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EMERGENCY NOTICE OF TIMBER OPERATIONS MONITORING AND REPORT ON EXEMPTION USAGE

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EMERGENCY NOTICE OF TIMBER OPERATIONS MONITORING AND REPORT ON EXEMPTION USAGE

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EXECUTIVE SUMMARY

Senate Bill 901, passed in 2018, requires monitoring and reporting of nondiscretionary Exemption and Emergency Notice timber harvests in the state of California. During the 2018 calendar year, the majority of nondiscretionary documents accepted by CAL FIRE were Exemptions (87%), with 57% of accepted Exemptions in the Cascade Forest Practice Area, and 21% and 22% in the Coast and Sierra Areas, respectively. Emergency Notices accounted for 13% of these timber harvests, with seven wildfires in 2017 and 2018 accounting for 82% of the reported acres under Emergency Notice in 2018. Emergencies were approximately split between the Cascade Forest Practice Area and Coast Forest Practice Area, with a nominal number in the Sierra Forest Practice Area. This report summarizes field-based monitoring conducted in 2019 of timber harvests under Emergency Notice of Timber Operations documents accepted by CAL FIRE in the 2018 calendar year.

Fifty-four (54) Emergency Notices were randomly selected from 272 Emergencies accepted in 2018 for tree damage and mortality due to wildfire, insects, or drought. Forty-nine (49) Emergencies were related to wildfire and five were related to insect or drought damage. Of these 54 Notices, seven (13%) were not harvested under the submitted Emergency Notice for reasons relating to market conditions, shortages of licensed timber operators, deteriorated timber quality, and/or timberland owners choosing to not go forth with timber harvesting.

For ease of communication, water quality-related performance/outcome designations were created and linked to volumetric estimates of sediment discharges for various elements within the sampled Emergency Notices. –For Emergencies with watercourse crossings on roads associated with harvest activity, 60% had an “Acceptable” outcome relative to sediment discharge, while 17% were deemed “Substandard,” and 23% were determined to be “Unacceptable.” Classified watercourses were found on 85% of the sampled Emergencies, and of those Emergencies, 77% had an “Acceptable” outcome for watercourse protection, while 10% of Notices were “Substandard” and 13% were “Unacceptable.” For roads used for timber hauling and harvest operations, performance for hydrologic disconnection was found to be “Acceptable” on 80% of the Emergencies, “Substandard” on 10% of the Notices, and “Unacceptable” on 10%.

In general, 26% of Emergencies had an “Unacceptable” outcome related to either watercourse crossings, road hydrologic disconnection, or watercourse protection. Water quality issues, when and where present, were related to crossings that were not adequately designed or maintained, ground based tractor yarding impacts, and road drainage onto fire-impacted bare hillslopes in close proximity to classified watercourses.

Sediment discharges were reduced, and "Acceptable" performances increased by 108%, when additional best management practices (BMPs) were utilized for watercourse crossings., ~~while d~~ -Discharges at ~~crossings~~ newly constructed watercourse crossings were larger than discharges from existing crossings. ~~as part of Emergency Notices were found to generally be larger~~. ~~Detrimental~~ Higher magnitude sediment discharges to watercourses were typically related to tractor operations and yarding, mainly skid trails, and were greater when excessive bare soil from wildfire effects were observed in watercourse protection areas. However, ~~timber harvesting~~tree removal within watercourse and lake protection zones (WLPZs) and equipment limitation zones (ELZs) was generally absent or ~~light touch~~of low intensity, ~~and observed to be the most intensive~~with the highest level of tree removal associated with ~~for~~ Class III watercourses. Discharges from road segments generally were found to increase as ground surface roughness decreased (i.e., when surface roughness decreases, runoff velocity increases) and more exposed bare soil was present downslope of road drainage points, and these discharges were most frequent to Class III watercourses. Discharges were fully "Acceptable" when the "Road Rules" (14 CCR § 923, 943, 963) erosion control requirements were applied to drainage facilities and structures. Road failures accounted for the largest sediment discharge estimates, of which seven were observed on two Emergencies.

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Of the 47 harvested Emergencies, the majority involved ground based tractor yarding or a combination of tractor yarding and cable yarding. Harvest intensity on Notices generally followed tree damage and mortality patterns, and ranged from minimal and low impact to extensive clearcut-equivalent timber harvests. In general residual green trees and ~~snag~~ dead trees (snags), of both conifer and hardwood species, were retained to some degree on Notices. Based on the quadratic mean diameter (QMD) of all residual trees measured on the Emergencies, 60% of Notices fell into the California Wildlife Habitat Relationship (CWHR; a method to determine relative size class of forest stands) Size Class 4 (11" to 24") for residual tree size. Rare, threatened, or endangered plant or wildlife species recorded in the California Natural Diversity Database were seldom located within mapped Notice boundaries, however Emergencies frequently were within a half mile of known populations or the established range of these species.

Professional Geologists identified in the field at least 12 Emergency Notices, or 25% of the harvested sample, that had unstable areas present; of these, three Emergencies also had subsequent timber operations occur on the unstable areas.

Data from this study indicates relatively low water quality-related performance when compared to previous monitoring studies focused on Timber Harvesting Plans (THPs) and Nonindustrial Timber Management Plans (NTMPs), but data from this study also indicates that performance can increase substantially when BMPs are implemented. Despite a relatively large proportion of unfavorable outcomes related to water quality on Emergency Notices, some Emergency timber harvests met or exceeded expectations and outcomes found on past green-tree THP timber harvests. The pace and scale at

which Emergencies can happen following landscape scale tree mortality events requires proper administration and implementation of timber harvests by Registered Professional Foresters (RPFs), and frequent inspection by Review Team agencies as their concerns warrant. Tracking inspections and greater involvement of Review Team agencies on Emergencies are recommended in order to discern linkages between improved outcomes and inspection and regulatory presence, as is the re-prioritization of field staff in response to large timberland fires where the widespread use of Emergency Notice-related timber harvests will occur. It is also recommended that education be provided to ~~nonindustrial~~ timberland owners regarding their legal obligations once they have an accepted Emergency Notice on their property, and for realistic expectations and outcomes during and after an Emergency timber harvest, in particular a post-fire salvage harvest.

Acknowledgements:

Will Olsen devised the monitoring strategy, and undertook the majority of the data analysis and report writing. Special thanks to Dorus Van Goidsenhoven for his assistance with collecting a significant amount of the field monitoring data.

In addition to CAL FIRE"s Watershed Protection Program, considerable effort was put forth for this report by field staff and Forest Practice Inspectors from CAL FIRE, Professional Geologists from the California Geological Survey, timber program staff from the North Coast and Central Valley Regional Water Quality Control Boards, and regional staff from the California Department of Fish and Wildlife.

Thanks are in order for the numerous RPFs, LTOs, and both industrial and nonindustrial timberland owners who participated in the field monitoring work, allowed monitoring teams access to timber harvests on their land, and provided valuable information on the logging activities implemented on sampled Notices.

Francesca Rohr, CAL FIRE Forest Practice GIS, developed the mobile survey application to digitally record field data and photos, and the CAL FIRE Forest Practice GIS staff are responsible for the mapping of all Emergency timber harvest boundaries that helped allow the field work to take place.

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Introduction

- Monitoring has occurred in the past on Timber Harvesting Plans and Nonindustrial Timber Management Plans, however little information, including field-based monitoring data, exists for Exemption and Emergency Notices

The effective management and regulation of ecosystem resources requires monitoring to evaluate whether desired objectives are being achieved. To date, most monitoring focus for non-federal timberlands in California has been on the Timber Harvesting Plan (THP) and Nonindustrial Timber Management Plans (NTMP) ~~populations~~ over the past 45 years (e.g., Cafferata and Munn, 2002; Brandow et al., 2006; Brandow and Cafferata, 2014), and these studies have shown steadily increasing implementation and effectiveness rates for elements such as Class I WLPZ canopy retention requirements and watercourse crossings from 1996 to 2013. ~~-~~However, there has been little information about the performance of timber harvest activities performed under non-discretionary timber harvest documents such as Exemption and Emergency (EX-EM) Notices. EX-EM Notices are documents containing strict operational prohibitions and requirements for use in exchange for rapid ministerial review and approval. ~~-~~EX-EM Notices are exempt from the requirement for a THP, but must adhere to the operational provisions of the California Forest Practice Rules (FPRs) and be compliant with all other relevant laws and regulations for protection of natural resources. Additionally, they are valid for only one year. The ministerial nature of these activities means that they do not receive the same interagency California Environmental Quality Act (CEQA) review as activities covered under discretionary documents such as THPs.

The number and types of EX-EM Notices have changed significantly over the past several years, with almost a complete restructuring of ~~EX-EM~~Exemption Notices in particular following the passage of ~~the State~~Senate Bill (SB) 901 in 2018. A key requirement in SB 901 is the need for an interagency assessment of the use, compliance, and effectiveness of Exemption and Emergency Notice provisions, with annual reporting at the end of each calendar year. This ~~document~~ is the first formal report to comply with the monitoring requirements of SB 901, and reflects a two year effort by the California Department of Forestry and Fire Protection (CAL FIRE) to initiate monitoring of the EX-EM Notice population. ~~-~~Pilot monitoring to test EX-EM protocols and gather preliminary data was initiated in 2018, and reported in 2019~~by Olsen and others~~ (Olsen et al., 2019). That report also includes an evaluation of trends in use of EX-EM Notices from 2008 through 2017, and EX-EM Notice FPR inspection and violation data over this 10-year period.

SB 901 requires a report on the use of EX-EM Notices, as well as compliance with EX-EM Notice provisions. However, in the post SB 901 landscape, there has been less than a years' worth of Exemption Notice submissions under the most recent rule changes. This precludes a robust assessment of trends in use and Exemption Notice provision

compliance. A description of the types of EX-EM Notices, as well as metrics on their use during 2019 are summarized in Appendix 1 (see page 42).

The main body of this report details the effectiveness of EX-EM Notice provisions in achieving desirable environmental outcomes (i.e., effectiveness). The different types of Exemption and Emergency Notices will be monitored over the next five years. Work will be phased over time (Appendix 2; pg 35; Table 14), with each year focusing on one or more EX-EM types for rigorous evaluation with additional agency staffing (through at least 2025). This monitoring work complements standard CAL FIRE Forest Practice Inspections, which are considered a form of compliance monitoring (MacDonald et al., 1991).

Due to staffing constraints and the changing number and type of ~~EX-EM~~ Exemption Notices available for use, it was ~~necessary~~ appropriate to focus this year's monitoring effort on a specific population of EX-EM Notices that has remained relatively unchanged following the passage of SB 901. Hence, the focus within this report is on the evaluation of post-harvest outcomes following the implementation of Emergency Notices under 14 CCR §1052. The Emergency Notice was created by the Legislature to allow "immediate commencement" of timber operations where a bona fide emergency condition such as fire-damaged commercial timber has been identified. This Notice type is strictly confined to emergency conditions whereas Exemption Notices provide for non-emergency thinning, fuels reduction, and oak restoration activities among others.

Wildfires can result in profound changes to physical and ecological processes (Wondzell and King, 2003; Steel et al., 2015). Researchers have identified the need to document the ecological and water quality-related consequences (i.e., good and/or bad) of postfire management activities (Beschta et al., 2004). Recent studies have shown both negative and positive consequences for runoff and erosion processes following post-fire salvage logging (see Prats et al., 2019), so there is considerable uncertainty how Emergency Notices under 14 CCR § 1052.1(b) perform under conditions following wildfire.

~~The different types of Exemption Notices will be monitored over the next five years. Work will be phased over time (Appendix 2; pg 35; Table 14), with each year focusing on one or more EX-EM types for rigorous evaluation with additional agency staffing (through at least 2025). This monitoring work complements standard CAL FIRE Forest Practice Inspections.~~

The use of Emergency Notices under 14 CCR §1052 tracks strongly with the magnitude of burned area in State Responsibility Areas (SRA), and the 2018 fire season was unparalleled in California's recorded history. To this end, we present a focused monitoring effort on the post-harvest outcomes following the implementation of Emergency Notices related to wildfire, insect, or drought tree damage and mortality that

were filed during the 2018 calendar year. Per legislative mandate, all field monitoring was done in conjunction with the other Review Team agencies, including the Regional Water Quality Control Boards (RWQCBs), the California Department of Fish and Wildlife (CDFW), and the California Geological Survey (CGS), in addition to California Department of Forestry and Fire Protection (CAL FIRE).

Random Sample Selection

It is not possible to monitor every activity, across the entire landscape, at all times. With limited resources, it is necessary to carefully design and focus monitoring, while incorporating statistical methods so that limited sampling can be extrapolated to the broader population. Proper statistical design, along with objective and repeatable sample protocols, means that data analysis will yield conclusions with an identifiable risk/error. Knowing the risk associated with a given line of evidence is critical for managers and policymakers ~~if~~ when used during the decision-making process.

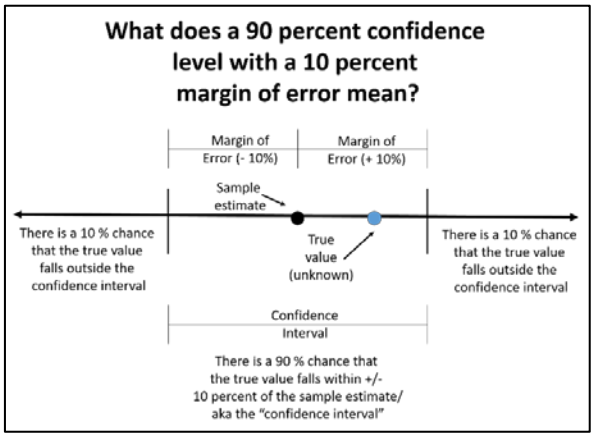

Figure 1: Visual representation of the confidence level and margin of error used in the study design.

Bias can systematically favor some conclusions over others, and it is vital to minimize bias when results are used in decision-making. To minimize bias, a random sampling scheme was implemented so that all Emergency Notices had an equal chance of being chosen. Fifty-four (54) Emergency Notices of Timber Operation harvests were selected from 272 Notices accepted in 2018 by CAL FIRE. Sampling approximately 20% of the Notice population results in a 90% confidence level and 10% margin of error (Figure 1)**.** Emergencies that did not overwinter or have significant precipitation events following operations, had a timberland owner who did not wish to be involved in monitoring, or were deemed unsafe for field inspection, were removed and a random replacement chosen from the remaining 2018 Emergencies. Altogether, 14 of the original Notices were replaced, with 9 being replaced due to not meeting the precipitation criteria, and the remaining 5 being replaced due to a combination of safety, timberland owner unwillingness to participate, and the inability to establish contact with timberland owners. -A sampled Emergency did not need to have a Completion Report filed, only operations completed in the monitored area and the overwintering/significant precipitation requirement (i.e., multiple storms of sufficient intensity to generate runoff in a burned environment; >0.2 inch per hour). If an

Emergency was not harvested (no operations), that Notice was kept in the sample and

- A goal of the methodology was to be as objective and as repeatable as possible
- Road and skid trail evaluations were done nearest to watercourses, when present, to evaluate the features where risk to water quality was greatest

recorded as a 'No Harvest" data point.

