portion of the Bonny Doon Ecological Reserve. The culvert should be appropriately sized to pass sediment and woody debris in a 100-year storm.

13. Within the Bonny Doon Ecological Reserve, an invasive non-native plant monitoring (including mapping) and control program is recommended.

[4] Notification with the Department of Fish and Game, or the requirement of a Lake or Streambed Alteration Agreement would not be needed before beginning the following emergency work: 1) immediate emergency work necessary to protect life or property; 2) immediate emergency repairs to public service facilities necessary to maintain service as a result of a disaster in an area in which the Governor has proclaimed a state of emergency; and 3) emergency projects undertaken, carried out, or approved by a state or local governmental agency to maintain, repair, or restore an existing highway, within the existing right of-way of the highway, that has been damaged as a result of fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide, within one year of the damage. Although notification is not required before beginning the emergency work, you must notify the Department in writing within 14 days after beginning the work.

14. Existing seasonal roads that were widened for dozer access should be monitored for the presence of invasive non-native plants. An invasive non-native plant control program should be implemented if monitoring results indicate that non-native plants are establishing.

15. To minimize the spread of invasive non-native plants, equipment used for fire suppression repair or any other type of repair or management related operation should be hosed off before and after working within the burn area.

16. Seeding and mulching of disturbed areas for erosion control (i.e. fire suppression repair) on the Bonny Doon Ecological Reserve is not recommended without prior approval from the Department of Fish and Game.

17. Within the Bonny Doon Ecological Reserve, the removal of standing burned trees (e.g. hazard trees) and burned downed woody debris should first be evaluated by a qualified biologist, ecologist or botanist to determine if any biological resourses are at risk from tree removal. Consideration should be made to closing certain areas off to the public if they are considered unsafe.

18. The closure of the Bonny Doon Ecological Reserve to the public for an additional period of time to allow sufficient time for recovery of burned sensitive habitats and plants should be considered.

19. Post-fire research and monitoring on the survival and germination of sandhills habitat vegetation communities, including state- and federal-listed plants is recommended.

20. Appropriately-timed surveys for Mount Herman June beetle and Zayante band-winged grasshopper should be conducted.

References

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Karr, James L., Jonathan J. Rhodes, G. Wayne Minshall, F. Richard Hauer, Robert l. Beschta, Christopher A. Frissell, and David A. Perry. 2004. The Effects of Postfire Salvage Logging on Aquatic Ecosystems in the American West. BioScience 54(11): 1029-1033.

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Appendix D
Water Quality Technical Specialist Report

TECHNICAL SPECIALIST'S REPORT
State Emergency Assessment Team

Resource: **Water Quality**

Fire Name: Summit Fire SCU-002548
Martin Fire CZU-005238
May/June 2008

Author Name: Julia Dyer, Environmental Scientist
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Ste. 101
San Luis Obispo, CA 93401

I. Potential Values at Risk

The values at risk to water quality identified in this assessment are Agricultural Supply; Preservation of Biological Habitats of Special Significance; Cold Fresh Water Habitat; Commercial and Sport Fishing; Estuarine Habitat; Freshwater Replenishment; Ground Water Recharge; Industrial Process Supply; Migration of Aquatic Organisms; Municipal and Domestic Supply; Navigation; Water Contact Recreation; Non-Contact Recreation; Rare, Threatened, or Endangered Species; Spawning, Reproduction, and / or Early Development; Warm Fresh Water Habitat; and Wildlife Habitat due to recreational trespassing; illegal dumping; reduction in vegetative cover; hydrophobic soils; increased erosion; anthropogenic soil disturbance; construction; release of toxic chemicals; poorly maintained culverts; fire suppression activities; and an alternation of levels of pH, sedimentation/siltation, turbidity, boron, fecal coliform, temperature, nutrients, nitrates, heavy metals, and pathogens.

All the values at risk listed above are critical factors when determining the most appropriate method for protecting and improving water quality. As related to the fires, the most critical values at risk are Cold / Warm Fresh Water Habitat, Migration of Aquatic Organisms, and Municipal Drinking Water Supply. Subsequent references to these values at risk will be denoted in bold font.

II. Resource Condition Assessment

A. Resource Setting

The Summit and Martin Fires burned in the Pajaro River and Soquel Creek Watersheds and in the Laguna Creek and San Vicente Creek Watersheds respectively. The fires burned almost exclusively in Santa Cruz County with a small portion of the Summit Fire impacting the headwaters of Uvas Creek in Santa Clara County. Except where indicated otherwise, observations and recommendations for this water quality section of the report pertain to both fire areas.

The Pajaro River, Soquel Creek, Laguna Creek, San Vicente Creek[5] and Uvas Creek Watersheds are comprised of several smaller subwatersheds, including but not limited to Alec Canyon Creek, Bates Creek, Browns Creek, Corralitos Creek, Croy Creek, Diablo Gluch, Hinckley Creek, Laguna Creek, Little Uvas Creek, Mill Creek, Ramsey Gluch, Rattlesnake Gluch, Redwood Canyon, Reggiardo Creek, San Vicente Creek, Shingle Mill Gluch, Soquel Creek, Soquel Point, Swanson Canyon Creek, Uvas Creek, Uvas Reservoir and several other undefined subwatersheds.

[5] Based on analysis of initial mapping efforts for the Martin fire, a portion of its footprint crosses into the San Vicente Creek Watershed and is therefore mentioned here. Although based on field review, it is not anticipated that the San Vicente Creek Watershed will receive much if any runoff from the Martin Fire.

The values at risk within these watersheds are defined in the Central Coast Regional Water Quality Control Board's Basin Plan (Basin Plan) as beneficial uses. These specific beneficial uses are defined per the following:

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Preservation of Biological Habitats of Special Significance (BIOL) - Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Cold Fresh Water Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates. Some water bodies affected by the fire contain runs of steelhead trout.

Fisheries along with all other native flora and fauna that depend on aquatic habitat for survival and reproduction will be impacted at all stages of their life cycles. Increased turbidity and sedimentation and decreased riparian vegetation can impede the ability for fish species to survive and reproduce in stream habitat. The increased turbidity and sedimentation can clogs fish gills greatly reducing efficiently for respiration, reduces clarity thus diminishing ability for forage, and silt destroys gravel beds critical for redds to produce healthy offspring. The decreased riparian vegetation is inversely related to stream temperatures. Elevated stream temperatures can potentially lead to increased mortality in fish species, particularly those that depend on cold water habitat. Additionally, a reduction in riparian habitat can limit shelter critical for fish to avoid predation.

Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Estuarine Habitat (EST) - Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds). An estuary is generally described as a semi-enclosed body of water having a free connection with the open sea, at least part of the year and within which the seawater is diluted at least seasonally with fresh water drained from the land. Included are water bodies which would naturally fit the definition if not controlled by tidegates or other such devices.

Freshwater Replenishment (FRESH) - Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity) which includes a water body that supplies water to a different type of water body, such as, streams that supply reservoirs and lakes, or estuaries; or reservoirs and lakes that supply streams. This includes only immediate upstream water bodies and not their tributaries.

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers. Ground water recharge includes recharge of surface water underflow.

Industrial Process Supply (PRO) - Uses of water for industrial activities that depend primarily on water quality (i.e., waters used for manufacturing, food processing, etc.).

Industrial Service Supply (IND) - Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Migration of Aquatic Organisms (MIGR) - Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply. The City of Watsonville has two surface water intakes for drinking water downstream of the Summit Fire, on Corralitos and Browns creeks. These intakes are both above the confluence of the two creeks. The Santa Clara Valley Water District manages Uvas Reservoir for drinking water supply, reservoir is downstream of the footprint of the Summit Fire. Finally, the City of Santa Cruz maintains a drinking water intake on Laguna Creek downstream of the footprint of the Martin Fire.

According to State Board Resolution No. 88-63, "Sources of Drinking Water Policy" all surface waters are considered suitable, or potentially suitable, for municipal or domestic water supply except where:

a. TDS exceeds 3000 mg/l (5000 uS/cm electrical conductivity);
b. Contamination exists, that cannot reasonably be treated for domestic use;
c. The source is not sufficient to supply an average sustained yield of 200 gallons per day;
d. The water is in collection or treatment systems of municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff; and;
e. The water is in systems for conveying or holding agricultural drainage waters.

Navigation (NAV) - Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels. This Board interprets NAV as, "Any stream, lake, arm of the sea, or other natural body of water that is actually navigable and that, by itself, or by its connections with other waters, for a period long enough to be of commercial value, is of sufficient capacity to float watercraft for the purposes of commerce, trade, transportation, and including pleasure; or any waters that have been declared navigable by the Congress of the United States" and/or the California State Lands Commission.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Rare, Threatened, or Endangered Species (RARE) - Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Spawning, Reproduction, and/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Warm Fresh Water Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Wildlife Habitat (WILD) - Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

The following two tables (one for each fire area) listing specific water bodies either directly impacted (primary) or downstream of a burned area (secondary). The tables also list which if any pollutants or stressors have been identified on the Clean Water Act Section 303(d) list for specific water bodies associated with the fires. Finally, the tables list the Beneficial Uses or values at risk for each of the water bodies as described above.

Table 1-Summit Fire

Watershed	**Water Body**	**Primary / Secondary**	**303(d)**	**Beneficial Uses (i.e. Values at Risk)**
Pajaro River			Boron Fecal Coliform Sediment Pathogens Nitrate	
	Alec Canyon Creek	Secondary		**COLD** COMM GWR **MIGR** **MUN** REC 1 REC 2 SPWN WILD
	Browns Creek	Primary		AGR **COLD** COMM IND GWR **MIGR** **MUN** REC 1 REC 2 SPWN **WARM** WILD

	Corralitos Creek	Primary	Fecal Coliform Pathogens	AGR **COLD** COMM IND GWR **MIGR** **MUN** REC 1 REC 2 SPWN **WARM** WILD
	Croy Creek	Secondary		COMM GWR **MUN** RARE REC 1 REC 2 **WARM** WILD
	Diablo Gulch	Primary		**COLD** COMM GWR **MUN** REC 1 REC 2 WILD
	Little Uvas Creek	Secondary		AGR COMM GWR **MUN** REC 1 REC 2 **WARM** WILD
	Ramsey Gulch	Primary		**COLD** COMM GWR **MIGR**

				MUN REC 1 REC 2 SPWN WILD
	Rattlesnake Gulch	Primary		**COLD** COMM GWR **MUN** REC 1 REC 2 WILD
	Redwood Canyon	Primary		**COLD** COMM **MIGR** **MUN** REC 1 REC 2 SPWN WILD
	Shingle Mill Gulch	Primary		**COLD** COMM GWR **MIGR** **MUN** REC 1 REC 2 SPWN WILD
	Swanson Canyon Creek	Primary		COMM GWR **MUN** REC 1 REC 2 WILD
	Uvas Creek	Secondary		**COLD** COMM FRESH GWR

				MIGR **MUN** RARE REC 1 REC 2 SPWN WILD
	Uvas Reservoir	Secondary		AGR COMM FRESH GWR **MUN** NAV RARE REC 1 REC 2 SPWN **WARM** WILD
Soquel Creek				
	Bates Creek	Secondary		BIOL **COLD** COMM **MIGR** **MUN** REC 1 REC 2 SPWN WILD
	Hinckley Creek	Secondary		AGR BIOL **COLD** COMM GWR IND **MIGR** **MUN** REC 1 REC 2

				SPWN WILD
	Soquel Creek	Primary		AGR BIOL **COLD** COMM FRESH GWR IND **MIGR** **MUN** REC 1 REC 2 SPWN WILD
	Soquel Point (Lagoon)	Secondary	Nutrients Pathogens Sedimentation / Siltation	**COLD** COMM EST **MIGR** REC 1 REC 2 RARE SPWN WILD

Table 2-Martin Fire

Watershed	**Water Body**	**Primary / Secondary**	**303(d)**	**Beneficial Uses (i.e. Values at Risk)**
Laguna Creek				
	Laguna Creek	Primary		AGR **COLD** COMM FRESH GWR IND **MIGR** **MUN** RARE REC 1 REC 2

				SPWN WILD
	Reggiardo Creek	Primary		**COLD** COMM GWR **MUN** RARE REC 1 REC 2 WILD
San Vicente Creek				
	San Vicente Creek	Secondary	Sedimentation / Siltation	AGR **COLD** COMM EST FRESH GWR IND **MIGR** **MUN** PRO RARE REC 1 REC 2 SPWN WILD
	Mill Creek	Secondary		**COLD** COMM GWR **MIGR** **MUN** REC 1 REC 2 SPWN WILD

B. Findings of the On-The-Ground Survey

1. Resource condition resulting from the fire

The footprints of the fire areas include low, moderate, and high burn severity. The highest burn severity areas seem to have occurred at the higher elevations and along ridge tops. The vegetation is already showing signs of recovery, including in the areas rated with the highest burn severity. This is especially significant considering the minimal amount of rain fall since the fires occurred.

The riparian areas along the banks of Reggiardo Creek in the center of the footprint of the Martin Fire exhibit the highest degree of damage and loss to riparian vegetation and therefore will most likely experience a higher degree of sediment movement during upcoming winter storms. Overall, the roads and other infrastructure in both burn areas appear to be, with some exceptions, in good condition. There are some steep slopes that have been denuded. It will be difficult to control sediment movement from these slopes.

III. Emergency Determination

Please see the geological and hydrological reports for an emergency determination.

IV. Treatments

Effective treatments within the burn area for the protection of water quality will depend greatly on the cooperation of private landowners, land use managers, and various governmental agencies responsible for the maintenance of roads, culverts, and other infrastructure throughout the area. All activities conducted on the post-fire landscape must be conducted in a way that is protective of water quality.

The recommendations in this report are designed to protect water quality. Although the recommendations are not all inclusive and the affected stakeholders should consult the local Natural Resource Conservation Service (NRCS) or appropriate fire restoration professionals as necessary for site specific help in insuring the protection of water quality and its beneficial uses.

V. Discussion/Recommendations

In the post- fire landscape, elevated levels of sedimentation and anthropogenic debris during winter storm-events should be expected. Any opportunity to decrease erosion on a post-fire landscape is critical to minimize impacts to the values at risk. Potential changes in water quality associated with post-fire conditions include alteration of pH, sedimentation/siltation, turbidity, boron, fecal coliform, temperature, nutrients, nitrates, heavy metals, and pathogens.

