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VIA ELECTRONIC FILING

Kimberly D. Bose
Secretary, Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: Supplemental Information Regarding Amended Application for Surrender of License; FERC Project Nos. 14803-001 and 2082-063

Dear Secretary Bose:

On December 16, 2020, the Commission filed notice of this application soliciting comments, motions to intervene, and protests.[1] Most interventions and comments addressed environmental impacts that are covered by the exhaustive record in this proceeding. The Renewal Corporation stands on the record it has submitted, including its studies, analyses, and plans, in denying comments in opposition to the application.

The Renewal Corporation now responds to comments on its Fire Management Plan (February 2021).[2] This new plan was not covered in prior environmental reviews by the Commission and the states. As a result of the Renewal Corporation's innovative and systematic approach, dam removal as proposed here will not increase wildfire risk (despite removal of reservoirs), will not reduce firefighting capacities, and indeed will improve the response time and effectiveness of fire suppression. For those reasons, the California and Oregon agencies with primary responsibility for fighting wildfires in this basin support the plan. The Renewal Corporation attaches supplemental information on this plan for the Commission's consideration (Attachment A).

Respectfully submitted,

s/ Markham A. Quehrn

Markham A. Quehrn
Perkins Coie LLP
Attorneys for the Renewal Corporation

cc: Service List (FERC Nos. P-14803-001 and P-2082-063)

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1 *Notice of Application for Surrender of License, Soliciting Comments, Motions to Intervene, and Protests*, FERC accession no. 20201216-3031.

2 *See Comments of Copco Lake Fire Protection Board*, FERC accession no. 20210212-5022; *Motion to Intervene, Copco Fire Protection District Board Members,* FERC accession no. 20210210-5013.

Technical Memorandum

DATE: June 14, 2021

FROM: Jack Zunka, PhD
River Design Group, Inc.

SUBJECT: Supplemental Information Regarding Fire Management Measures; Amended Application for Surrender of License, FERC Project Nos 14803-001 and 2082-063

This Technical Memorandum contains supplemental information regarding measures the Klamath River Renewal Corporation (Renewal Corporation) will implement to address fire risks associated with its Proposed Action, the physical removal of four dams (Iron Gate, Copco No. 1, and Copco No. 2 in California, and J.C. Boyle in Oregon) of the Lower Klamath Project (FERC Project No. 14803).

Development and Peer Review of the Fire Management Plan

The Renewal Corporation developed a Fire Management Plan (FMP) to analyze and address near- and long-term fire risks associated with the Proposed Action. Implementing the FMP entails numerous fire management measures, including near-term measures focused on risks associated with construction activities, and long-term measures including detection systems and suppression strategies. The objective of these management measures and the Renewal Corporation's supporting risk analysis is to assure that the Proposed Action, post-dam removal, will neither increase the wildfire risks that exist prior to the Proposed Action nor cause a net diminution in firefighting resources in the Basin.

The Renewal Corporation developed the FMP in consultation with CalFire Siskiyou Unit (CFSU), Oregon Department of Forestry (ODF) Klamath Lake and Southwest Oregon Districts, and local fire departments. On behalf of the Renewal Corporation, River Design Group (RDG) sought to consult with the Copco Fire Protection District (Copco FPD) via voicemail on April 1, 2019 and in May 2019, and by leaving a written request at the Copco Lake Fire Station on April 10, 2019. While Copco FPD never returned contact, the Renewal Corporation welcomes consultation with Copco FPD.

The state agencies (ODF and CalFire), which are responsible for managing and fighting wildfires within their respective jurisdictions, provided substantial input to the FMP on both near-term and long-term fire management. ODF contributed significant information on aerial suppression capabilities, needs, and local constraints and on the effectiveness and technical elements of monitored detection cameras and software. CFSU provided important details on local firefighting strategies, long-term management solutions, and regulatory requirements. Local volunteer fire departments, who are instrumental in fighting local events and small structure fires, provided useful information on the inventory of local firefighting resources. Section 8 of the FMP provides a detailed consultation log.

