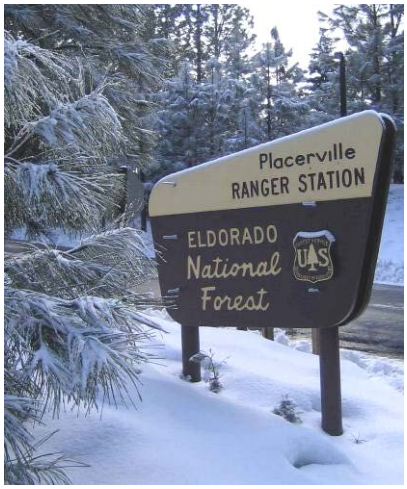
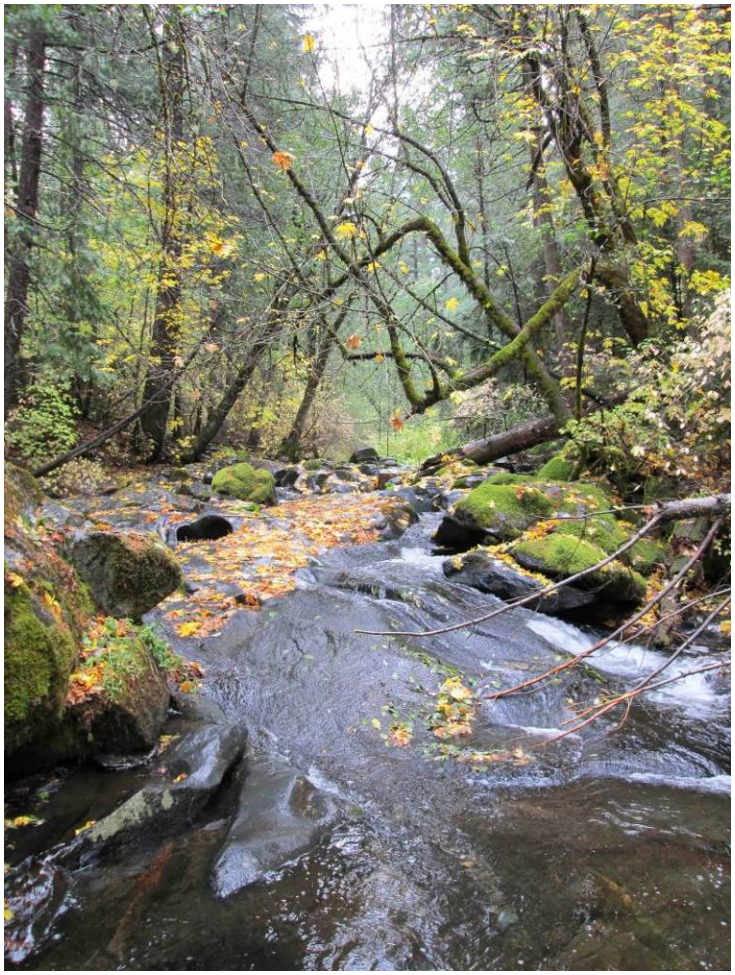
TRESTLE FOREST

HEALTH PROJECT

HYDROLOGY REPORT



October 10, 2014
(Minor additions on June 13, 2017)



Steely Fork Cosumes River, a perennial stream in the project area.

Steve G. Markman, Hydrologist

EXECUTIVE SUMMARY

This report analyzes the impacts to aquatic resources that are likely to result from the Trestle Forest Health Project, referred to as the TFHP in this report.

The TFHP is located in the Eldorado National Forest in northern California. The TFHP includes a portion of seven watersheds (HUC 7 scale) in the headwaters of the Cosumnes River drainage basin. All of the watersheds are mountainous and forested, and the project area ranges between 3,200 and 5,800 feet in elevation.

The TFHP would involve a number of activities that would likely begin in 2016 and continue for a number of years. The major activities include: commercial and pre-commercial thinning of trees, prescribed burning both within and outside of thinning areas, restoration activities (such as rehabilitation of camping areas adjacent to streams), and activities associated with roads (reconstruction, repair, and maintenance).

There are over 44 miles of named perennial streams in the seven watersheds that contain the TFHP. Most of these streams flow west/northwest and directly or ultimately into the North Fork Cosumnes River or Middle Fork Cosumnes River, which in turn flows to the west and into the Cosumnes River. The condition of perennial streams is variable by stream and stream segment, ranging from good to somewhat degraded. The water quality of perennial streams during low flows is good.

Direct and indirect effects from Alternative 1 (No Action) include: 1) a greater risk of adverse effects to aquatic resources (water quality and quantity, stream condition, and aquatic habitat) as a result of a large, high severity wildfire, and 2) long-term improvement (greater than five years) to water quality and aquatic habitat of several streams in the project area may occur at a slower rate.

In the short-term (less than five years), direct and indirect effects to aquatic resources from Alternatives 2, 4, and 5 are expected to be minor or negligible. This is largely the result of the design criteria that would protect aquatic features. In the long-term (greater than five years), there may be an improvement in water quality and aquatic habitat of several perennial streams. This is largely the result of restoration activities near those streams.

As a result of the above, Alternatives 2, 4, and 5 would meet all of the Riparian Conservation Objectives (RCOs) and associated Standards and Guidelines (S&Gs) in the Sierra Nevada Forest Plan Amendment, Record of Decision (SNFPAROD) of January 2004. The analysis of the RCOs and associated S&Gs is contained in a separate document: *Riparian Conservation Objectives Consistency Report.*

The risk of cumulative watershed effects (CWE) is currently is ***low*** or ***moderate*** in six of the seven watersheds that contain the TFHP, and one watershed is currently at a ***very high*** risk of CWE. Alternative 1 (No Action) would result in no change or a decrease in the risk of CWE in each watershed. Alternatives 2, 4, and 5 would increase the

risk of CWE in six of the seven watersheds for at least several years. Alternative 2 would result in two watersheds at a ***very high*** risk of CWE for a longer period of time than Alternatives 4 and 5. Those two watersheds are Lower Steely Fork Cosumnes River and Clear Creek - Steely Fork Cosumnes River. The risk of CWE is very similar, but not identical, for Alternatives 4 and 5.

AFFECTED ENVIRONMENT

The Trestle Forest Health Project - referred to as the TFHP in this report - is located in the Eldorado National Forest in northern California.

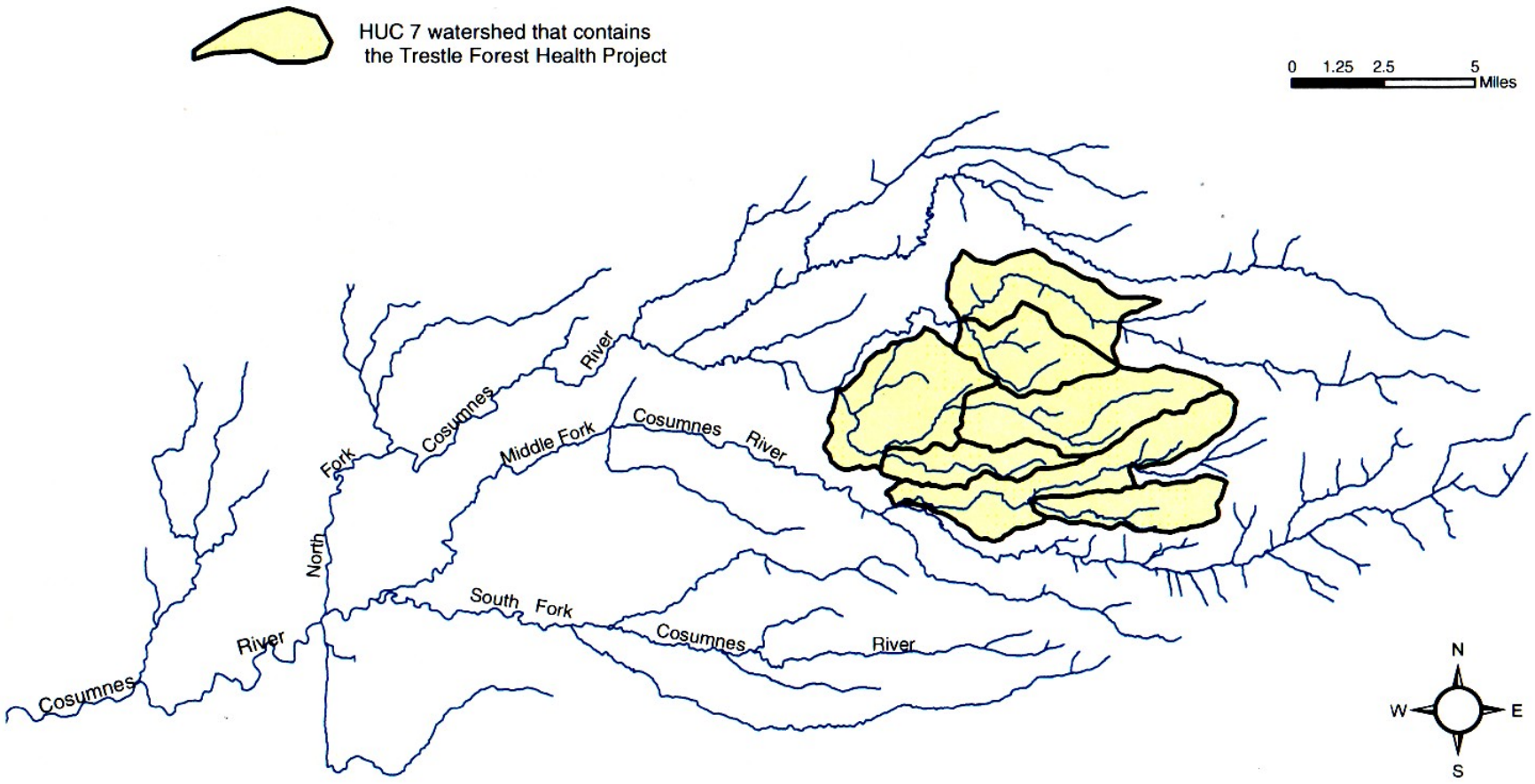
The landscape of the TFHP is mountainous and forested (Figure 1) in the headwaters of the Cosumnes River drainage basin (Figure 2), and includes a portion of seven watersheds at the HUC 7 scale (Figure 3).

There are over 44 miles of named perennial streams in the seven watersheds that contain the TFHP. Most of these streams flow west/northwest and directly or ultimately into the North Fork Cosumnes River or Middle Fork Cosumnes River, which in turn flows to the west and into the Cosumnes River.

Physical characteristics of the TFHP are summarized in Table 1 and aquatic features are described in Table 2.

Figure 1. A portion of the Dogtown Creek watershed at an elevation of approximately 4,400 feet.

Figure 2. Headwaters of the Cosumnes River drainage basin.[1]



[1]HUC = Hydrologic Unit Code.

Figure 3. Watersheds (HUC 7 scale) that contain the Trestle Forest Health Project (TFHP).[1]

[1] Map shows the largest perennial streams – intermittent and ephemeral streams are not shown. HUC = hydrologic unit code.

Table 1. Physical characteristics of the Trestle Forest Health Project (TFHP).