Methodology

Monitoring focused on outcomes pertaining to water quality, wildlife habitat, and timber operations, with a focus on road watercourse crossings, watercourse and lake protection zones (WLPZs), road performance and hydrologic disconnection, skid trail evaluations, fixed and variable radius plots for forest structure and habitat, and generalized questions about each Emergency. Outcome-based (i.e., performance-based) monitoring can be analogous to effectiveness monitoring in that it can be used to determine if activities achieved a desired intent or objective. All sampling was initially based on a Notice centroid for the forested area within a mapped Notice boundary, determined using ArcGIS, to reduce bias in sampling site selection. Within Notice sampling intensity and distribution was dependent upon reported acreage of each Emergency; when over 20 acres, distances between plots and replicate samples were increased to capture a broader sample for larger Notices. For the full field methodology, see Appendix 3 – Study Outline and Protocol. Monitoring was conducted from April 8, 2019 through October 9, 2019. Data were recorded both digitally on tablets and on paper forms.

Sediment discharges observed during watercourse crossing, road, and watercourse assessments were recorded as binned volumetric estimates of cubic yardage of sediment discharged, along with associated variables related to the discharge, including relation to timber harvest operations. Due to the potential confounding effects of fire-induced runoff and erosion on performance, additional data on slope conditions (e.g., ground cover) and fire-related runoff accumulation was collected to help distinguish the effects of fire from operational outcomes. Sediment discharge estimates were made based on visual evidence of connectivity to a classified watercourse and erosion void evaluations (i.e., estimating the volume of depleted sediment), using the professional judgement of Registered Professional Foresters (RPFs) and Professional Geologists (PGs). Volume estimates were converted to median discharges (Table 1). For each assessment type on each Emergency, the median discharges were summed and divided by the number of crossings, roads, or watercourses sampled (either 1 or 2), to get an "averaged median total" (AMT) for each assessment type.

The AMT represents the average volume of sediment delivered to a watercourse for a given assessment type. To make this more understandable for the layperson, we assigned performance/scoring designations related to ranges of AMT. The criteria used to determine performance for each assessment category present, and the subsequent final performance evaluation for each Emergency as a whole with respect to water quality, is shown in Table 1, and an example is shown in Figure 2. "Substandard" for an individual assessment category accounts for outcomes that are detrimental sediment discharges, but may be mitigated, while "Unacceptable" accounts for outcomes well outside the recognized standard of practice, sometimes in conjunction with less resilient harvest areas~~, and clearly resulting in significant sediment discharge as per 14 CCR §895.1~~. While these performance designations connote a value determination, the intent is to provide a relative characterization of water quality outcomes using data collected during a rapid assessment. As such, these terms and their associated range of values should not be construed as an official regulatory interpretation of 14 CCR §895.1 (i.e., significant sediment discharge).

There are no requirements to retain wildlife habitat or structure within the Forest Practice Rule Emergency provisions. The assumption for emergency operations has been that the entirety of the project area submitted is subject to clearcutting and applied as such. ~~Metrics for trees: conifer or hardwood, snag or green inform size class for WHR class is present. Other metrics collected included downed wood, shrub cover, and ground cover that can be used for cover and foraging.~~ Certain terrestrial wildlife species have the potential to use the residual habitat left post-emergency, post-operations. To help quantify residual habitat, forest stand structure data was collected, grouped as conifers or hardwoods, live (green) or dead (snag), with diameters measured.

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B~~B~~asal area (i.e., a method to estimate tree density), trees per acre, and quadratic mean diameter (QMD) were calculated using the same methods as in Olsen et al. ~~and others~~ (2019). Other metrics collected included downed wood, shrub cover, and ground cover that can be used for cover and foraging. These measurements were not meant to provide a rigorous characterization of a given Emergency, as that would require a sampling intensity beyond the scope of a rapid assessment. Rather, it provides a relative snapshot of each Emergency so that a reasonable sample estimate of post-harvest habitat conditions can be determined for the 2018 statewide population of Emergencies.

CDFW and the North Coast RWQCB implemented additional and/or separate protocols with a subset of the Notices sampled in 2018. These were done to beta test specific protocol refinements for habitat and were tiered to the fixed and variable plots (i.e., CDFW), or to answer specific questions related to water quality (i.e., North Coast RWQCB). Results from these additional efforts are not contained herein.

Table 1: Assignment of median volumes to each volumetric category observed in the field for sediment discharges. Averaged median total (AMT) and subsequent scores are also shown. Scoring terminology used only for communicative purposes, and are not meant to be regulatory interpretation of 14 CCR §895.1.

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Volume Estimate	Median Volume	**Crossing/Road/Watercourse Scoring**
No Discharge	0 yards^3	AMT - Averaged median total for each Notice
Trace	0.1 yards^3	AMT **< =** 1 yard^3, "**Acceptable**"
Under 1 yard^3	0.5 yards^3	1 yard^3 **<** AMT **<** 3 yards^3, "**Substandard**"
1-5 yards^3	3 yards^3	AMT = **>** 3 yards^3, "**Unacceptable**"
5-10 yards^3	7 yards^3	**Entire Emergency Performance**
Over 10 yards^3	10 yards^3	All scores "Acceptable" = "**Acceptable Performances**"
		Mix of scores = "**Acceptable to Unacceptable**"
		All scores "Unacceptable" = "**Unacceptable Performances**"

Crossing, Road, and Watercourse Scoring Example: EMERGENCY 123

– 1 watercourse crossing, 2 non-public roads, 2 watercourses

Watercourse Crossing Performance

Crossing 1: Discharge of **Under 1 yard^3** (0.5 median)

0.5 ÷ 1 crossing = 0.5 yards^3 averaged median total = "**Acceptable**"

Road Segment Performance

Segment 1: Discharges of "**Trace**" (0.1 median) + **Under 1 yard^3** (0.5 median)

Segment 2: Discharge of **1-5 yard^3** (3 median)

0.1 + 0.5 + 3 ÷ 2 roads = 1.8 yards^3 averaged median total = **"Substandard"**

Watercourse Protection Performance

Watercourse 1: Discharges of **Under 1 yard^3** (0.5 median), **Under 1 yard^3** (0.5 median), **Under 1 yard^3** (0.5 median)

Watercourse 2: Discharges of **1-5 yard^3** (3 median), **5-10 yards^3** (7 median)

0.5 + 0.5 + 0.5 + 3 + 7 ÷ 2 watercourses = 5.75 yards^3 averaged median total = "**Unacceptable**"

Overall: 1 "Acceptable", 1 "Substandard", 1 "Unacceptable"

– Emergency performance is "Acceptable to Unacceptable"

Figure 2: A hypothetical Emergency scoring example for each category of watercourse crossings, roads, and watercourse protections, in addition to an overall performance level for the Emergency.

Sample Description

- The majority of Emergencies were implemented on areas burned by wildfire
- Thirteen percent of Emergencies were not harvested under the submitted Notice

The 54 Emergencies sampled are shown in Figure 3. Forty-nine (49) Emergencies were submitted for the harvest of substantially damaged timber following wildfires, and five were for tree mortality related to drought or insects (Figure 3, Table 2). Fifty-six percent (56%) of the samples were in the Cascade Forest Practice Area, 39% in the Coast Area, and 5% in the Sierra Area (Figure 3, Table 2). Reported acreage on the Notices ranged from 2 to 651 acres, with a median of 71.5 acres (Table 2). Most of the sample was on Emergencies over 20 acres in reported size (n = 42), with a minority on Notices 20 acres or less (n = 12). Using the Erosion Risk Rating (ERR) system developed by the USFS Pacific Northwest Research Station (Steel and Cunningham 2018), 5% of the selected Emergencies had a 'Low" rating, 52% 'Moderate', and 43% 'High'. This rating is based on inherent erosion risk for a landscape, irrespective of land use, or disturbance such as wildfire. Emergencies with a 'High' rating were present in all three Forest Practice Areas (Table 2). As such, we consider the sample to include reasonable estimates of post-harvest outcomes on areas most sensitive to the combined erosional effects of disturbance and timber operations. Table 2 has additional metrics for the sampled Notices. ~~Excluding four initial Emergencies, 47~~Forty-seven percent~~%~~ of harvested Emergencies had full Review Team Agency participation in monitoring, and 95% had at least two Review Team agencies present for monitoring. The logged Emergencies had 66 inspection or completion reports on 72% of the Notices in our sample; no Notices had reported violations.

Commented [OW1]: This includes inspecitons/completions in 2019 on our sample. I include completions because some Notices did not have an inspection, but did have a completion – such as one we monitored, where the completion insp. Was done concurrent with monitoring

Seven Emergencies were never harvested under the Notice. Five of these were in the Coast Area and two were in the Cascade Area. Based on our sample, 13% of the 272 Emergencies accepted in 2018 were not harvested or operated on, despite all necessary paperwork being filed and accepted by CAL FIRE. Reasons given for non-operations included timberland owners deciding not to go forth with harvesting, shortage of licensed timber operators (LTOs) for a Notice in a region, poor market conditions, and/or deteriorated timber quality.

Table 2: Description of the 54 Emergencies sampled, by Forest Practice Area and for the full sample.

	Coast Area	Cascade Area	Sierra Area	Full Sample
Emergencies (All) (#)	21	30	3	54
Unharvested Emergencies (#)	5	2	0	7
Minimum-Maximum Acreage	5 - 207.5 ac	8 - 651 ac	2 - 339 ac	2 - 651 ac
Median Reported Acreage	39 ac	146 ac	91 ac	71.5 ac
Post-Fire/Insect & Drought (#)	21/0	26/4	2/1	49/5
'High' ERR Risk (#)	10	12	1	23
Harvested Notices Only (n = 47)				
Watercourse Present (#)	14	24	2	40
Watercourse Crossing Present (#)	9	20	3	32

Non-Public Road Present (#)	15	26	3	44

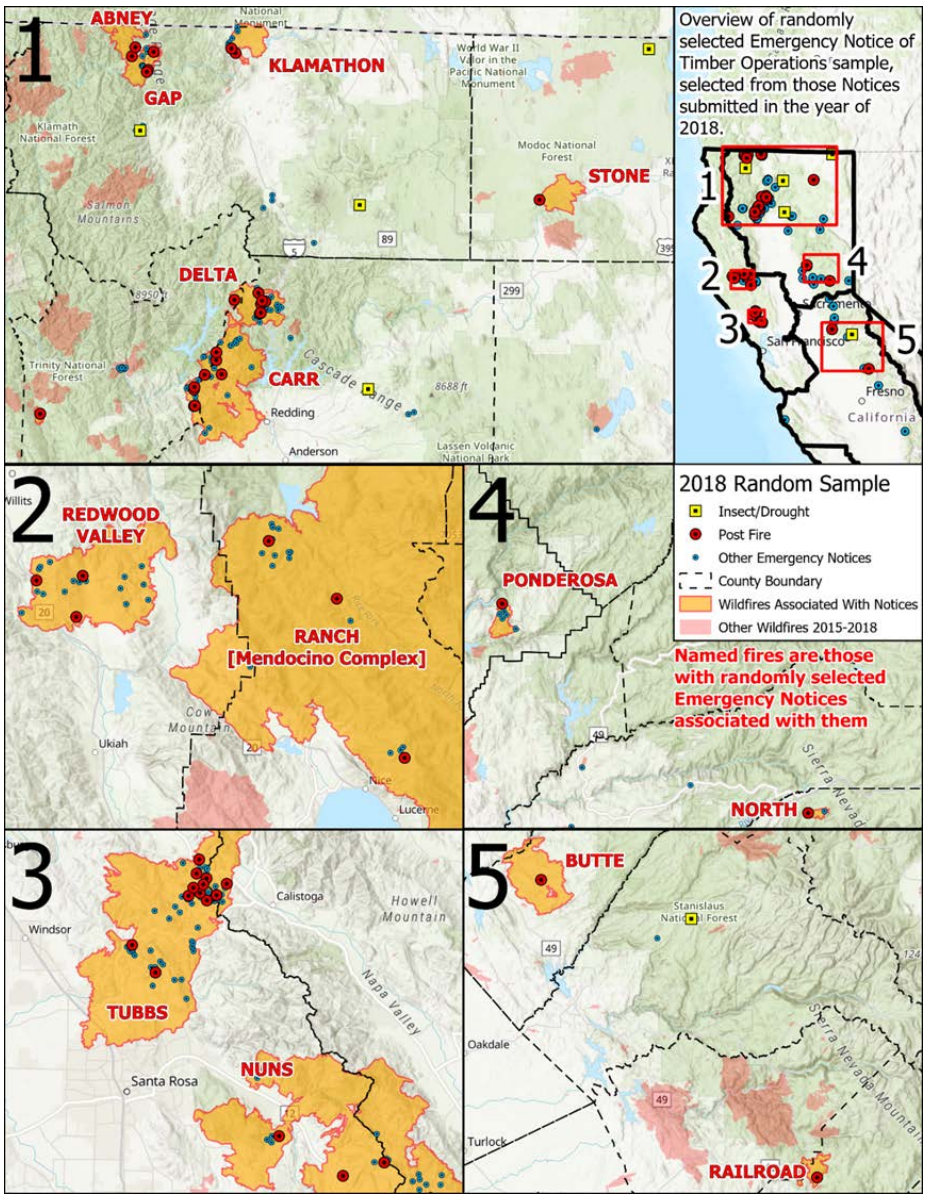

Figure 3: Randomly selected Emergencies, shown as red dots for post-fire Emergencies and yellow squares for insect/drought related Emergencies, wildfire boundaries from 2015 to 2018 as transparent red polygons, and wildfires associated with the sample shown as orange polygons. Blue dots indicate other Emergencies accepted by CAL FIRE in 2018, but not sampled.

A Note on Results Interpretations

The inclusion of unharvested Emergencies as data points resulted in a slightly smaller sample size of measured Notices, resulting in a margin of error of +/- 11%, in applying results to the 2018 population.

When addressing sample-wide outcomes, we can address results for features *where present.* For example, we can determine that 85% of the 2018 Emergencies (+/-11%) had watercourses present, and, *where present,* 77% of Notices had acceptable water quality outcomes.