The Renewal Corporation engaged REAX Engineering, Inc. (Reax) to evaluate the effectiveness of the draft FMP. Reax has extensive experience in wildland fire hazard analysis and monitoring, including providing expert services to utilities and public utility commissions on management of wildfire risks associated with transmission lines and generation assets throughout the western states. For example, Reax co-chaired the Peer Development Panel tasked by the California Public Utilities Commission (CPUC) with developing a statewide fire hazard risk map, which has been adopted by CPUC for regulatory purposes, and has been retained as subject matter experts by several California electric utilities and communications companies in similar mapping efforts. Reax's team comprises individuals with a range of educational and professional backgrounds and experience types to provide a well-rounded expertise on all facets of wildfire management. The team was led by a licensed Fire Protection Engineer, who has over 20 years of experience, wildfire modeling post-doctoral experience and peer-reviewed publications, and has provided expert testimony on over 25 occasions. The team also included a former firefighter, who has 40 years of experience specializing in fire and fuels management, including over 22 years of experience as a fire behavior analyst working with Incident Management Teams.

With respect to the FMP, Reax approached quantifying the change in fire risk associated with the Proposed Action using validated advanced wildfire risk Monte Carlo computer modeling. The Monte Carlo modeling is similar to the modeling underlying the CPUC fire threat maps, as well as recent efforts by Australian authorities to quantify fire risk associated with overhead electrical utility ignited fires. Reax's modeling quantified the impacts to landscape-scale burn probabilities associated with increased burnable vegetation (from dewatering the reservoirs) and improved detection times (from detection cameras installed as part of the FMP). Wildfires were modeled using site specific geospatial data and stochastically selected historical weather and ignition locations within the 570-square-mile CalFire-defined Aerial Suppression Extent (ASE), which delineates the land area where water drafted from the existing reservoirs could be used in aerial fire suppression. The Reax analysis for the Proposed Action was peer-reviewed by an independent third-party wildfire risk consulting firm (Spatial Informatics Group), which provided a letter validating the Reax methodology and interpretation of the results. More detail regarding the Reax methodology is provided below.

In all, the Reax analysis (appended to the FMP) accounted for fire history in the area, vegetation growth in areas that were previously inundated, water availability for firefighting purposes, removal of potential ignition sources associated with electrical generation, and risk reduction and mitigation countermeasures such as real-time fire detection monitoring and the introduction of additional water sources for ground crews. This analysis concluded that the impacts of dewatering the reservoirs on landscape-scale burn probability are insignificant and an order of magnitude smaller than the modeled decreases in burn probability associated with the expected reductions in detection time and improved probability of containment on initial attack within the ASE. These improvements in initial attack success have important implications for reducing wildfire impacts and firefighting costs.

Expert Agency Support for the Fire Management Plan

CalFire and ODF each reviewed the draft FMP. The reviews included a detailed evaluation of the FMP's long-term measures, its description of tactical air operations and geomorphic conditions during and after dam removal, and the Reax analysis. The review was conducted by a wide range of ODF and CalFire personnel, including CalFire's Fire Science and Environmental Science Specialists from their Fire and Resource Assessment Program and ODF's tactical air operations specialist. The review included dozens of conference calls and in-person discussions, as detailed in the FMP consultation log.

Each state agency provided a letter of support for the FMP which concurs with the underlying risk assessment and endorses the management measures embodied by the FMP. The FMP appends these letters of support.

The ODF letter states, in part: "we agree with the plan's analysis of wildfire risks and fire-suppression resources in the area. We conclude that its analysis of the incremental risks associated with [the] dam removal project is accurate."

The CalFire letter states, in part: "Firefighting agencies always need as many water sources as possible for firefighting purposes. Nevertheless, CalFire believes the system of actions proposed in the Fire Plan are adequate to manage construction-related first risks, comply with all applicable laws, and will not adversely affect CalFire's ability to provide an adequate and effective firefighting capability in Siskiyou County and beyond."

Regional Fire Conditions, History, and Climate Change

Wildfire is a naturally-occurring disturbance within the CalFire-defined ASE. The hot, dry summers and low fuel loads associated with the grass-dominated vegetation contribute to a historical fire regime characterized by very frequent, low severity fires (Spies et al., 2018). The ASE area supports a range of fuel types but is mostly grass and shrub vegetation (CalFire, 2016), which dominate the area surrounding Iron Gate and Copco reservoirs (Reax, 2020). These fuels can ignite and support rapid wildfire spread but represent a small areal fuel load compared to timber (Reax, 2020). The size of vegetation is an important factor, whereby fine fuels (< ¼" diameter) control rate of fire spread and larger particles (e.g., limbs to timber) control the intensity and duration (WFT, 2016). Overall, the climate, dominant fuel types, and high frequency of wildfires moderate the accumulation of fuel loads and can thereby limit the severity of individual wildfire events within the ASE relative to more heavily timbered areas.