Location	▪ Approximately 52 air miles east of Sacramento, California. ▪ Southern portion of the Eldorado National Forest on the south side of highway 50. ▪ Approximately 13 air miles southeast of Pollock Pines, California.
Terrain	▪ Mountainous and forested. Mostly mixed conifer forest. ▪ The project area covers 20,452 acres (31.96 square miles). The elevation ranges between 3,200 feet on the west side of the project area to 5,800 feet on the east side of the project area.
Drainage basin	Cosummnes River. 936 square miles (total).
HUC 7 watersheds	▪ Big Canyon Creek. #2226. 3,535 acres. ▪ Lower Steely Fork Cosumnes River. #2301. 6,966 acres. ▪ Upper Steely Fork Cosumnes River. #2326. 6,831 acres. ▪ Dogtown Creek. #2436. 6,849 acres. ▪ Clear Creek – Steely Fork Cosumnes River. #2316. 2,891 acres. ▪ Middle Dry Creek. #2446. 3,414 acres. ▪ North Fork Cosumnes River – Bear Meadow Creek. #2216. 6,278 acres. The seven watersheds listed above total 36,744 acres (57.4 square miles), which is 6.1 percent of the entire Cosumnes River drainage basin. (HUC = Hydrologic Unit Code).
Climate	▪ Average annual precipitation is approximately 40 to 50 inches. ▪ Much of the precipitation falls between October and April in the form of both rain and snow, although snow dominates above 5,000 feet. Thunderstorms can occur in the summer.
Aquatic features	There are over 44 miles of named perennial streams in the seven HUC 7 watersheds that contain the TFHP. These streams include: North Fork Cosumnes River, Big Canyon Creek, North Canyon Creek, Steely Fork Cosumnes River, Salt Rock Creek, South Steely Creek, North Steely Creek, Clear Creek, Dogtown Creek, and Middle Dry Creek (Figure 3).
Condition of aquatic features	▪ The condition of perennial streams is variable by stream and stream segment, ranging from good to somewhat degraded. Degraded stream segments show one or more of the following characteristics: excessive and on-going lateral and/or vertical erosion of the channel, headcuts in the channel, excessive deposition of alluvial material, lack of large woody debris in the channel, sparse riparian vegetation, and upland vegetation next to the channel. ▪ Water quality of perennial streams is fairly good at low flows, based on limited measurements and parameters.
Aquatic life	Rainbow trout (*Oncorhynchus mykiss*) occur in all of the perennial streams in the project area. Rainbow trout can occur in the intermittent streams when they are flowing.
Geology	Mixture of granitic, metamorphic, and volcanic rocks. The granitic rocks occur in the higher elevation areas in the eastern portion of the project area, and the metamorphic rocks occur in the lower elevation areas in the western portion of the project area.
Beneficial uses of water[1]	Municipal water supplies for domestic use; hydropower generation; contact and non-contact recreation; canoeing and rafting; cold freshwater habitat; spawning habitat; and wildlife habitat.
303(d) listed water bodies[2]	The entire Cosumnes River is on the 303(d) list for exotic species.
Land disturbances	▪ Past timber harvest is evident throughout the project area. ▪ Roads occur throughout the project area and near many streams. ▪ Off-road vehicle (OHV) use and camping are on-going activities near a number of streams. ▪ Residential development exists at the town of Grizzly Flat.

[1] Beneficial uses of water are designated by the Central Valley Regional Water Quality Control Board (CVRWQCB).
[2] Refers to Section 303(d) of the Clean Water Act, which gives states the authority to identify bodies of water that are impaired.

Table 2. Summary of selected aquatic features in the Trestle Forest Health Project (TFHP).[1,2,3,4,5]

Aquatic feature	HUC 7 watershed	Proximity of thinning units (within the RCA) to aquatic feature for Alternative 2	Characteristics
North Fork Cosumnes River	North Fork Cosumnes River – Bear Meadow Creek	There are no thinning units within the RCA of the North Fork Cosumnes River.	▪ Perennial stream. ▪ Flows to the west and into the Cosumnes River. ▪ Length of the stream in the watershed is approximately 5.8 miles. ▪ Surface flow is year-round (perennial). Flow can decrease to less than 5.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Rosgen B/C channel. Aquatic habitat of low gradient riffles with pools, runs, and bedrock cascades (Figure 4). Average channel width of 25 feet with an active floodplain. ▪ Water quality fairly good, based on limited parameters and measurements. pH = 7.1 (near nuetral); electrical conductivity = 7.7 uS (indicates low concentrations of dissolved solids); turbidity = 1.2 to 2.4 NTU (indicates low concentrations of suspended sediment). ▪ The stream channel is in fairly good condition overall, with stable streambanks, low amounts of fine-grained sediment in the channel, abundant riparian vegetation, functional large woody debris (somewhat lacking in amount).
Big Canyon Creek	Big Canyon Creek	Approximately 2,960 feet of thinning units border the stream – this is 13.4 percent of the length of the stream.	▪ Perennial stream. ▪ Flows to the west and northwest and into the North Fork Cosumnes River. ▪ Length of the stream is approximately 4.2 miles. ▪ Surface flow is year-round (perennial). Flow can decrease to less than 1.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Aquatic habitat mostly consists of low gradient riffles with pools, runs, and higher gradient bedrock cascades (Figure 5).

[1] The location of streams is shown in Figure 3.
[2] Descriptions of stream condition and water quality measurements are based on: a.) observations by Steve Markman (Hydrologist), and b.) field survey forms (contained in the Project Record).
[3] RCA = Riparian Conservation Area. The RCA - a land allocation defined in the 2004 Sierra Nevada Forest Plan Amendment - is 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams.
[4] The flow of several perennial streams for the 2, 10, and 100 year return intervals is shown in Figure 8.
[5] Values for the proximity of thinning Units to aquatic features for Alternatives 4 and 5 would be the same or less than Alternative 2, depending on the stream.

Table 2 (continued). Description of selected aquatic features in the Trestle Forest Health Project (TFHP).[1,2,3,4]

Aquatic feature	HUC 7 watershed	Proximity of thinning units (within the RCA) to aquatic feature for Alternative 2	Characteristics
Steely Fork Cosumnes River	Upper Steely Fork Cosumnes River	Approximately 9,840 feet of thinning units border the stream – this is 58.8 percent of the length of the stream within the Upper Steely Fork Cosumnes River watershed.	▪ Perennial stream. ▪ Flows to the west and into the North Fork Cosumnes River. ▪ Length of the stream in the watershed is 3.2 miles (not including the major tributaries of North Steely Creek and South Steely Creek). ▪ Surface flow is year-round (perennial). Flow can decrease as low as 2.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Aquatic habitat of low gradient riffles with pools, runs, and higher gradient bedrock cascades. ▪ Water quality fairly good, based on limited parameters and measurements. pH = 7.5 (near nuetral); electrical conductivity = 57 uS (indicates low concentrations of dissolved solids); turbidity = 1 NTU (indicates low concentrations of suspended sediment). ▪ The 0.8 mile long stream segment in the vicinity of Units 623476 and 623477 is in fairly good condition overall, as evidenced by stable streambanks and channel, fairly low amounts of fine-grained sediment in the channel, and abundant riparian vegetation (Figure 6). In addition, a Stream Condition Inventory (SCI) of one segment of the river showed negligible difference in measured parameters between 1998 and 2012. ▪ Some of the intermittent/ephemeral tributaries of the Steely Fork Cosumnes River contain large numbers of dead trees (standing and down) in the Riparian Conservation Area (Figure 7).
Clear Creek	Clear Creek – Steely Fork Cosumnes River	Approximately 1,170 feet of thinning units border the stream – this is 4.3 percent of the length of the stream.	▪ Perennial stream. ▪ Flows to the west and into the Steely Fork Cosumnes River. ▪ Length of the stream in the watershed is 5.2 miles. ▪ Surface flow is year-round (perennial). Flow can decrease to less than 1.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Aquatic habitat of low gradient riffles with pools, runs, and higher gradient bedrock cascades.

[1] The location of streams is shown in Figure 3.
[2] Descriptions of stream condition and water quality measurements are based on: a.) observations by Steve Markman (Hydrologist), and b.) field survey forms (contained in the Project Record).
[3] RCA = Riparian Conservation Area. The RCA - a land allocation defined in the 2004 Sierra Nevada Forest Plan Amendment - is 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams.
[4] The flow of several perennial streams for the 2, 10, and 100 year return intervals is shown in Figure 8.
[5] Values for the proximity of thinning Units to aquatic features for Alternatives 4 and 5 would be the same or less than Alternative 2, depending on the stream.

Table 2 (continued). Description of selected aquatic features in the Trestle Forest Health Project (TFHP).[1,2,3,4]

Stream(s)	HUC 7 watershed	Proximity of thinning units (within the RCA) to aquatic feature for Alternative 2	Characteristics
Dogtown Creek	Dogtown Creek	Approximately 5,873 feet of thinning units border the stream – this is 11.6 percent of the length of the stream.	▪ Perennial stream. ▪ Flows to the west and into the Middle Fork Cosumnes River. ▪ Length of the stream is 9.6 miles. ▪ Surface flow is year-round (perennial). Flow can decrease to less than 1.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Aquatic habitat of low gradient riffles with pools, runs, and bedrock cascades. ▪ Water quality fairly good, based on limited parameters and measurements. pH = 7.5 (near nuetral); electrical conductivity = 130 uS (indicates fairly low concentrations of dissolved solids); turbidity = 2.0 NTU (indicates low concentrations of suspended sediment). ▪ Much of Dogtown Creek is in fairly good condition (stable streambanks, absence of active channel downcutting, low amounts of fine-grained material, abundant riparian vegetation), but there are short segments where the stream is in poor condition (active channel erosion, absence of large woody debris, and sparse riparian vegetation). The 0.5 mile segment of the stream downstream of road 10N83 (North-South road) is particularly degraded as a result of a concrete box structure (where the stream crosses 10N83), two camping areas next to the stream, and historic mining activity.
Middle Dry Creek	Middle Dry Creek	Approximately 6,640 feet of thinning units border the stream – this is 41.9 percent of the length of the stream.	▪ Perennial stream. ▪ Flows to the west and into Dogtown Creek. ▪ Length of the stream is 3.0 miles. ▪ Surface flow is year-round (perennial). Flow decreases to less than 1.0 cubic feet per second (cfs.) in late summer and early fall. ▪ Aquatic habitat of low gradient riffles with pools and runs. ▪ Two segments of Middle Dry Creek are degraded: 1) The 0.5 mile long segment just downstream of road 10N83 (North-South road) has excessive and on-going lateral and/or vertical erosion of the channel, excessive deposition of alluvial material, lack of large woody debris in the channel, and sparse riparian vegetation, and 2) a staging area for the Elkins Flat OHV trail system, located on road 09N55, is contributing runoff and sediment into the stream (Markman 2011).

[1] The location of streams is shown in Figure 3.
[2] Descriptions of stream condition and water quality measurements are based on a.) observations by Steve Markman (Hydrologist), and b.) field survey forms (contained in the Project Record).
[3] RCA = Riparian Conservation Area. The RCA - a land allocation defined in the 2004 Sierra Nevada Forest Plan Amendment - is 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams.
[4] The flow of several perennial streams for the 2, 10, and 100 year return intervals is shown in Figure 8.
[5] Values for the proximity of thinning Units to aquatic features for Alternatives 4 and 5 would be the same or less than Alternative 2, depending on the stream.

Figure 4. North Fork Cosumnes River.

Figure 5. Big Canyon Creek near road 09N44.

Figure 6. Steely Fork Cosumnes River near road 09N73.

Figure 7. A portion of the Riparian Conservation Area bordering an intermittent stream in Unit 623403.

Figure 8. Flow of several perennial streams in the project area that contains the Trestle Forest Health Project (TFHP) for the 2-year, 10-year, and 100-year recurrence intervals (USGS 2014).