Results

Yarding, Silviculture, and Extent of Operations on Emergencies

Operations on Emergencies

- 96% of Notices used tractor yarding or a combination of tractor and cable yarding
- Emergencies vary from single tree selection to functional clearcuts, however complete removal of harvestable timber was rare
- Harvest intensity often followed tree damage and mortality patterns
- Small, adjacent Emergencies with different owners were operationally treated as a single timber harvest in some cases

Ground based tractor yarding was the most dominant form of timber yarding on most Emergencies, reflective of licensed timber operator (LTO) availability, the resources of many nonindustrial timberland owners, and timber markets. Of the 47 Emergencies that were harvested, 79% employed tractor yarding, 17% had combined methods of tractor and cable yarding, and one Emergency Notice (2%) exclusively used cable yarding. In the case of one Emergency, timber falling was completed but no yarding, processing, and hauling of timber occurred due to market conditions. In the case of another, tree falling and yarding was completed in its entirety on a portion of the Notice, however the landowner decided to forgo harvesting on the remaining area of the Notice due to disagreements with the LTO. Observationally, field teams did encounter instances where Notices with steeper areas were unharvested, or had delayed harvesting, due to the inability to obtain LTOs with cable yarding equipment.

Figure 4: An example of a harvest that was closest in silviculture to a clearcut.

While a portion of the Emergencies had complete removal of merchantable timber, harvesting trends within most Emergency boundaries were typically less intensive spatially, following post-fire/post-insect tree mortality patterns and the presence of merchantable commercial timber. Forty-three percent of the Emergencies were closest to single tree selection (i.e., dispersed

tree removal) for a silvicultural treatment, 36% were closest to a clearcut (i.e., complete or almost complete tree removal), and 21% were approximate to group selection (i.e., small to medium groups of trees removed). ~~Habitat retention areas were observed on several Emergencies that were similar to clearcuts.~~ The total proportion of the Notice area harvested ranged from minimal across an entire Emergency boundary, with 19% of the harvested Notices having only 0-25% of the total area harvested, to 23% experiencing 75-100% harvest. Twenty-six (26%) and 32% of the Emergencies fell in the 25-50% and 50-75% area harvested categories, respectively.

Nine Notices also had some level of tree planting completed; several timberland owners or RPFs also indicated plans to reforest at a later time. Only two post-fire Emergencies had no observed green conifers within the project boundaries; both were in areas observed to have experienced very high fire severity.

Water Quality Outcomes

Watercourse Crossings

Watercourse Crossings

- 64% of Emergencies had watercourse crossings associated with harvest activity
- 59% of crossings assessed had trace amounts or less than 1 yard^3 of discharge
- 60% of Notices with crossings on roads used for harvest activity had "Acceptable" performance, 17% were "Substandard", 23% were "Unacceptable"
- Additional BMP measures resulted in decreased sediment discharges
- 17% of the crossings assessed had diversion potential

Thirty of the 47 harvested Emergencies (64%) had at least one watercourse crossing on a non-public haul road within the project boundary or directly associated with the Notice on an identified appurtenant road. Four Notices had a crossing not associated with a haul road. A total of 51 crossings were assessed. Of these, 46 were on haul roads, while five were on roads not associated with harvest activity, but within the Emergency boundary. Of the crossings on haul roads, 67% were on Class III watercourses, 26% on Class II's ~~(no separation between Class II, Class II-S, and Class II-L)~~, and 7% on Class I's. Eighty percent (80%) of the crossings on haul roads were pre-existing to the Emergency Notice, 7% were pre-existing crossings that were upgraded, and 13% were newly constructed crossings under the Notice~~; this includes one crossing that was "newly" abandoned after operations~~.

Commented [CP2]: If you don't add trace amounts or less than 1 cubic yard, it would have to be 70% (none (11% + 59%).

In terms of water quality performance, the 46 individually assessed crossings on roads used for harvest activity are summarized in Table 3. Eleven percent (11%) had no visible sediment discharge evidence, 59% had discharges that were "Trace" or under 1 yard^3, and the remaining 30% were 1 yard^3 or greater.

The performance outcomes for Emergencies with watercourse crossings used for harvest activity were rated as 60% "Acceptable", 17% as "Substandard", and 23% as

"Unacceptable" (Table 3). Watercourse crossing performance was higher in ~~non-wildfire~~insect or drought related ~~harvests~~Emergency Notices.

Table 3: Observed discharges on all assessed watercourse crossings on roads used for hauling, by volumetric estimate, top. Blue shading indicates crossing performance of acceptable, while yellow shading indicates inadequate performance. The bottom half of the table shows the crossing performance (where applicable) for each Notice as a whole, for all Notice types, post-fire only Notices, and Insect/Drought related Notices.

Volumetric Estimate	None	Trace	< 1 yard^3	1-5 yard^3	5-10 yard^3	>10 yard^3
Observed Discharges (#)	5 Crossings	11	16	13	1	0

Emergency Performance	All Notices (%/#)	Post-Fire (%/#)	Insect/Drought (%/#)
Acceptable	60% / 18	58% / 15	75% / 3
Substandard	17% / 5	19% / 5	0% / 0
Unacceptable	23% / 7	23% / 6	25% / 1

Extra effort to reduce runoff and discharge at crossings resulted in decreased detrimental discharges, while a majority of newly built crossings had detrimental sediment discharges. When additional Best Management Practices (BMPs) such as rock armoring of outlets were observed, 76~~80~~% of the discharges on crossings were less than 1 yard^3, while without additional BMPs only 6~~2~~% of discharges were less than 1 yard^3 (Figure 5). Newly constructed crossings had a higher percentage of discharges over 1 yard^3, compared to pre-existing and upgraded pre-existing crossings (Figure 5). When both the hillslope and road prism (i.e., road runoff combined with runoff from burned hillslopes) contributed runoff to a crossing, 50% of discharges were over 1 yard^3, compared to 30% of discharges being over 1 yard^3 when it was only from the road prism.

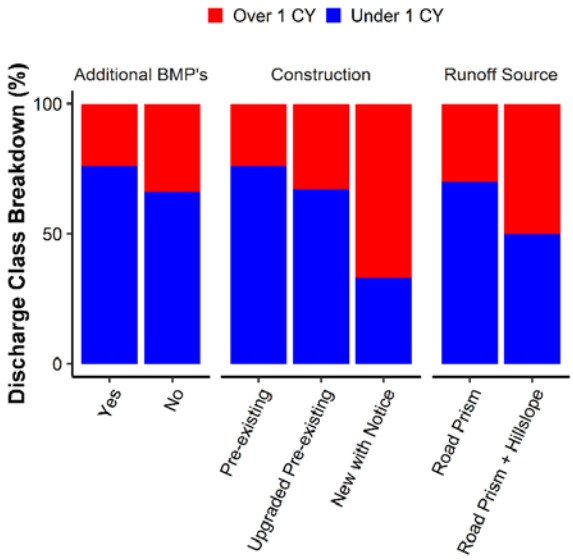

Figure 5: Watercourse crossing discharges, as under 1 yard^3 and greater than or equal to 1 yard^3, by the presence of extra BMPs, crossing construction, and the runoff and runoff source at crossings.

~~**The physical construction of some crossings, and materials used, may explain many of the "Substandard" and "Unacceptable" performances, in addition to crossings not including**~~

Figure 6: Two crossings, a culvert crossing of a Class II watercourse with a "Trace" discharge (left) and extra rock added on the outboard edge, and a dry ford crossing on a Class III with rill erosion on the~~th an eroding~~ road prism ~~(partially shown)~~ and failing outboard edge, with a 1~~5~~-5~~10~~ yard^3 discharge estimate.

~~certain BMPs or being subject to winter operations.~~ Eight watercourse crossings, or 17% of the crossings, had the potential for watercourse diversion (i.e., watercourses being routed down roads with the potential for severe erosion), and these occurrences were associated with seven Emergencies. There was no clear trend relating sediment discharge estimates to crossing approach length and hydrologic connectivity; this may be due in part to the occurrence of crossings on paved residential roads that doubled as haul roads (n = 4), adequacy of the crossing construction itself, and the occurrence of flat roads that showed no/little evidence of erosion.

Observationally, visual signs of hauling activity in wet or saturated conditions, such as significant rutting on road surfaces with insufficient rock or native material surfaces on or near some crossings, created performance issues that often led to sediment discharges.

Of the five crossings assessed within a Notice boundary but not associated with harvest activity, two had no sediment discharges and three had discharges. In one case, the access road was not used, as the logs were skidded to an adjacent Emergency Notice. The other four Notices had limited harvesting over large mapped boundaries, such that the assessed roads never experienced hauling or activity related to harvesting.

Watercourse Protection

Watercourse Protection

- 85% of harvested Emergencies had watercourses
- 25% of assessed watercourses had at least one sediment discharge from operations or roads
- Discharges to watercourses occurred on 28% of the logged Emergencies
- 77% of Emergencies with watercourses had an "Acceptable" performance
- Canopy removal within WLPZ and ELZ buffers was generally light
- 36% of the observed discharges were from skid trail drainage, and most of these discharges were more than 1 yard^3 and from skid trails outside of the WLPZ/ELZ with bare soil downslope of skid trail drainage.

Eighty-five percent (40/47) of the harvested Emergencies had at least one classified watercourse present. A total of 65 watercourses were assessed. Of these 65 watercourses, 69% were Class III's, 23% were Class II's ~~(no differentiation between Class II, Class II-S, and Class II-L)~~, and 5% were Class I's. The remaining percentage of watercourses were mixed classifications; one occurrence was a Class III that transitioned to 'Other', a wet spring area with a marginally defined channel, and one case of a Class II transitioning to a Class III along the survey distance.

Table 4: Observed discharges on all assessed watercourses by volumetric estimate, top, including the number of watercourses with no discharge from operations. Blue shading indicates protection performance of good to passable, while yellow shading indicates inadequate outcomes. The bottom half of the table shows the watercourse protection performance (where applicable) for each Notice as a whole for all Notice types, post-fire only Notices, and Insect/Drought related Notices.

Volumetric Estimate	None	Trace	< 1 yard^3	1-5 yard^3	5-10 yard^3	>10 yard^3
Observed Discharges (#)	49 Watercourses	1	6	10	3	2

Emergency Performance	All Notices (%/#)	Post-Fire (%/#)	Insect/Drought (%/#)
Acceptable	77% / 31	75% / 27	100% / 4
Substandard	10% / 4	11% / 4	0% / 0
Unacceptable	13% / 5	14% / 5	0% / 0

Of the 65 watercourses, 16 (25%) had at least one sediment discharge related to timber operations, while 49 (75%) had no harvest-related discharges (Table 4). Of the harvest-related discharges, 32% were “Trace” or under 1 yard^3, while 68% had discharges 1 yard^3 or greater (Table 4). Eighty-six percent (86%) of the discharges were to Class III watercourses, 5% to Class II’s, and 9% to Class I’s.

Discharges related to harvesting occurred on 13 of the logged Notices. Where watercourses were present, 77% of the Emergencies had a “Acceptable” performance for watercourse protection (31/40), 10% of the Notices were “Substandard” (4/40), and 13% of the Notices were “Unacceptable” (5/40) (Table 4).

Of note is that the “Acceptable” Emergencies are driven in part by those with a lack of any observed sediment discharge to a watercourse from harvest activity; 27 of the 31 “Acceptable” Emergencies had no discharge in the sample segment, while four had an average median total of less than 1 yard^3. All Emergencies related to drought/insect mortality had “Acceptable” protection performance of watercourses.

Generally, harvesting in riparian buffer areas was less intensive (i.e., light touch) or absent, and equipment disturbance limited to Class III watercourses. Seven watercourses (11%) had equipment crossings occurring on seven Emergencies (15% of the harvested Notices). All crossings occurred on Class III watercourses. There were no observed encroachments into WLPZs by equipment on any of the Class II or Class I watercourses. Thirty percent (30%) of the Emergencies that had a Class III watercourse

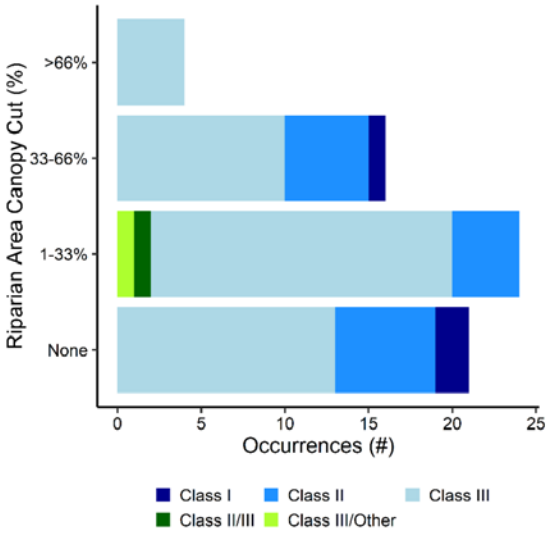

Figure 7: Binned percent canopy cut in riparian protection areas. Fill colors correspond to the watercourse classification on the assessed segment.

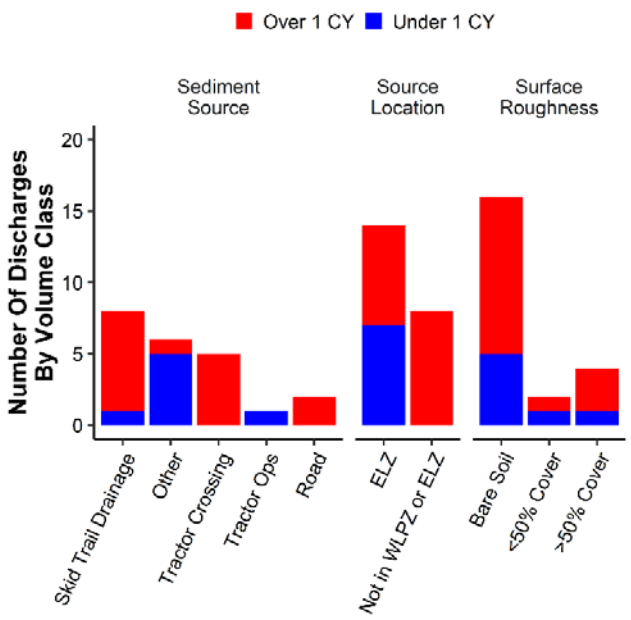

Figure 8: Discharges to watercourses under 1 yard^3 and greater than or equal to 1 yard^3, by the sediment source, source location, and downslope surface roughness below the sediment source.

present had encroachments on a Class III, for a total of 11 encroachments on Class III's. Harvesting of the canopy in protection zones was generally non-existent to relatively low; 68% of the watercourses were in the "None" and "1-33%" canopy cut categories (Figure 7). Twenty-five percent had more intensive 33-66% cut, and 6% were more than 2/3rd or 66% cut (Figure 7). The latter category was exclusively on Class III watercourses.