The terrain within the ASE is steep, rugged, and remote with few access roads, sparse population, and poor cellular coverage. As a result, fire detection and reporting can often be delayed significantly relative to ignition. The primary cause of wildfire ignition is lightning, which tends to follow a more random spatial distribution compared to human-caused ignitions but does favor high topography over valley bottoms (Reax, 2020). The densities of lightning-caused ignitions are very low and low-moderate around Iron Gate and Copco reservoirs, respectively, relative to other locations within the ASE.

Climate change has and will continue to influence wildfire occurrence frequency and behavior within the ASE. The frequency of large wildfires has increased within the ASE in recent decades (Reax, 2020). In northern California, mean annual temperatures are expected to rise by 1.5 to 4.5 degrees C by 2100 under mitigation-oriented and high-growth emission scenarios, respectively, with the greatest increases during summer months (Cayan et al., 2008). Summers in the region are dry, and summer precipitation is forecasted to decrease by 4 to 68 percent by 2100 (Cayan et al., 2008). Climate projections indicate that the wetter winter season may see an increase in precipitation (Neelin et al., 2013). Interannual variability in wet and dry extremes during the wet season are expected to increase, meaning periods of drought may be more common in the fall and winter (Berg and Hall, 2015). These climate projections are consistent with increased frequency of fire in the region. The dominance of grass and shrub vegetation within the ASE provides constraints on the local wildfire severity, relatively to heavily timbered areas, even under a projected warmer and drier climate.

The Klamath River as a Source of Water for Aerial Fire Suppression

The Proposed Action will result in the loss of three reservoirs which are currently used as a water source for firefighting aircraft. The reservoirs, however, will be replaced by a free-flowing Klamath River that will provide adequate firefighting water supply.

Stretches of free-flowing Klamath River are currently used for helicopter drafting within the ASE. There are currently 96 inventoried pools for drafting in the free-flowing Klamath River within the ASE that will continue to provide a stable and accessible long-term water source following implementation of the Proposed Action. In addition, geomorphic analysis of bathymetry, geology, and historical air photos supports that 41 new locations will be hydraulically suitable for dipping in the reservoir footprints post-removal. These existing and new locations for in-river helicopter drafting, coupled with remaining reservoirs in the region and additional measures such as dip tanks, will provide ample water supply for aerial fire suppression.

For some fires, drafting from the river will be slower and more challenging than drafting from the large reservoirs as a result of the smaller drafting area and valley bottom locations. That said, the magnitude of the increases in drafting turnaround time are expected to be modest. Increases in travel distance for drafting in the river compared to the edge of the reservoir will be less than 1 mile. The pilots are skilled and trained to draft from the river and even small water bodies like ponds if they are near the application area. For example, three of the five dip sites for the 2018 Klamathon Fire were the Klamath River and two ponds. ODF has confidence in their pilots' ability to draft from the river as they routinely draft water from the narrow and challenging Klamath Canyon upstream of Copco Lake.

Klamath River flows will be more than sufficient to provide firefighting water supply even in the driest, hottest months and under the greatest drafting demand. The 2019 National Marine Fisheries Service Biological Opinion (NMFS, 2019) prescribes post-removal flows for July and August of 900 cubic feet per second (cfs) or greater, which is equivalent to 400,000 gallons/minute and is enough to support 200 snorkel helicopters drafting continuously. This is an order of magnitude more helicopters than are drafting on even the largest campaign fires.

The transition from existing conditions will be gradual, so the ability to successfully and safely draft water from the Proposed Action area will be sustained throughout dam removal. Drawdown will begin in January of the removal year, and the exposure of the reservoir sediments and the free-flowing Klamath River will proceed from upstream to downstream throughout the winter and into the summer. Standing reservoir water will be available as a helicopter drafting source in the downstream portions of Copco and Iron Gate reservoirs during this time until a final breach of the Iron Gate coffer dam in fall of the removal year.