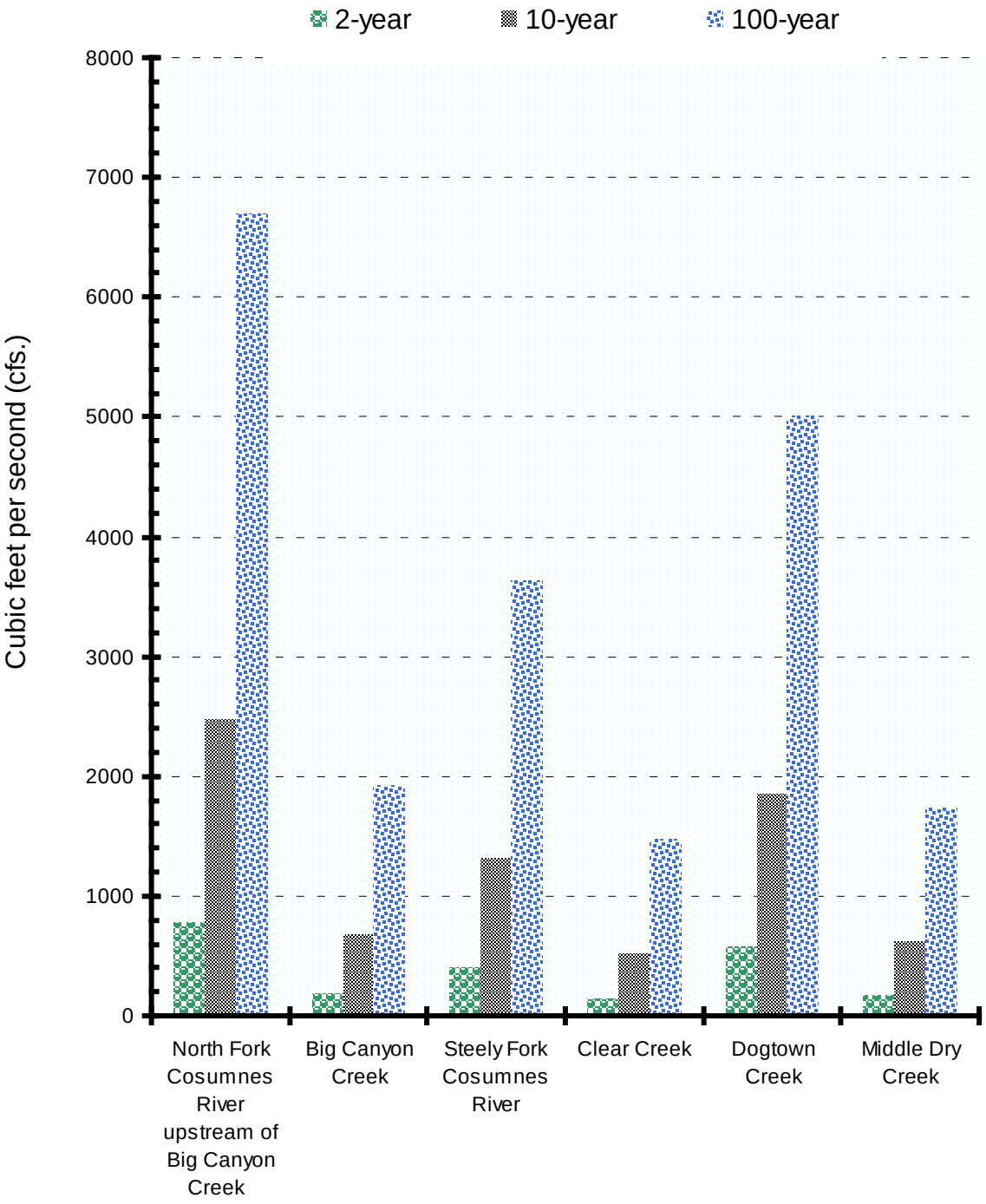


Table 3. Summary of selected sites that contribute sediment directly into streams of the TFHP.[1,2]

Stream	Features and locations
Dogtown Creek	• 2 camping areas (each approx. 0.1 acres in size) are adjacent to Dogtown Creek and road 09N45. The 2 camping areas are less than 0.1 miles from the intersection of roads 09N45 and 09N73.[3] • 1 camping area next to Dogtown Creek, which is accessed from a spur road off of road 09N45D. (Figure 9).[3] • Road 09N45D, which is 1.1 miles in length, is mostly within the RCA of Dogtown Creek. The road contains a number of landings, as well as crossings of several seasonal streams that flow into Dogtown Creek. One of the stream crossings is failing, and the road is actively eroding sediment into the stream.[3] • OHV trail 14E31 is contributing sediment into several tributaries of Dogtown Creek.
Steely Fork Cosumnes River	• 1 camping area is approximately 0.4 miles from the intersection of 09N73 and 09N59.[3] • 1 camping area and spur road is between 09N73A and the Steely Fork Cosumnes River.[3] • Most of road 09N65B, approximately 2.0 miles in length, is within the RCA of the stream.[3] • Approximately 1.0 miles of non-system roads, located on north side of the river and approximately 0.4 miles of where road 09N73 crosses the river. (Figure 10). • Several OHV trails are contributing sediment into several tributaries of the Steely Fork Cosumnes River.
Middle Dry Creek	• Segment of road 09N55 (approx. 1.1 miles in length) is mostly less than 100 ft. from the stream.[3] • OHV trails 14E25 and 14E26 are contributing runoff and sediment into Middle Dry Creek at several locations.[3] • A staging area (approximately 2.0 acres in size) of the Elkins Flat OHV trail system on road 09N55 is contributing runoff and sediment into Middle Dry Creek during rainfall events (Figure 11).[4]
Big Canyon Creek	Road 09N44 parallels Big Canyon Creek for 1.6 miles and is generally less than 200 feet from the stream.

[1] This Table does not include a description of all of the locations in the project area where roads may be contributing sediment into streams.

[2] The Riparian Conservation Area (RCA) is 300 feet on each side of perennial streams.

[3] Site is included for restoration under Alternatives 2, 4, and 5 of the TFHP. Sites that are not included for restoration in Alternatives 2, 4, and 5 are candidates for future restoration projects.

[4] This is described in more detail in the following document: *Polka Dots Motorcycle Club Special Use Permit – Hydrology Report (Markman 2011).* A restoration project is currently being designed for this area by the Placerville Ranger District, Eldorado National Forest.

Figure 9. Camping area next to Dogtown Creek near road 09N45D. The large rill in the denuded area (middle of photo) extends to the edge of Dogtown Creek (upper half of photo).

Figure 10. Non-system road near Steely Fork Cosumnes River.

Figure 11. Staging area at Elkins Flat OHV trail system, adjacent to road 09N55 and Middle Dry Creek.

DIRECT AND INDIRECT EFFECTS[1]

Alternative 1 (No Action)

There are two primary effects to aquatic resources from Alternative 1 (No Action) when compared to Alternatives 2, 4, and 5.[1]

1.) There would be a greater risk of adverse effects to aquatic resources as a result of a large, high severity wildfire. The hydrologic response to a high severity wildfire is well documented in the literature. Runoff and erosion rates increase by two or more magnitudes for several years after a high severity fire, and frequently decline to near pre-wildfire levels within four or five years (Figure 12). Since the TFHP includes portions of seven watersheds (HUC 7 scale), there is the potential for a high-severity fire to affect all of the streams in those watersheds (Figure 3). The potential effects within and downstream of the project area include the following:

- An increase in the suspended sediment and turbidity levels of streams during and immediately after rainfall events and periods of rapid snowmelt (Figure 13). This can directly affect the health and survival of fish and other aquatic organisms. For example, the growth of rainbow trout (*Onchorhychus mykiss*) decreases when turbidity pulses of 23 NTU occur over a number of days (Shaw and Richardson 2001).
- Deposition of fine-grained sediment in stream channels, which can reduce the amount and quality of habitat for all life phases of fish. This effect can last for many years after runoff and erosion rates in the wildfire area have declined to pre-burn levels.
- Deposition of ash in streams, which can increase nutrient levels in streams for several years.
- Increases in runoff during rainfall events tend to result in an increase in the peak flows of streams - this in turn can cause stream channel erosion and degradation of aquatic habitat for fish and other aquatic organisms.
- A fire in the project area would not affect municipal drinking water supplies because there are no reservoirs used for water supply downstream of the project area.

An example of the effects of a large, high-severity fire occurred in the Eldorado National Forest in 2004 from the Power Fire, located to the southeast of the TFHP. This is described in detail in Appendix A. It should be noted, however, that the effects to aquatic features and beneficial uses of water both within and downstream of a high severity wildfire are difficult to predict and depend on many factors. The single most important factor is often the size of the rainfall event that occurs during the first several years after the wildfire - when the ground is most vulnerable to accelerated runoff and erosion (USDA 2010; Dissmeyer 2000).

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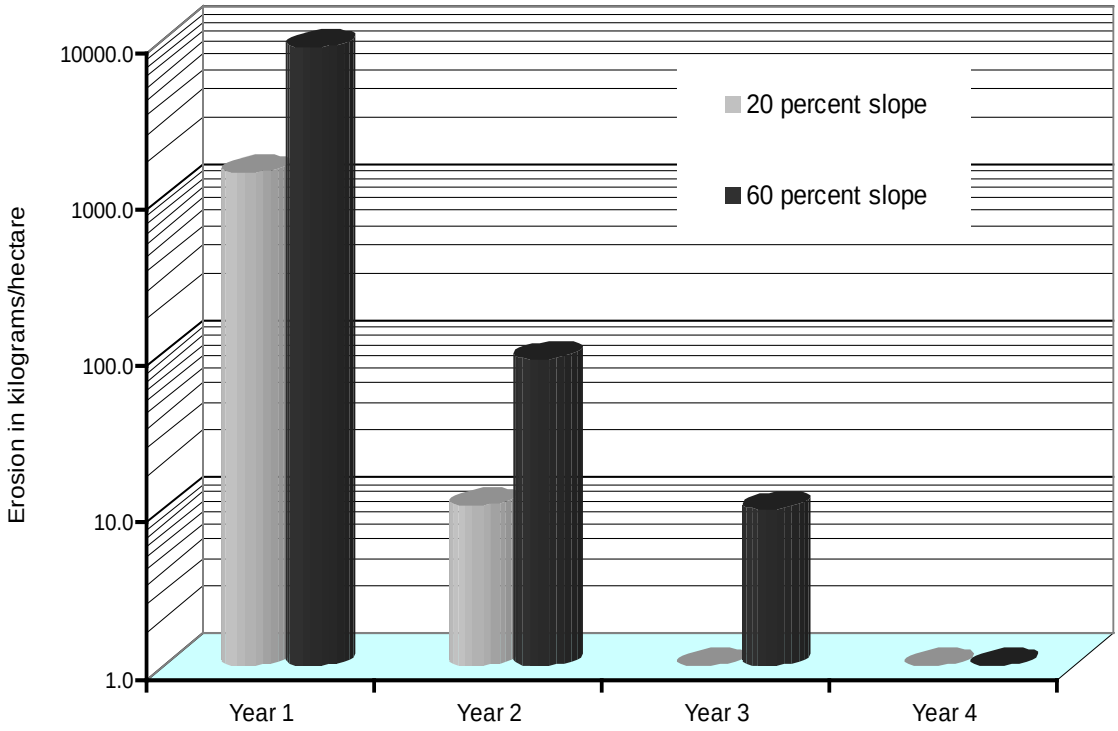
[1] Effects in this section are both short-term (less than five years) and long-term (greater than five years), unless stated otherwise.

2.) Long-term improvement (greater than five years) to water quality and aquatic habitat of a number of streams in the project area may occur at a slower rate. There are two reasons for this conclusion:

- Restoration activities would not occur at a number of sites that are contributing sediment into streams. These sites, which include camping areas and roads next to streams, are described in Tables 3 and 4.
- The reduction in the amount of road-related sediment to a number of streams would not occur because the reconstruction/repair and obliteration of roads near streams would not occur. This is discussed in more detail in the following section: *Alternative 2, items 1E and G.*

Figure 12. Erosion following a wildfire in eastern Oregon (Robichaud and Brown 1999).[1]



[1] Erosion rates represent hillslope erosion, not the amount of sediment delivered to streams. Note that the vertical scale is logarithmic - erosion decreased three orders of magnitude between year 1 and 4 after the fire. (1 hectare = 2.571 acres; 1 kilogram = 2.2 pounds.

Figure 13. Turbidity of water samples from streams after the Power Fire of 2004, Eldorado National Forest.

1 NTU Cole Creek	**34 NTU** Beaver Creek	**77 NTU** East Panther Creek	**71 NTU** Tiger Creek	**230 NTU** Tributary of Beaver Cr.
The Power Fire occurred in October 2004. The above water samples were taken on December 8, 2004, after approximately 2.76 inches of rain. Turbidity is measured in Nephelometric Turbidity Units (NTU). The Power Fire is located to the southeast of the Trestle Forest Health Project.				

Alternative 2

Alternative 2 would meet all of the Riparian Conservation Objectives (RCOs) and associated Standards and Guidelines (S&Gs) in the Sierra Nevada Forest Plan Amendment, Record of Decision (SNFPAROD) of January 2004. The reasons for this conclusion are described in the following pages and in a separate document: *Riparian Conservation Objectives Consistency Report (2014).*

In the short-term (less than five years), adverse effects to aquatic resources (water quality and quantity, stream condition, and aquatic habitat) in the project area and downstream of the project area are expected to be minor or negligible. In the long-term (greater than five years), there may be an improvement in the condition and aquatic habitat of a several perennial streams in the project area. The reasons for these conclusions are described in the following five pages.

1. A minor, short-term (less than five years) increase in the suspended sediment concentrations and turbidity levels of the streams that flow through or adjacent to Units of the TFHP may occur during and immediately after large rainfall events. This increase - should it occur - should not exceed state water quality standards for turbidity or sediment. The reasons for this conclusion are listed below.