Providing assistance for and implementing the flowing recommendations has the potential to minimize negative impacts to beneficial uses identified for the primary and secondary water bodies.

1. Projects that could potentially impact the nearby water bodies (i.e. construction, road maintenance, land-use practices, etc.), either already in progress, planned or in planning stages, in primary and secondary water bodies need to be revised to include components protective of values at risk due to severe modification to the landscape as a result of the fires.

2. The burn greatly reduced vegetative cover, particularly on those areas of moderate and high intensity severity, exposing dump sites throughout the burn area. The debris at these dump sites includes cans, bottles, derelict equipment, plastics, broken glass, metals, and other non-native debris. Due to the reduction of vegetation, materials associated with dump sites exposed by the fire are more prone to enter nearby water bodies. Since this is an additional threat to water quality as a direct result of the fire, the debris should be removed and property disposed of offsite. Additionally, removal of this debris will discourage additional dumping in exposed areas.

3. Recreational trespassing is a widespread problem throughout Santa Cruz County. Trespassing activities such as use of Off Highway Vehicles (OHVs) can damage current road infrastructure and cut new trails, severely altering drainage patterns leading to increased erosion. Considering the landscape's increased susceptibility to erosion in post-fire conditions, trespassing becomes an issue of specific importance. Private landowners and the Santa Cruz County Sheriff's office should work collaboratively to take appropriate steps to discourage and prevent illegal trespass activities.

4. The fires severely reduced the amount of preexisting vegetative cover. Vegetative cover is essential for reducing sediment movement via rainfall interception and root structure. Where appropriate and feasible, revegetation and soil stabilization techniques should be established. Revegetation efforts should be done in consultation with the local NRCS or other post-fire restoration professionals and include components to eliminate the introduction of non-native invasive plant species that include the use of weed free straw and sterilized seed mixes.

5. Many home sites were destroyed by the Summit Fire. These home sites are either in active reconstruction or currently unmanaged. Reconstruction of the home sites should be implemented consistent with the requirements of the Central Coast Regional Water Quality Control Board's (Water Board) Construction General Permit and any applicable Santa Cruz County codes. The Water Board's permit can be viewed via the following link:

6. http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

7. Unmanaged home sites destroyed by the fire should be evaluated prior to the winter period to determine the most appropriate way to secure the perimeter and prevent associated materials (including household hazardous waste) from entering the nearby water bodies.

8. A majority, if not all, of the home sites discussed in the previous recommendation have onsite septic systems. Home sites in active reconstruction should install or reinstall septic systems per Santa Cruz County code, California Plumbing code, and Basin Plan requirements for septic systems. Unmanaged sites should be evaluated for abandoned septic systems. Abandoned septic systems have the potential to fail and adversely impact water quality. Such septic systems should be appropriately treated per Santa Cruz County code, California Plumbing code, and Basin Plan requirements to prevent fecal coliform and pathogen contamination of nearby water bodies.

9. Landowners and land-use managers with grading projects in primary or secondary water bodies should consult with the NRCS prior to project implementation to ensure the project is protective of water quality. Construction of new roads and other projects that require soil disturbance should be minimized.

10. Culverts located in primary and secondary water bodies have an increased risk for plugging due to the anticipated increase of sediment loads and debris during upcoming winter storms. Land owners and land use managers with culverts on their property should inspect their infrastructure prior to the rainy season to determine if the installation of "trash racks" is appropriate. Additionally, they should inspect and clean-out culverts during the winter after every significant storm event (two-inches of rain or greater within a twenty-four hour period or any the land use manager determinate appropriate) to prevent the potential for plugging and ultimately catastrophic failure of the crossing.

11. According to Jed Wilson , California Department of Forestry and Fire Protection Fire Captain, who participated in suppression activities on the Summit Fire, fire retardant was utilized as part of the suppression activities. The Pajaro River is listed on the Clean Water Act's 303(d) list as

impaired for boron, a substance found in some fire retardants. Additionally, fire retardants have been found to be toxic to fish and other aquatic organisms. A focused evaluation of where fire retardant was dropped during suppression activities should be conducted to determine the risk to the beneficial uses of water. Appropriate follow-up activities should be implemented to minimize damage to beneficial uses.

VI. References

Central Coast Regional Water Quality Control Board Basin Plan
http://www.waterboards.ca.gov/centralcoast/BasinPlan/Index.htm

Introduction to Wildland Fire Second Edition
http://books.google.com/books?id=yT6bzpUyFIwC&pg=PR32&dq=Introduction+to+Wildland+Fire+Second+Edition&sig=ACfU3U2jlsA4rhfRXnAEh7TN4Iz_sx9Isw

Appendix E
General Location Map

Summit and Martin Fires - SEAT
General Location Map

Legend

- Highways
- Streams
- Fire Perimeter

N
W E
S

Scale

0 2 4 6 8 10 Miles

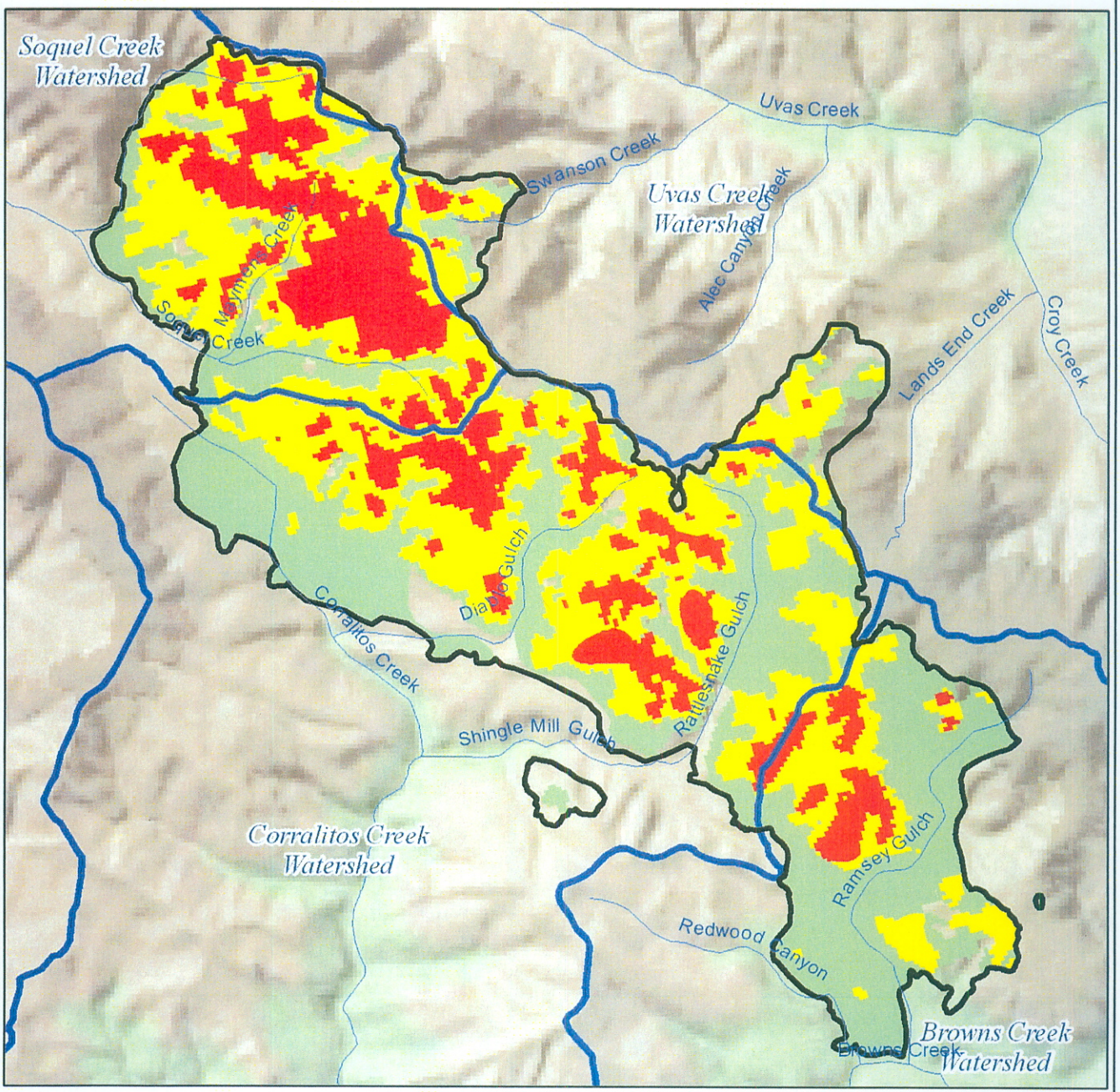
0 2 4 6 8 10 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx E-1

Appendix F
Burn Severity Maps

Summit Fire - SEAT
Burn Severity Map



Legend

Burn severity

- Unchanged
- Low Severity
- Moderate Severity
- High Severity
- CalWater 2.21 Planning Watersheds

N
W E
S

Scale

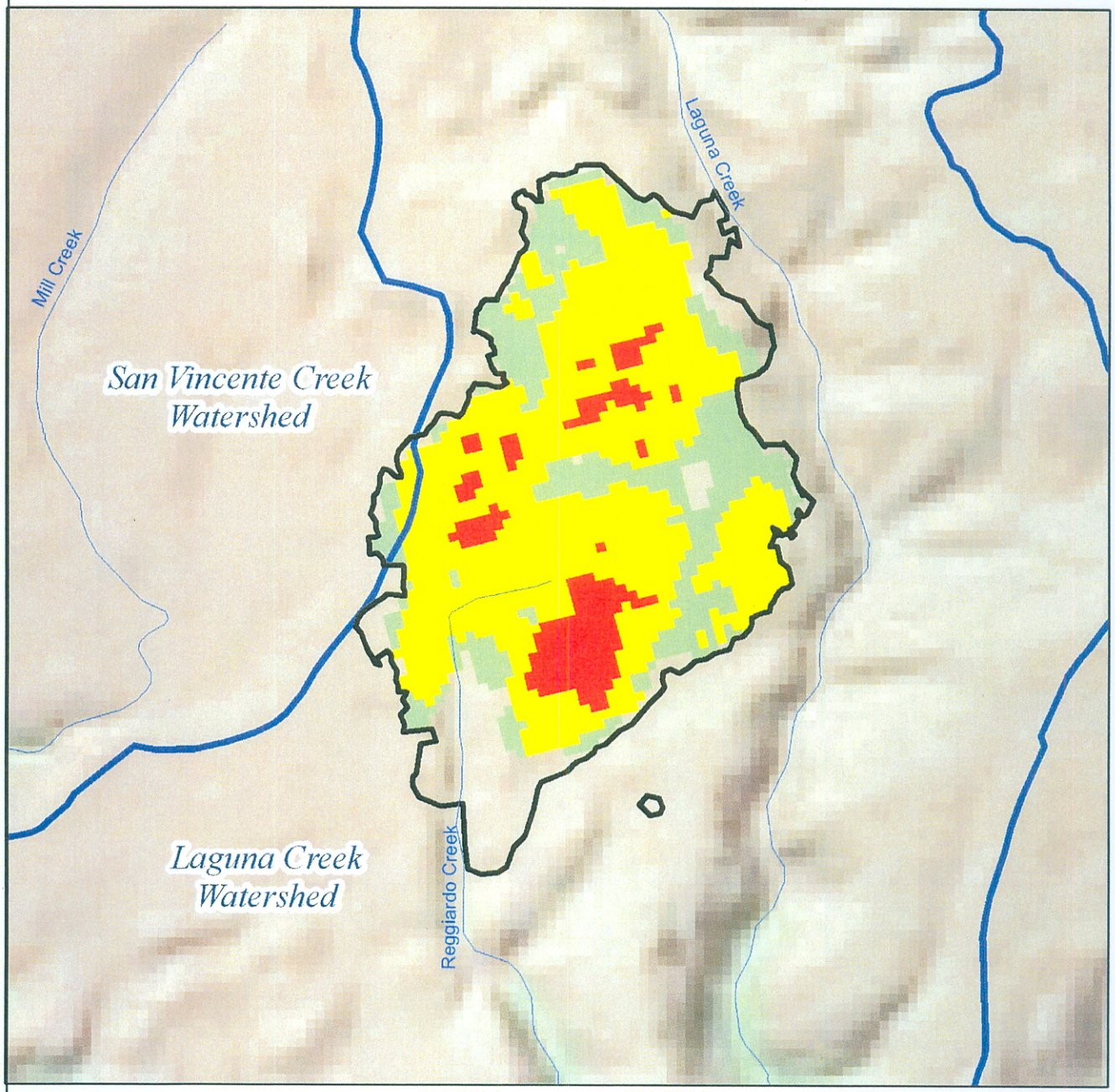
0 0.25 0.5 0.75 1 Miles

Kilometers
0 0.25 0.5 0.75 1

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, CDFG, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx F-2

Martin Fire - SEAT
Burn Severity Map



Legend

Burn severity

- Unchanged
- Low Severity
- Moderate Severity
- High Severity
- CalWater 2.21 Planning Watersheds