Impacts to existing helicopter drafting sites in the Klamath River will be limited to primarily to 2 miles downstream of Iron Gate Dam in the first 2 years following the Proposed Action. Morphodynamic modeling completed for the Proposed Action drawdown scenario constrains the timing and magnitude of sediment erosion and deposition as a result of mobilization of reservoir sediments and can be used to estimate impacts to drafting resources during and after drawdown (Renewal Corporation, 2021). The reservoir material is predominantly silt- and clay-sized sediment (BOR, 2011), which will be easily eroded and flushed to the Pacific Ocean by the free-flowing Klamath River during drawdown, even during low flows and without intermediate deposition. The sand-sized sediment fraction will be mobilized more gradually, first concentrating in the deep waters in the downstream portions of Iron Gate and Copco reservoirs and deposited temporarily downstream of Iron Gate Dam. Reach-averaged increases in sediment thickness in the 4.5-mile reach from Bogus Creek to Willow Creek will be less than 1 foot for all modeled scenarios with the increases occurring primarily in the second winter after dam removal. Downstream of Willow Creek, reach-averaged increases in sediment thickness will be on the order of a few inches. Some of this sediment is expected to deposit in pools, particularly in the 2 miles downstream of Iron Gate Dam, but subsequent small to intermediate-sized floods will flush this material in the following years. This pool filling is not anticipated to significantly impair drafting capabilities in this reach and should only impact approximately 6 of the 96 inventoried existing pools.

New Klamath River drafting sites will be exposed in the reservoir footprints from upstream to downstream during drawdown in the first year of dam removal. In the reservoir footprints, the Klamath River will be confined by either bedrock or steep canyon valley walls, so the channel will readily reoccupy its historical planform and will not be prone to lateral migration or shifting. As such, the predicted location of drafting sites and timing of their availability in the first year of dam removal is constrained, and the locations and quality of the dip sites will be stable in the long-term.

The Renewal Corporation will implement the maintenance of aerial river access points (2 per reservoir), which are locations in the free-flowing Klamath River that will meet the rotor safety clearance performance criterion for large Type 1 snorkel helicopters. While there are a range of helicopter sizes and drafting mechanisms used for firefighting, California is increasing its number of these larger aircraft that require more space to safely draft water. Wetland vegetation will be present in the reservoir footprints and will generally be appropriate for meeting the safety clearance criterion because such vegetation generally lacks woody species and does not grow as tall. Because the valley morphology will allow the channel to readily reoccupy its historical pathway in the first year of removal, aerial river access points can likely be identified in the field during the first year of drawdown. It is also likely that many additional locations will naturally meet the safety clearance criterion in the first two years of dam removal as riparian vegetation is just beginning to establish. Smaller helicopters with buckets will be able to safely draft from many locations in the Klamath River even after taller permanent woody vegetation is present. Therefore, both large and small helicopters will have safe dip locations in the Klamath River beginning in year 1 of dam removal.

Aerial Fire Suppression from Fixed-Wing Aircraft

Fixed-wing aircraft are an important part of the regional firefighting regime. While the reservoirs will no longer be available for drafting from fixed-wing aircraft, these aircraft have represented only a small fraction of the firefighting aircraft on recent fires and are primarily designated for dropping fire retardant as most do not have the capability to draft water by skimming the surface of a reservoir. The Proposed Action does not affect the ability of fixed-wing aircraft not drafting from bodies of water to return to regional bases to refill retardant or water. The availability of large airtankers has become very limited in recent years as much of the national fleet has been grounded due to new requirements and regulations (WFT, 2016). As of 2016, only a dozen fixed-wing aircraft were stationed in southern Oregon and northern California, and all but 3 or 4 of these were not used for dropping water or retardant (WFT, 2016). Historically, the Klamath Falls airtanker base had two airtankers and a lead plane during fire season, but now is primarily used as a retardant reload base and only houses one Type 1 Air tactical plane (WFT, 2016).

The very large airtankers (Douglas DC-10 and Boeing 747; 12,000 - 24,000 gallon capacity), most large Type 1 airtankers (e.g., Douglas DC-6 and DC-7; Lockheed C-130 and P-3 Orion) and many smaller Type 2 and 3 airtankers (e.g., Grumman S-2T; Lockheed P-2 Neptune) are used primarily for dropping retardant and cannot refill by skimming on reservoirs (CalFire, n.d.). A small subset of the medium and small fixed-wing aircraft fleet can draft by skimming water from reservoirs. These include the Martin Mars Type 1 Air Tanker (7000-gallon capacity), Type 2 Canadair/Bombardier CL-215 and CL-415 "Superscooper" or "Canadian Water Otter" (1621-gallon capacity), and the Air Tractor AT-802 "Fire Boss" (800-gallon capacity) (CalFire, n.d.). The tank capacity of the Superscooper and Fire Boss are smaller than the more commonly used Type 1 helicopters, which have capacities up to 3000 gallons.