A.) A number of design features would minimize the amount of sediment delivered to the streams and other aquatic features as a result of the TFHP. These design features are described in Tables 5 and 6. The single most important design feature in this regard is the zone of no ground disturbing activities (or "buffer zones") adjacent to streams and other aquatic features. All aquatic features in the project area have ground-based equipment exclusion zones, ranging from 10 feet for draws to 150 feet next to some segments of perennial streams. One study demonstrated that the amount of sediment delivered to a stream was reduced by 75 to 80 percent as a result of a 30 meter buffer (Parkyn 2004). It should be noted, however, that the effectiveness of buffer zones in removing sediment before reaching a stream depends on a number of site-specific factors such as slope, soil type, degree of ground disturbance outside of the buffer zone, size of ground disturbance outside of the buffer zone, and type of vegetation in the buffer zone. The design features in Tables 5 and 6 for aquatic features and RCAs reflect these factors as a result of site specific field visits by resource specialists (Hydrologist, Soil Scientist, and Fisheries Biologist).

B.) A number of recent research studies in forested environments have shown that partial timber harvest near streams resulted in no effects or limited effects to water quality – this includes sediment delivery to streams (Jones 2013; Gravelle 2009; Lischert 2009; Hotta 2007; Karwan 2007). These studies included buffer zones next to streams and the implementation of Best Management Practices (BMPs) – activities that are part of the design criteria in Tables 5 and 6. Most of the studies that show substantial changes in water quality following timber harvest involved clear-cutting of large portions of a watershed (Jones 2013).

C.) Ground-disturbing activities would occur in a relatively small percentage of the Riparian Conservation Areas (RCAs) next to streams. *(The RCA is 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams).*

- Ground disturbing activities would occur in less than 5.0 percent of the RCA of 12 perennial streams when the entire length of the stream within a watershed (HUC 7 scale) is considered.
- Ground disturbing activities would occur in approximately 0.0 to 22.5 percent of the RCA of 12 perennial streams when only the RCA within thinning units is considered. For eight of the 12 perennial streams, the percent of the RCA subjected to ground-disturbing activities would be less than 10 percent.
- The calculations of ground-disturbing activities in the RCAs of these streams consider: a)

the number of acres of RCA both within and outside of commercial harvest units, b) the width of the equipment exclusion zone adjacent to the streams within the commercial harvest units, and c) estimates of the amount of ground-disturbing activities within the zone of ground-based equipment, and d) the definition of ground-disturbing activities as defined in the SNFPA of 2004, which says: *"Activities that result in detrimental soil compaction or loss of organic matter beyond the thresholds identified by soil quality standards."*

- Additional information with regard to ground-disturbing activities in the RCAs, including calculations for specific streams, is in Appendix A. Ground-disturbing activities and soil quality standards are discussed in detail in the *Soils Report* (Nicita 2014).

D.) Best management practices (BMPs) would be implemented during project operations that are designed to protect water quality, soils, and vegetation. The implementation of BMPs, which include established riparian buffers, have generally been shown to decrease the negative effects of timber harvest activities on water quality (USDA 2010). The implementation and effectiveness of the BMP's from 2008 through 2012 in the Pacific Southwest Region of the U.S. Forest Service is summarized below.

- Approximately 90 percent of the prescribed BMPs were implemented on-the-ground. This includes all major activities – timber, roads, recreation, grazing, fuels, mining, and vegetation management.
- Approximately 80 percent of the implemented BMPs were rated as "effective," 14 percent were rated as "at risk," and 6 percent were rated as "not effective." This includes all major activities.
- For timber related activities alone, approximately 88 percent of the implemented BMP's were rated as "effective."
- For fuels related activities alone, approximately 92 percent of the implemented BMP's were rated as "effective."
- For road related activities alone, approximately 68 percent of the implemented BMP's were rated as "effective."
- Approximately 98 percent of the on-site evaluations found that there were "no significant adverse impacts" on water quality (USDA 2013).

The BMP monitoring fulfills commitments by the U.S. Forest Service to the State Water Quality Resources Control Board. The BMPs are described in: W*ater Quality Management Handbook for Forest System Lands in California, Best Management Practices (December 2011).*

E.) Nearly all of the roads located near streams in the project area would receive treatments that are likely to reduce the amount of road-related sediment that is delivered to these streams in the long-term.

- Reconstruction would occur on approximately 84 miles of system roads. Reconstruction

activities would involve the replacement of inadequate drainage crossings, elimination of ruts, ditch repair, installation of waterbars and dips with inadequate water runoff control, gate installation to control seasonal use or replacement of existing non-functional gates or barricades, and removal of brush and small trees encroaching on roads.

- The Final Environmental Impact Statement (FEIS) contains maps that show the roads that would be affected by the above treatments.

F.) There would be no construction of new, permanent roads. The construction of temporary roads in RCAs, if needed, would be reviewed prior to construction by one or more resource specialists. After use, temporary roads would be obliterated and appropriate erosion control measures implemented. In forested watersheds that contain roads, the roads are frequently a major source of sediment that reaches streams and other aquatic features (Dissmeyer 2000).

G.) Approximately 3.6 miles of existing non-system roads would be obliterated after being used for project operations.

- The obliteration of these "temporary" roads would consist of one or more of the following: removal of drainage structures (such as culverts), ripping of the surface to improve reduce compaction of the road surface and improve infiltration, seeding, the application of slash, placement of barricades to prevent vehicle access, and the camouflaging of the junction of the temporary road with the system road.
- The obliteration of the 3.6 miles of "temporary" roads, as described above, complies with Best Management Practices (BMPs) 2.2, 2.3, and 2.4 of the 2011 Water Quality Management Handbook for Region 5 of the U.S. Forest Service. These BMPs contain a number of guidelines that pertain to the use, maintenance, reconstruction, and removal of existing roads.
- Nearly all (approximately 99.9 percent) of the 3.6 miles of these "temporary" roads are not located in the Riparian Conservation Areas (RCAs) of perennial and intermittent streams; however, much of the 3.6 miles of roads are located within the RCA of one or more ephemeral streams. *(The RCA is 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams.)*

2. The effects to the water quality of streams - outside of suspended sediment and turbidity (discussed in item #1) - should be negligible or minor. Specific water quality parameters are discussed below.

A.) Temperature.

- According to a stream temperature model, the maximum potential stream temperature increase would range between 0.0 and 3.8 degrees Fahrenheit (^{o}F) for 12 perennial stream segments in the project area. For six of the streams, the maximum potential stream temperature increase would be less than 2.0 ^{o}F. A major reason for these results is that the design criteria in Tables 5 and 6 that would limit the removal of vegetation near perennial streams, which in turn would result in a small decrease in the amount of shade on the surface of streams. The calculations and assumptions are in Appendix A. It should be noted that for small streams in a forested setting, the research indicates that elevated water temperatures usually decrease to pre-disturbance levels within 500 feet downstream of the zone of vegetation removal (USDA 2010).
- Streams that flow seasonally (intermittent and ephemeral streams) - this includes many streams and stream segments in the project area - have no surface flow during the time of year (early summer to early fall) when an increase in stream temperatures the most likely to occur.

B.) Nutrients. Two recent studies have shown that partial timber harvest near streams resulted in limited effects to nutrients (Jones 2013; Gravelle 2009). With regard to prescribed fire and the burning of slash piles, the bulk of the published research has shown that increases in the nutrient levels of streams are minor or negligible and short-term. The published research is summarized in Appendix A.

3. Changes to the water yield, peak flow, and timing of flow of all streams in the project area and downstream of the project would likely be negligible and not measurable. This conclusion is based upon the following:

- The research indicates that *". . . fuels reduction treatments in forested watersheds have little detectable impact on water yields either on-site or downstream. Most prescriptions are not likely to remove the 20 percent of the basal area that is needed in most areas to generate a detectable change in flow."* (USDA 2010).
- Alternative 2 would decrease the basal area in commercial thinning areas by approximately 17 percent between 2013 and 2026 (Howard 2014).
- Alternative 2 would decrease the canopy cover approximately 15 percent between 2013 and 2026 (Howard 2014).
- Changes in groundwater in upland recharge areas, if such occurs, often take years or decades to influence the flow of streams in valley bottoms (Smerdon, et. al. 2009).

4. The decrease in the recruitment of large woody debris (LWD) to perennial streams in the TFHP as a result of the removal of trees should be minor. This is largely because few trees within one site-potential tree height would be removed as result of the protection measures in Tables 5 and 6. The research has shown that approximately 96 percent of the LWD that reaches streams is from within a ground distance of one site potential tree height of the stream channel (Reid and Hilton 1998).

5. Impacts to the water quality of perennial streams downstream of the project area should be negligible.

- The suspended sediment and turbidity levels streams flowing through or adjacent to thinning units of the TFHP area should not exceed state standards for turbidity and suspended sediment. The reasons for this conclusion are described under #1.
- The flow of the Cosumnes River, which is located downstream of the project area, is larger than the flow of the streams in the project area. As a result, the larger Cosumnes River would dilute inputs of sediment from the streams that flow through or adjacent to Units of the TFHP.
- The increase in the temperature of perennial streams within the project area should be minor or negligible. The reasons for this conclusion have been previously described in #2.

6. In the long-term (greater than five years), there may be an improvement in the condition and aquatic habitat of segments of several perennial streams. The reasons for this conclusion are described below.

- Restoration activities at a number sites that are eroding sediment into perennial streams, such as Dogtown Creek, Steely Fork Cosumnes River and Middle Dry Creek (Tables 3 and 4.).
- Reconstruction of approximately 84 miles of roads. This would likely include repairs to roads at sites where runoff and sediment from the road is reaching a stream.

7. Impacts to groundwater are expected to be negligible or minor. The reasons for this conclusion are described below.

- There would be no direct removal of groundwater under Alternative 2. Direct removal of groundwater typically involves the pumping of groundwater from wells.
- Changes to the water yield, peak flow, and timing of flow of all streams in the project area and downstream of the project area would likely be negligible and not measurable for the reasons previously described in #3. This suggests that impacts to groundwater would also be negligible or minor, since groundwater greatly influences the baseflow of streams.
- Changes in groundwater in upland recharge areas, if such occurs, often take years or decades to influence the flow of streams in valley bottoms (Smerdon, et. al. 2009).
- It should be noted that there are few published studies on the effects of vegetation management activities on groundwater (Smerdon, et al. 2009).

Table 4. Summary of restoration sites near aquatic features.

	Number of restoration sites	Alternative 2 (Proposed Action) item numbers[1]	Types of sites
Dogtown Creek	2	13, 14	2 camping areas adjacent to the stream; segment of road 09N45D.
Steely Fork Cosumnes River	3	10, 11, 12	2 camping areas adjacent to the stream; segment of road 09N65D.
Middle Dry Creek	1	23	1.1 mile segment of road 09N55.
Meadow near Harrel Water Tank	1	24	Meadow.

[1]Alternative 2 (Proposed Action) of the *Draft Environmental Impact Statement* contains descriptions of the restoration activities.

Alternatives 4 and 5

The direct and indirect effects from Alternatives 4 and 5 are the same as Alternative 2. There are several reasons for this conclusion:

- The design features that would minimize adverse effects to aquatic features and Riparian Conservation Areas (RCAs) are the same for Alternatives 2, 4 and 5. These design features are in Tables 5 and 6.
- Restoration activities at sites that are contributing sediment into streams would be the same under Alternatives 2, 4, and 5. These sites, which include a number of camping areas next to streams, are summarized in Table 4.
- Reductions in forest basal area and canopy cover would be similar to Alternative 2.
- The number of miles of existing non-system roads that would be obliterated after project operations would be similar to Alternative 2. The obliteration of these "temporary" roads is described under *Alternative 2, item #1G.*

Table 5. Equipment exclusion zones features for aquatic features of the Trestle Forest Health Project.[1,2,3,4]

	Ground-based equipment exclusion zone (feet)[1]			
	< 15 % slope	**15 – 25 % slope**	**25 – 35 % slope**	**> 35 % slope**
Perennial stream	75	100	150	Requires approval from a resource specialist after an on-site visit.
Intermittent stream	50	50	75	
Ephemeral stream	25	25	50	
Draw	10	25	25	
Special aquatic feature (springs, wetlands, meadows, etc.)	75	100	150	
Sierra Nevada yellow-legged frog Habitat	**100** feet for all perennial and intermittent streams above 4,500 feet in elevation. There would be no reach-in to remove vegetation within the equipment exclusion zone.[5]			

[1] The equipment exclusion zones in Table 5 are intended to: 1) allow for fuel reduction activities near the majority of the aquatic features in the project area, which in turn reduces the risk of a high-severity wildfire in and near these features, 2) limit the amount of ground disturbance immediately adjacent to these aquatic features, which in turn minimizes the amount of sediment delivered to these features as a result of the TFHP, 3) protect areas where the slope of the ground is steep, such as in inner gorges, where the risk of slope failures is often high and the removal of vegetation and/or ground disturbance greatly increases this risk, and 4) maintain the diversity and cover of riparian vegetation adjacent to aquatic features, while maintaining coarse woody debris in riparian zones and large woody debris in stream channels.