Overall, ground based tractor yarding, and associated skid trails, represented the most sediment discharges to watercourses; ~~drainage issues~~excess runoff and its interaction with the skid trail network, which ~~were~~ was often compounded by minimal post-fire ground cover and skidding in convergent areas, led to many larger magnitude sediment discharges. Sediment sources outside the ELZ or WLPZ sometimes involved accumulated upslope drainage that led to large sediment inputs. Thirty-six percent of the sediment discharges were from skid trail drainage, with almost all of these discharges being over 1 yard^3 in volume (Figure 8).

Of these occurrences, 75% were from skid trails that did not enter a WLPZ or ELZ area (i.e., not associated with tractor crossings). Skid crossings of Class III watercourses accounted for 23% of the discharges, all of which were 1 yard^3 or greater. "Other" discharges were related in part to burn piles in close proximity to watercourses, and

mechanical ~~drag~~ yarding disturbances from long line and cable yarding. These were cases where the lack of ground cover and surface roughness due to fire effects created conditions more prone to sediment delivery from disturbances, with most discharges under 1 yard^3 (Figure 8). Discharges with sources in the ELZ were evenly split between discharges under 1 yard^3 and those 1 yard^3 and more, while all discharges sourced from outside a WLPZ or ELZ were 1 yard^3 or more (Figure 8). When downslope flowpaths were bare soil, most sediment discharges exceeded 1 yard^3 (Figure 8). Fifteen discharges occurred on Notices with a "Moderate" Erosion Risk Rating, 53% of which were 1 yard^3 or more, and seven discharges occurred on notices with a "High" ERR, all of which were 1 yard^3 or greater.

Finally, ~~in addressing the fire effects on a watershed,~~ 47% of the watercourses evaluated on post-fire Emergencies exhibited erosional signs and scour related to fire effects irrespective of timber operations.

Road Hydrologic Disconnection and Performance

Road Hydrologic Disconnection and Performance

- 20% of the non-public roads that were used for harvest activity on sampled Emergencies were either substandard or did not meet the desired outcome for sediment delivery
- 42% of observed sediment discharges from roads were 1 yard^3 or greater
- Discharges were generally limited to <1 yard^3 if roads drained onto sites with greater than 50% cover or armored slopes

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Emergencies generally had native surface roads with gentle-to-moderate slope, on hillslopes less than 40% in gradient, with over 1/3rd of the sampled roads discharging to a classified watercourse. A total of 70 non-public road segments were assessed on 44 of the 47 harvested Emergencies, of which 90% (n = 63) were used for hauling and timber harvest activity on 39 (83%) of the logged Emergencies. An expanded description of the 63 haul roads sampled is presented in Table 5. Discharges from haul roads to watercourses were observed on 37% (23/63) of the roads. Sixty-two percent (62%) of these roads were assessed for the full 1,320 feet segment length, and the remaining 38% were surveyed for an average of 830 feet. The majority of haul roads were native surfaced, pre-existing roads (Figure 10), with almost ¼ of the roads also serving as residential access roads.

Table 5: Characterization of the sampled haul roads from harvested Emergencies.

Road Characteristics		Road Surface		Road Slope		Hillslope Gradient	
Serves as Residential Access Road	*24 %*	Gravel/Rocked	8 %	< 5 %	*54 %*	> 40 %	*30 %*
New Construction with Notice	*6 %*	Native Surface	81 %	5-10 %	*32 %*	< 40 %	*70 %*
Roads w/o Drainage structures	*36 %*	Paved	11 %	> 10 %	*14 %*		
Roads w/ discharge to watercourse	*37 %*						

Table 6: Observed discharges from assessed roads used for hauling and harvest activity, by volumetric estimate, top, including the number of road segments with no discharges. Blue shading indicates hydrologic disconnection of good to passable, while yellow shading indicates inadequate performance. The bottom half of the table shows the road performance (where applicable) for each Notice as a whole for all Notice types, post-fire only Notices, and Insect/Drought related Notices.

Volumetric Estimate	None	Trace	< 1 yard^3	1-5 yard^3	5-10 yard^3	>10 yard^3
Observed Discharges (#)	40 roads	4	24	12	4	4

Emergency Score	All Notices (%/#)	Post-Fire (%/#)	Insect/Drought (%/#)
Acceptable	80% / 31	77% / 27	100% / 4
Substandard	10% / 4	11.5% / 4	0% / 0
Unacceptable	10% / 4	11.5% / 4	0% / 0

Overall, 58% of the sediment discharges observed were under 1 yard^3, while the remaining discharges were 1 yard^3 or more, including 8% observed as 10 yards^3 or more (Table 6). Sixty-three percent (63%) of the road segments had no observed discharge; four road segments had no observed discharges due in part to the absence of a watercourse on the Emergency, negating any possible discharge.

Where roads were present that were used for hauling and harvest activity on Notices, 80% of the Emergencies had an "Acceptable" performance with regard to water quality, 10% had "Substandard" performance, and 10% were "Unacceptable" (Table 6).

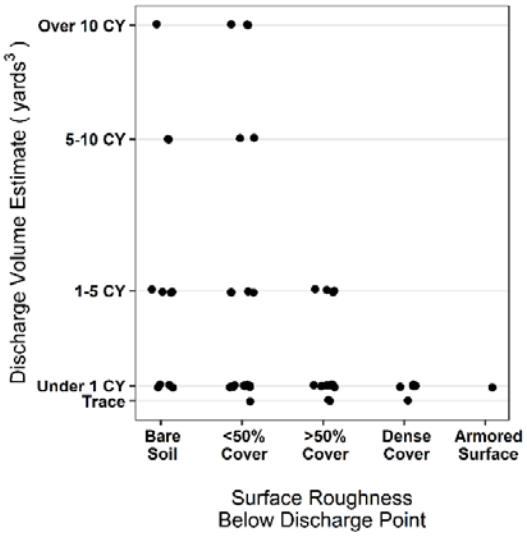

Figure 9: Discharges from haul roads to watercourses and the downslope roughness category (simplified category names shown). Decreasing sediment volume estimates followed increasing surface roughness.

Overall, sediment discharges were most common to Class III watercourses, frequently related to crossings, road drainage onto bare hillslopes, and road prisms intercepting increased upslope runoff due to fire effects. Road failures resulted in some of the most substantial sediment discharges. Class III watercourses received 75% of the discharges from haul roads, followed by 23% for Class II's, and 2% on "Other" watercourses. Crossings accounted for 25% of the discharge points on assessed road segments (~~additional crossings encountered besides the one used for a crossing~~

~~assessment~~additional crossings along surveyed road segments were evaluated as sediment discharges only), followed by rolling dips and waterbars, with 38% and 12% of the discharges, respectively. Outsloped roads accounted for 8% of the discharge points on road segments, followed by 2% for ditch relief features. Fifteen percent (15%) of the road discharge points occurred at road failures (n = 7), which were observed on two Notices. Six of the seven road failures exceeded 1 yard^3. Observed discharge volumes from haul roads decreased as the surface roughness downslope of a discharge point increased, particularly where bare soil was minimal (Figure 9).

Figure 10: A midslope road on a post-fire Emergency with a road slope of < 5%.

When discharges from roads used for harvest activity included from both the road prism and the burned hillslope, 55% of the discharges were 1 yard^3 or more, while when only the road prism itself was involved, only 31% of the discharges were 1 yard^3 or more.

Overall Emergency Notice Water Quality Outcomes

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Overall Emergency Notice Performance Relative to Water Quality Outcomes

The following represents a composite assessment of performance from surveyed watercourse crossings, watercourses, and road segments:

- **62%** of the Emergency Notices had water quality performances that were entirely "Acceptable", including two occurrences where there were no watercourses, non-public roads, or crossings present within the Emergency or associated road network.
- **32%** of the Emergency Notices were "Acceptable to Unacceptable", with a mix of water quality performances, and at least one "Substandard" or "Unacceptable" performance
- **6%** of the Emergency Notices had only "Unacceptable" performances for all crossings, roads, and watercourses present
- **85%** of Emergencies had at least one "Acceptable" assessment present, or an absence of crossings, non-public roads, and watercourses
- **15%** of Notices had no "Acceptable" (i.e., only "Substandard" or "Unacceptable) watercourse, road, or crossing assessments present
- **26%** of Notices had at least one "Unacceptable" watercourse, road, or crossing assessment
- **In general, sediment discharge issues, where and when present, were attributable to watercourse crossings, ground based tractor yarding, and road drainage onto fire-impacted bare hillslopes in close proximity to watercourses**

Skid Trail Evaluations

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- 18% of skid trails had some level of sediment discharge to a watercourse, approximately half due to temporary watercourse crossings, and half due to drainage from skid trails
- Altogether, 10 Notices (21%) had an instance of sediment delivery from a skid trail
- Generally, sediment breakthroughs from skid trails into a riparian buffer zone also resulted in sediment discharge
- Of 72 surveyed skid trails, 24% did not have waterbreaks within the surveyed length of the skid trail

Figure 11: Gully erosion below a skid trail waterbar, cause in part by accumulated upslope drainage, which discharged to a watercourse.

Skid trails were prevalent on most Emergencies; skid trails were frequently observed following the topographic contour of steep hills. Forty-fire (45) of the 47 harvested Emergencies had at least one skid trail present that was evaluated, for a total of 72 skid trail segments, inclusive of Emergencies over 20 acres in size where two were assessed. Eighty-six percent (86%) of the skid trails were on hillslopes less than 50% slope gradient, while the remaining skid trails were assessed on hillslopes over 50% gradient. No skid trails were observed with a trail slope over 50%, and 42% of the skid trails had a slope of less than 10%, indicative of skidding along the contour or on gentle topography.

In 17 cases (24%), the skid trail segment had no waterbars installed along the 200-foot assessment. Some of these incidences were on skid trails that were flat or functionally outsloped but potentially still capable of generating runoff. Waterbar spacing averaged 102 feet, where present. The average spacing on hillslopes under 50% averaged 105 feet, and 86 feet on gradients over 50%. As the slope of the skid trail itself increased, mean waterbar spacing decreased from 132 feet (0-10% slope) to 83 feet (25-50% slope).

Skid trails were observed discharging into watercourses when they crossed a watercourse, and when they were near a watercourse with an associated buffer area with insufficient ground cover to intercept runoff before it entered a stream network. Skid trails frequently had erosion features on the trail itself or at

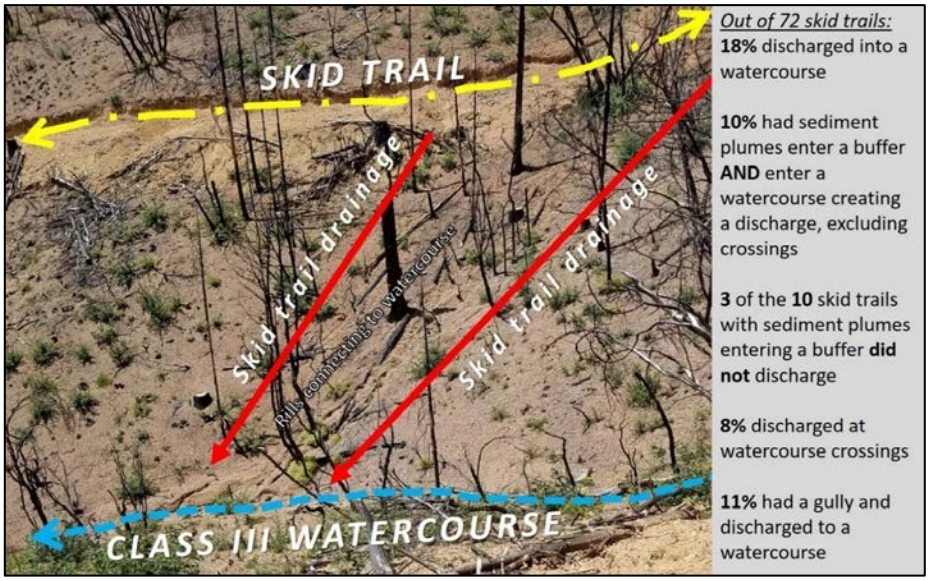

Figure 12: *Summary of the skid trail evaluations with respect to runoff and discharge to watercourse protection areas and watercourses.*

drainage points, and these were sometimes associated with sediment discharges. Eighteen percent (n = 13) of the skid trails had some degree of sediment discharge to a watercourse. Six of the skid trails discharged at temporary crossings of watercourses, all of which were Class III's. Seven of the skid trails, or 10%, had a discharge occur when drainage from a trail passed through buffer zones and into a watercourse. There were three occurrences of a sediment plume entering a protected buffer area without a discharge occurring. The discharges from skid trails to a watercourse occurred on 10 separate Emergencies, or 21% of the harvested Notices.

Thirty-seven of the 72 skid trails assessed had some type of erosion feature observed. Rills were observed on 51% of the skid trails and gullies were observed on 15%; in every case where a gully was observed, rills were also observed on skid trails. Ten of the 27 skid trails with rills also had a discharge into a watercourse, while eight of the 11 skid trails with a gully feature discharged into a watercourse. In three cases, there were neither rill nor gully features on skid trails that discharged; discharges were instead due to sheetwash erosion and observed plumes of fine particulates in the watercourse.

Unstable Areas

While assessments in the field were not exhaustive for unstable areas, Professional Geologists from CGS identified 12 separate Emergency Notices that had field verified unstable areas present, or 25% of the harvested Emergencies. Three Emergencies also

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had subsequent ~~timber operations~~tree removal occur on the unstable areas, but no tractor operations or road building occur through the areas.

Forest Structure and Habitat

- 55% of fixed radius plots had dead sub-merchantable residual trees
- 57% of Emergencies had at least one fixed radius plot with large wood present
- 43% of Emergencies had >50% ground cover in all fixed radius plots
- Green and snag conifers were present in variable radius plots on 60% and 68% of Emergencies, respectively
- Insect/Drought related Emergencies had greater basal area for green conifers compared to post-fire Emergencies, but less basal area for conifer snags
- Based on the QMD of all tree types present, 60% of Emergencies fell into the WHR 4 (11-24" diameter) size class

Table 7: Percent of Notices with tree types and conditions absent, and the percent of Notices in each WHR size class based on all tree types and conditions present.