CalFire prefers helicopters to smaller water drafting aircraft because they have larger capacity and can draft from smaller locations (Porter, T. written communication. April 16, 2020). While fixed-wing aircraft are instrumental in their ability to drop large volumes of retardant, most firefighting aircraft are helicopters. Furthermore, the fixed-wing aircraft that are capable of drafting from reservoirs can still draft from Lake Ewauna and Upper Klamath Lake with limited additional travel time depending on fire location.

Loss of the Reservoirs as a Fuel Break

The three reservoirs have also provided a broad fuel break to halt wildfire spread. Following drawdown, the reservoirs will gradually be replaced with vegetation. Revegetation of the exposed reservoirs will be initiated during reservoir drawdown as land is exposed, but fuel loads will be small the first year or two as it takes time for the vegetation to establish in the fine-grained remnant reservoir sediments. During this transition period, the ignition risk and potential fire severity in the reservoir footprints will be low, the reservoir areas will continue to function as a partial fuel break, and vegetation will not hinder helicopter access to any drafting sites in the free-flowing Klamath River. The minor impact on burn probability within the ASE caused by replacing the reservoirs with vegetation is demonstrated quantitatively in the Reax analysis described below.

When vegetation is fully established, the Klamath River will continue to function as a fuel break, albeit a narrower one than the reservoirs. The effectiveness of the free-flowing Klamath River as a fuel break was evident during the 2014 Oregon Gulch Fire, where fire spread along 7 miles of the southern perimeter was halted by the river (Reax, 2020). Similarly, during the 2018 Klamathon Fire, the Klamath River functioned as an effective fuel break for 4 miles of the southeastern perimeter (Reax, 2020). In both cases, the Klamath River functioned as a fuel break for a much greater percentage of the fire perimeters than the reservoirs.

Long-Term Fire Management Measures

As described in the FMP and in cooperation with fire agencies, the Renewal Corporation will implement long-term fire management measures to assure that the loss of the Project reservoirs does not result in an increase in wildfire risk within the 570-square-mile ASE. These measures include the installation of new fire-detecting cameras as part of a monitored detection system (MDS), portable dip tanks and maintained dip sites in the Klamath River for helicopter crews (as described above), and new water access points (i.e., dry hydrants and boat launches) for ground crews. The measures are not intended to replicate the precise fire-management utility of the reservoirs; rather, the measures provide a flexible suite of diverse firefighting tools that will, in the aggregate, offset the loss of the reservoirs in terms of wildfire risk.

Resources available for initial attack or a sustained fire suppression effort vary widely depending on locality, time of year, and the distribution of resources to other fires. The Renewal Corporation's long-term measures help manage this variability by meeting broad objectives for improved firefighting resource availability and decreasing ignition risk in the Basin relative to the status quo. Details regarding the measures are provided below as well as in the FMP.

Monitored Detection System

A critical component of the overall long-term fire management strategy is reliable, rapid fire detection following an ignition, including accurately placing the ignition location and prompt notification of responding authorities. The shorter the length of time between fire start and fire detection, the higher the probability of a successful initial attack. It is much cheaper and easier to suppress fires when they're small. The largest campaign fires are typically associated with extreme conditions (> 90th percentile for fire weather indices) and cannot be suppressed initially (first 48 hours) even with unlimited resources, with near zero percent initial attack success rates. The most effective target for fire suppression is those fires that can be prevented by successful initial attacks (Keating et al., 2012). The quick-burning fuel types and remoteness of the ASE area reinforce the need for rapid detection of wildfires.

The Renewal Corporation will implement the installation of new Monitored Detection System (MDS) cameras throughout the ASE area to vastly improve early detection capabilities and initial attack effectiveness. The MDS technology transmits high-definition video and images via a microwave (as opposed to cellular) communications system from cameras to an integrated Geographic Information System (GIS) platform that is monitored by ODF and CFSU staff. The software that enables this integration also enables triangulation of the fire location if more than one camera or "observer" sees the fire. The MDS cameras can automatically rotate 360 degrees, have an auto-detection surveillance distance of up to 12.4 miles (20 kilometers), and can be manually and remotely controlled. The infrared and near-infrared capabilities allow the cameras to see through haze and nighttime conditions.