N
W E
S

Scale

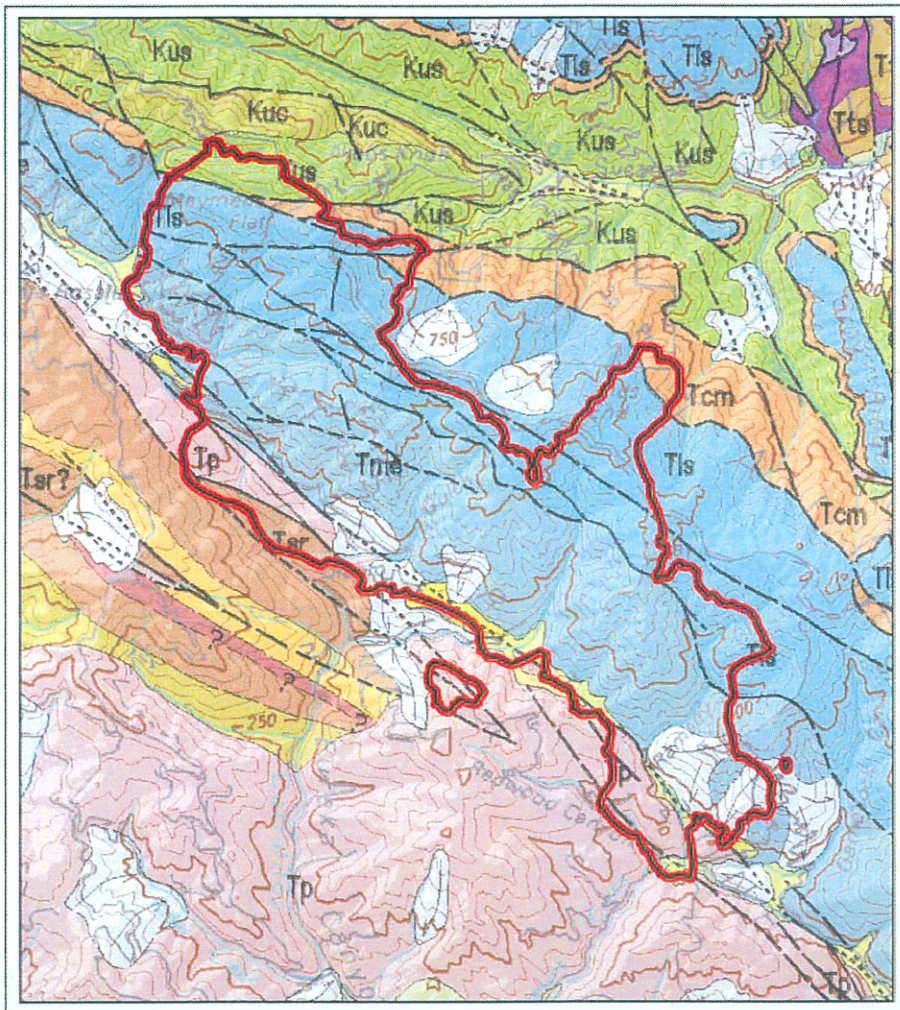
0 0.25 0.5 0.75 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, CDFG, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx F-3

Appendix G
Geologic Maps



EXPLANATION

SANTA CRUZ BLOCK

Tp — **Purisima Formation (Pliocene and Upper Miocene)** - Thick-bedded to massive, locally cross-bedded, bluish-gray, fine- to medium- grained sandstone, with abundant andesitic grains, and very thick-bedded, yellowish-gray, tuffaceous and diatomaceous siltstone.

Tsr — **San Lorenzo Formation, Rices Mudstone Member (Oligocene and Eocene)** - Nodular light-gray mudstone, locally bioturbated and glauconitic.

SIERRA AZUL BLOCK

Tme — **Shale and sandstone of Highland Way (Lower Miocene to Lower Eocene)** - Hard, black, siliceous, carbonaceous marine shale and interbedded shale and arkosic sandstone.

Tls — **Sandstone and shale of Loma Chiquita Ridge (Eocene)** - Thickly to thinly bedded, locally pebbly, quartzofeldspathic and arkosic sandstone and interbedded micaceous carbonaceous mudstone. Upper part of unit locally includes thin-bedded, fissile, brown siliceous mudstone.

Tcm — **Mottled mudstone and sandstone of Mount Chual (Lower Eocene)** - Maroon red to olive green, mottled foraminiferal mudstone, locally with glauconitic, bioclastic, conglomeratic lithic sandstone at base. Basal bioclastic sandstone includes detritus from Franciscan Complex and Coast Range ophiolite. Strongly cemented bioclastic beds in the Santa Teresa Hills were mapped as limestone (Bailey and Everhart, 1964). The overlying mottled mudstone contains a deep marine foraminiferal fauna (bathyal to abyssal) of early Eocene age (P8-P9). Mottled mudstone is overlain by quartzo-feldspathic sandstone and interbedded carbonaceous green to brown mudstone.

Great Valley Sequence

Kus — **Sandstone and shale (Upper Cretaceous)** - Arkosic to feldspathic wacke, lithic, laumontized, locally massive or rhythmically interbedded with dark gray to green shale. Upper part of sandstone and shale unit is massive shale with carbonate concretions locally containing macrofossils of Late Cretaceous (Campanian) age (Elder, 1990).

Summit Fire Perimeter - 20080527 (final)

Geology of Summit Fire Area

Scale: 1:62,500

0 0.5 1 2 3 Miles

Projection: Teale Albers NAD83

DATA SOURCES: Preliminary Geologic Map of the San Jose 30 X 60 Minute Quadrangle, California: A Digital Database by Carl M. Wentworth, M. Clark Blake, Jr., Robert J. McLaughlin, and Russell W. Graymer, 1998 (USGS); Fire perimeter from CAL FIRE/OES

Map created August 22, 2008

N

MAP LOCATION

CGS CALIFORNIA GEOLOGICAL SURVEY

Figure Appx G-4

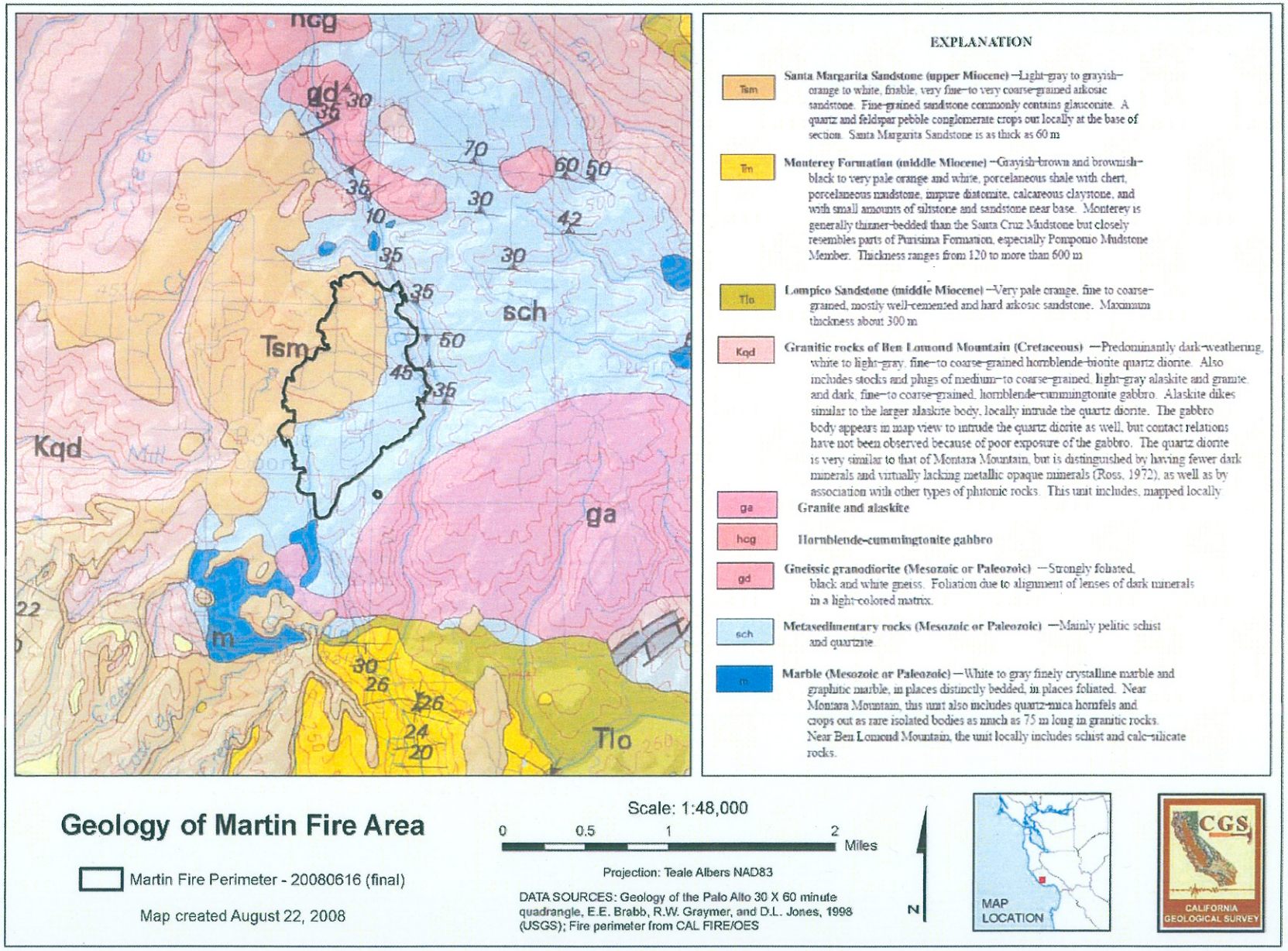
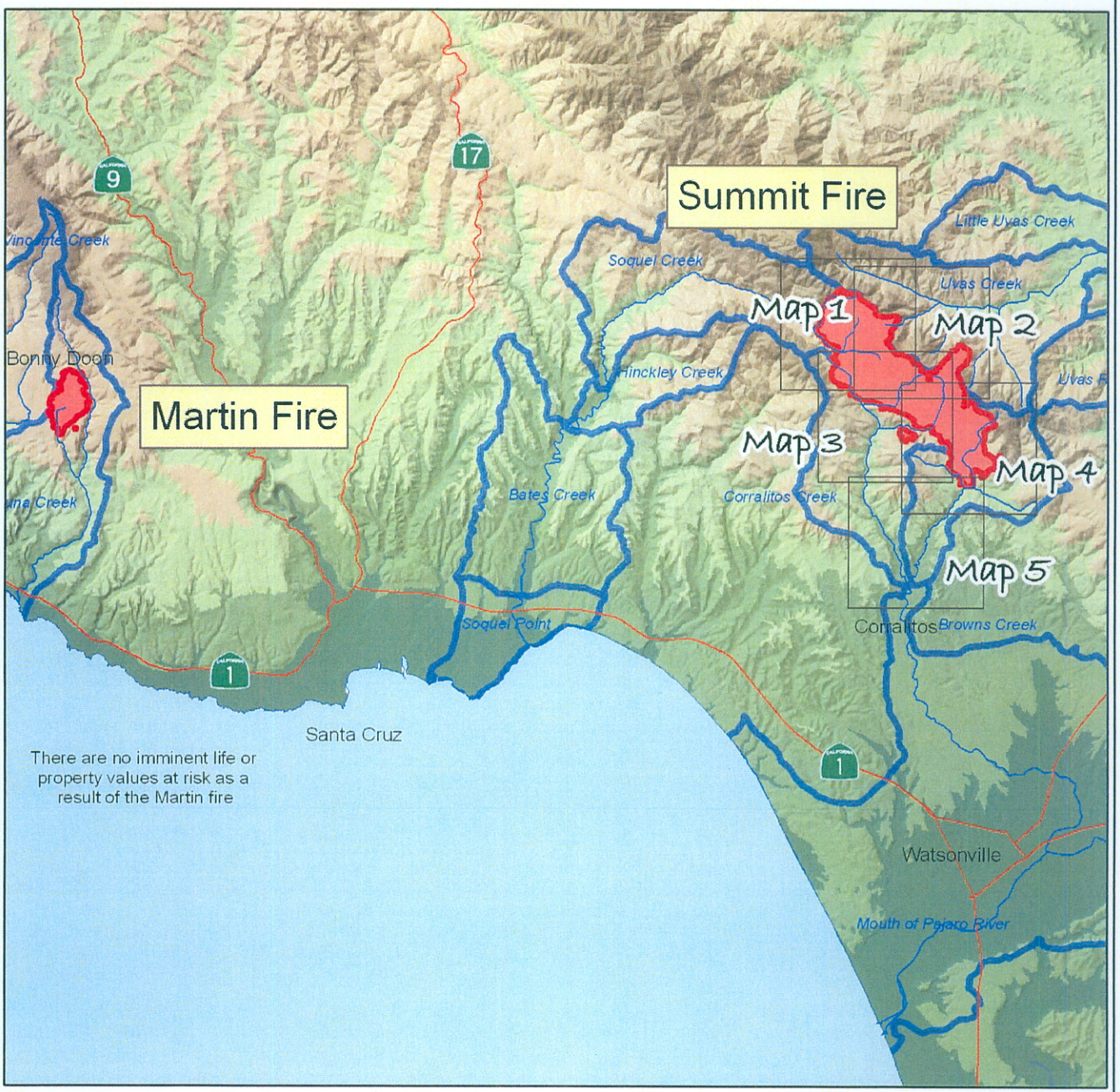


Figure Appx G-5

Appendix H
Burn Site Evaluation - Risk to Lives and Property Maps

Summit and Martin Fires - SEAT
Burn Site Evaluation Map Index



Legend

- Highway
- Streams
- Map Index Block
- Fire Perimeter
- CalWater221 Planning Watersheds