Tree Class and Condition	Percent of Notices with Tree Class/Condition PRESENT
Conifers (Green)	60%
Hardwood (Green)	58%
Conifers (Snag)	68%
Hardwood (Snag)	66%
Percent of Notices in each WHR-Size Class based on all tree types and conditions PRESENT	
WHR 3 (6-11")	30%
WHR 4 (11 to 24")	60%
WHR 5 (>= 24")	10%

In general, merchantable and sub-merchantable (commercial and non-commercial) timber was found on most Emergencies, including post-fire Notices. Certain habitat elements such as large wood were present often, while shrub cover was found to be minimal to moderate in abundance.

Within the fixed radius plots,[1] 28% of all the plots had sub-merchantable, or less than 6" DBH (diameter at breast height) green trees of some type present, while 55% of the plots had some type of dead sub-merchantable tree. Large wood pieces (≥12" DBH and 10' long) were found in 39 of the 131 fixed radius plots (28%), and 57% of the harvested Emergencies had a large piece of wood in at least one fixed radius plot. One Notice had large wood pieces in all three fixed radius plots, while 10 Notices had large wood in 2/3rd of the fixed radius plots, followed by 16 Notices with large wood pieces in 1/3rd of the plots.

[1] 1/60th acre (~15 feet radius) for Notices ≤20 acres; 1/30th acre (21.5 feet radius) for Notices >20 acres.

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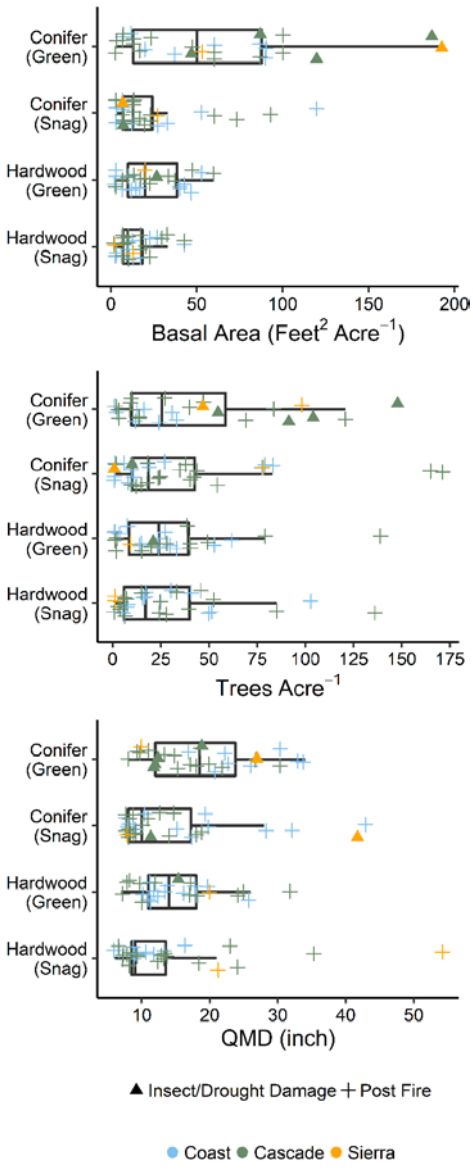

Figure 13: Basal area, trees per acre, and quadratic mean diameter (QMD) by tree type and condition. Shape indicates Notice type, and color indicates Forest Practice Area.

The majority of Emergencies had only 0-20% shrub cover within all the fixed radius plots (26/47), likely reflective of fire effects and in some cases ground-based yarding. Seven Notices had 20-50% shrub cover in 2/3rd of the fixed radius plots. Ground cover of 50% or more was found on all three fixed radius plots for 20 of the 47 Notices, and nine of 47 Notices had over 50% ground cover on at least 2/3rd of the plots.

Few Emergencies had a near total absence of forest structure remaining; rather, most had some combination of live and/or dead conifers and/or hardwoods within the mapped boundaries. Approximately two-thirds of Emergencies had conifer and hardwood snags present, with green conifers and hardwoods present on 60% and 58% of Notices, respectively (Table 7). For quadratic mean diameter (QMD) based on all trees present (green trees and snags, commercial and non-commercial), 30% of the Notices were in the WHR 3 size class, 60% were in the WHR 4 size class, and 10% were in the WHR 5 size class (Table 7).

Where each tree type and condition was present, the basal area of green conifers averaged 43 feet^2 acre^{-1} on post-fire Notices, and 127 feet^2 acre^{-1} on Notices for insect/drought damage and mortality. For conifer snags, post-fire and insect/drought Notices averaged 24 and 7 feet^2 acre^{-1}, respectively (Figure 13,Table 8).

Conifer snags were largely absent from Notices related to insect or drought mortality, while green conifers were in greater abundance on those Emergencies

than post-fire Emergencies (Figure 13, Table 8). Hardwood snags had the lowest basal area, density, and QMD on Emergencies, and were exclusively found on the post-fire Emergencies. Relative comparisons to the Drought Mortality Exemptions monitored in 2018 can be found in Table 8. In general, conifer snags were more abundant and denser on the sampled post-fire Emergencies in this report than on the Drought Mortality Exemptions reported in Olsen and others (2019).

In terms of diversity present, the majority of Emergencies had one or two species present of green trees (any type) (Figure 14). For the snag trees, regardless of tree type, while a large number of Notices had only one snag species present, the majority had two, three, or even four different species present, indicating a high level of diversity in residual snag trees (Figure 14).

Table 8: Averages of basal area, trees per acre, and quadratic mean diameter (QMD) by tree type and condition, Notice type, and results from the 2018 monitoring of Drought Mortality Exemptions. All averages are based on where measurement classes were present.

	Notice Type		
	Post-Fire	**Insect/ Drought**	**2018 Monitoring of Drought Mortality EX Notices**
BASAL AREA			
Green Conifer	43	127	62
Snag Conifer	24	7	11
Green Hardwood	23	27	22
Snag Hardwood	14	NA	1
TREES PER ACRE			
Green Conifer	30	89	66
Snag Conifer	38	6	26
Green Hardwood	29	21	40
Snag Hardwood	29	NA	2
QMD			
Green Conifer	20	16	20
Snag Conifer	14	27	14
Green Hardwood	15	15	15
Snag Hardwood	14	NA	14

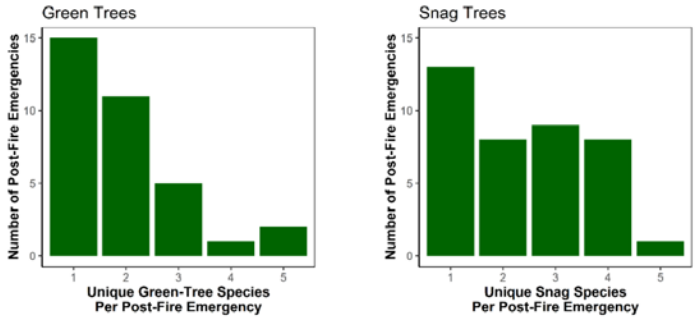

Figure 14: Number of Emergencies by number of unique tree species present, for green trees of any type (left), and snag trees of any type (right).

Rare, Threatened, and Endangered Species Presence

Emergency operations do not preclude adherence to other laws and regulations, specifically those pertaining to the federal and State endangered species acts. As such, the project proponent must ensure that take of any species listed under the two laws is avoided, however, they are not required to demonstrate how they scoped for species or provide protection measures within the Emergency Notice.

The California Natural Diversity Database (CNDDB), managed by CDFW, is the typical tool used for species scoping within a project area. It is a positive detection database meaning it doesn't include surveys that were conducted with negative results. Detections include site observations to protocol surveys. Observations are being updated from provided submissions with the earliest record dating back to 1842. Over 2500 unique species can be found in the database. Species within the database not only include those with an endangered or threatened status, but also species of special concern, watch list, or rare plant rank. Detections can be from non-specific observation to specific locations, such as a raptor flying through an area vs. a raptor nest, as an example.

Project proponents should scope for listed species within and up to an adjacent map quadrangle from the Notice to determine if species are known within and/or adjacent to the area. If species are present in the scoping area, they should then determine if habitat is present within the project boundary to support the species. If habitat is present, then surveys for those species should be conducted and site specific protection measures applied. If surveys can't be conducted, then habitat protection measures should be applied when implementing Emergency operations. Because this information is not part of the Notice, the assumption is that proponents are providing adequate species protection.

The CNDDB and the Spotted Owl Database, also managed by CDFW, were queried for occurrences of rare, threatened, or endangered plants or animals. Database query

results for the 54 Emergencies in the sample are displayed in Table 9 and Table 10. In general, rare, threatened, or endangered plant or wildlife species recorded in these databases were seldom located within mapped Notice boundaries, however Emergencies frequently were within a half mile of known populations or the established range of these species.

Due to the complex suite of sensitive species that inhabit forested environments and the rigor and time involved in conducting surveys at appropriate times of the year and in sufficient number, no specific species surveys or spotted owl habitat monitoring were conducted during this monitoring effort. Further investigation may be needed to prioritize key forest species to determine impacts to species.

~~The California Natural Diversity Database (CNDDB) and the Spotted Owl Database, both managed by CDFW, were queried for occurrences of rare, threatened, or endangered plants or animals. Database query results for the 54 Emergencies in the sample are displayed in Table 9 and Table 10. In general, rare, threatened, or endangered plant or wildlife species recorded in these databases were seldom located within mapped Notice boundaries, however Emergencies frequently were within a half mile of known populations or the established range of these species.~~

Table 9: Query results from the CNDDB for the 54 sampled Emergencies, harvested and unharvested.

	Occurrences	**Elements**
Species Within Projects Total	**4**	**2**
Botanical Species	4	2
Species Within 0.5 miles of Projects Total	**111**	**55**
Amphibian	18	5
Botanical Species	65	33
Birds	9	5
Crustacean	1	1
Fish	1	1
Insects	1	1
Mammals	13	6
Mollusks	2	2
Reptiles	1	1

CNDDB occurrences and unique species type (elements) within Emergency and within 0.5 miles of Emergency projects broken down by taxon type

Table 10: Query results from the CNDDB for the Northern Spotted Owl and California Spotted Owl for the 54 sampled Emergencies, harvested and unharvested.

	Number of Emergency Projects within Range of Spotted Owl	**Activity Centers within Emergency Boundary**	**Activity Centers within 0.5 miles of Emergency Boundary**
Northern Spotted Owl	40	0	7
California Spotted Owl	6	1	3

Discussion

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- 62% of Emergencies had “Acceptable” composite performance outcomes, while 32% of Emergencies had “Acceptable to Unacceptable” mixed performance outcomes and 6% had entirely “Unacceptable” outcomes.
    - “Unacceptable” outcomes for watercourse crossings, road hydrologic disconnection, or watercourse protections were found on 26% of Emergencies, underscoring the need to focus additional attention on approximately one-quarter of the population that fail to meet desired outcomes in one of those categories.
- Only 60% of road watercourse crossings used for harvest activity were rated as “Acceptable”, and this represents one of the most significant areas where positive outcomes can be increased.
- Lack of operational rule and/or BMP implementation was the most likely causal factor for poor performance, and data from this report suggests performance can be considerably increased with the implementation of well-designed BMPs.
- Instances where post-fire conditions may have exacerbated sediment discharges included when ~~Ground~~ ground based yarding and skid trails ~~can result in detrimental erosion issues, in particular when~~intercepted and rerouted upslope drainage creating a network of ~~and a lack of ground cover create cascading~~ drainage pathways. This was particulary common on ~~Convergent~~ convergent unchanneled swale~~s features~~ in conjunction with a lack of ground cover.~~ When proximal to may also compound cumulative downslope drainage from skid trails, and when in proximity to~~ watercourses, this often result~~ed~~ in high magnitude sediment discharges.
- Review Team agencies may need to re-prioritize field staff following extensive wildfires in forested areas and subsequent Emergency Notice submittals to ensure that the Forest Practice Rules and other relevant laws and regulations for protection of natural resources are upheld as necessary.
- Varying levels of residual forest structure remain on post-harvest Emergencies, due to tree mortality patterns, timberland owner goals, and market conditions.
    - Discussions on appropriate residual forest structure following

This study focuses predominantly on the water quality outcomes related to the implementation of Emergency Notices. ~~-~~Other studies have specifically evaluated the hydrologic/geomorphic effects of salvage logging activities following wildfire within an experimental and/or case study framework. ~~-~~These investigations focused on quantifying the effects of a purposeful management intervention (i.e., varied salvage logging treatments) relative to burned and unlogged sites (i.e., controls), and these

studies were done at the scale of hillslopes and small catchments. These studies have shown mixed results in terms of impacts (Silins et al., 2009; Wagenbrenner et al., 2015; Olsen, 2016; James and Krumland, 2018). Unlike the studies mentioned above, this study did not used a replicated plot and/or paired catchment approach to test the effectiveness of Emergency Notice provisions against unmanaged controls, as this was inconsistent with objectives of this study. This study's objective was to provide a statistically rigorous population estimate of project level performance/outcomes of Emergency Notice provisions (i.e., implementing operational FPRs) conducted under 14 CCR § 1052 using rapid assessment protocols. Emergency Notices provisions require compliance with operational FPRs irrespective of potential post-fire conditions or precipitation magnitude. Since burned and unmanaged areas do not require the implementation of operational FPRs, sampling within controls areas was not consistent with our study objectives.

The performance/outcome designations used herein are a method to frame numeric findings in a way that is understandable to the layperson. These performance designations are applied without consideration of receiving waterbody sensitivity, including whether the waterbody is listed as impaired under Section 303(d) of the Clean Water Act or have Total Maximum Daily Load (TMDL) wasteload allocations under an approved TMDL. In the case of 303(d) listed or TMDL-regulated waterbodies, performance classified as "Acceptable" may still not be sufficient to meet water quality objectives. The performance designations apply to individual or discharge-averaged Emergency Notice elements such as road segments, watercourse crossings, and watercourse protection measures, and do not evaluate performance as related to the avoidance of cumulative watershed effects.

Previous studies across the western states have generally shown relatively high forestry BMP implementation rates (~90%), with California having documented implementation rates of 92 to 94 percent (Ice et al., 2004; Ice et al., 2010). California specific THP monitoring on non-federal timberlands has shown steadily increasing effectiveness rates for higher risk elements such as watercourse crossings, with the number of crossing-related effectiveness problems improving from approximately 64% to 87% from 1996 to 2013 (Brandow and Cafferata, 2014). While this study does not follow the same protocols as those used in previous studies, it is reasonable to compare the water quality-related outcomes documented in this study to those from past monitoring efforts, as these previous studies provide a baseline of achievable performance for operations conducted under California's Forest Practice Rules.