The MDS technology is an invaluable addition to the Basin's fire suppression capabilities because it can shorten by minutes or even hours the initial attack response time from fire ignition to arrival of initial attack resources compared to the existing capabilities. Fire suppression personnel in much of the ASE area relies on fielding 911 calls, which may be delayed getting into cellular range and may not have specific information on fire location, thereby requiring a time-consuming search for the fire location in the field. The ASE area is currently monitored by two ODF MDS cameras and two periodically-staffed fire lookouts. The additional cameras implemented as part of the FMP increase the viewshed or total observer coverage within the 570-square-mile ASE from 66 to 92 percent and will increase the ability to triangulate ignition locations (i.e., 2 or more camera observers) from 10 to 50 percent. These conclusions are supported by the numerical modeling and quantitative analysis performed by Reax (described below) and in letters of support from CalFire and ODF. Much of the new coverage is in the southern portion of the Basin, which has a higher concentration of timber vegetation type, so the improved detection in this region will significantly decrease the probability of severe wildfire in an area with greater fuels. The MDS cameras also enable detection at smaller fire sizes than the human eye can detect and will thereby expedite suppression response and increases probability of containment in initial attack. Increased success during initial attack will decrease the costs and damages associated with fighting longer, larger wildfires and may represent significant cost savings for fire agencies over the long-term.

The reductions in times for ignition detection and resources deployment will increase initial attack effectiveness within the ASE despite the impacts of the loss of the reservoirs. The Reax analysis, described in detail below, quantifies the large decreases in wildfire burn probability within the ASE that can result from even modest improvements initial attack containment time. ODF has documented the significant improvements in early detection using the MDS cameras in other locations within their jurisdiction for nearly a decade. There will continue to be plentiful water supply and enough drafting locations to not limit initial attack effectiveness. The improvements in detection and resource deployment time will greatly outweigh the small increases in drafting turnaround time, particularly in the early stages of fire suppression. The increases in turnaround time for drafting may factor into campaign fire firefighting in locations near the existing reservoirs, but the cameras also add situational awareness to improve efficiency of deployed resources during these campaign fires.

Dip tanks

The Renewal Corporation will cover the costs of seven portable dip tanks of varying sizes and styles, with mobile pump systems, to support firefighting efforts within the ASE. Dip tanks are not intended as a replacement for the reservoirs but are a proven method for providing reliable alternative water sources for helicopter drafting and added versatility in rugged and remote terrain. The dip tanks can be deployed in remote areas and either filled by helicopter drafting from the river to provide water supply for ground crews where there is none or can be positioned to pump water from smaller water sources (i.e., creeks) to create a local dip site for helicopters. The Renewal Cooperation's cooperative agreement with CalFire provides for seven portable dip tanks, including five portable, self-supporting tanks (5,000 - 6,000 gallons each) and two portable helicopter sling tanks (350 gallons each) with hoses and pumps for refilling. These tanks can be stored in fire department buildings or in strategic locations along existing roads or in open areas with suitable helicopter clearance within the ASE.

Boat Launches

The Renewal Corporation will construct or improve three boat launches (one near each reservoir) to provide simple and reliable water supply access for ground crews. These boat launches have been designed to meet regulatory and National Fire Protection Association (NFPA) standard requirements (e.g., grade/steepness, width, bearing capacity) for use by firefighting equipment. Drawdown of the reservoirs will be completed in the first year of dam removal, so boat launches will be constructed or improved during this time.

The Proposed Action will result in the decommissioning of several existing boat launches, including two around Copco Lake. However, one of these (Copco Cove) is already too steep to be used by firefighting equipment, and the access road to the other (Mallard Cove) does not meet the width or turning radius requirements for firefighting equipment making access difficult. As a result, the loss of these boat launches will have a minor, if any, impact on firefighting resources relative to the status quo.

Copco Lake Gravity-Fed Hydrant System

The water supply for the existing gravity-fed hydrant system at Copco Lake is maintained by a groundwater-fed storage tank. This system is not expected to be impacted by the Proposed Action, but, if directed by CalFire, the FMP provides for the maintenance of the system's functionality during dam removal.