N
W E
S

Scale

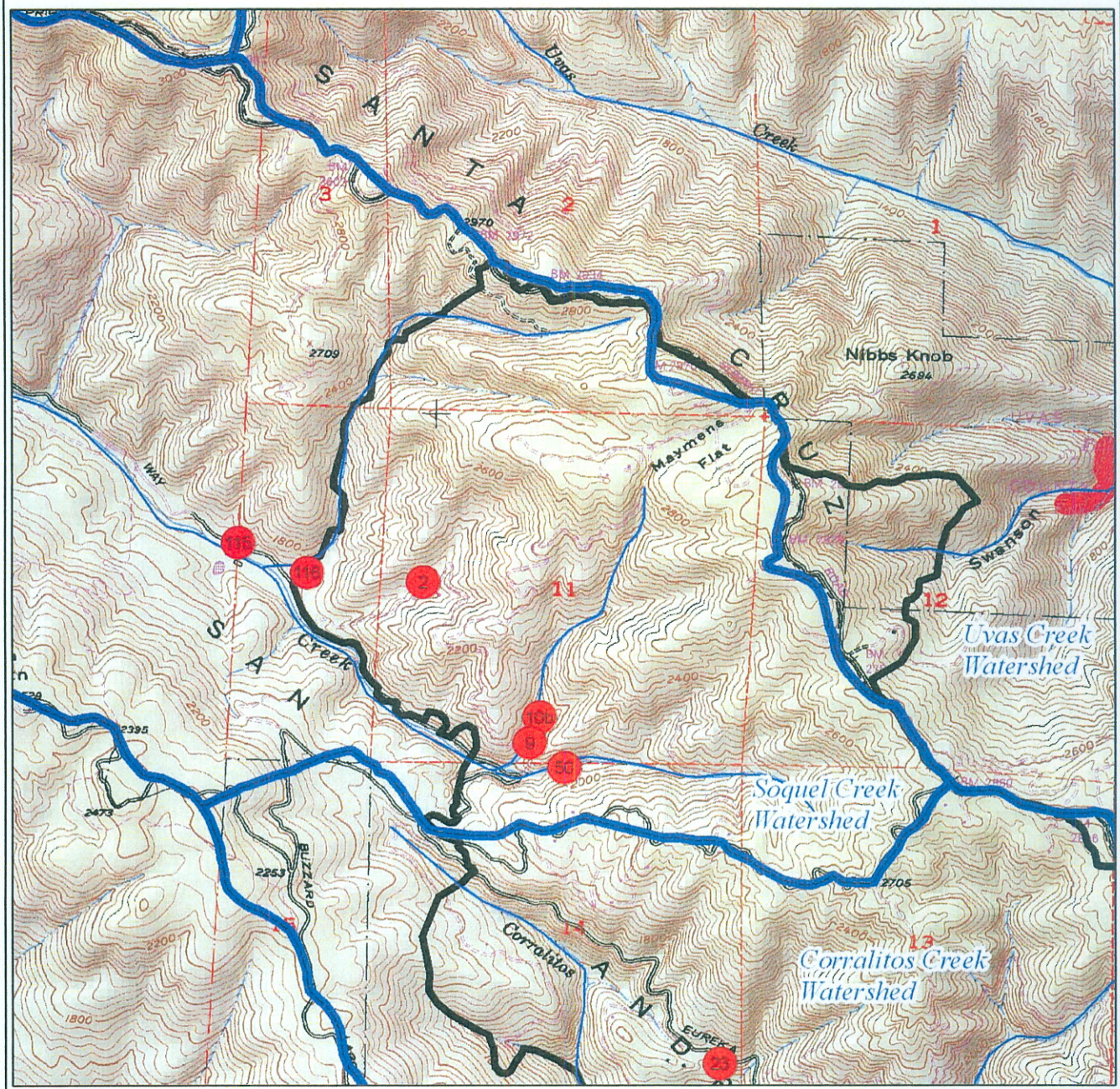
0 2 4 6 8 Miles

0 2 4 6 8 10 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-6

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #1



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

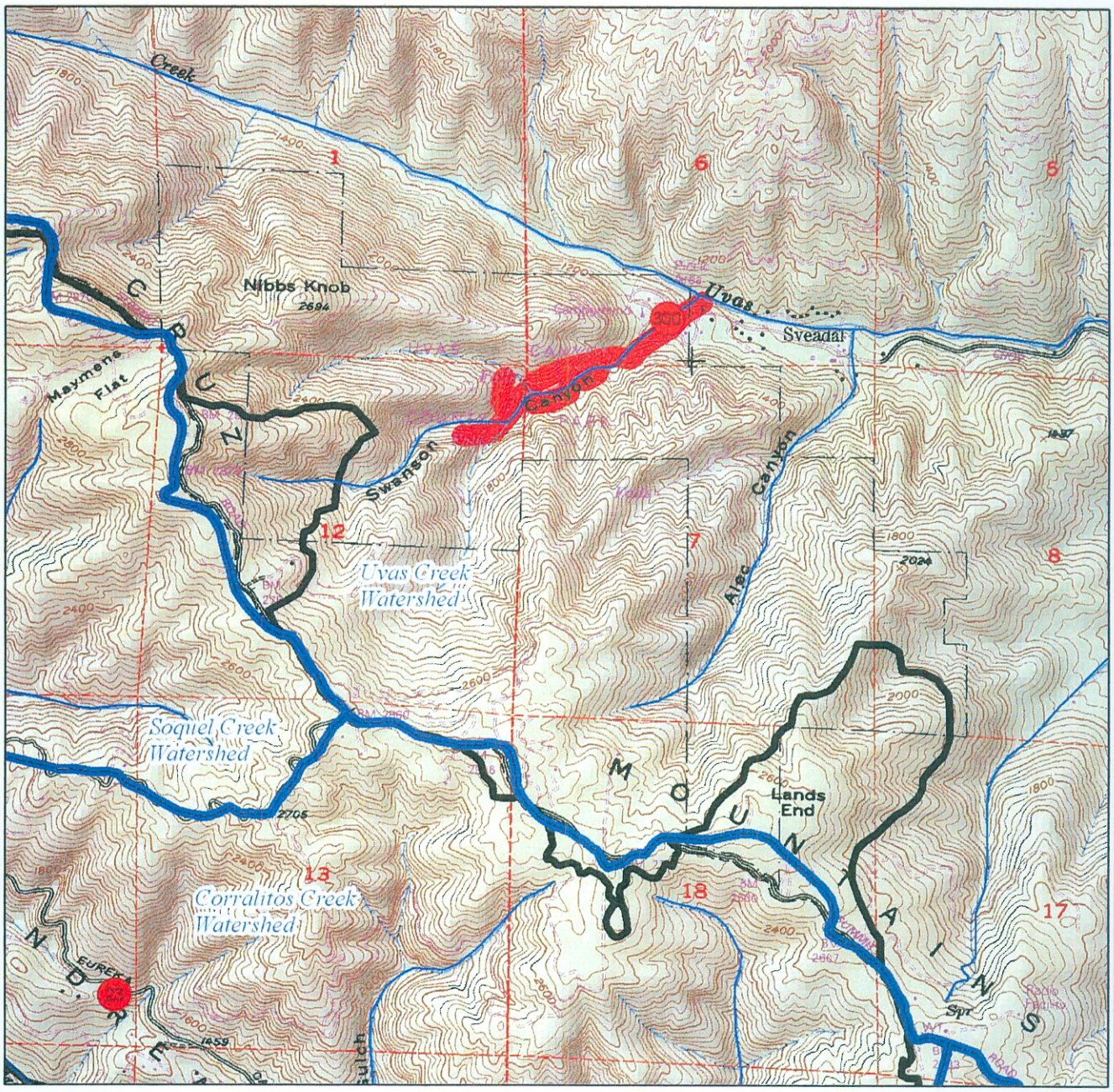
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-7

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #2



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Uvas Canyon County Park
- Fire Perimeter

N
W E
S

Scale

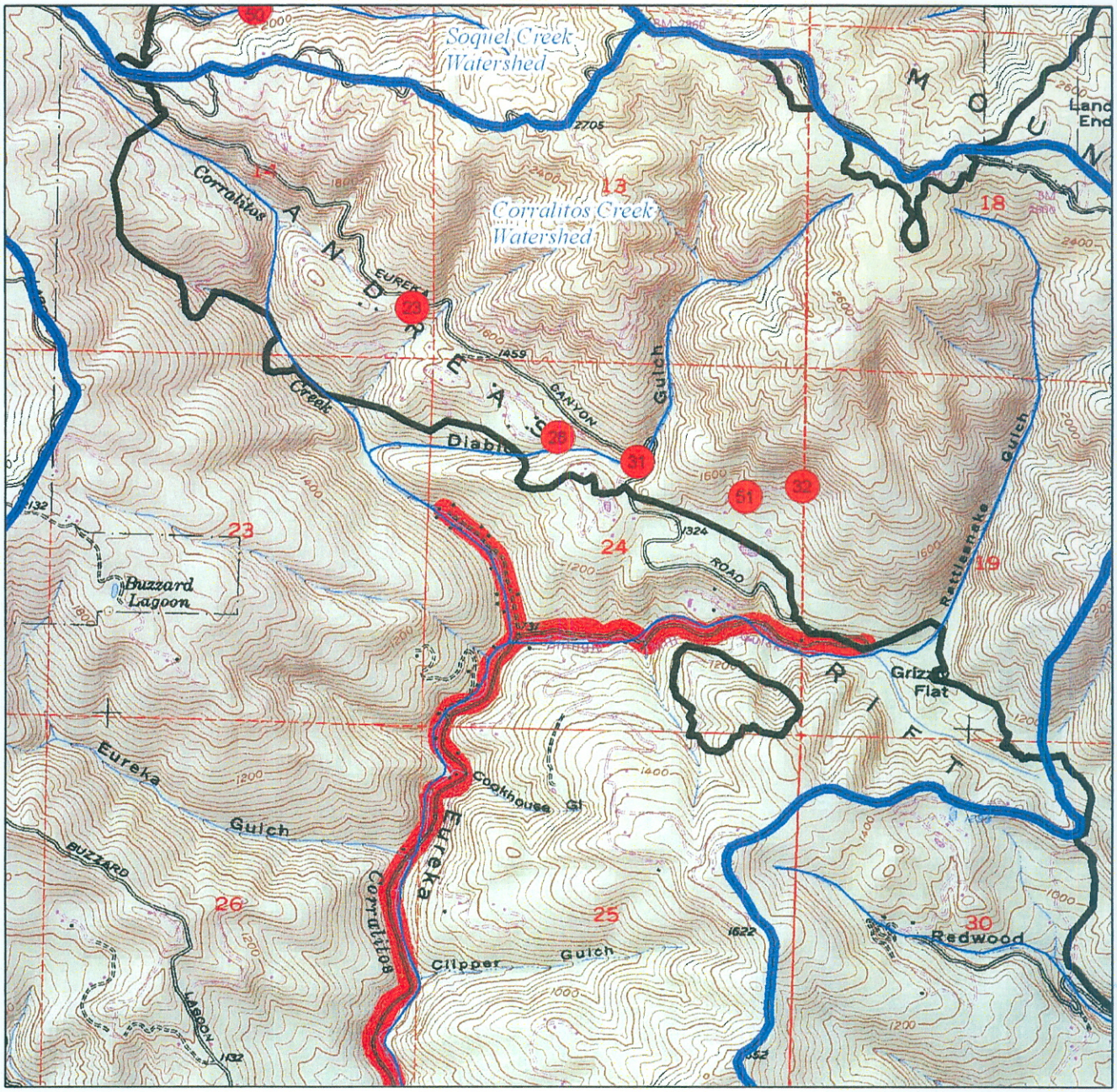
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-8

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #3



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

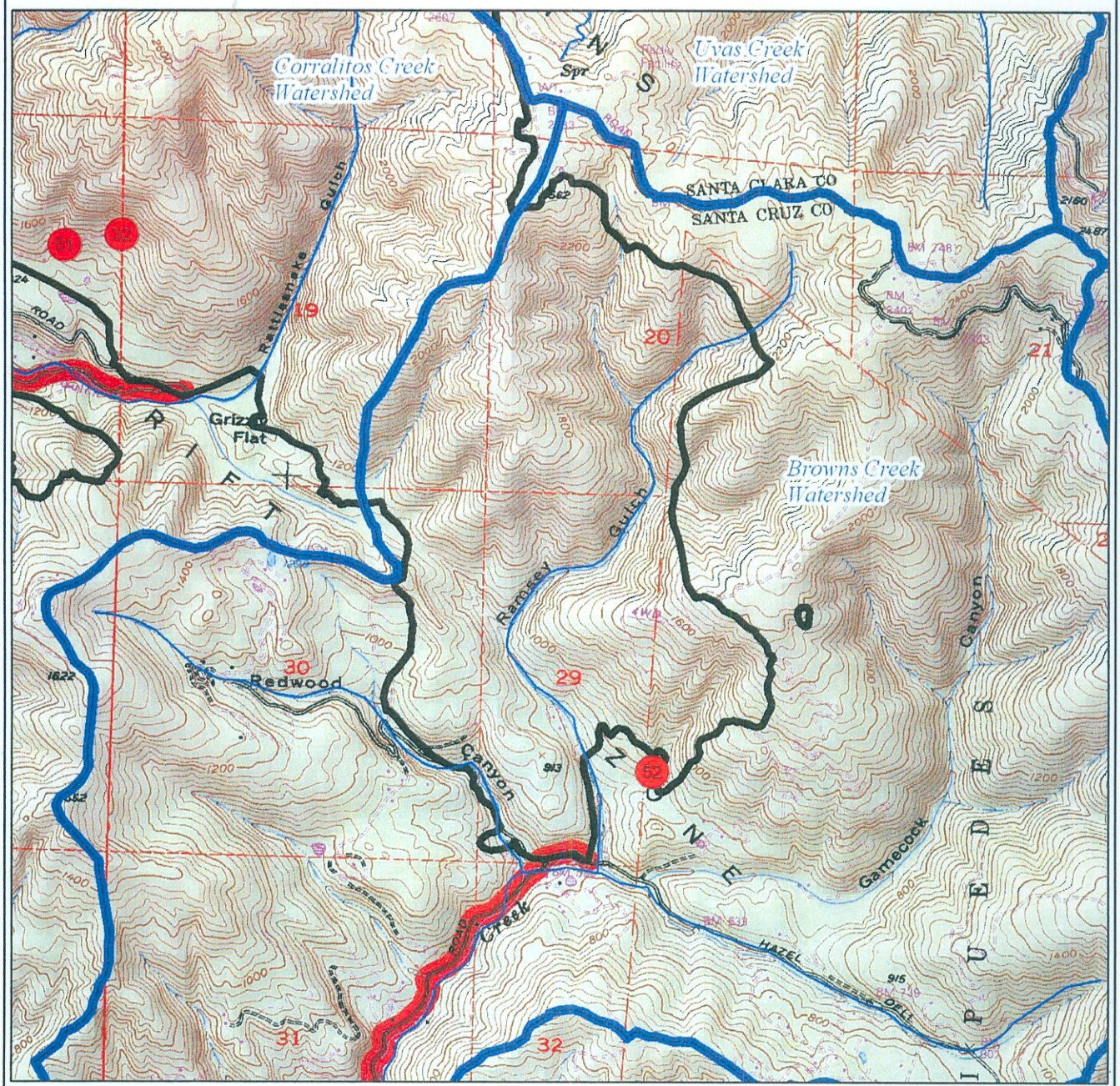
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-9