This study differs from previous monitoring reports in that it offers a composite assessment of outcomes related to water quality across several operational elements. The Emergency Notices submitted in 2018 and monitored in 2019 had a range of outcomes in regards to water quality. While a majority had "Acceptable" performance outcomes (62%), either watercourse crossings, road hydrologic disconnection, or

watercourse protections on over one-quarter of the 47 Emergencies were found to have an "Unacceptable" outcome, and just over one-fifth of Emergencies had a "Substandard" performance outcome for one of those categories. In particular, this study documents a 60% "Acceptable" rating for watercourse crossings, which is substantially lower than the "effectiveness" rate of 87% documented for THP watercourse crossings by Brandow and Cafferata (2014). The composite assessment percentage is also low (62%) when compared to older THP monitoring results (i.e., pre-2000, post January 1997 storm event) of single elements such as watercourse crossings (i.e., 67% effectiveness rate for watercourse crossings from Cafferata and Munn, 2002).

Data from this study and observations from monitoring staff indicate that the primary causal factor for lower water quality-related performance was the lack of FPR implementation. The "Road Rules" (14 CCR § 923, 943, 963) require that use of roads and watercourse crossings during operations comply with requirement to prevent significant sediment discharges. This includes:

- Discharging road runoff into vegetation, woody debris, or rock. If possible erosion resistant material should be placed to prevent significant sediment discharge (14 CCR 923.5, 943.5, 963.5 (h));
- Not hauling during conditions that can result in significant sediment discharges (14 CCR 923.6, 943.6, 963.3 (b and h)); and
- Preventing the erosion of crossing fills by using appropriate protective structures (i.e., rock slope protection) (14 CCR § 923.9, 943.9, 963.9 (h and l)).

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Results indicate that by implementing additional BMPs (e.g., rock armoring of inlets), the proportion of watercourse crossings that delivered less than one cubic yard increased from 6~~2~~ to 76~~80~~ percent (Figure 5). In 2/3rd of the observed crossings that had been upgraded relative to the pre-fire state ~~with additional BMP implementation under during~~ the Emergency, sediment discharges were recorded as only "Trace~~.~~". This suggests that upgrades and additional BMP implementation resulted in favorable outcomes and resulted in a ~~similar~~closer level of effectiveness as that documented in previous monitoring studies (i.e., 76~~80~~% vs 87% in FORPRIEM; Brandow and Cafferata, 2014). Data from the road segment evaluation also suggested that increased compliance with 14 CCR 923.5, 943.5, 963.5 (h) resulted in a much lower occurrence of substandard and/or unacceptable water quality outcomes (Figure 9), with no discharges exceeding one cubic yard when road runoff was discharged onto densely covered slopes or rock armored surfaces. Furthermore, field observations indicated that operations during wet or saturated conditions, as evidenced by rutting, often led to increased sediment discharges and lower performance. Finally, 24% of surveyed skid trails had no waterbreaks installed, indicating less than ideal implementation of erosion control measures as required under 14 CCR § 914.6, 934.6, and 954.6. ~~The second phase of Emergency Notice monitoring will require a more thorough rule/BMP~~

~~implementation protocol, so that the extent of rule compliance and/or lapse can be rigorously documented.~~

Another possible causal factor for the lower performance of Emergency Notices may be attributed to the increase in runoff and erosion following wildfire. To account for this, the protocol distinguished when watercourse crossings and road segments received additional runoff from upslope areas, a potentially common condition in burned areas. Of the 48 haul roads surveyed that had documented sediment discharges, 46% (22) received additional runoff from upslope areas, with 55% (12 out of 22) having discharges greater than one cubic yard. Of the 41 watercourse crossings with documented discharge, only 8 of the 41 crossings (20%) showed evidence of receiving additional runoff from the burned area. Forty-seven percent of evaluated Watercourse and Lake Protection Zones showed some sign of erosion and scour irrespective of the timber operations. In addition, monitoring staff observed multiple instances where ground based yarding in combination with low ground cover and convergent topography resulted in a cascading network of drainage, often times resulting in high magnitude sediment discharges.

While the post-fire condition may have led to decreased performance on roads and at watercourse crossings, the operational requirements of the "Road Rules" necessitate the prevention of significant sediment discharge as defined in 14 CCR § 895.1 This requires the progressive implementation of BMPs that disperse runoff, disconnects road drainage from watercourses, and treats erodible surfaces to prevent "significant" sediment delivery to watercourses. Guidance and principles for implementing these rules are provided in Board of Forestry Technical Rule Addendum No. 5. Observations indicate that in road-associated areas where discharges were "Substandard" to "Unacceptable", full implementation of the "Road Rules" to prevent significant sediment discharge was rare. The likely increase in runoff and erosion following wildfire necessitates the deliberate design and implementation of BMPs to achieve the performance required under the FPRs. Until fully implemented BMPs can be evaluated and tested under post-fire conditions, we consider the potential influence of post-fire conditions to be less important than the lack of appropriately designed and implemented BMPs. If BMPs are fully implemented, we can test whether they are sufficient to prevent impacts following wildfire. The second phase of Emergency Notice monitoring will require a more thorough rule/BMP implementation protocol, so that the extent of rule compliance and/or lapse can be rigorously documented.~~As such, the second phase of Emergency Notice monitoring should require a robust rule implementation component~~

A third possible causal factor for the lower performance may be attributed to the severity of storm events during the 2019 water year (i.e., October 1, 2018 through September 30, 2019). Gage records indicate that annual precipitation for weather stations in and around the study areas ranged from the following (https://www.cnrfc.noaa.gov/monthly_precip_2019.php): 94% of average for Yreka; 105% of average for Potter Valley Power House; 107% of average for Mount Shasta;

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133% of average for Whiskeytown Reservoir; and 142% of average for Shasta Dam. These annual precipitation values represent average to above average annual rainfall totals, but do not indicate the erosive energy applied to the Notice areas, as this is more a function of rainfall intensity.- Once again, tThe FPRs require implementation and performance irrespective of the likely magnitude or frequency of storm events.- Hence, we consider storm characteristics to be less important in affecting performance than the lack of BMP implementation. -If BMPs are fully implemented, we can test whether they are sufficient to prevent impacts following wildfire and severe storm events.

When additional BMPs are installed at watercourse crossings, such as rocking the crossing approaches, the level of sediment inputs decreased. In 2/3rd of the observed crossings that had been upgraded with the Emergency, sediment discharges were recorded as only "Trace." Emergency Notices may serve as an opportunity to ensure new or upgraded permanent watercourse crossings meet the requirement to pass 100-year flood flow events; the increased runoff and debris loading associated with post-fire landscapes may overwhelm crossings that fail to meet necessary design guidelines.

In a few cases, erosion and sediment discharge issues were compounded by activities not related to commercial timber operations, such as utility right-of-way operations. Education of utility and city/county/state transportation department entities in the operational Forest Practice Rules will benefit both those entities and the timberland owners with right-of-ways present.

Despite unfavorable outcomes on several Emergency timber harvests, manysome met or exceeded expectations of a traditional green-tree THP administered timber harvest, indicative of the potential for successful timber harvests following the requirements of 14 CCR §1052. Several small nonindustrial landowners encountered during sampling indicated that the Emergency Notice of Timber Operations process allowed them to harvest timber, whereas the cost of a traditional THP would have been prohibitive. In one case, an Emergency Notice was used as a mechanism to extract timber for in-stream placement of large woody debris for a riverine restoration project.

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The results of this study suggest that post-fire salvage activities covered by Emergency Notices have led to a higher frequency of unfavorable water quality impacts, especially when compared to previous monitoring studies focused on "green tree" timber harvesting (Cafferata and Munn, 2002; Brandow et al., 2006; BCTF, 2011; Brandow and Cafferata, 2014; Olsen et al., 2019). Limited staffing to administer logging across large burned areas and the limited time frame in which to recover timber value may be causal factors for implementation lapses and the decrease in performance relative to "green

tree" timber harvesting. Additionally, the timing of fire events and Emergency Notice submittal, LTO availability, and market conditions sometimes causes operations to occur during wet winter months, where water quality issues may be compounded. Observationally, significant erosion and sediment delivery were observed on Notices with steeper slopes and highly erodible soils, such as decomposed granitic soils.

Impacts from timber operations varied depending on the scale of the operation, the timberland owner objectives, the level of effort provided by the RPF and LTO, the physical site factors present (e.g., slope and lithology), and additional management practices implemented as part of the Notice. Some Emergencies experienced extensive timber harvesting, including ~~a~~ large proportions of clearcut equivalent areas and/or significantly large group openings. These features were related to factors such as fire severity or insect damage extent, commercial timber presence, market conditions, and suitability of the landscape for harvesting. However, many Emergencies had abundant residual green and snag trees left. Moving forward, it may be critical to assist nonindustrial landowners in reforestation efforts, such as through the California Forest Improvement Program (CFIP), to ensure that salvaged areas do not have subsequent delayed forest regrowth or long-term type conversion to more flammable underbrush. These efforts may also be an opportunity to ensure reforestation is done to create forest resiliency to future severe wildfire and drought events.

In order to avoid threat or damage to rare, threatened, and endangered plants and animals, RPFs are encouraged to consult with trustee agencies as necessary. Additionally, they are urged to use the best available science and monitoring products, such as the USFS RAVG data (https://fsapps.nwcg.gov/ravg/) to assess canopy cover and basal area loss in forested settings, in addition to field verification and assessment. ~~Similarly, RPFs should consult with Archaeologists as necessary to avoid damage to significant archaeological sites.~~

Ongoing Applicable Research ~~T~~to Inform Future Salvage Operations

While this study focuses on the performance-based outcomes following implementation of Notice provisions under 14 CCR §1052 using rapid assessment protocols, CAL FIRE has implemented several research projects at the Boggs Mountain Demonstration State Forest to look at detailed post-fire and post-salvage response following the 2015 Valley Fire. -This includes:

1) Boggs Mountain Post-Fire Salvage Runoff and Erosion Studies -
   a) A study looking at runoff and erosional response of small catchments across a range soil burn severity;
   b) A study looking at the effectiveness of post-fire salvage logging and herbicide application at the hillslope scale;
   c) Two distinct studies using rainfall simulation to test the effects of post-fire salvage and slash cover at the small plot scale in situ and under laboratory conditions (see Prats et al., 2019);

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d) A study us-ing runoff simulation to test the effectiveness of different skid trail erosion control BMPs at the hillslope scale;

2) Boggs Mountain Postfire Bird Occupancy Study –

a) Boggs Mountain Postfire Bird Occupancy Study. A study looking at bird occupancy in post-fire setting using automated recording units in unsalvaged plots and two types of salvage treatment plots; one in which the ground is replanted and one in which the other is not. The study establishes baseline occupancy with the goal to revisit the plots in 10 – 20 years as the ecology of the forest changes through conifer and shrub growth with the assumption that bird assemblages will change. Preliminary results are showing that bird species are utilizing the various treatments consistent with their life strategies.

3) Fire and Resource Assessment Program's (FRAP) Fire Effects, Carbon, and Forest Regeneration Study –

A study looking at the effects of post-fire management activities on plant succession, regeneration, fuels, and carbon.

a)

As such, data and findings from this study should be used in conjunction with the more focused investigations on effectiveness listed above to inform managers and policy makers during the decision-making process.

~~The use of ministerial timber harvest documents such as Emergency Notices allow timberland owners to capture financial value after a wildfire event. However, the rapid pace and extent of these operations, less resilient landscapes, and elevated impacts from stressing storm events demand a high level of harvest administration by RPFs, good judgement on the part of LTOs, and frequent inspection by the Review Team agencies, as their concerns warrant.~~

Finally, this monitoring effort is meant to address performance-based outcomes as a product of adherence to the operational rules by RPFs and LTOs that must be followed under Emergency Notices per 14 CCR §1052, being non-discretionary ministerial documents. This effort does not address outcomes where timberland owners choose not to undertake salvage logging, salvage logging on Federal ownership, or the overarching wildfire effects on a watershed in the absence of post-fire management. It was meant to be rapid in nature, and focused on individual timber harvests. Therefore, addressing cumulative effects, particularly after landscape scale events, is outside the scope of this document and current monitoring effort.

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Recommendations

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1. It is recommended RPFs and LTOs ensure proper administration and implementation of salvage activities, especially in post-fire salvage harvests
2. It is recommended all Review Team agencies prioritize inspections of Emergencies to address concerns, and track these inspections in order to facilitate feedback and adaptive management
3. It is recommended to educate ~~nonindustrial~~ timberland owners on legal responsibilities and expected outcomes once an Emergency is filed on their property
4. It is recommended all Review Team agencies participate in the monitoring process in its entirety and remain engaged in all components, and adhere to

The use of ministerial timber harvest documents such as Emergency Notices allow timberland owners to capture financial value after a wildfire event. However, the rapid pace and extent of these operations, less resilient landscapes, and elevated impacts from stressing storm events demand a high level of harvest administration by RPFs, good judgement on the part of LTOs, and frequent inspection by the Review Team agencies, as their concerns warrant.

For these reasons, ~~This~~ the recommendations in this report ~~report offers substantive recommendations to improve the environmental outcomes associated with the implementation of Emergency Notices, as well as recommendations to improve future monitoring of EX-EM Notices over time~~do not focus on changes in Emergency Notice provisions and/or specific rule changes for Emergency Notices at this time. Rather, the recommendations are generally focused on increasing rule and BMP implementation through a combination of education and increased regulatory presence. ~~Internal process refinements to improve monitoring are not included herein:~~

1. It is recommended that RPFs and LTOs ensure administration and proper implementation of planned salvage activities, especially as post-fire landscapes are dynamic environments and may change with significant precipitation events. Since education and outreach efforts have appeared to increase performance in the past, we suggest that outreach and education on Emergency Notice monitoring results and findings need to be coordinated with landowner representatives, LTO representatives, and the RPF community. Clear guidance on which operational FPRs apply to activities under 14 CCR § 1052 may be necessary to ensure operational rule compliance.
2. A key recommendation in this report is to prioritize the inspections of Emergency Notices during years when timberland wildfire acreage is high, and subsequent Emergency Notice submissions will be high. An assumption in this recommendation is that increased regulatory presence will result in better water quality-related performance, as quantified by future monitoring of the Emergency

Notice population. To effectively implement this recommendation, and test its efficacy in improving outcomes related to water quality performance, it is necessary to track inspections by the various Review Team agencies so that increased inspection presence can be linked to changes in performance. Linking changes in management/regulatory approaches to outcomes is a central tenet of adaptive management. Hence, it will be necessary to report the number of inspections by agency to validate the assumption between increased regulatory field presence and improved water quality outcomes (Figure 15). A resample of Emergency Notices is tentatively scheduled for 2021 (see Table 14).

- In order to address concerns and determine outcome improvements over time, CDFW, RWQCBs, and CGS must develop their own metrics on inspection levels and frequency, and participation in ministerial document assessment. If possible, the Review Team agencies should report on inspection metrics for the 2018 Emergency Notice population. This will allow us to determine if frequency of inspections is truly increasing over time.