[2] For streams, distances are as measured from the edge of the channel or riparian vegetation, whichever is greater.

[3] For draws, distances are as measured from the bottom of the draw. Draws have a poorly defined channel, and generally do not show evidence of recent flow.

[4] For special aquatic features, distances are as measured from the edge of wet area or riparian vegetation, whichever is greater, Special aquatic features includes lakes, ponds, meadows, wetlands, springs, seeps, etc.

[5] These requirements are necessary in order to achieve a *no effect determination* for the endangered Sierra Nevada yellow-legged frog (without consultation with the USFWS).

Table 6. Additional design features for Aquatic Features and Riparian Conservation Areas (RCAs) of the Trestle Forest Health Project.[1,2,3,4,5,6]

Watershed or Unit(s) or Aquatic Feature(s)	Design Features	Rationale for Design Features
HUC 7 watersheds at a very high risk of Cumulative Watershed Effects (CWE)	Monitoring of a least one stream segment as described in Section 16.34 of the 2011 Water Quality Management Handbook for Region 5 of the Forest Service. This applies to watersheds are currently at a *very high* risk of CWE (above the Threshold of Concern) and watersheds that will be at *very high* risk of CWE as result of the Trestle Forest Health Project.	Required as described in Section 16.34 of the 2011 Water Quality Management Handbook for Region 5 of the Forest Service.
Riparian Conservation Areas (RCAs) in all Units	<u>Entire RCA</u> ▪ Ground cover will be maintained at 70 percent or greater where the ground cover is currently 70 percent or greater. ▪ Reviews by a Hydrologist, Fisheries Biologist, or Soil Scientist is needed for: a) construction of new landings and/or modification and use of existing landings, b) construction of permanent and/or temporary roads, c) use of ground-based equipment and/or removal of vegetation in inner gorges. ▪ Review by a Hydrologist or Fisheries Biologist is needed for equipment crossings of perennial and intermittent streams or the placement of temporary stream crossing structures. ▪ Felling and removal of hazard trees next to haul routes would have the following restrictions: a) no end-lining to remove trees, b) should a felled hazard tree enter a stream course, the Sale Administrator and Resource Specialist would recommend the fate of the tree (e.g. repositioning of the tree, leaving a portion of the tree as felled, etc.), c.) hazard trees with no commercial value and those outside the reach of skidding equipment would be retained in place provided the felled trees would not interfere with the safe use of the road or adversely affect a stream course and associated culverts. <u>Equipment Exclusion Zones</u> ▪ Reach-in to remove non-riparian vegetation (typically 25 feet) is allowed (but not required) from the edge of the equipment exclusion zone. ▪ No end-lining of trees out of equipment exclusion zones. ▪ Construction of handlines for fire is allowed. Rehabilitation of the handlines would include waterbars and maintain at least 70 percent ground cover. <u>Stream channels</u> ▪ For ephemeral streams, removal of non-riparian vegetation (living or dead) by hand is allowed up to the edge of the channel so long as the vegetation is not embedded into or growing out of the channel or streambank. ▪ For all streams, no removal of woody debris or vegetation (living or dead) within stream channels or on streambanks. ▪ No hand treatments within 25 feet of the edge of perennial stream channels or within riparian vegetation, whichever is greater. ▪ No hand treatments within 10 feet of the edge of intermittent stream channels or within riparian vegetation, whichever is greater. ▪ Ignition of fire would not occur within 25 feet of the edge of the channel of perennial streams and special	▪ Allows for fuel reduction activities near the majority of the aquatic features in the project area, which in turn reduces the risk of a high-severity wildfire in and near these features. ▪ Limits the amount of ground disturbance immediately adjacent to these aquatic features, which in turn minimizes the amount of sediment delivered to these features as a result of the TFHP. ▪ Protects inner gorges, where the risk of slope failures is often high and the removal of vegetation and/or ground disturbance greatly increases this risk. ▪ Maintains the diversity and cover of riparian vegetation adjacent to aquatic features, while maintaining coarse woody debris in riparian zones and large woody debris in stream channels.

Watershed or Unit(s) or Aquatic Feature(s)	Design Features	Rationale for Design Features
	aquatic features or 25 feet from the edge of riparian vegetation, whichever is greater. ▪ Ignition of fire would not occur within 10 feet of the edge of the channel of intermittent streams and ephemeral streams or within 10 feet of riparian vegetation, whichever is greater. ▪ No burn piles would be placed within ignition exclusion zones or within 25 feet of any stream channel, whichever is greater. ▪ For perennial and intermittent stream segments above 4,500 feet in elevation, there would be no ignition of prescribed fire within 82 feet of the edge of the stream channel or riparian vegetation (whichever is greater, unless fire ignition is needed within that buffer to regain control of the fire and reduce potential effects to a stream channel.[7]	
Unit 623473	▪ 10 ft. equipment exclusion zone for ephemeral streams and draws in Unit. ▪ For the intermittent stream in the eastern edge of unit, same equipment exclusion zones as described in Table 5.	Allows for the removal of high fuels buildup near these streams. Private land and buildings are nearby.
Unit 623474	10 ft. equipment exclusion zone for ephemeral streams and draws in the Unit.	Allows for the removal of high fuels buildup near these streams. The slopes adjacent to these streams are less than 15 percent.
Unit 623415	10 ft. equipment exclusion zone for ephemeral streams and draws in the Unit.	
Unit 622100	Equipment exclusion zones for all streams (perennial, intermittent, and ephemeral) are the same as described for perennial streams in Table 5.	Lack of ground cover and other erosional issues next to stream merits the wider equipment exclusion zones for perennial streams.

[1]The design features in Tables 5 and 6 apply to thinning units and plantations. The design features are the same for Alternatives 2, 4, and 5 of the TFHP.
[2] Riparian Conservation Areas (RCAs) are 300 feet on each side of perennial streams and 150 feet on each side of intermittent and ephemeral streams (SNFPAROD 2004).
[3] Protection measures would be reviewed for a specific site by a resource specialist (Soil Scientist, Fisheries Biologist, Botanist, Hydrologist) during implementation where necessary.
[4] Draws have poorly defined channels or no visible channel.
[5] Inner gorges are defined as areas with slopes greater than 70 percent adjacent to aquatic features.
[6] Riparian vegetation is defined as any native plant community composed of species which primarily occur where surface water or a shallow water table are accessible during the summer months and fall. Common, easily recognized riparian species include creek dogwood (Cornus sericea), white alder (Alnus rhombifolia), indian rhubarb (Darmera peltata), chain fern (Woodwardia fimbriata), wild ginger (Asarum lemmonii), columbine (Aquilegia formosa), and common monkey flower (Mimulus guttatus). Non-desirable vegetation targeted for herbicide use generally consists of upland woody brush species such as deer brush (*Ceanothus integerrimus*), whitethorn (*Ceanothus cuneatus*), manzanita (Arctostaphylos sp), bearclover (*Chamaebatia foliosa*), and bitter cherry (*Prunus emarginata*). A complete list of common riparian plants in California can be found in: *Common Riparian Plants of California, a field guide for the Layman* (Faber and Holland).
[7] Required for protection of habitat for the endangered Sierra Nevada yellow-legged frog.

CUMULATIVE WATERSHED EFFECTS

Method

The analysis of cumulative watershed effects (CWE) considers all past, present, and likely future land disturbances in a given drainage area. In the Eldorado National Forest (ENF), the major potential cumulative watershed effect is the degradation of habitat for aquatic and riparian species. This can result when land disturbances - roads, timber harvest, wildfire, etc. - increase the amount of sediment delivered to aquatic features. In the ENF, the risk of the occurrence of CWE for each watershed (HUC 7 scale) is assigned to one of the following four categories: *low*, *moderate*, *high*, or *very high*. The assignment of the risk of CWE is based on a quantitative evaluation of the land disturbances in the watershed using the method of equivalent roaded acres (ERA). The ERA method is described in more detail in Table 7, and additional background information on CWE is in Appendix A.

Land Disturbances

A number of land disturbances have occurred or are expected to occur in the seven watersheds (HUC 7 scale) that contain the Trestle Forest Health Project (TFHP).

- Approximately 24,200 acres of timber harvest and other vegetation management activities has occurred since 1975. Timber harvest is visible on aerial photographs, and evident on-the-ground in the form of cut tree stumps and skid trails. (It should be noted that the 22,400 acres represents an estimate of the total number of acres of activities over the past 38 years – a timber harvest and prescribed fire on the same 1.0 acres of ground in a different year counts as 2.0 acres of activity).
- There are approximately 278 miles of roads. This translates to a high road density of 4.8 miles of roads per square mile of land over the entire seven watersheds. The density of roads of roads ranges between 2.8 to 6.0 miles per square mile for the individual watersheds.
- Approximately 33 miles of the Elkins Flat OHV trail system occurs in four of the seven watersheds (HUC 7 scale). This trail system has been a major contributor of sediment into Middle Dry Creek (Markman 2011).
- The use of recreational vehicles - both on and off of current designated routes - is evident in a number of areas. The use of recreational vehicles on current designated routes may increase in the coming years in response to the expected increase in the population of the nearby Sacramento metropolitan area.
- There are a number of user-created camping areas next to perennial streams, and these camping areas are a source of sediment into those streams. Several of these areas are described in Table 3.
- A large area of residential development (buildings, parking lots, areas cleared of vegetation) exists on private lands in the vicinity of Grizzly Flat, which is located in the Lower Steely Fork Cosumnes River watershed.
- Wildfires have occurred in the project area in several watersheds, as evidenced by areas of burned trees.
- The TFRP would involve a number of vegetative management activities in a portion of seven watersheds (HUC 7 scale). The watersheds are shown in Figure 3 in the section *Affected Environment.*

- Approximately 280 acres of timber harvest on private lands would occur in the project area within the next few years.

Table 7. Description of the Method of Equivalent Roaded Acres (ERA) for assessing the risk of Cumulative Watershed Effects (CWE).

Summary
The risk of cumulative watershed effects (CWE) is assessed using the Equivalent Roaded Acre (ERA) method developed by R5 USFS. The process was further refined and adapted for the Eldorado National Forest (1993). In this method, an index is calculated for an entire watershed that expresses most land use in terms of the percent of the watershed covered by roads. Based on the ERA and a threshold of concern (TOC), a given watershed is assigned a relative risk – *low, moderate, high,* or *very high* - of CWE. The primary cumulative impact of concern is an increase in sediment delivery to streams and degradation of aquatic habitat.
Important aspects of the ERA method
▪ Roads, which are considered to have the greatest potential to increase runoff and sediment to streams, are given a value of 1.0. The number of acres of roads in a watershed is divided by the size of the entire watershed (in acres). This gives the percent of the watershed covered by roads. ▪ For each land disturbance activity other than roads, the number of acres is multiplied by a number less than 1.0. The result (for each land disturbance activity) is then divided by the number of acres of the entire watershed. This gives the percent of the "equivalent roaded acres" in the watershed for each type of land disturbance. ▪ The values for equivalent roaded acres for all of the land disturbance activities are added together. The final number represents the percent of the watershed that is covered by the 'equivalent' of roads. ▪ The threshold of concern (TOC) is usually between 10 and 18 percent. That is, when 10 to 18 percent of a watershed is covered by the equivalent of roads, there is a "*very high* risk" that increased peak flows of streams and sediment delivery to streams will occur. This does not mean these effects will occur precisely when the ERA reaches the TOC, or that an increase in peak flows and sediment delivery to streams will automatically result in a degradation of fish habitat or diminish the experience of recreationists. It is merely a warning that cumulative effects might occur.
Assumptions and limitations of the ERA method
▪ The method is intended for watersheds between 3,000 and 10,000 acres in size, although the method is commonly used for watersheds slightly outside of this range. ▪ ERA values, as well as the TOC, are only indicators of the risk of cumulative impacts occurring. They cannot be used to determine the percent or numerical amount of increase of sediment delivery to streams, stream channel eroded, fish habitat degraded or lost, or any other change in watershed condition. Such quantitative assessments require additional analysis. ▪ The location of land disturbance activities within a watershed is not considered. For example, roads near streams are treated exactly the same as roads that are far from streams. In reality, roads located within or next to riparian areas tend to contribute more sediment to streams than roads in upland areas. ▪ Recovery of the watershed from land disturbing activities occurs with time. For timber harvest activities, hydrologic recovery is assumed to be thirty years (i.e. ERA contribution is zero thirty years after timber harvest.) ▪ The ERA calculations do not take into account site specific BMPs that will be applied. ▪ ERA values start one year after a land use is implemented.
Risk categories[1]
▪ Low risk of CWE - ERA is less than 50% of TOC ▪ Moderate risk of CWE - ERA is between 50% and 80% of TOC ▪ High risk of CWE - ERA is between 80% and 100% of TOC ▪ Very high risk of CWE - ERA is greater than TOC

[1]Guidance to reducing the risk of CWE can be found in Section 2509.22, Chapter 20 of the Soil and Water Conservation Handbook (USDA 1990).