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #4



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

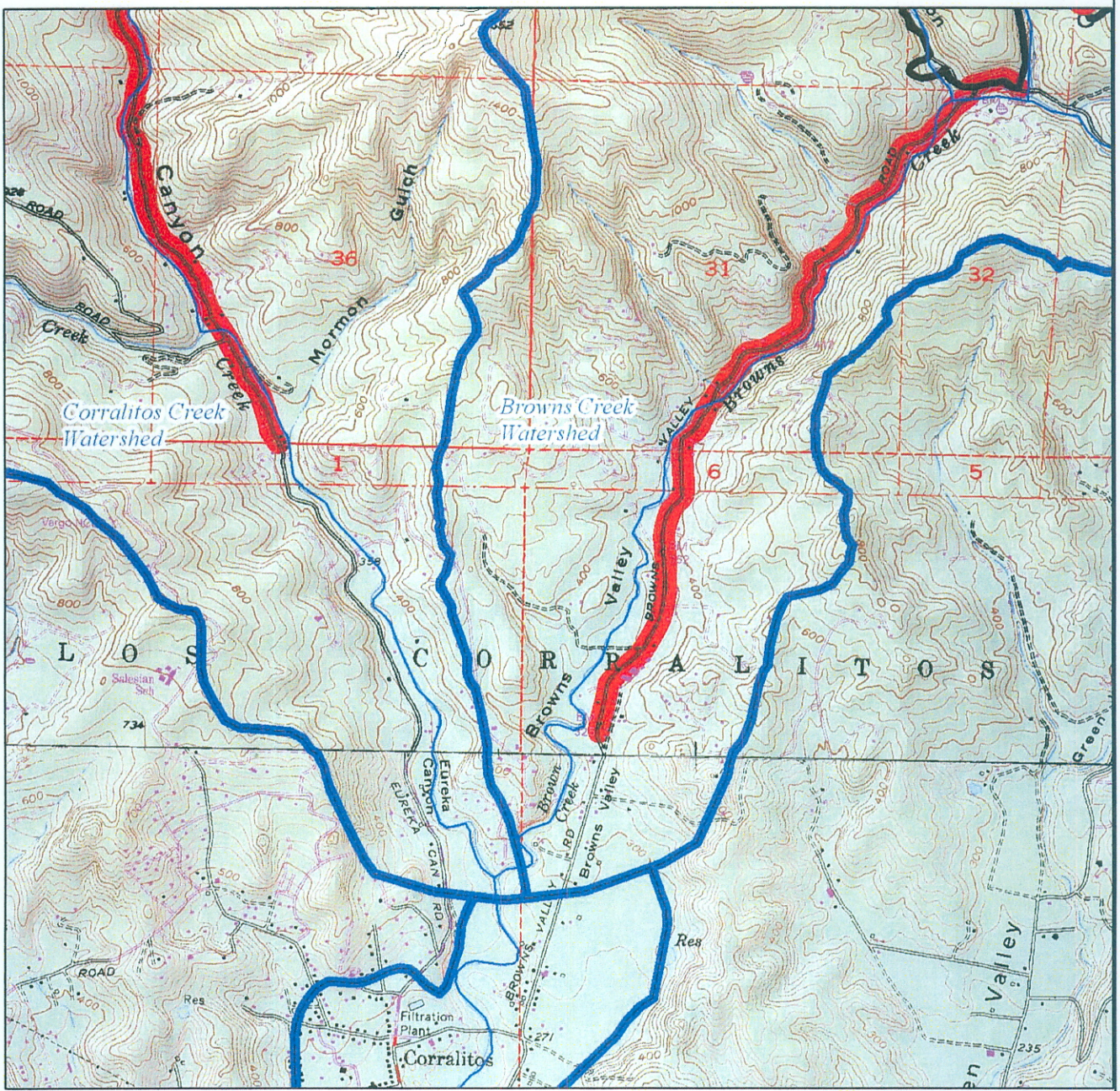
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-10

Summit Fire - SEAT
Burn Site Evaluation - Risk to Lives - Map Area #5



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

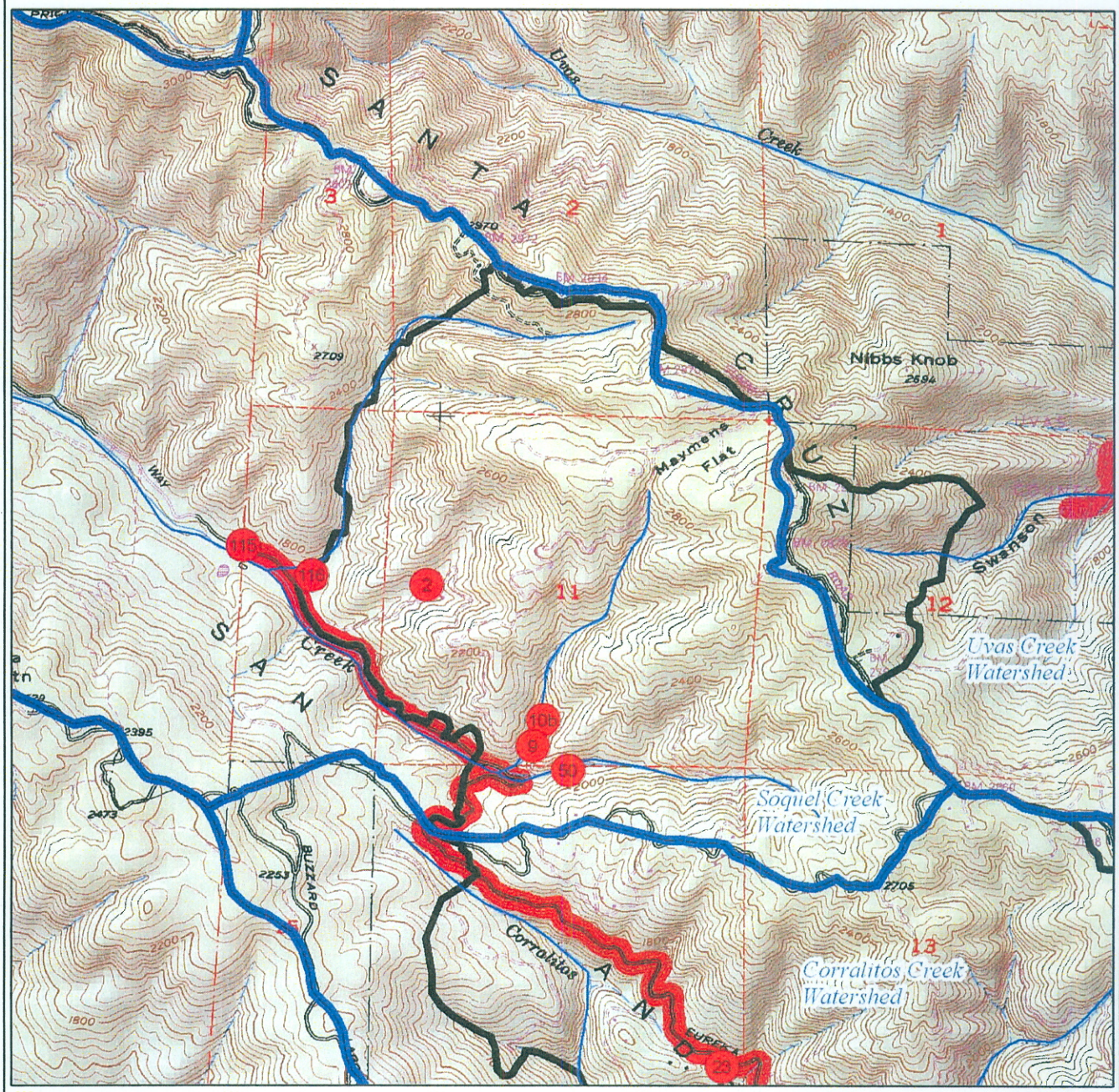
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-11

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #1



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

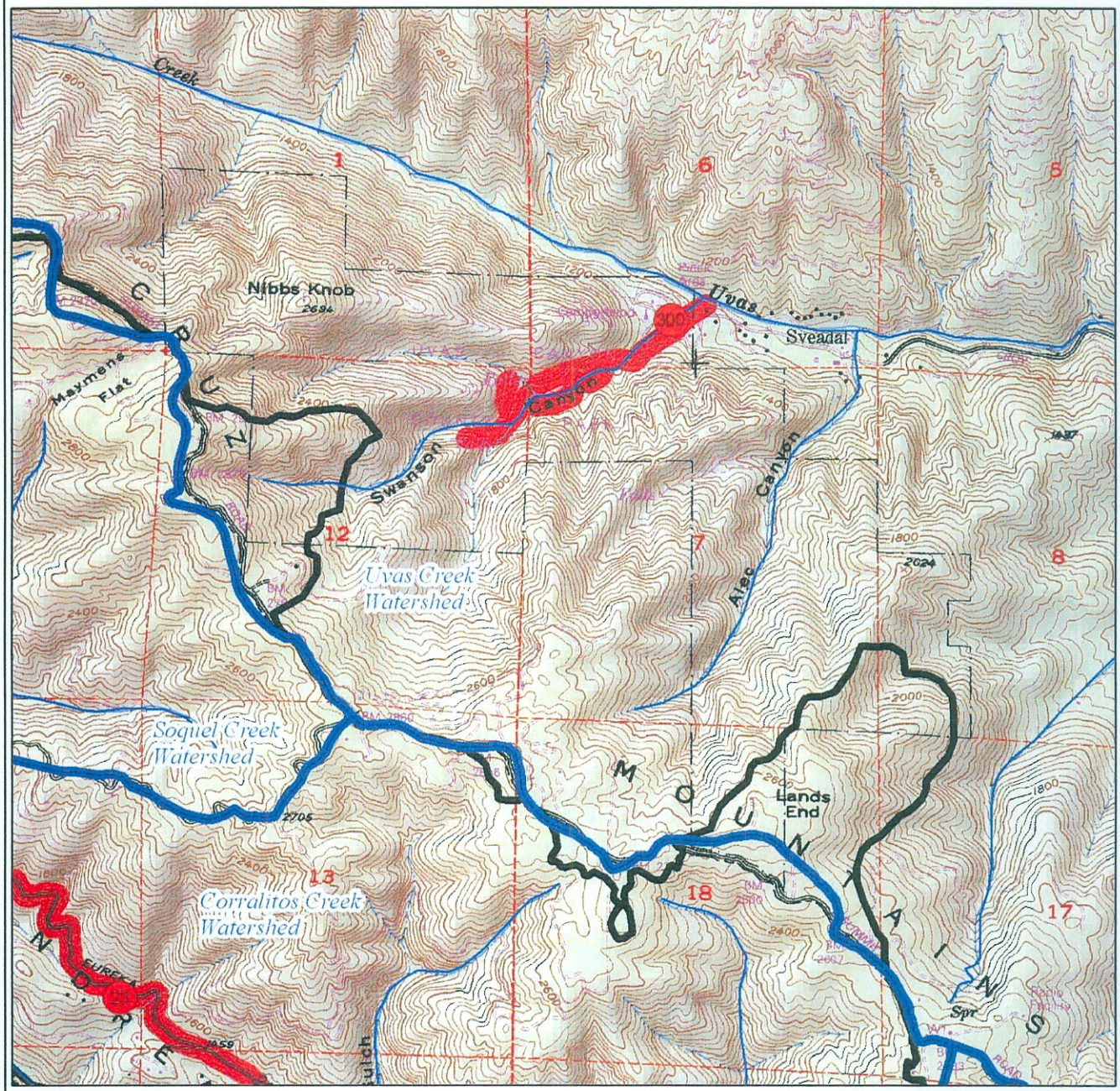
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-12

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #2



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Uvas Canyon County Park
- Fire Perimeter

N
W E
S

Scale

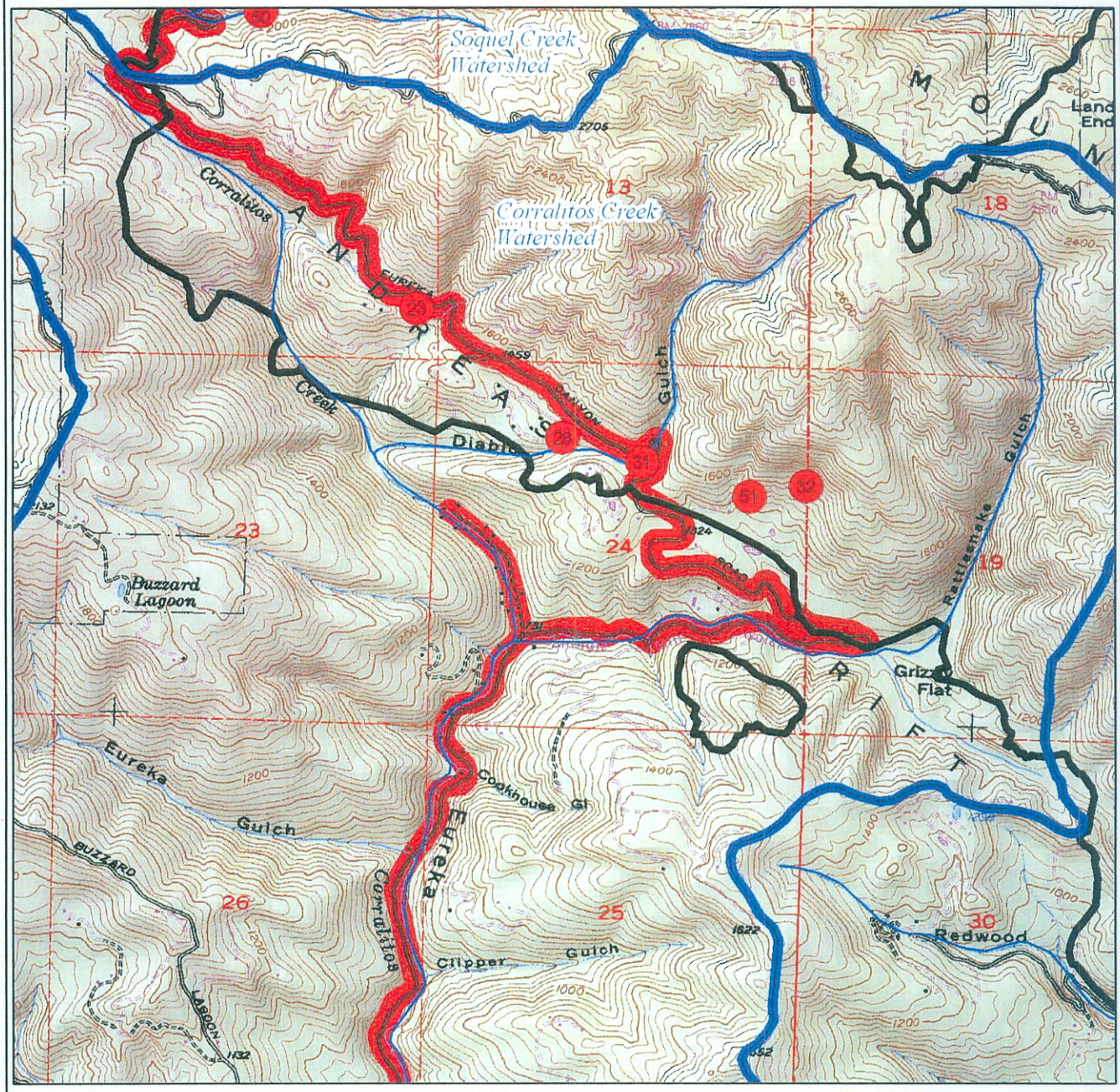
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-13