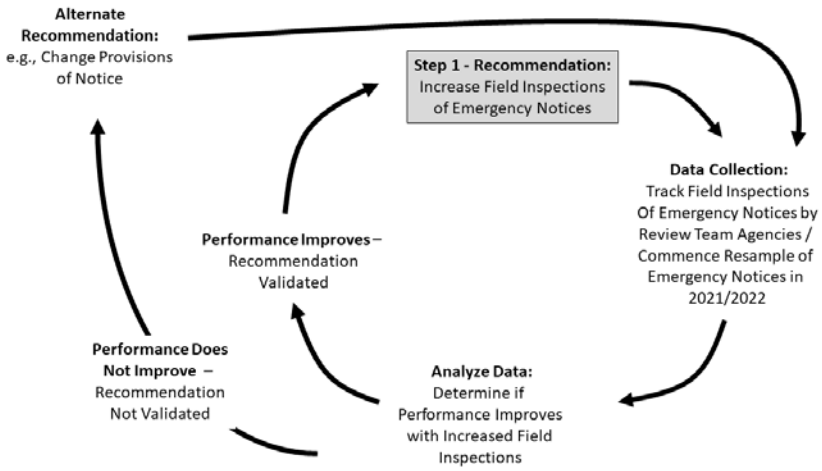

Figure 15. A schematic showing how the effectiveness of Recommendation 2 can be tested in an adaptive management framework.

3. It is recommended CAL FIRE and the Board ~~to create~~ develop educational materials and conduct outreach for ~~nonindustrial~~ timberland owners (1) regarding their legal obligations once an Emergency Notice has been filed on their property, including CAL FIRE, Regional Water Quality Control Board, and CDFW permitting requirements, to reduce legal conflicts; and (2) to ~~gain a better~~improve landowner understanding of expectations and outcomes following post-fire

salvage ~~for avoiding~~so that conflicts between timberland owners and RPFs/LTOs may be avoided.

4. For future monitoring, it is recommended all the Review Team agencies have a sustained presence throughout the entire monitoring process. Early and active involvement is especially critical when defining explicit monitoring objectives so that critical questions related to EX-EM Notices and resource(s) of concern can be answered, and ensuring that Review Team agencies' questions can be answered and be built in to developing and refined protocols. Monitoring objectives, critical questions, and resource constraints will largely dictate future monitoring protocols and sample designs. ~~-~~Adherence to objective and unbiased monitoring protocols and sample design should be a common goal for all Review Team agencies.
    ~~4.~~ o CAL FIRE proposes to convene a monitoring working group in early 2020, to discuss monitoring objectives, critical monitoring questions, future protocol development, and existing protocol refinement.~~-~~ This can be a venue for CDFW and the Water Boards to discuss findings from the additional and/or separate protocols implemented for a subset of the 2018 sample population.

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Appendix 1 – Statewide Emergency and Exemption Submissions in 2018, Inspections, and Violations

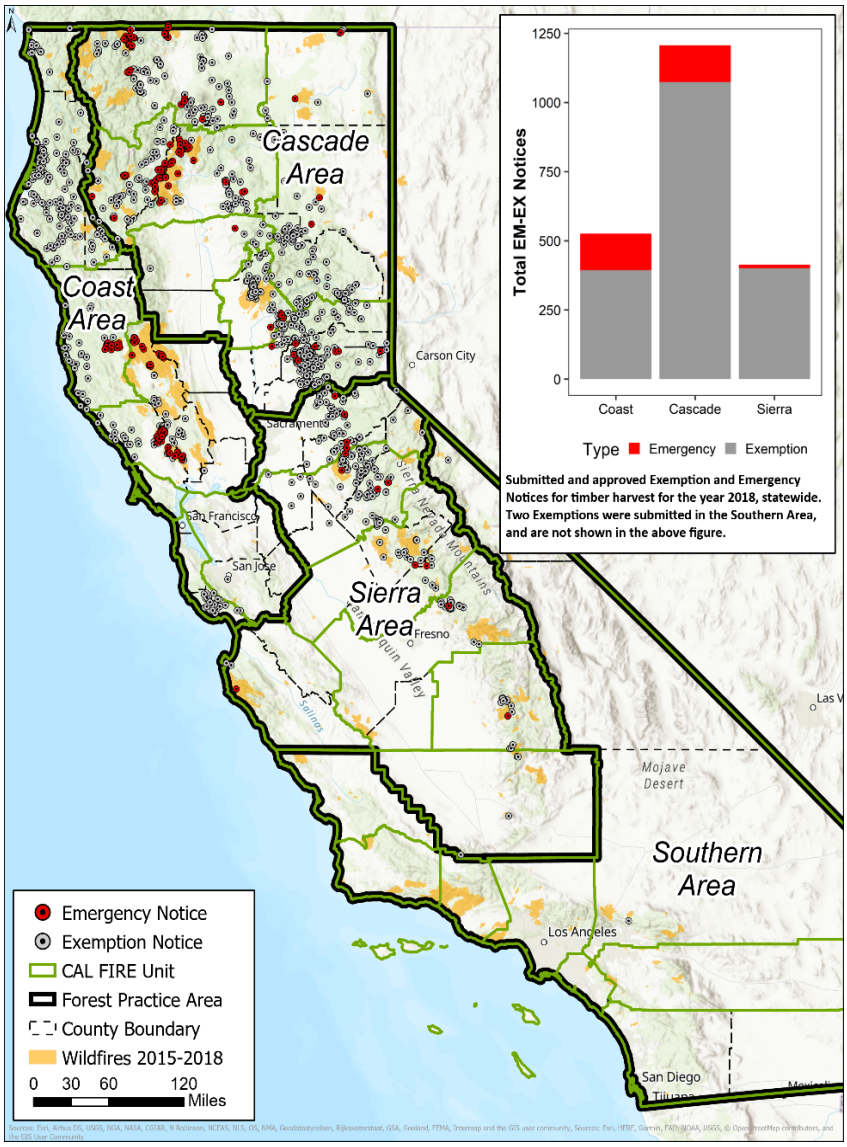

Figure 15: Total number of accepted Emergency and Exemption Notices in 2018 by Forest Practice Area. Colors indicate the type of document. Forest Practice Area 3 (Southern) is not shown, and had a nominal number of two Exemptions in 2018.

Of the 2,147 ministerial documents accepted by CAL FIRE in 2018, 87% were Exemptions and 13% were for a Notice of Emergency Timber Operations (Figure 15). This appendix focuses on options that were available for the 2018 calendar year, reflective of timber harvesting trends; Table 11 shows the current options available post SB 901 and effective in 2019.

Table 11. Exemption and Emergency Notice types available for use in 2019.

Exemption Notice Types		Emergency Notice Type	
1038(a)	Christmas trees	**1052.1(a)**	Dead from insects, disease, animal damage
1038(b)	Dead, dying, diseased trees (<10% of avg. volume/acre)	**1052.1(b)**	Dead from drought, fire, wind, flood, landslides
1038(c, c(6))	Removal of fire hazard trees within 300 feet of structures	**1052.1(c)**	Dead from air or water pollution
1038(d)	Substantially damaged timberland, including drought related stress	**1052.1(d)**	Tree removal for emergency construction or repair of roads
1038(e)	Removal of conifers to restore oak woodlands	**1052.1(e)**	High or very high fuel hazard conditions; financial emergency
1038(f)	Small timberland owner exemption	**1052.1(f)**	Sudden Oak Death
1104.1(a)	Less than 3 acre conversion		
1104.1(b)	Right-of-way work by public agency on public property		
1104.1(c)	Utility right-of-way clearance		

Total Approved Notices and Reported Acreages

For 2018, a total of 278 Notice of Emergency Timber Operations documents were approved by CAL FIRE, with 272 of those related to substantially damaged timber, five for fuel hazard reduction, and one for sudden oak death disease. Emergency Notices were nearly equally split among the Coast and Cascade Forest Practice Areas, with a small proportion in the Sierra Forest Practice Area (Figure 15).

For Exemptions, 1,869 documents were accepted in 2018. The Cascade Forest Practice Area comprised 57% of the Exemptions, with the remaining 21% and 22% in the Coast and Sierra Areas, respectively (Figure 15). Thirty-one percent (31%) of the Exemptions were for the less than 10% Dead, Dying, Diseased, Fuelwood, Splitwood, Christmas Tree Exemption options (hereafter “10% Exemptions”), followed by 20% for the 0-150 Foot Structure Protection Exemption, 19% for the Public/Private Utility Right-of-Way Exemption, 13% for Less Than 3 Acre Conversions, and 10% for the Drought Mortality Exemption. No other Exemption type exceeded 3% of the total Exemption Notices in 2018 (Table 12), although 150-300 Foot Structure Protection Exemptions accounted for 2.8% of accepted Exemptions in 2018.

A total of 31,058 reported acres were under Emergency Notices in 2018 (Table 12, Figure 16). Thirty-seven percent (37%) of the reported acres were in the Coast Forest Practice Area, 60% in the Cascade Area, and 3% in the Sierra Area (Figure 16). Most

acreage for this Notice type was under Emergency Notice of Timber Operations, and were related to extensive wildfires in 2017 and 2018 (Table 12). Seven fires, including the 2017 Tubbs, Nuns, and Redwood Valley fires (Sonoma, Napa, and Mendocino counties), 2018 Carr and Delta fires (Shasta and Trinity counties), 2018 Klamathon Fire (Siskiyou County), and 2018 Ranch Fire (Mendocino Complex, Mendocino, Colusa, Lake, and Glenn counties) contained 82% of the total reported acreage in 2018 (Table 13).

Exemption Notices, when the 10% Exemptions and Public/Private Utility Right-of-Way Exemptions are excluded, had 26,601 reported acres in 2018. Seventeen percent (17%) of this acreage fell in the Coast Forest Practice Area, 26% in the Cascade Area, and 57% in the Sierra Area (Figure 16), with a nominal three acres in the South Area. The Drought Mortality Exemption involved 82% of the acreage, while 11.4% of the acreage was filed under the Forest Fire Prevention Pilot Project and Forest Fire Prevention Exemptions combined (Table 12). The 0-150 Foot Structure Protection Exemptions accounted for 2.4%, and Less Than 3 Acre Conversions 1.6% of the reported acreage (Table 12). When the 10% Exemptions and Utility Right-of-Way Exemptions are included for acreage, all other Exemption types account for < 1% of the reported acreage. The Drought Mortality Exemption was altered in 2019, in addition to both Forest Fire Prevention Exemption types being combined into an altered version in 2019.

The 10% Exemptions covered 3,281,466 reported acres statewide, which includes property-wide industrial timberland owner Notices, while the Public/Private Utility Right-of-Way Exemptions covered 422,567 reported acres in 2018. Twenty-three percent (23%) of the 10% Exemptions accepted in 2018 exceeded 1,000 reported acres, while for the Public/Private Utility Right-of-Way Exemptions, 38% exceeded this threshold.

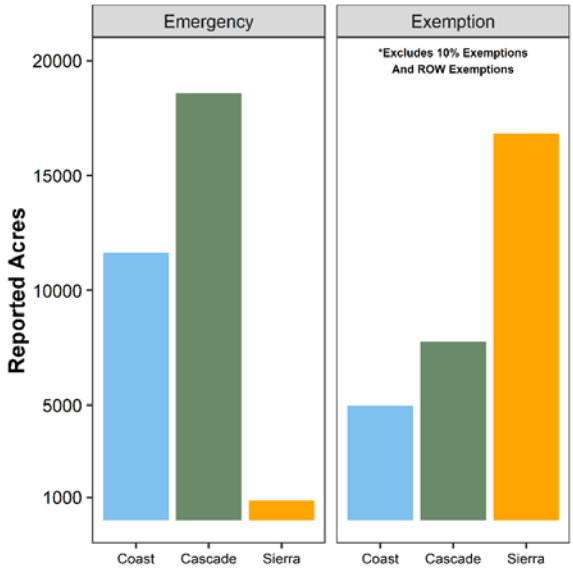

Figure 16. Reported acreage for Emergencies and Exemptions in 2018, by Forest Practice Area. Note, Forest Practice Area 3 (Southern) is not shown due to the nominal number of acres reported, and 10% Exemption and Public/Private Utility Right-of-Way Exemption acreage has been excluded.

Table 12. Emergency and Exemption Notice totals and percentages for all accepted ministerial documents in 2018. Numbers are for Exemptions and Emergencies as they existed in 2018.

EMERGENCY NOTICE	Emergency Total	% of Total	Reported Acres	% of Acres	
Emergency Notice of Timber Operations	272	97.8	30,728	98.9	% Acres (Excluding 10% Exemptions and Right-of-Way)
Fuel Hazard Reduction	5	1.8	230	0.7	
Sudden Oak Death Disease	1	0.4	100	0.3	
EXEMPT TIMBER HARVEST	Exemption Total	% of Total	Reported Acres	% of Acres	
10% Exemptions	587	31.5	3,281,466	87.9	-
Structure Protection (0 to 150 feet)	365	19.5	699	< 0.1	2.4
Public / Private Utility Right-of-Way	348	18.6	422,567	11.3	-
Less than 3 Acre Conversion	250	13.4	477	< 0.1	1.6
Drought Mortality	201	10.7	24,228	0.6	81.8
Structure Protection (150 to 300 feet)	53	2.8	255	< 0.1	0.9
Forest Fire Prevention Pilot Project	34	1.8	2,760	0.1	9.3
Post Fire Recovery	14	0.7	32	< 0.1	< 0.1
Woody Debris and Slash Removal	7	0.4	439	< 0.1	1.5
Forest Fire Prevention Project	5	0.3	610	< 0.1	2.1
Oak Woodland Management	5	0.3	92	< 0.1	0.3
Substantially Damaged Unmerchantable Sawlog	2	0.1	9	< 0.1	< 0.1

Table 13. Wildfires within which a majority of acreage in 2018 was filed under Emergency Notice of Timber Operations Notices. The left column shows the fire name, year, and size, and the right column shows the percent of the 2018 reported acreage under Emergencies in each fire, along with that acreage total.