Assumptions

The following assumptions were used in assessing the risk of CWE for the TFHP:

- The implementation of the TFHP would begin in 2016.
- The removal of vegetation with ground-based equipment, which includes pile burning, would occur in 2016.
- The removal of vegetation by hand (no ground-based equipment), which includes pile burning, would occur from 2016 through 2020. The total number of acres of such activity in each watershed would be evenly divided over that period of time.
- Prescribed fire outside of thinning units would occur from 2016 through 2020. The total number of acres of such activity in each watershed would be evenly divided over that period of time.

Results

The land disturbances and assumptions previously described have resulted in the following conclusions with regard to the risk of CWE in the watersheds that contain the TFHP.

- The risk of CWE currently is ***low*** or ***moderate*** in six of the seven watersheds.
- The Lower Steely Fork Cosumnes River watershed is currently at a ***very high*** risk of CWE - this is largely the result of residential development and past timber harvest on private lands.
- Alternative 1 (No Action) would result in no change or a decrease in the risk of CWE in each watershed.
- Alternatives 2, 4, and 5 would increase the risk of CWE in six of the seven watersheds for at least several years.
- Alternative 2 would result in two watersheds at a ***very high*** risk of CWE for a longer period of time than Alternatives 4 and 5. The two watersheds are Lower Steely Fork Cosumnes River and Clear Creek - Steely Fork Cosumnes River.
- The risk of CWE is very similar, but not identical, for Alternatives 4 and 5.

The number of watersheds at a ***very high*** risk of CWE for each alternative from 2016 through 2016 is listed in Table 8. The risk of CWE for each alternative and watershed from 2016 through 2026 is described in Table 9. The risk of CWE for each of watershed is illustrated in Figures 16 through 23. Individual land disturbances in each watershed are depicted in Figure 24. Additional information on CWE is in Appendix A.

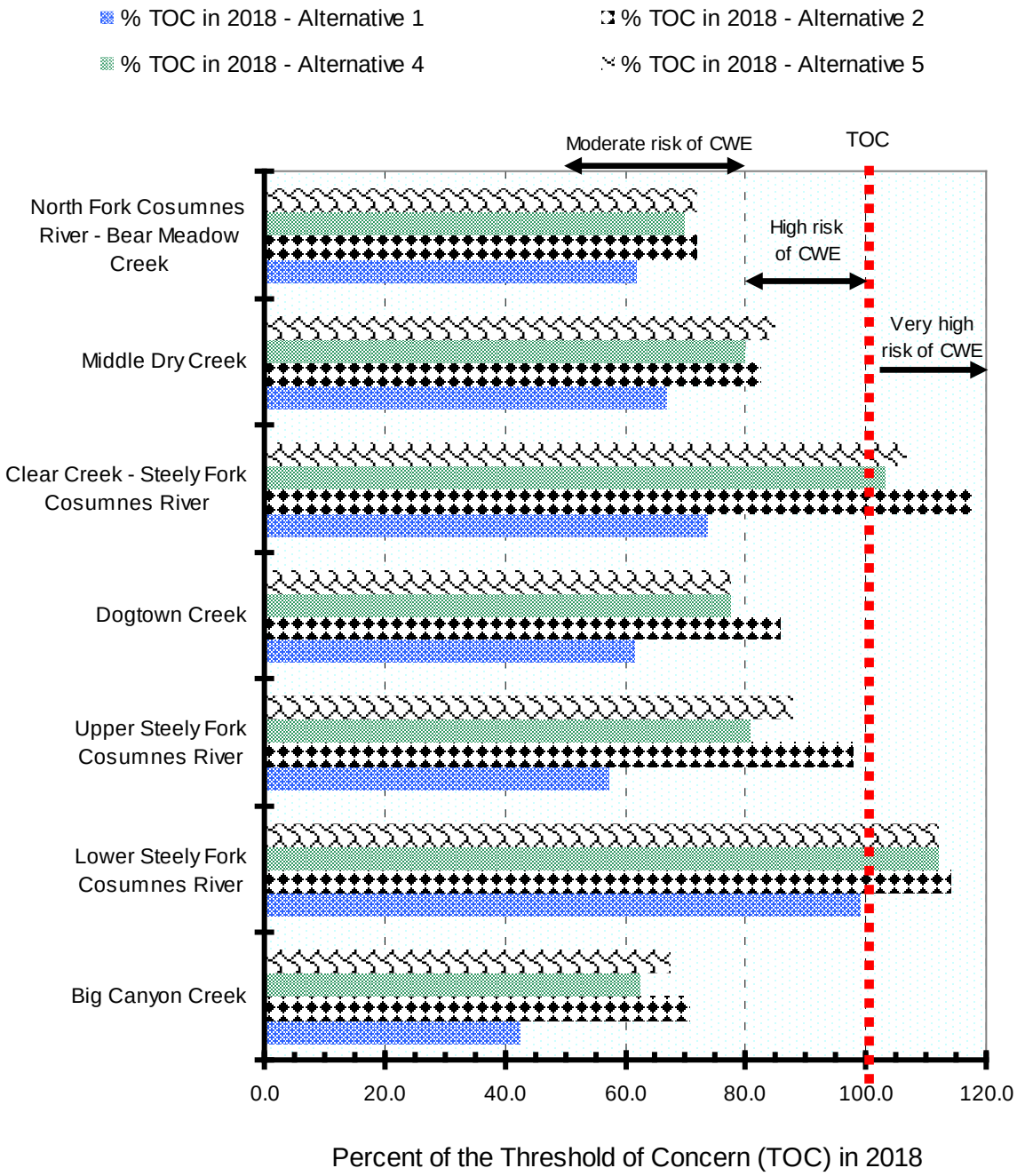
Table 8. The number of watersheds at a ***very high*** risk of CWE for each alternative for 2016 - 2026.

	2016	2018	2020	2022	2024	2026
Alternative 1	1	0	0	0	0	0
Alternative 2	1	2	2	2	2	2
Alternative 4	1	2	2	1	1	1
Alternative 5	1	2	2	1	1	1

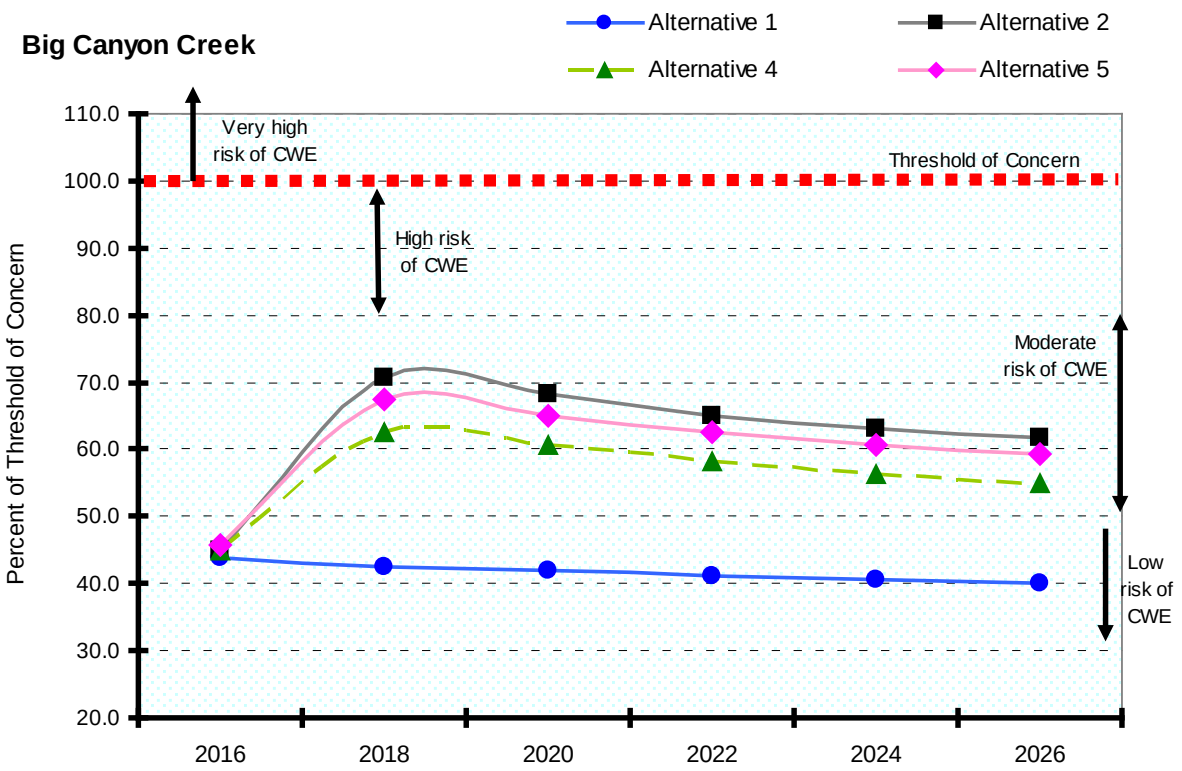
Table 9. Risk of Cumulative Effects (CWE) of the Trestle Forest Health Project (TFHP) for each watershed and alternative for 2016 through 2026.

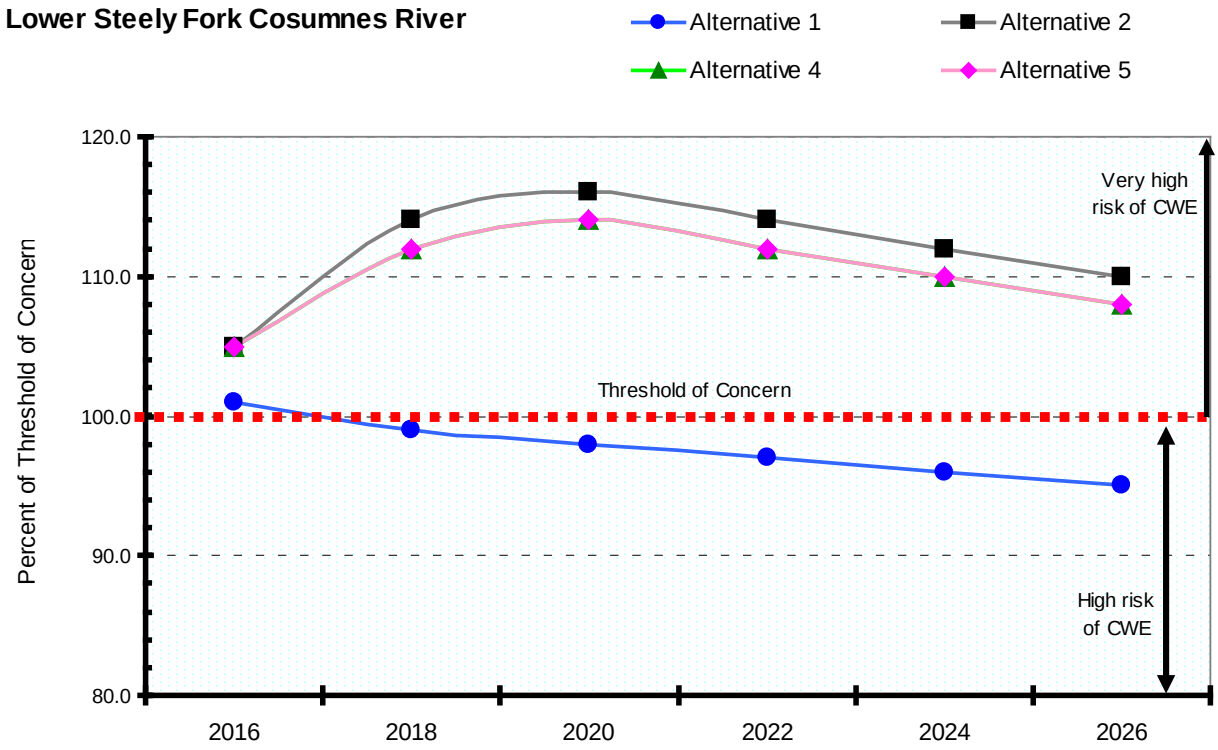
		HUC 7 Watershed						
		Big Canyon Creek #2226 3,535 acres	**Lower Steely Fork Cosumnes River** #2301 6,966 acres	**Upper Steely Fork Cosumnes River** #2326 6,831 acres	**Dogtown Creek** #2436 6,849 acres	**Clear Creek – Steely Fork Cosumnes River** #2316 2,891 acres	**Middle Dry Creek** #2446 3,414 acres	**North Fork Cosumnes River – Bear Meadow Creek** #2216 6,278 acres
2016	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low	**Very High**	Moderate	Moderate	Moderate	Moderate	Moderate
2018	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low Moderate Moderate Moderate	High **Very High** **Very High** **Very High**	Moderate High High High	Moderate High Moderate Moderate	Moderate **Very High** **Very High** **Very High**	Moderate High High High	Moderate
2020	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low Moderate Moderate Moderate	High **Very High** **Very High** **Very High**	Moderate High Moderate High	Moderate High Moderate Moderate	Moderate **Very High** **Very High** **Very High**	Moderate	Moderate
2022	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low Moderate Moderate Moderate	High **Very High** **Very High** **Very High**	Moderate High Moderate High	Moderate High Moderate Moderate	Moderate **Very High** High High	Moderate	Moderate
2024	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low Moderate Moderate Moderate	High **Very High** **Very High** **Very High**	Moderate High Moderate High	Moderate	Moderate **Very High** High High	Moderate	Moderate
2026	**Alternative 1 (No Action)** **Alternative 2 (Proposed Action)** **Alternative 4** **Alternative 5**	Low Moderate Moderate Moderate	High **Very High** **Very High** **Very High**	Moderate High Moderate Moderate	Moderate	Moderate **Very High** High High	Moderate	Moderate