Dry hydrants

The Renewal Corporation will construct five permanent dry hydrants to provide additional water supply access to ground crews. Dry hydrants are passive, unpressurized water supply systems with a screened intake placed in the channel above the channel bed in a location of satisfactory water depth, flow rate, and channel stability. Dry hydrants have an above-ground fire hose connection to which truck mounted pumps can be connected. The dry hydrants will be placed at or near bridge crossings over larger tributaries with perennial flow with minimum flow rates of several cfs or greater. Dry hydrants will be designed, permitted, and constructed to meet NFPA standards and in coordination with landowners and fire agencies using the resource. The selected tributary locations should not be impacted by drawdown of reservoir water levels, and dry hydrants will be constructed in the first year of dam removal.

The suitability of the dry hydrant locations and water sources with respect to the NFPA standards were field checked in late summer during low flow conditions. While most of the sites met the standards, several site constraints and limitations were identified. NFPA standards for minimum flow depth and rate are 3 ft and 2.2 cfs, respectively, and each hydrant location should be able to provide these values most of the year. The NFPA maximum lift height (i.e., distance from intake to hose connection) reference value is 10 feet, although greater lift heights are possible depending on vehicle pump specifications. The lift height at each hydrant location is less than 10 ft, except at Deer Creek, which may exceed the maximum value of local firefighting equipment. Ease of access to the Deer Creek hydrant, which is located adjacent to a county road, is limited by turnaround space, which measures 55 ft locally. The Beaver Creek hydrant is accessed by a gravel road that meets the 12-foot width NFPA standard, and a suitable turnaround is located 200 feet to the southwest.

The dry hydrants are new resources to the reservoir areas and provide an additional alternative for water supply that does not currently exist. There is currently no avenue for ground crews to access a water source near the Beaver Creek location on the north side of Copco Lake, for example, so the dry hydrant provides a valuable resource. Site constraints may limit some functionality at the Deer Creek location, but it still represents a new water source that was not previously available, and designs can be modified to, e.g., reduce lift height, if necessary, to comply with the capabilities of local and agency firefighting equipment.

Reax Methodology

As discussed above, Reax employs probabilistic, Monte Carlo numerical modeling techniques to generate robust statistical evaluations of fire risk using state-of-the-science wildfire process formulations, detailed site-specific datasets, and high-powered computing. Monte Carlo simulations, in which fire spread is modeled from tens of thousands of separate ignition locations under a range of weather conditions, are one of the most powerful tools for quantitative wildland fire risk/hazard assessment. Monte Carlo fire spread modeling is an accepted standard for wildfire risk evaluation, and these modeling techniques are now being applied in regulatory proceedings. Monte Carlo wildfire spread modeling has been recently vetted by the CPUC, eight public utilities like PacifiCorp, and fire agencies such as CalFire. Reax is part of the Pyregence consortium, which is currently integrating this type of modeling into real-time wildfire risk forecasting for the entire state of California and southern Oregon in a project funded by the California Energy Commission to inform proactive de-energization decisions. This type of sophisticated wildfire modeling and risk analysis has never been applied to evaluate the wildfire risks associated with dam removal or management and is a significant advancement relative to qualitative evaluations.

Wildfires are unique and each situation is different, so while examination of past wildfire events is informative, they are not necessarily representative of overall conditions or risk. Wildfire is influenced by a complex interaction of many variables. While qualitative relationships are important, all of the influencing variables must be incorporated over a range of their conditions to understand the overall impact. In this respect, probabilistic models are an effective tool to quantitatively evaluate wildfire risks. Most documented fires within the ASE over the last 50 years are small, except for the 2014 Oregon Gulch and 2018 Klamathon fires. These two fires, which are examined in detail in the Reax report, were large, rare events caused by extreme fire weather (i.e., strong winds with hot, dry conditions). The Reax methodology models fire spread for a range of conditions, including these types of extreme weather events. Consequently, such rare and large events are included in the Reax results and statistics.