FIRE (Year of Fire) (Fire Size)	% of 2018 Emergency Reported Acres
Carr (2018) (229,651 ac)	22 % (6682 ac)
Delta (2018) (63,458 ac)	15 % (4739 ac)
Redwood Valley (2017) (36,523 ac)	15 % (4787 ac)
Ranch (2018) (410,203 ac)	11 % (3288 ac)
Tubbs (2017) (36,701 ac)	8 % (2351 ac)
Klamathon (2018) (38,008 ac)	7 % (2237 ac)
Nuns (2017) (55,797 ac)	4 % (1209 ac)

Discussion of 2018 Totals and Reported Acreages

Utilization of Emergency and Exemption Notices in 2018 followed some of the same trends observed in CAL FIRE's Exemption and Emergency Notice Monitoring Pilot Project Report (Olsen and others, 2019). Submittals of Emergency Notice of Timber Operations documents were driven by individual wildfire events.; however, following Following SB 901 revisions, fuel hazard reduction Emergencies have continued use forbeen used for fuel break creation and thinning; there were five Notices total, four of which are the revised version, as of September 30, 2019. While following a substantial wildfire the fire-related emergency may be over, it is clear these events, when they occur on private timberlands, create substantial usage of Emergency Notice of Timber Operations activity for one to two years following wildfires, such as in the Tubbs, Carr, and Delta fires.

Extensive reported acreage under Exemptions were again due to the 10% Exemptions, Public/Private Utility Right-of-Way Exemptions, and Drought Mortality Notices; these ministerial documents may not be accurate representations of implemented timber harvest always, however, as indicated in the 2018 Exemption and Emergency Notice Monitoring Pilot Project Report. Additionally, the 0-150 and 150-300 Foot Structure Protection Exemptions, and the Less Than 3 Acre Conversion Exemptions, while not a substantial portion of the reported acreage, were a large proportion of the number of accepted Exemption Notices.

The utilization of the Drought Mortality Exemption in the Sierra Nevada region, in response to the remaining effects of the 2012-2015 drought and 2012-2017 bark beetle epidemic in the Sierra Nevada, is likely seeing a decline in 2019. While this Exemption was altered in early 2019, a query of CalTREES as of September 30, 2019 indicated that both versions represented a combined total of 3.2% of Exemptions submitted in 2019.[2] This likely reflects a diminished trend in tree mortality on private timberlands, as related to drought impacts.

In the case of ministerial documents such as the Emergency Notice of Timber Operations being used in response to stochastic, landscape scale events such as the Carr or Tubbs wildfires, or exempt timber harvests following forest mortality due to events such as extreme drought, regulatory workloads can increase for the life of those documents for Review Team agencies in the state of California. It may be that at times Review Team agencies will need to re-prioritize staffing assignments to fulfill their regulatory objectives and requirements to the public.

While data for 2019 is incomplete, a CalTREES query on September 30, 2019 showed two new and revised Exemptions, the Forest Fire Prevention Exemption and Small

[2] CalTREES is an on-line system to streamline the submission and review processes for timber harvesting documents on non-federal timberlands in California. https://caltreesplans.resources.ca.gov/caltrees/

Timberland Owner Exemption, had 26 and five accepted Exemption Notices, respectively. Five of the 26 FFP Notices, or 19%, had new road construction or reconstruction that totaled 1,583 reported feet, with a minimum reported length of 100 feet and a maximum of 600 feet. The five Small Timberland Owner Notices totaled 141.8 reported acres, with an average of 28 acres. Additionally, 381 accepted Exemptions were for the Butte Post Fire Recovery Exemption.

Inspections and Violations on Emergency Notices in 2018

CAL FIRE Region staff reported that in 2018, irrespective of the year of Emergency Notice submittal but based on those Notices that were active during the 2018 calendar year, 274 inspections of Emergency Notices took place. 5 violations were also subsequently reported.

Appendix 2 – EX/EM Monitoring Workplan

Table 14. Tentative work plan for phased EX-EM monitoring through 2025.

Title 14 CCR Section	Exemption Type	Year							
		2018	2019	2020	2021	2022	2023	2024	2025
14 CCR § 1038(b)	Fuelwood or Split Products or Slash & Woody Debris		○	●Δ					
14 CCR § 1038(c)	0-150 Ft Structure Protection		○ ● ◊			◊		◊	
14 CCR § 1038(c)(6)	150-300 Ft Structure Protection		○ ● ◊			◊		◊	
14 CCR § 1038(d)	Harvesting Dead, Dying or Diseased Trees, Fuelwood or Split Products in Response to Drought or Unmerchantable Sawlog-Sized Timber Located Upon Substantially Damaged Timberland	○ ●		●◊			◊		◊
14 CCR § 1038(e)	Oak Woodland Management						○ ●	◊	
14 CCR § 1038(f)	Small Timberland Owner		○	○ ●	◊		◊		◊
14 CCR § 1038.3	Forest Fire Prevention	○ ●	○	○ ●	◊		◊		◊
14 CCR § 1104.1.a	Less Than 3 Acre Conversion		○	● ◊		◊		◊	
14 CCR § 1104.1.c	Private/Public Agency Right of Way		○ ●	● ◊		◊		◊	
14 CCR § 1052.1(a)	Various Emergencies	○ ●	○ ● ◊		◊				◊
○ Protocol Development; ● Protocol Testing and/or Refinement; ◊ Statistical Sample; Δ Case Study									

Appendix 3 – Study Outline and Protocol

Emergency Notice Outline for 2019

For the 2019 field season focus on 1052.1 Emergency Notice of Timber Operations submitted in 2018, a group of core questions will be focused on for a random selection of notices. In part, compliance and implementation levels will be addressed, and in part

general outcomes related to the core questions will be addressed, following timber harvests.

This monitoring will not attempt to address and answer every conceivable concern within a project area, nor will it exhaustively examine a project area 100%. It is instead intended to be rapid, reproducible given its rapid nature, and focused on core concerns and areas within an Emergency Notice operations boundary where the California Forest Practice rules, and timber harvesting activities in general, may be more prone to push boundaries of established best management practices.

Like the 2018 Pilot Study on Exemption and Emergency Notices, the field sampling will be based heavily off of a project centroid. In the protocol associated with the 2019 Emergency Notice evaluations, this approach has been slightly modified. Centroids are still used as an objective point of initiation for field work, with the modification that the centroids have been, within a project area, forced into areas designated as forested landcover (conifer or hardwood) within the California Wildlife-Habitat Relationship descriptions in the CALVEG GIS data set. This approach was used to further limit sampling to forested areas, and thus areas that likely may have undergone harvesting, as opposed to non-forest settings such as grasslands or developed areas.

Core questions

1) What kind of habitat structure exists following a completed 1052 Notice of Emergency Timber Operations?
2) What are the road-watercourse crossing performance levels?
3) Under Emergency conditions, to what degree is road-hydrologic disconnection being implemented or maintained?
4) For questions #2 and #3, are these areas of concern within the project boundaries also subsequently used in active timber operations, and are they simultaneously associated with residential access or non-timber related landowner activities?
5) Are watercourses being adequately protected from timber harvest operations?
6) Are ground-based tractor yarding operations resulting in observable erosion beyond that of the disturbance (e.g., fire) itself?
7) Are unstable areas being adequately identified and addressed within project boundaries?
8) Are timber operations occurring in overlap with NSO/CSO Activity Centers, and/or Activity Center buffers, to indicate potential take?
9) ~~Are archaeological sites being properly identified and protected from timber operations?~~

To answer these questions, there will be an office-based inter-disciplinary and inter-agency analysis done, and accompanying field evaluations using fixed and variable radius plots, assessment of road-watercourse crossings, assessments of segments of

private forest roads, assessments of watercourse segments, and a rapid assessment of moderate to highly trafficked skid trails (Figure 17). Part of the protocol is assessing, where applicable, how unstable areas, NSO/CSO activity center and buffers, and Lake or Streambed Alteration Agreements~~, and archaeological sites~~ were being protected or implemented.

The field sampling will be tiered based on the reported size of a project. For projects over 20 acres in reported size, the fixed plot radius and distance between variable radius plots will be increased, while, as applicable, a second watercourse crossing, road segment, watercourse segment, and skid trail will be assessed.

Relative to the Pilot Study, this increased sampling number and footprint in a project area comes with a trade-off of using more binned categorical estimates, presence/absence assessments, and a focus on only the most important variables associated with each surveyed feature. Another change is the use of a threshold of a DBH of 6" or greater for measuring trees in the variable radius plots, with a fixed plot assessment of the presence or absence of live and dead trees less than 6" in DBH. 6" was chosen as it is the WHR-Size Class 3 lower limit, below which trees are described as only saplings or seedlings, in addition to lending to a rapid field assessment break.

Road and watercourse segment assessments are meant to be rapid and heavily visual; clear forensic evidence will be required in order to investigate potential sediment discharges. Surveys may be conducted from the road prism or WLPZ/ELZ boundary in order to identify such discharges. Skid trail assessments will similarly be heavily focused on the disturbance itself, identifying areas of concern where further investigation is required.

Another core part of this monitoring is to perform field surveys in a method that is as reproducible as possible given its rapid nature. While monitoring of private forests and property inherently does not lend to scientific replication, it is nonetheless important to maintain reproducibility and objectivity in all field assessments. GPS points will be recorded where all segment surveys initiative.

A categorical break down of variables assessed will include:

1. Fixed plots
   - Harvest status, mechanical disturbance presence
   - Ground cover, shrub cover categories
   - Presence/absence of green and dead trees <6" DBH
   - Presence/absence of large wood piece, snags
2. Variable radius plots
   - 5-7 trees (ideally) per plot, with DBH, green or dead condition, and conifer or hardwood type recorded
3. Watercourse crossing

- Use for harvest-related activity, if it serves as residential access also
- Watercourse classification
- Construction status under notice, crossing type, diversion potential
- Surfacing used on crossing approaches, approach lengths and connectivity
- Record of additional BMPs used on crossing
- Sediment discharge at the crossing, volumetric estimate, and source
    - Source has been simplified to either 'Road Prism', or 'Road Prism + Hillslope' for cases where overland runoff from hillslopes may have been an additional factor

4. Road segments (up to 1320 feet total per segment)
    - Road segments are associated with the crossing, where applicable, and start from the first hydrologic break in the road (waterbar, rolling dip, etc.) or 50 feet from the crossing in the absence of a break in a reasonable distance
    - Use for harvest-related activity, serves as residential access also
    - Construction under notice, dominant road surface
    - Number of road drainage structures encountered on the surveyed segment
    - Average hillslope gradient road is built on, binned and categorical, average road slope, also binned and categorical
    - Recording any sediment discharges from a road to watercourse
        - Record of the source, as either 'Road Prism' or 'Road Prism + Hillslope'
        - Record of the discharge point, where runoff/sediment leaves the road prism
        - Volumetric estimate of delivery to the watercourse
        - Distance from the discharge point to the watercourse, as either a 'crossing' (excluding the assessed crossing), less than 100 feet, or over 100 feet.
        - Downslope roughness class below the discharge point.
        - Receiving watercourse type

5. Watercourse segment (up to 400 feet total for each segment)
    - Starts from crossing, or as nearest watercourse to the centroid.
    - Record of classification(s) present in the watercourse
    - Record of the WLPZ or ELZ overstory canopy harvested, both green and dead trees
    - Record of the number of ELZ and WLPZ equipment encroachments, determined in part by the watercourse classification
    - Record of the number of equipment crossings on the watercourse segment
    - A presence/absence record of non-harvest related hillslope erosion being observed entering the watercourse
    - Harvest-related sediment discharges to a watercourse
        - Record of the source, and if the source was in the ELZ or WLPZ
        - A volumetric estimate of sediment discharge

- Downslope roughness class from the sediment discharge
- Receiving watercourse type

6. Skid trail segment (up to 200 feet total for each segment)
   - Starts at the nearest moderate to heavily trafficked skid trail nearest to the watercourse assessed, or nearest the centroid in absence of a watercourse.
   - Record of the average hillslope gradient on which the skid trail is on, binned categories
   - Record of the average slope of the skid trial itself, binned categories
   - Record of the number of waterbars installed on the segment assessed
   - Presence/absence record of either rills or gullies on the skid trail or at drainage points
   - Presence/absence of observed sediment plumes from the skid trail entering into the WLPZ or ELZ area
   - Presence/absence of observed sediment discharges entering a watercourse
     - This part of the protocol is rapid and only presence/absence, and does not involve individual sediment discharge identifications and subsequent data collection.

Project areas will also be assessed as a whole to determine the yarding methods used, the closest approximate silvicultural treatment (clearcut, group selection, single tree selection, based on an ecological approach – how much of the merchantable timber was cut in the Emergency Notice area), how much of the project area had actual harvesting occur on it, in addition to recording the presence of residential structures in the project area, including those recently burned in wildfires. Last, while the time period of assessing these Emergency Notices that are more recent may preclude observing any reforestation activity, observations of tree planting will be recorded, along with a note of the presence of green conifer trees still present within the project boundary.

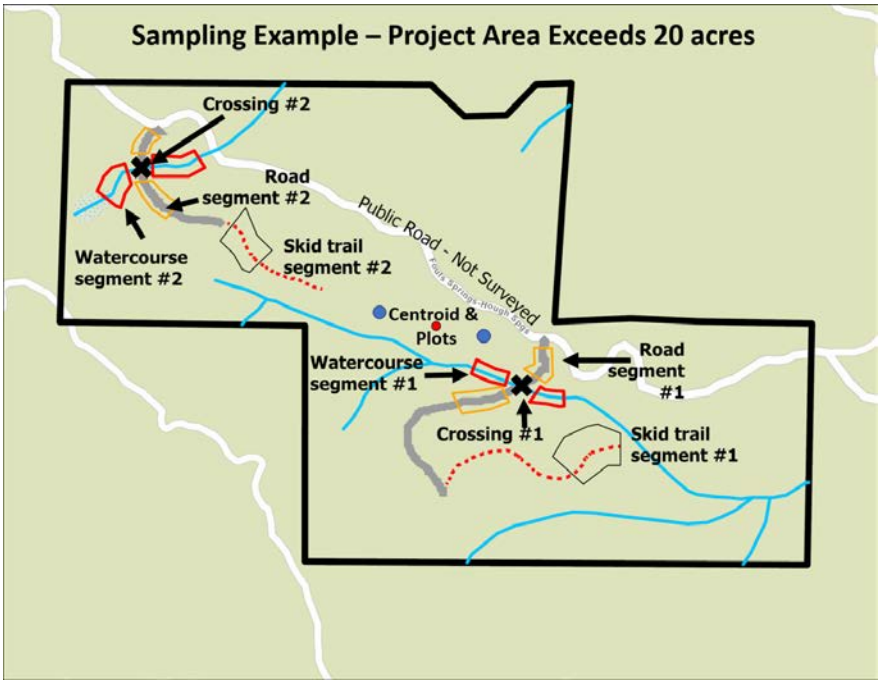

Figure 17. Simplistic example of sampling within an Emergency Notice of Timber Operations project area.

The resulting data set should allow for a multitude of approaches for analysis, both qualitative and statistical, in addition to post-hoc office based analysis with the field data and spatial layers.