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #3



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N
W E
S

Scale

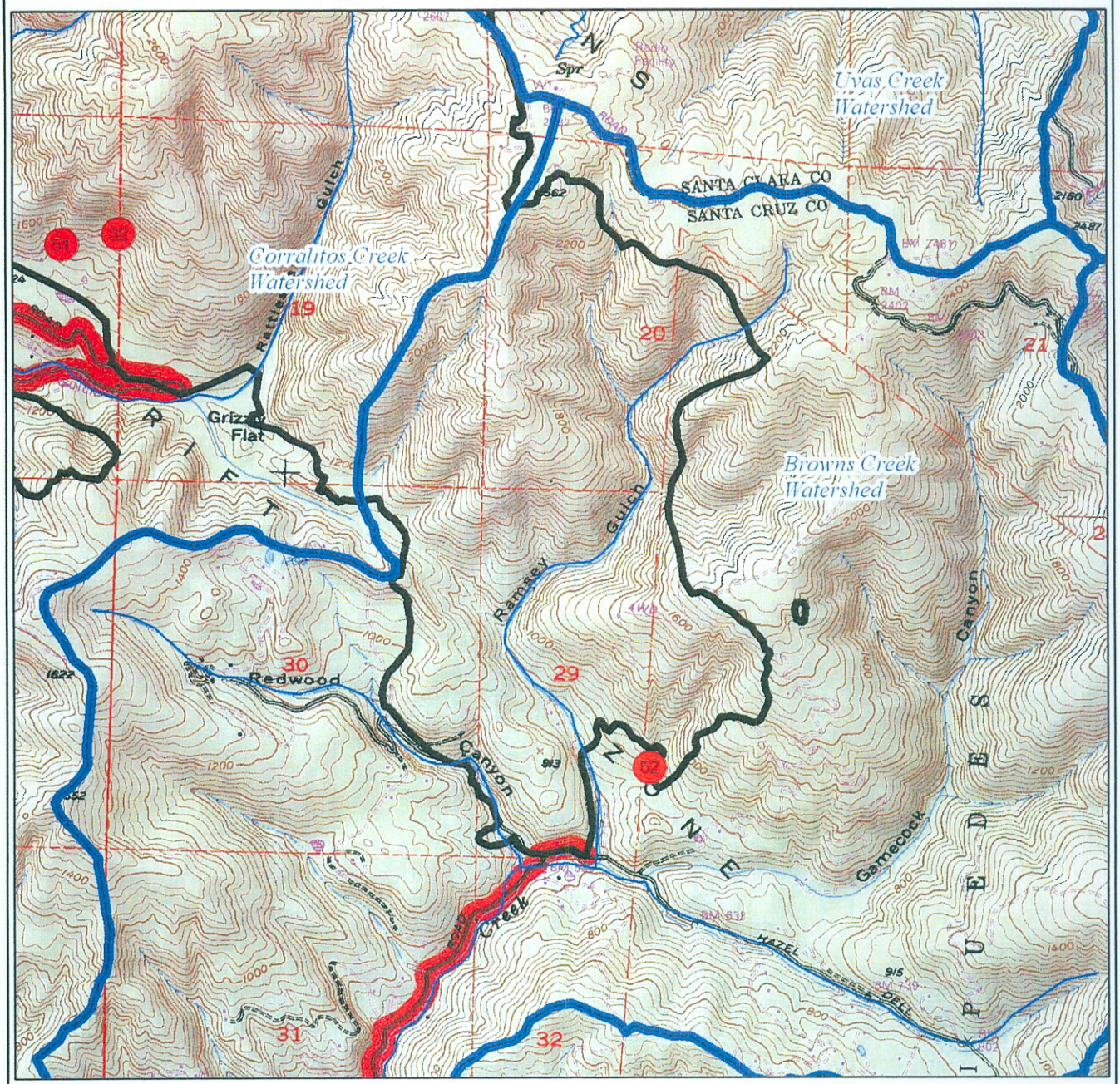
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-14

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #4



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

Scale

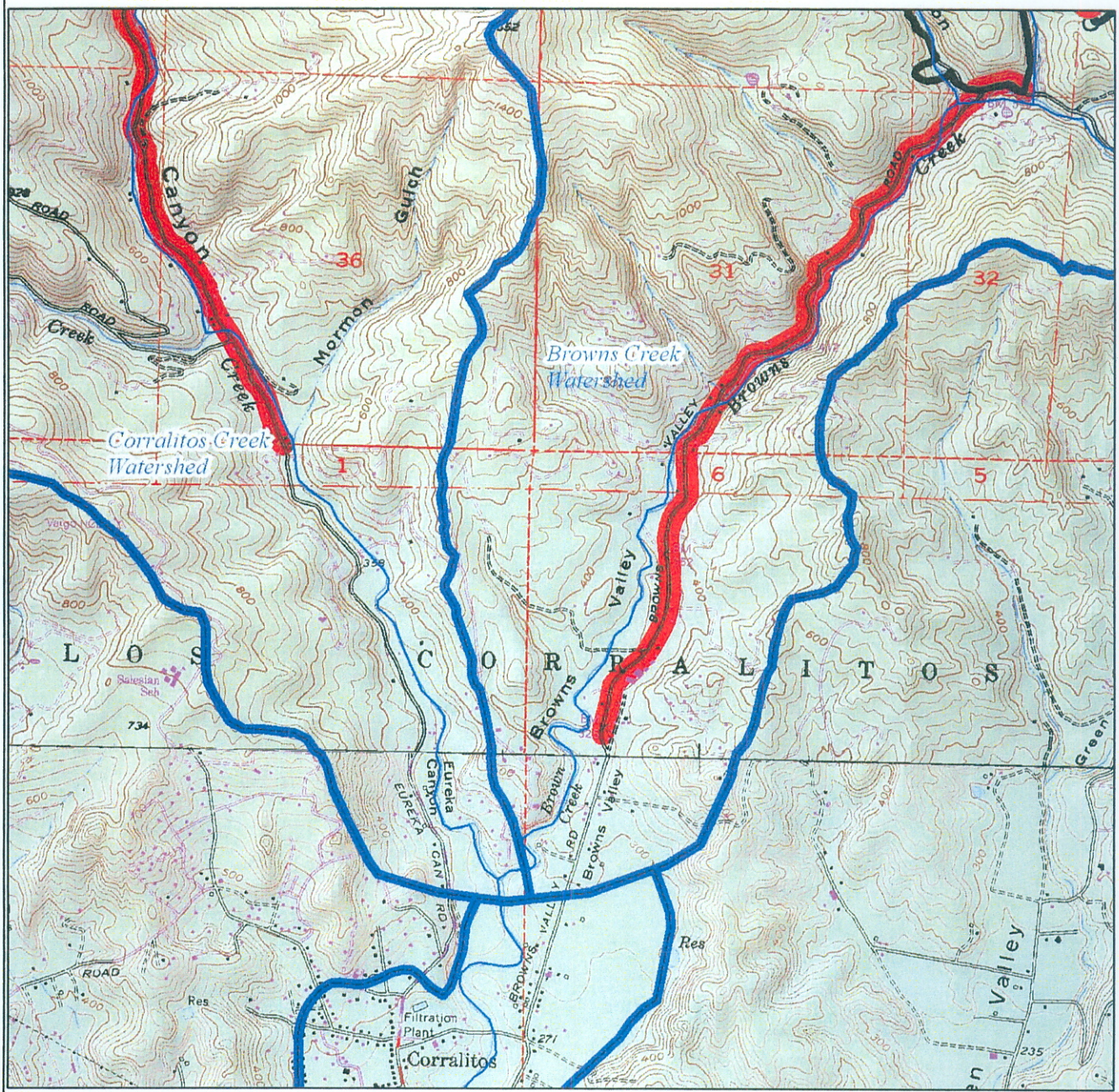
0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-15

Summit Fire - SEAT
Burn Site Evaluation - Risk to Property - Map Area #5



Legend

- Values at Risk (w/ Site ID)
- Values at Risk
- Streams
- Calwater 2.2.1 Planning Watersheds
- Fire Perimeter

N W E S

Scale

0 0.25 0.5 0.75 1 Miles

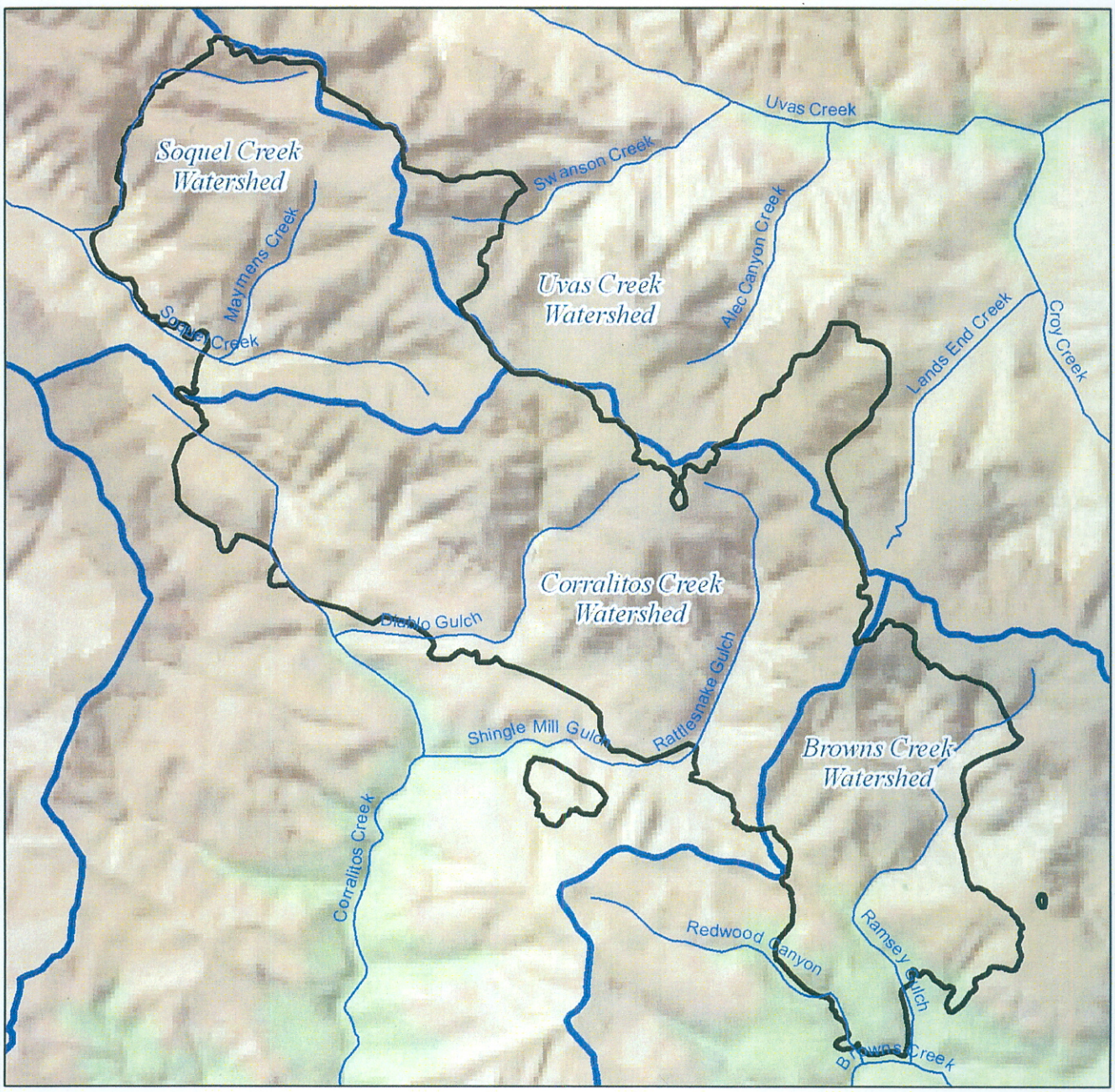
0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, DWR, FRAP, CASIL, OES, CDFG
NAD83, California Teale Albers