Reax ran two sets of simulations to quantify the impacts of the Proposed Action on landscape-scale burn probability in response to 1) creation of addition burnable landmass in the reservoir footprints, and 2) reductions in detection and travel times from the impact of the measures on initial attack success rate. Burn probability is a quantitative measure of the likelihood that a point on the landscape will be impacted by a fire during a given period of time. The modeling methodology uses a real terrain model of the 570 sq. mi. ASE area and simulates wildfire spread over the landscape for hundreds of thousands ignition locations. For each model run, real historical weather conditions (high resolution, hourly gridded data for wind speed and direction, temperature, humidity, and dead fuel moisture) are randomly selected from a severe “fire weather days” subset of local climatology data compiled from the last 41 years. Each ignition location is generated randomly from the historical ignition density record. Real spatial vegetation data for the ASE area is used and influences fuel load and fire spread rate. The burn probability at each location is the number of times each point on the landscape burned in model runs divided by the total number of model runs and results in a spatial distribution of burn probability. The model will produce spatial variability in local burn probability, but the focus of the analysis is primarily on burn probability at the landscape scale, i.e., for the entire ASE area.

In the first set of simulations, Reax modeled both existing “pre-restoration” conditions with the reservoirs present and a “post-restoration” scenario where the reservoirs have been replaced with vegetation. The Project reservoirs serve as a fuel break that can halt the spread of wildfires and as land area excluded as ignition origins. The Reax modeling demonstrates quantitatively that the Proposed Action and the replacement of the reservoirs with vegetation will cause an insignificant (< 1%) increase on mean burn probability within the ASE. The local burn probability increases in the reservoir footprints as expected, but these increases are within the range of stochastic changes to burn probability across the ASE area.

The environmental conditions related to naturally-caused fire ignition (e.g. lightning, high temperatures, high wind speeds, and drought conditions) will be unaffected by the Proposed Action, and the human-caused ignitions may decrease with the removal of over 15 miles of transmission lines and 160 power poles. There is an increased risk of lightning striking fuel sources rather than water with the loss of the reservoirs, and this risk is captured in the Reax analysis. However, lightning tends to strike the highest objects in the landscape, so the risk of strikes occurring in the “post-restoration” Klamath River valley bottom are lower. As a result, the Reax analysis demonstrates that burn probability within the ASE is relatively unaffected by the replacement of the reservoirs with various fuel sources.

In the second set of simulations, Reax enabled modeling of initial attack and fire suppression to investigate the effects of the proposed early detection cameras on initial attack success and burn probability. Modeling showed that small reductions in initial attack arrival time after fire ignition more than compensate for the modeled <1% increase in burn probability associated with removal of the reservoirs. For example, reductions in average arrival from 30 minutes to 20 and 25 minutes result in decrease in modeled mean burn probability of 34% and 7%, respectively, within the ASE. Fire detection and reporting times will, at worst, remain unchanged as a result of the Proposed Action, but are more likely to decrease significantly as a result of the increased coverage of the MDS camera system. As a result of the Proposed Action, travel times by responding units will be relatively unchanged, and there will be ample water availability for firefighting purposes for the initial attack. Therefore, mean burn probability within the ASE should decrease as a result of the proposed long-term management measures relative to the status quo.

While the Reax modeling does not expressly forecast the impacts of climate change on environmental variables, such an effort would not qualitatively change the results of the analysis. Reax used only extreme fire weather conditions from the historical record for their analysis. More intense or more frequent occurrence of extreme fire weather, which are some of the predicted climate changes, do not fundamentally change the result that improved initial attack success decreases burn probability. If anything, early detection and initial attack success becomes more critical under the forecasted climate changes. Increases in lightning frequency and ignitions would likely continue to follow historical spatial distributions and with more ignitions, the improvements in fire detection become more impactful. Goals of the modeling and the FMP include analyzing impacts of the Proposed Action relative to the status quo, not future conditions of variable certainty. Furthermore, the Monte Carlo modeling requires high-resolution environmental data, and regional climate predictions are only available at a much coarser resolution. The application of coarser climate predictions to the high-resolution historical data has additional uncertainties and limitations. The results of the Reax analysis remain qualitatively unchanged if climate change simulations are incorporated, and the impacts of the long-term management measures, particularly the MDS cameras, become more valuable.

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CERTIFICATE OF SERVICE

I hereby certify that, on this 14th day of June 2021, I have served the public filing of Supplemental Information: Cover Letter and RDG Technical Memo Regarding Fire Management regarding FERC Project Nos. P-14803-001 and P-2082-063 via email containing a link thereto, or via U.S.P.S. if no email address was available, upon each person designated on the official service list compiled by the Secretary in these proceedings.

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