Figure 16. Percent Equivalent Roaded Acres - expressed as the Percent of the Threshold of Concern (% TOC) - and the risk of Cumulative Watershed Effects (CWE) for the watersheds of the Trestle Forest Health Project in 2018.

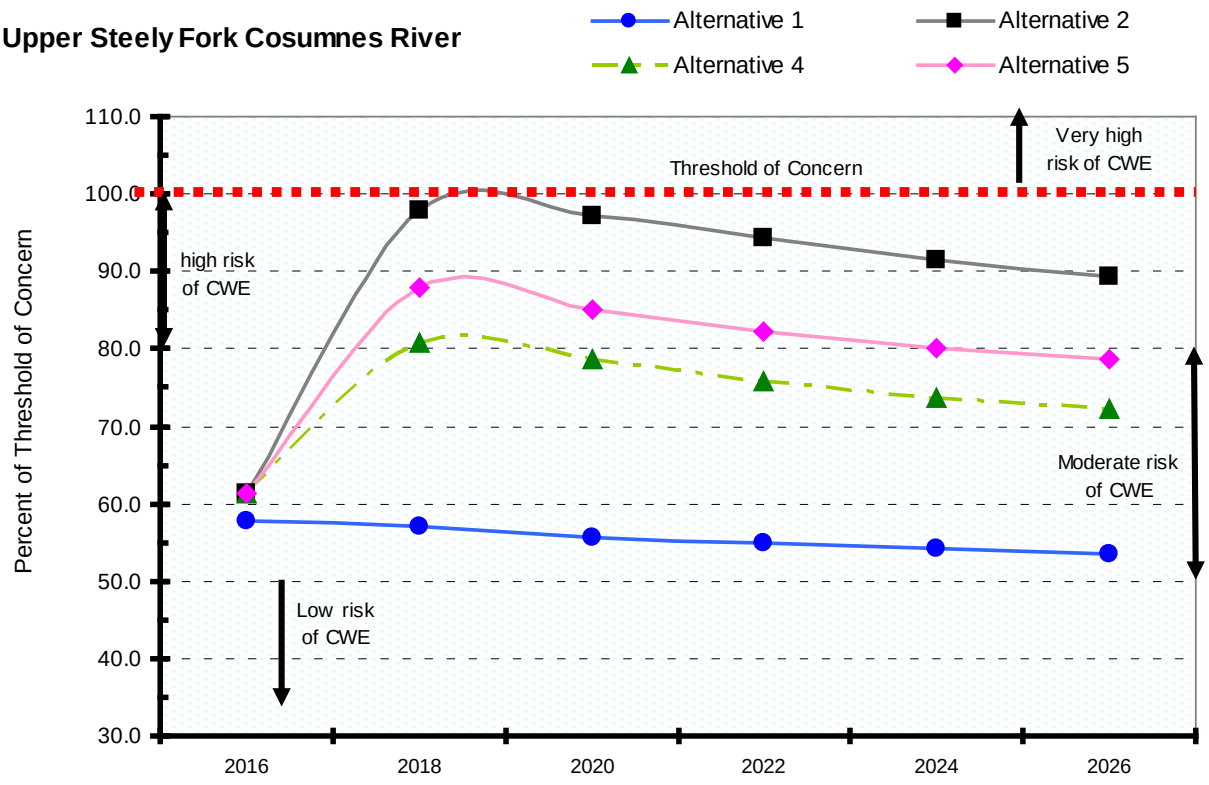


Figures 17 through 23 (next four pages).
Percent Equivalent Roaded Acres (% ERA) - expressed as the Percent of the Threshold of Concern (% TOC) - and the risk of Cumulative Watershed Effects (CWE) for the watersheds that contain the Trestle Forest Health Project.

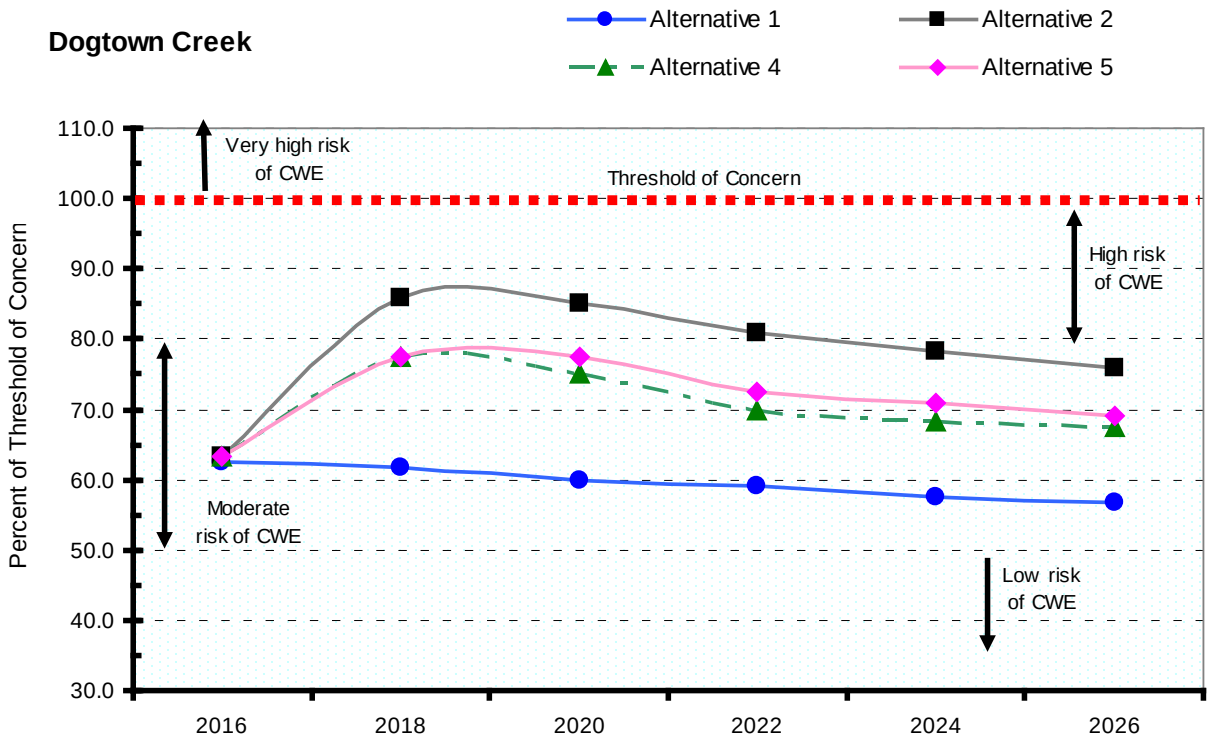

Big Canyon Creek
Alternative 1
Alternative 2
Alternative 4
Alternative 5
Very high risk of CWE
Threshold of Concern
High risk of CWE
Moderate risk of CWE
Low risk of CWE
Percent of Threshold of Concern
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
2016
2018
2020
2022
2024
2026


Lower Steely Fork Cosumnes River
Alternative 1
Alternative 2
Alternative 4
Alternative 5
Very high risk of CWE
Threshold of Concern
High risk of CWE
Percent of Threshold of Concern
120.0
110.0
100.0
90.0
80.0
2016
2018
2020
2022
2024
2026