Figure Appx H-16

Appendix I
Watershed Maps

Summit Fire - SEAT
Streams and Watersheds



Legend

- Streams
- Fire Perimeter
- CalWater 2.21 Planning Watersheds

N
W E
S

Scale

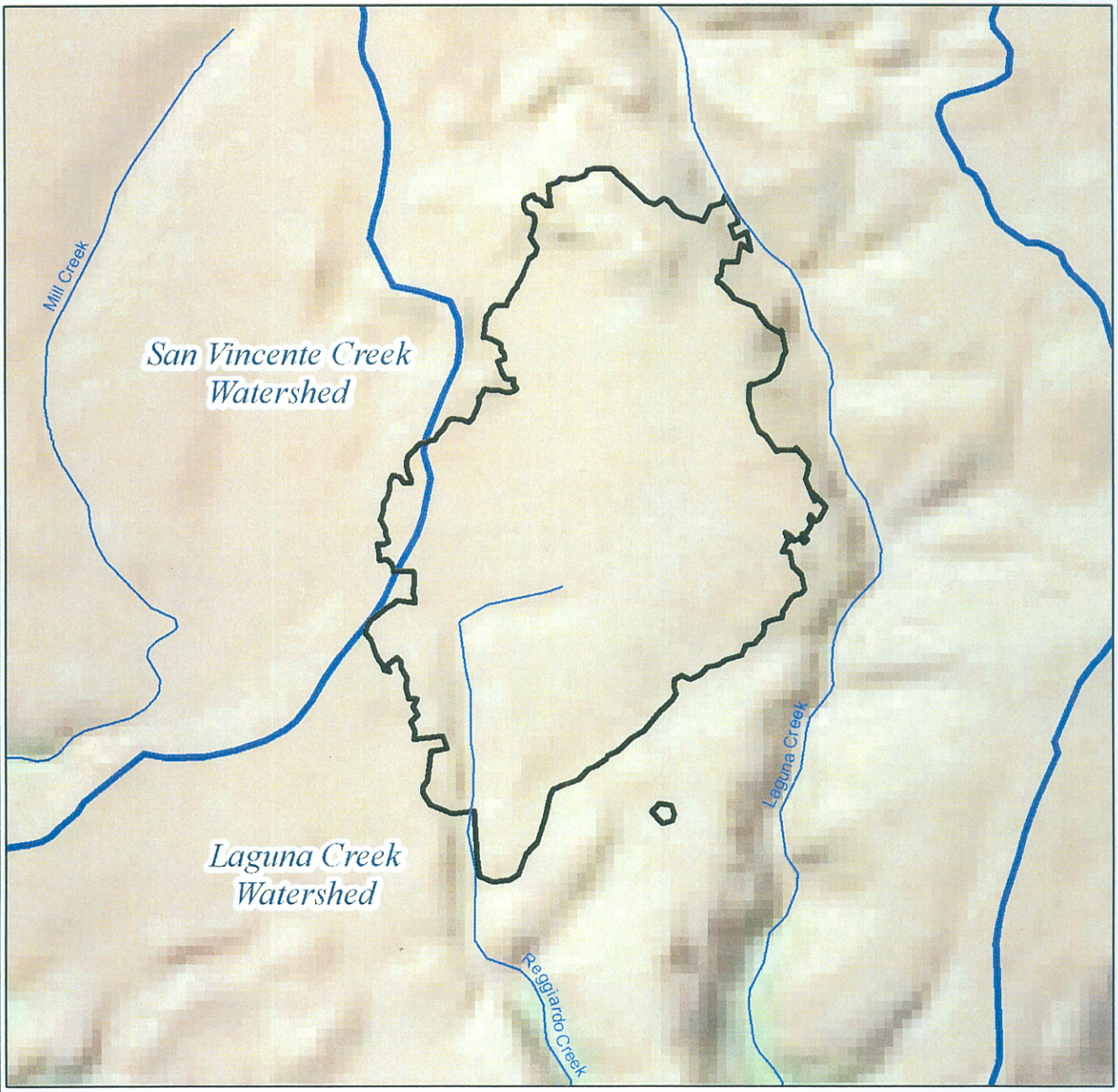
0 0.25 0.5 0.75 1 Miles

Kilometers
0 0.25 0.5 0.75 1

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, CDFG, DWR, FRAP, CASIL, OES
NAD83, California Teale Albers

Figure Appx I-17

Martin Fire - SEAT
Streams and Watersheds



Legend

- Streams
- Fire Perimeter
- CalWater 2.21 Planning Watersheds

N
W E
S

Scale

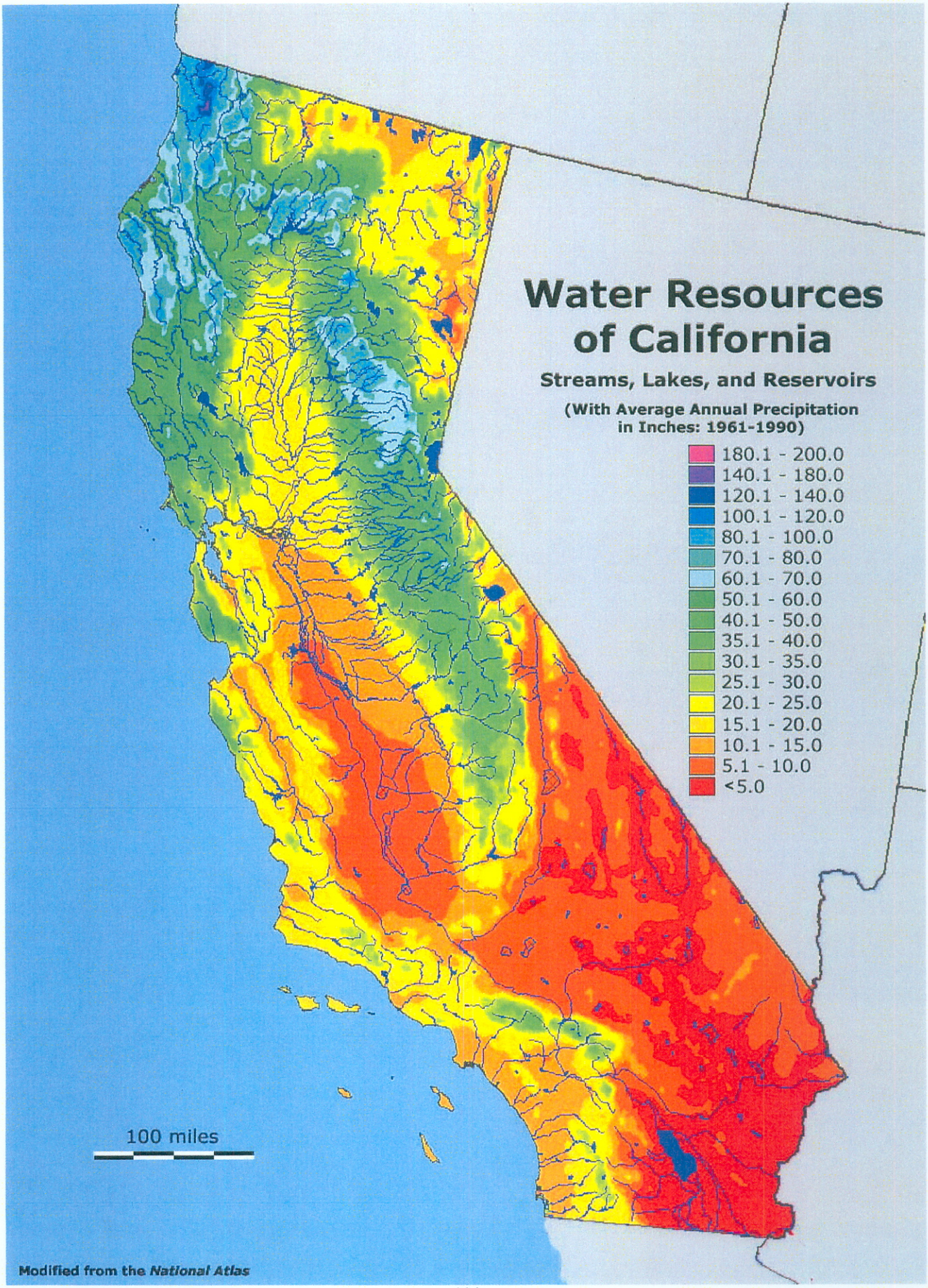
0 0.25 0.5 0.75 Miles

0 0.25 0.5 0.75 1 Kilometers

Santa Cruz SEAT, Rob Rutland - GISS, CALFIRE, 9/08
Data Sources – CALFIRE, CGS, CDFG, DWR, FRAP, CASIL, OES
NAD83, California Teale Albers

Figure Appx I-18

Appendix J
California Precipitation Map


Water Resources of California
Streams, Lakes, and Reservoirs
(With Average Annual Precipitation in Inches: 1961-1990)
180.1 - 200.0
140.1 - 180.0
120.1 - 140.0
100.1 - 120.0
80.1 - 100.0
70.1 - 80.0
60.1 - 70.0
50.1 - 60.0
40.1 - 50.0
35.1 - 40.0
30.1 - 35.0
25.1 - 30.0
20.1 - 25.0
15.1 - 20.0
10.1 - 15.0
5.1 - 10.0
<5.0
100 miles
Modified from the National Atlas

Appendix K
Ownership

Table 1-Major Landowners by Fire

Major Landowners by Fire		
Fire Name	Major Landowners	Total
Martin	Bonny Doon Ecological Reserve	342
	Private - Less Than 100 Acres	151
	Santa Cruz City Of	27
Martin Total		520
Summit	Private - Greater Than 100 Acres	985
	Private - less than 100 acres	2,980
	Santa Clara County	144
	Santa Cruz County Youth Activities	73
	United States Government	10
	Watsonville City Of	78
Summit Total		4,270
Grand Total		4,790

Appendix L
Soil Burn Severity

Soil Burn Severity

Soil Burn Severity is a map of fire caused change to soils. It is based on an indication of the post-fire vegetation condition as a result of the amount of heat that is released by a fire. It can be used to help predict subsequent effect on other resources. The BARC4 data (Burned Area Reflectance Classification) as provided by the U.S. Forest Service Remote Sensing Application Center (RSAC) was the beginning point for field verification. The Burn Severity data is the result of that effort culminating in the final analysis and maps.

"The severity ratings are based on the effects to vegetation. The vegetation severity rating is based upon a composite of the severity to the understory (grass, shrub layers), midstory trees and overstory trees. Because there is a strong correlation between vegetation and soil effects, this algorithm works in many cases. It is not, however, accurate in all ecosystems." (USFS BARC Summit_fire_20080707_metadata.txt)

Table 2-Soil Burn Severity by Fire

Soil Burn Severity - Summit and Martin Fires by Fire			
Fire Name	**Burn Severity**	**Total**	
Martin	High Severity	44	9%
	Moderate Severity	274	53%
	Low Severity	116	22%
	Unchanged	86	17%
Martin Total		520	100%
Summit	High Severity	783	18%
	Moderate Severity	1,567	37%
	Low Severity	1,625	38%
	Unchanged	295	7%
Summit Total		4,270	100%
Grand Total		4,790	

Table 3-Soil Burn Severity by Fire and Watershed

Soil Burn Severity of Summit and Martin Fires by Calwater 2.2.1 Planning Watershed				
Fire Name	**Watershed**	**Burn Severity**	**Total**	
Martin	Laguna Creek	High Severity	44	9%
		Moderate Severity	271	53%
		Low Severity	112	22%
		Unchanged	84	16%
	Laguna Creek Total		511	100%
	San Vincente Creek	High Severity	0	0%
		Moderate Severity	3	37%
		Low Severity	4	43%
		Unchanged	2	21%
	San Vincente Creek Total		9	100%
Martin Total			520	
Summit	Browns Creek	High Severity	92	11%
		Moderate Severity	197	23%
		Low Severity	524	62%
		Unchanged	34	4%
	Browns Creek Total		847	100%
	Corralitos Creek	High Severity	292	15%
		Moderate Severity	759	38%
		Low Severity	801	40%
		Unchanged	142	7%
	Corralitos Creek Total		1,994	100%
	Soquel Creek	High Severity	382	34%
		Moderate Severity	487	43%
		Low Severity	227	20%
		Unchanged	34	3%
	Soquel Creek Total		1,130	100%
	Uvas Creek	High Severity	15	5%
		Moderate Severity	123	41%
		Low Severity	74	25%
		Unchanged	87	29%
	Uvas Creek Total		293	100%
Summit Total			4,270	
Grand Total			4,790	

Note: "Unchanged" indicates areas within the fire perimeter that were either unburned or not burned enough to meet the specifications of the "Low Severity" classification.

The parameters below reflect in the changes to the data documented in the "ChangedBy" field in the Burn Severity shapefile. The hydophobicity tests proved to be extremely variable, therefore often inconsistent to the BARC data. In conclusion, it was not used to provide input for changes to the Burn Severity data.

Low Severity

- Full canopy,
- Loss of ground litter,
- Small brush partially consumed,
- 1 tree or less torched per 5 acres.

Moderate Severity
- Partial canopy loss in an area of 1 acre,
- Complete ground litter loss,
- Brush consumed.

High Severity
- Complete canopy loss,
- Completed ground litter loss,
- Complete brush consumed

The following is the **Field Guide for Classifying BAER Soil Burn Severity as** Adapted from the National Wildfire Coordinating Group, Fire Effects Guide; Hungerford, as cited by DeBano, et al; and USFS Handbook 2509.13.

Soil Burn Severity: Soil burn severity is a term that qualitatively describes classes of fire-caused changes to soil hydrologic function, as evidenced by soil characteristics and surface fuel and duff consumption. Large diameter down, woody fuels and organic soil horizons are consumed during longterm, smoldering and glowing combustion. The amount of duff or organic layer reduction is also called depth of burn, or ground char (Ryan and Noste 1985, as cited by the Fire Effects Guide). The amount and duration of subsurface heating determine the degree of soil burn severity, and can be inferred from fire effects on ground fuels (plants other organic matter) and soils.

Descriptive classes
An example of a set of soil burn severity classes is given below, in narrative as well as tabular format. Users must recognize that these are guidelines to visual indicators only, and the boundaries between the classes often become "blurred" in real world situations.

(a) **Unburned to very low soil burn severity**. Fire has not entered the area, or has very lightly charred only the litter and fine fuels on the ground; soil organic matter, structure, and infiltration unchanged.

(b) **Low soil burn severity**. Low soil heating or light ground char occurs; mineral soil is not changed; leaf litter may be charred or partially consumed, and the surface of the duff may be lightly charred; original forms of surface materials, such as needle litter or lichens may be visible; very little to no change in runoff response. Indicators include very small diameter (<¼ inch) foliage and twigs are consumed, some small twigs may remain; generally, foliage may be yellow; the surface is mostly black in a grassland or shrubland ecosystem, but some gray ash may be present; above-ground portions of vegetation may be consumed, but root masses are intact. Change in runoff response is usually slight.