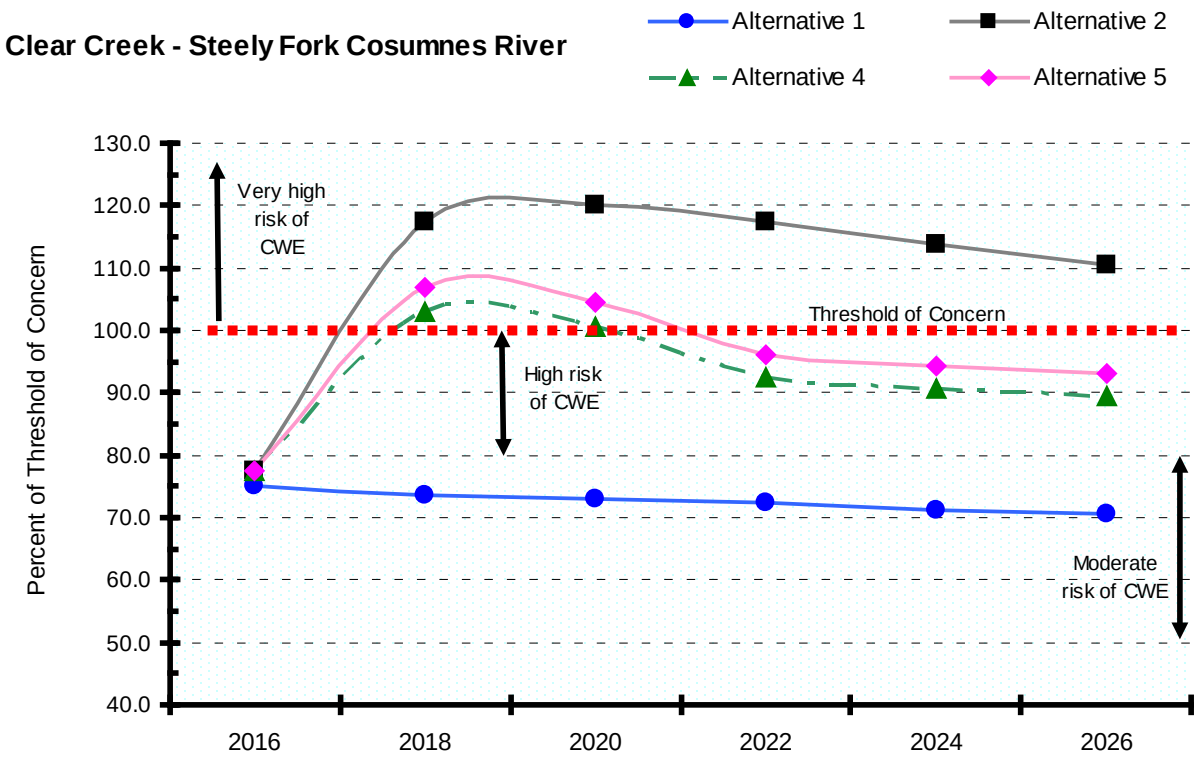
Upper Steely Fork Cosumnes River



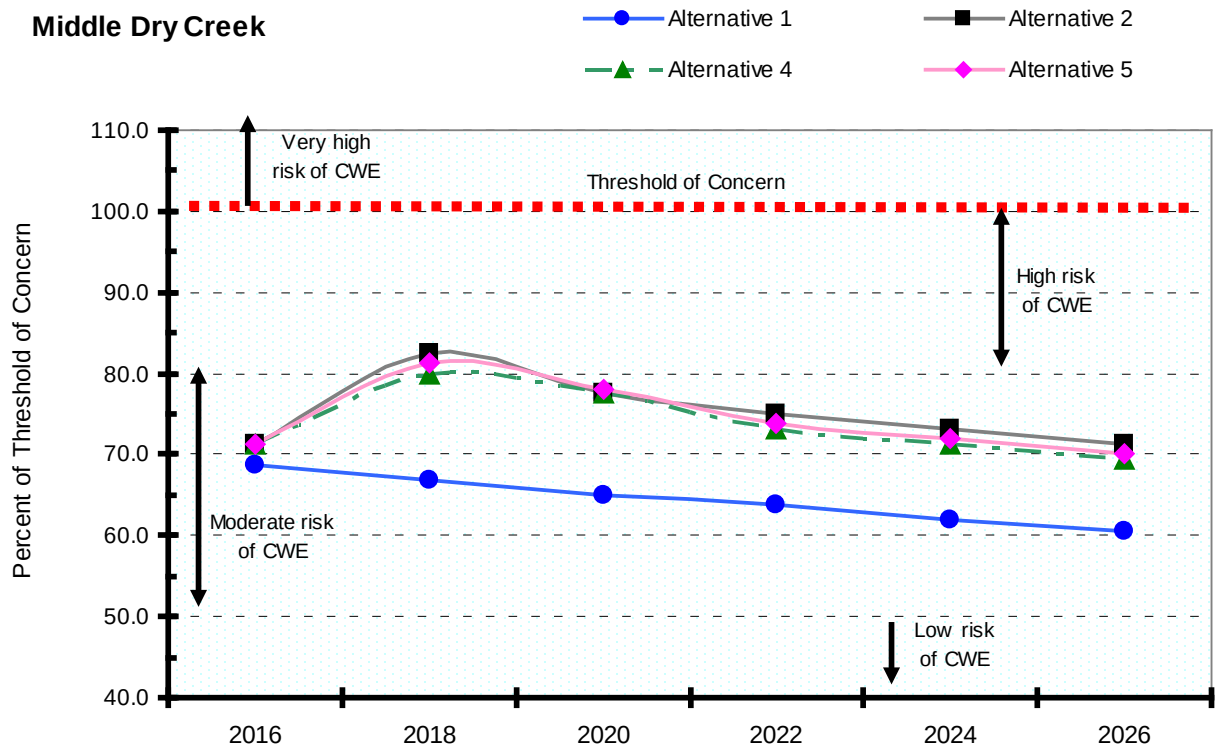
Dogtown Creek



Clear Creek - Steely Fork Cosumnes River



Middle Dry Creek



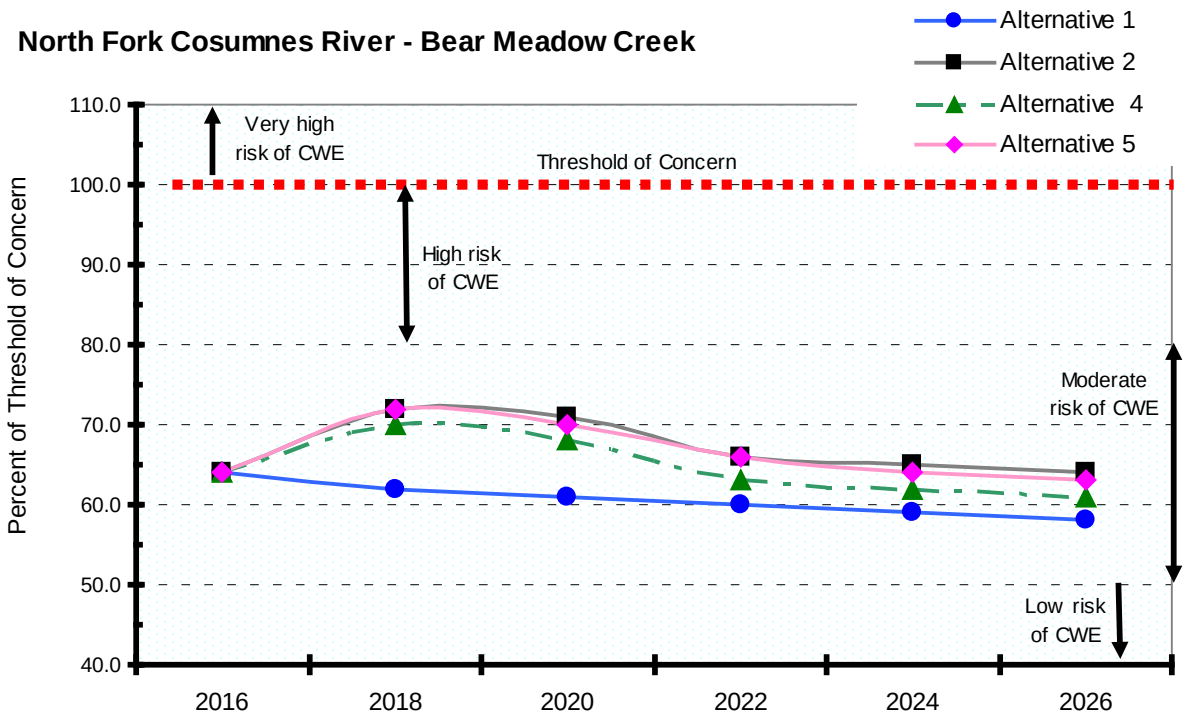
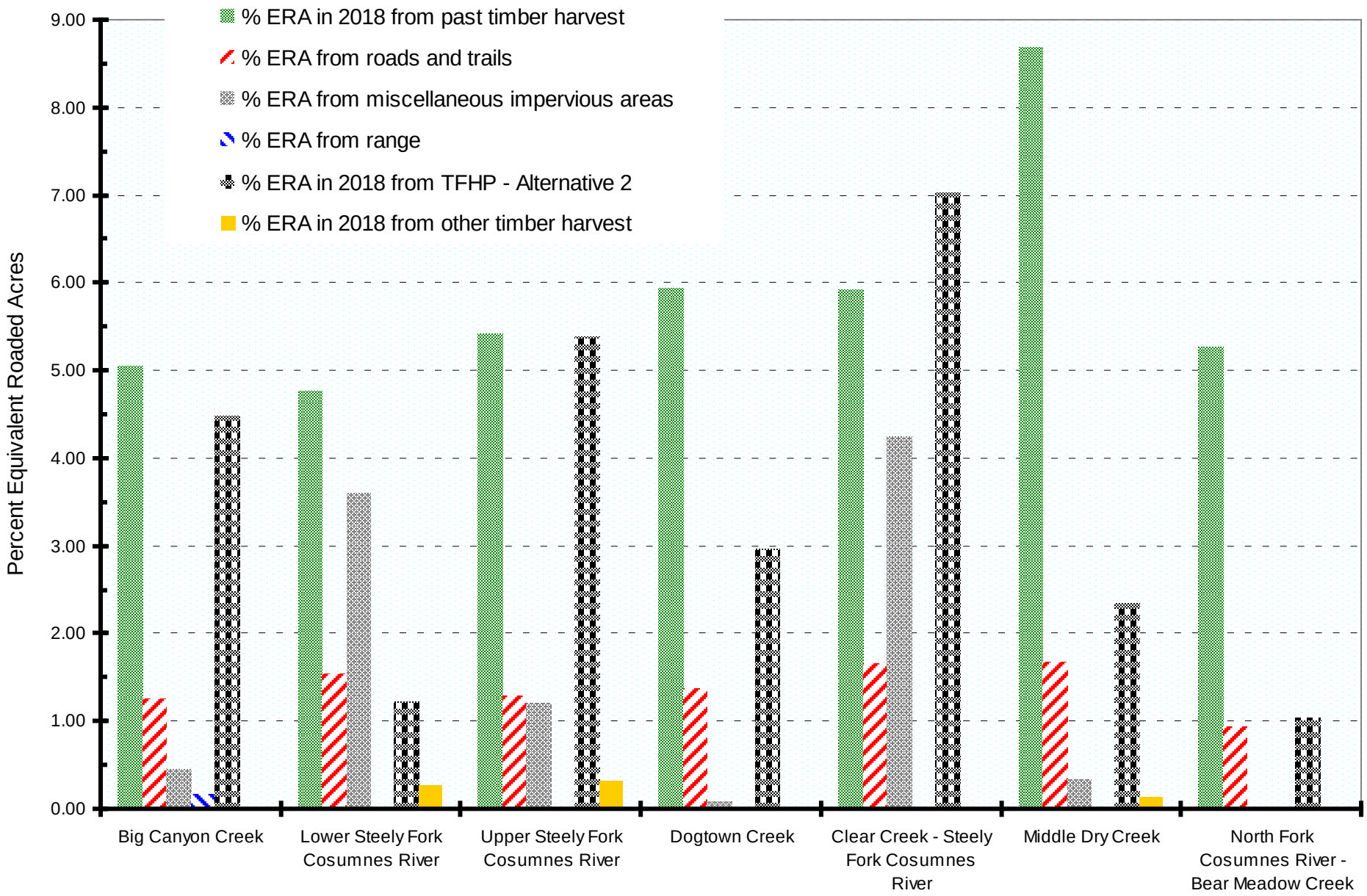


Figure 24 (next page).

Percent Equivalent Roaded Acres (% ERA) in 2018 for different types of land disturbances in the seven watersheds that contain the Trestle Forest Health Project (TFHP).

Notes:

- Miscellaneaous impervious areas include buildings, parking lots, mining sites, and other denuded and compacted areas.
- There are zero equivalent roaded acres from past fire.
- "Other timber harvest" mostly refers to planned timber harvest on private lands.


% ERA in 2018 from past timber harvest
% ERA from roads and trails
% ERA from miscellaneous impervious areas
% ERA from range
% ERA in 2018 from TFHP - Alternative 2
% ERA in 2018 from other timber harvest
Percent Equivalent Roaded Acres
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Big Canyon Creek
Lower Steely Fork Cosumnes River
Upper Steely Fork Cosumnes River
Dogtown Creek
Clear Creek - Steely Fork Cosumnes River
Middle Dry Creek
North Fork Cosumnes River - Bear Meadow Creek

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GLOSSARY

best management practice (BMP) A practice or practices that is the most effective and practical means of preventing or reducing the amount of pollution generated by nonpoint sources. BMPs are contained in *Water Quality Management for Forest System Land in California, USDA Forest Service, September 2000* – the BMPs have been approved by the California Water Quality Control Board under the jurisdiction of Section 208 of the Clean Water Act (PL 92-500).

beneficial uses of water State law defines the beneficial use(s) of bodies of water. In California, the beneficial uses of a particular body of water may include one or more of the following: domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

cumulative watershed effects (CWE) All effects on the beneficial uses of water that occur away from the location of actual land use which are transmitted through the fluvial system.

cumulative impact "… the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes other such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (NEPA, § 1508.7)

draw A land feature that resembles a stream in some respects, but has a poorly defined channel and shows little or no evidence features that are characteristic of flowing water. Surface flow can occur during rainfall events of high intensity. Draws can develop into streams over geologic time if the climate becomes wetter.

ephemeral streams have a defined channel throughout much, but not necessarily all of their length. Surface flow exists only during and for a short time following precipitation events. There is little or no riparian vegetation. Non-riparian vegetation, including conifers, may be found on the streambanks and even in the streambeds. Rocks in the channel are generally not covered with green moss. The ephemeral stream layer in GIS of the Eldorado Natioanal Forest typically shows more ephemeral streams than actually exist on-the-ground - some ephemeral streams in GIS are actually draws or swales.

equivalent roaded acre (ERA) A method of categorizing the amount of soil compaction from land management activities into the common base of a compacted road surface. Roads are assigned an ERA value of 1.0; all other disturbed areas are assigned ERA values less than or equal to one.

intermittent or seasonal stream have a well-defined channel throughout the entire length of the stream. Surface flow exists part of the year and may exist most of the year, but not year-round. There is usually some riparian vegetation adjacent to the channel. Green moss on rocks in the channel and adjacent to the channel is often an indicator that a stream is seasonal, not ephemeral.

perennial streams have a well-defined channel throughout the entire length of the stream. Surface flow exists year-round. Riparian vegetation is usually dominant adjacent to the channel, although non-riparian vegetation may also exist.

threshold of concern (TOC) The point where there is a concern that cumulative watershed effects are at a very high risk of occurring.