(c) **Moderate soil burn severity**. Moderate soil heating with moderate ground char; soil structure is usually not altered; decreased infiltration due to fire-induced water repellency4 may be observed; litter and duff are deeply charred or consumed; shallow light colored ash layer and burned roots and rhizomes are usually present. Indicators include understory foliage, twigs (¼ to ¾ inch) are consumed; rotten wood and larger diameter woody debris are deeply charred or partially consumed; on shrubland sites, gray or white ash is present and char can be visible in the upper 1 cm of mineral

soil, but the soil is not altered; in forested ecosystems, brown needles or leaves may remain (but not always) on overstory trees—these are important as mulch, and should play a role when identifying treatment candidate sites; increase in runoff response may be moderate to high, depending on degree of fire-caused changes to the pre-fire vegetation community, density of pre-fire vegetation, and presence or absence of mulch potential, sprouting vegetation, etc.

(d) **High soil burn severity**. High soil heating, or deep ground char occurs; duff is completely consumed; soil structure is often destroyed due to consumption of organic matter; decreased infiltration due to fire induced water repellency is often observed over a significant portion of the area; top layer of mineral soil may be changed in color (but not always) and consistence and the layer below may be blackened from charring of organic matter in the soil; deep, fine ash layer is present, often gray or white; all or most organic matter is removed; essentially all plant parts in the duff layer are consumed; increase in runoff response is usually high. Other indicators include large fuels > ¾ inch including major stems and trunks are consumed or heavily charred. On a shrub site, shrub stems and root crowns are often consumed. In forested ecosystems, generally no leaves or needles remain on standing trees; high soil burn severity areas are primary treatment candidate sites if there are downstream values at risk.

References

USDA Forest Service, 2008, Summit_fire_20080707_metadata.txt, BAER Imagery Support Data Download (Summit fire) @ http://activefiremaps.fs.fed.us/baer/download.php, U.S. Geological Survey Sioux Falls, South Dakota, USA

Annette Parsons, 2003, Soil Burn Severity Definitions and Mapping Guidelines, Burned Area Emergency Rehabilitation (BAER), Soil Burn Severity Definitions And Mapping Guidelines (draft). From Field Guide for Classifying BAER Soil Burn Severity, (Adapted from the National Wildfire Coordinating Group, Fire Effects Guide; Hungerford, as cited by DeBano, et al; and USFS Handbook 2509.13).

Appendix M
Burn Site Evaluation Summary Table

Table 4-SEAT Team Burn Site Evaluation Summary - Resource Specialty: Geologist and Hydrologist

Fire Name : Summit and Martin Fire

Bold where risks are high

NAD 83

Site number	At-risk Feature	Hazard Location	GPS location Latitude N	GPS location Longitude W	Hazard	Likeli-Hood*	Risk to lives* fire	Risk to lives* pre-exist	Risk to property/habitat* fire	Risk to property/habitat* pre-exist
1	**60" CMP**	**Highland Way MP 1.18**	**37.07492**	**121.84058**	**debris plugging**	**H**	**L**	**L**	**H**	**M**
2	**Houses**	**north of Highland Way CALFIRE: 2-007 & 2-008**	**37.07623**	**121.83445**	**Houses close to debris torrent channel**	**H**	**H**	**L**	**H**	**M**
3	**18" CMP**	**Highland Way MP 1.01**	**37.07366**	**121.83802**	**debris plugging**	**H**	**L**	**L**	**H**	**H**
4	**18" plastic**	**Highland Way MP 0.80**	**37.07138**	**121.83603**	**debris plugging**	**H**	**L**	**L**	**H**	**M**
5	**18" culvert**	**Highland Way MP 0.76**	**37.07110**	**121.83547**	**debris plugging**	**H**	**L**	**L**	**H**	**M**
6	**18" plastic**	**Highland Way MP 0.62**	**37.07000**	**121.83324**	**debris plugging**	**H**	**L**	**L**	**H**	**M**
7	**60" CMP**	**Highland Way MP 0.49**	**37.06918**	**121.83114**	**debris plugging**	**H**	**L**	**L**	**H**	**M/L**
8	**60" CMP**	**Highland Way MP 0.42**	**37.06907**	**121.82991**	**debris plugging**	**H**	**L**	**L**	**H**	**M/L**
9	**RV site**	**Upstream of 60" CMP Highland Way MP 0.49**	**37.07055**	**121.82967**	**debris flow**	**H**	**H**	**L/M**	**H**	**L/M**
10	**House**	**40 ft above channel CALFIRE: 2-005**	**37.07093**	**121.82921**	**debris flow**	**H**	**L**	**L**	**L**	**L**
11	**18" CMP**	**Highland Way MP 0.27**	**37.06891**	**121.83228**	**debris plugging**	**M**	**L**	**L**	**M**	**L**
12	**18" CMP**	**Highland Way MP 0.20**	**37.06812**	**121.83289**	**debris plugging**	**M**	**L**	**L**	**M**	**L**

13	18" CMP	Highland Way MP 0.13	37.06730	121.83302	debris plugging	M	L	L	M	L
14	18" CMP	Highland Way MP 0.07	37.06732	121.83393	debris plugging	M	L	L	M	L
15	12" CMP	Eureka Canyon Road MP 8.77	37.06559	121.83288	debris plugging	H	L	L	H	M
16	18" plastic	Eureka Canyon Road MP 8.68	37.06485	121.83169	debris plugging	H	L	L	H	M
17	18" CMP	Eureka Canyon Road MP 8.54	37.06401	121.82945	debris plugging	H	L	L	H	L
18	36" CMP	Eureka Canyon Road MP 8.41	37.06395	121.82830	debris plugging	H	L	L	H	M
19	24" CMP	Eureka Canyon Road MP 8.26	37.06233	121.82528	debris plugging	H	L	L	H	M
20	30" CMP	Eureka Canyon Road MP 8.11	37.06148	121.82355	debris plugging replace	H	L	L	H	M
21	24" CMP	Eureka Canyon Road MP 7.91	37.06048	121.82266	debris plugging damaged inlet	H	L	L	H	M
22	House Site	Below Eureka Canyon Road CALFIRE: 3-009	37.05931	121.82340	debris flow	M	M	L	M	L
23	House	Below Eureka Canyon Road CALFIRE: 3-031	37.05770	121.81937	debris flow	M	H	L	H	L
24	36" CMP	Eureka Canyon Road MP 7.58	37.05797	121.81869	debris plugging undersized	H	L	L	H	M
25	House	Below Eureka Canyon Road CALFIRE: 3-033	37.05526	121.81500	debris flow	H	H	L	H	L
26	Road	Eureka Canyon Road	37.05495	121.81395	deris flow	M	M	L	M	L
27	Road	Eureka Canyon Road	37.05435	121.81349	deris flow	M	M	L	M	L
28	Houses	CALFIRE: 3-039	37.05318	121.81247	debris flow	H	H	L	H	L

29	60" CMP	Eureka Canyon Rd MP 6.76, Diablo Gulch	37.05270	121.80820	debris plugging	H	L	L	H	L
30	18" CMP	Eureka Canyon Road MP 6.86	37.05226	121.80902	deris plugging	H	L	L	H	M
31	House	Next to Diablo Gulch CALFIRE: 3-056	37.05185	121.80878	deris flow	H	H	L	H	L
32	House	Eureka Cnyn Rd, E. of Diablo Gul. CALFIRE: 3-021	37.04935	121.80191	debris slide/rock fall	H	H	M	H	M
33	Houses	on small ridge south of pond, n. of Eureka Cyn Rd	37.04822	121.80415	none	L	L	L	L	L
34	12" CMP	Eureka Canyon Road MP 6.13, below pond	37.04807	121.80656	deris plugging	H	L	L	H	L
35	Bridge	Browns Valley Road, Ramsey Gulch x-ing	37.02637	121.77757	deris plugging	H	L	L	M	L
36	Houses	Browns Valley Road	37.02597	121.78062	flooding	M	M	L	M	L
37	Creek	Martin Fire, Reggiardo Creek	37.04505	122.13739	Fallen tree in creek, preexisting	M	L	L	M	M
38	erosion feature	Martin Fire, Near Reggiardo Creek	37.04517	122.13686	old gully	L	L	L	L	L
39	18" CMP	Martin Fire, on Reggiardo Creek	37.04545	122.13653	Plugged culvert	H	L	L	H	M
40	Hydropho Test	Martin Fire, west side of burn area	37.05293	122.13065	not hydrophobic					
41	Hydropho Test	Martin Fire, west side of burn area	37.05312	122.13033	not hydrophobic					
50	2 houses	Upper Soquel Creek CALFIRE 2-014	37.06938	121.82803	Flood/debris flow	H	H	L	H	L
51	4or 5 houses	N. side Eureka Canyon Rd 1/4 mile east of Diablo Gulch	37.01862	121.80890	debris flow/rock fall	H	H	M	H	M

52	cabin	in Big Gulch, on private timber land	37.03323	121.77089	debris flow	H	H	M	H	M
100	Box Culvert	Highland Way, MP 1.32 in Camp Loma	37.07677	121.84184	Flood / Debris Flow	H	L	L	H	M
101	12" CMP	Highland Road MP 1.27, Camp Loma	37.07617	121.84128	Overtopping Flow	H	L	L	M	L
102	30" CMP	Eureka Canyon Road MP 5.17	37.04575	121.80333	NOT FIRE RELATED					
103	60" CMP	Eureka Canyon Road MP 5.18 at Shingle Mill Gulch	37.04566	121.80281	Overtopping Flow	M	L	L	M	L
104	60" CMP	Bridge over Shingle Mill Gulch	37.04531	121.80506	Overtopping Flow	M	L	L	M	L
105	Arch clvrt / Bridge	Eureka Canyon Road mp 4.80 at Shingle Mill Gulch	37.04478	121.80893	Overtopping Flow	M	L	L	L	L
106	House	Lower Highland Way	37.04948	121.81784	Flooding	H	H	L	H	L
107	Garage 1690	Lower Highland Way			Flooding	H	L	L	M	L
108	House	Lower Highland Way	37.04793	121.81565	Flooding	H	L	L	M	L
109	House	Lower Highland Way	37.04644	121.81519	Flooding	H	H	L	H	L
110	House	Lower Highland Way	37.04475	121.81503	Flooding	H	H	L	H	L
111	Bridge	Eureka Canyon Road over Shingle Mill Gulch	37.04442	121.81549	Flooding	M	L	L	M	L
112	Foot-bridge	Confluence of Corralitos Creek and Shingle Mill Gulch	37.04398	121.81604	Washout bridge	M	L	L	M	L
115	House	Camp Loma Caretaker House - Soquel Creek	37.07738	121.85275	Flood/Debris flow	H	H	L	H	L
116	Tent Camping	Camp Loma Tent Camp Area - N. side Soquel Ck	37.07688	121.84092	Debris flow	H	H	L	H	L
200	Bridge Pedestrian	Uvas Canyon Park, crosses Swanson Creek	37.08380	121.79561	flooding	H	H	L	H	L

201	Bridge Car	Uvas Canyon Park, crosses Swanson Creek	37.08402	121.79529	flooding	H	H	L	H	L
202	Hydropho Test	Summit Fire, Santa Clara County	37.07982	121.81611	High severity					
203	Hydropho Test	Summit Fire, Santa Clara County	37.07962	121.81291	High severity					
204	Hydropho Test	Summit Fire, Santa Clara County	37.07739	121.81582	High severity					
205	Hydropho Test	Summit Fire, Santa Clara County	37.07756	121.81616	High severity					
206	Hydropho Test	Outside of Burn Area	37.07305	121.81328	Still Hydrophobic					
207	Hydropho Test	Outside of Burn Area	37.06373	121.78971	Still Hydrophobic					
300	Hiking Trail	Uvas Canyon Park, Waterfall Loop			debris flow/flood	H	H	L	H	L
471	Vehicle Bridge	Eureka Canyon Road	37.04319	121.81613	flood					
472	Arch clvrt. / Bridge	Eureka Canyon Road	37.04107	121.81854	flood					
473	Vehicle Bridge	Eureka Canyon Road	37.04044	121.81835	flood					
474	House	Eureka Canyon Road, near Corralitos Cr	37.03880	121.81845	flood	M	M	L	H	M
475	Bridge	Eureka Canyon Road	37.03591	121.82002	flood	L	L	L	L	L
476	Box Culvert	Eureka Canyon Road	37.02639	121.82003	flood	L	L	L	L	L
477	Homes	Eureka Canyon Road, near Corralitos Cr	37.01887	121.81777	flood	M/H	M	L	M	L
478	Houses	Eureka Canyon Road, near Corralitos Cr	37.01767	121.81690	flood	M/H	M	L	M	L
479	Box Culvert	Browns Creek Road, Browns Creek Xing	37.02639	121.77985	flood	M	L	L	M	L
480	Box Clvrt / Bridge	Browns Creek Road	37.02529	121.78093	flood	M	L	L	M	L

481	Bridge	Browns Creek Road	37.01455	121.79209	flood	L	L	L	L	L
482	Bridge	Browns Valley Rd over Corralitos Creek	36.98911	121.80254	flood	L	L	L	L	L

* L=Low
M=Moderate
H=High

Appendix N
FEMA Flood Insurance Rate Maps Table

Table 5: List of FEMA Flood Insurance Rate Maps

FIRM Map ID	County	Description
06087CIND0D	Santa Cruz	Index Map of Corralitos Creek
06087C0411D	Santa Cruz	Corralitos Creek
06087C0392D	Santa Cruz	Corralitos Creek
06087C0384D	Santa Cruz	Corralitos Creek
06087C0383D	Santa Cruz	Corralitos Creek
06087C0381D	Santa Cruz	Corralitos Creek
06087C0275D	Santa Cruz	Corralitos and Browns Creeks
06087C0235D	Santa Cruz	Soquel Creek
06087C0245D	Santa Cruz	Soquel Creek
06087C0237D	Santa Cruz	Soquel Creek
06087C0239D	Santa Cruz	Soquel Creek
06087C0352D	Santa Cruz	Soquel Creek
060337IND0	Santa Clara	Index Map of Uvas Creek
0603370600D	Santa Clara	Uvas Creek
0603370605E	Santa Clara	Uvas Creek