

TRUCKEE TAHOE AIRPORT DISTRICT BOARD OF DIRECTORS AGENDA ITEM SUMMARY

Topic: Waddle Ranch Forest Management

Purpose	Information:	Guidance:	Decision: XX
Recommendation	<ol style="list-style-type: none"> 1. Accept the integration of the estimated road improvement cost of \$100,000 into the Waddle Ranch Long Term Forest Management Plan (FMP) dated April 15, 2013, (Exhibit A&B.). 2. Approve the final, updated Forest Management Plan dated April 15, 2013. 3. Release funding flagged in line 134 of the adopted Truckee Tahoe Airport District budget for fiscal year 2012-2013 for the purposes of executing work outlined in the FMP Table 6: Year 2013 Unit 13 in the amount not to exceed \$25,000. 		
Last Action	<p>At the April 25, 2013 regular meeting the Board of Directors accepted the Waddle Ranch Long Term Forest Management Plan (FMP) with direction to staff. The Board requested additional information regarding the road improvement integration of the Truckee River Watershed Council Mid Martis Restoration Project with the anticipated Waddle Ranch lower access road repair.</p>		
Discussion	<p>The Waddle Ranch Long Term Forest Management Plan (FMP) dated April 15, 2013 remains unchanged including total allocation for annual forestry projects. The total Land Management allocation for FY 2012-2013 is \$100,000. Of this, \$50,000 is allocated to airside operations for obstruction (tree) removal to the north of runway 11/29. The remaining \$50,000 is allocated to all other lands. At the April 25, 2013 regular meeting, the Board moved to approve an expenditure in the amount of \$10,000 payable to the Truckee River Watershed Council (TRWC) for the hydrologic study necessary for design of the Mid Martis Restoration Project. Since that time, staff has worked directly with the TRWC to adjust the project boundary and gain the necessary permission from the Army Corp of Engineers to improve the portion of the road that resides on their land. The TRWC has released the MidMartis Restoration RFP. This document includes the Waddle Ranch lower access road within the project boundary. Following discussions with the TRWC, it has been determined that cost associated with the extension of the project boundary, including permits and engineering, are estimated to be less than \$10,000. No invoices are currently pending for this work but an allocation of funding from the flagged lands management budget will be requested in August or September. This allocation is outlined in exhibit A line 23, "Estimated Road Repair Cost".</p>		
Fiscal Impact	<p>No budgetary increase.</p> <p>Allocation of \$25,000 from flagged line 134 'Land Management' to execute work outlined in FMP Table 6: Year 2013 Unit 13.</p> <p>Allocation of surplus funds from airside operations obstruction removal to fund work outlined in the FMP Table 6: Year 2013 Unit 13.</p>		
Communication	Strategy	<p>Communication of project details handled through partner agency, Truckee River Watershed Council. Request for Proposal covering work affecting District lands is posted on the TRWC website at http://www.truckeeriverwc.org/news/223. Cal Fire permits process dictates publication under certain treatment prescriptions; it is currently unknown if publication of treatment areas is required. Possible e-blast or newsprint publication if required.</p>	
Attachments	<p>Exhibit A 13-Year Forest Management Activity Tracking and Cost Summary Exhibit B Waddle Ranch Access Road Project Cover Exhibit C Maps Exhibit D Waddle Ranch Forest Management Plan dated April 15, 2013</p>		

EXHIBIT A

Table 6: 13-Year Forest Management Activity Tracking and Cost Summary

13-YEAR FOREST MANAGEMENT ACTIVITY TRACKING AND COST SUMMARY															
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	20-year Treatment Cost By Unit
Unit															
1		\$105,000							\$105,000						\$210,000
2															\$0
3					\$70,500					\$70,500					\$141,000
4															\$0
5															\$0
6				\$52,500					\$52,500						\$105,000
7								\$72,000						\$72,000	\$144,000
8			\$57,600					\$54,000							\$111,600
9					\$260,800										\$260,800
10								\$105,600							\$105,600
11A		\$52,800						\$49,500				\$49,500			\$151,800
11B		\$9,000													\$9,000
11C								\$10,500							\$10,500
11D								\$48,000							\$48,000
12						\$168,000									\$168,000
13	\$25,000					\$69,000					\$69,000				\$229,500
14				\$106,200											\$106,200
15			\$112,000												\$112,000
Total Treatment Cost, All Units, All Yrs	\$25,000 \$29,500 obstruction	\$166,800	\$169,600	\$158,700	\$331,300	\$237,000	\$155,100	\$184,500	\$157,500	\$70,500	\$69,000	\$49,500	\$0	\$72,000	\$1,009,300
Estimated Road Repair Costs	\$20,000	\$80,000													\$100,000
Estimated Permitting Cost	\$20,107														\$90,000
Total Cost	\$94,607														\$1,199,300
Average Total Cost, Per Year															\$92,254
KEY:															
Initial Treatment Cost															
Rx Fire Cost															

Exhibit B

Project: Waddle Ranch Access Road	
Acres: Length	Less than one mile
Treatment Method	Grading, drainage repair, culvert installation, base improvement, erosion control
Estimated Treatment Cost:	\$100,000
Permit Required	<p>Lahontan Regional Water Quality, Placer County Grading permit, State of California Dept. Fish & Wildlife streambed alteration agreement, 401 Water Quality Certification, NPDES Small Construction Permit, Federal Nationwide 27 Authorization from the U.S. Army Corp of Engineers. California Environmental Quality Act, National Environmental Protection Agency.</p> <p>Truckee River Watershed Council as the acting lead agency/organization will handle the permit compliance. Verified by TTAD staff.</p>
Permit/Forester Cost	<p>\$4000 for North Valley Resource Management \$5000 for Truckee River Watershed Council **(included in 'Estimated Treatment Cost')**</p>
Current Condition	<p>Poor. Road lacks standard conditions to allow for safe passage. Road has been a determinant factor in erosion and sediment transportation to surrounding watercourses. Road does not support the management objectives and goals outlined in the Strategic Plan area 3.2.</p>
Photo	
Timeline	2013 & 2014

EXHIBT C

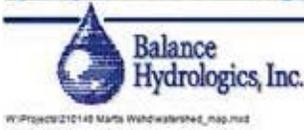
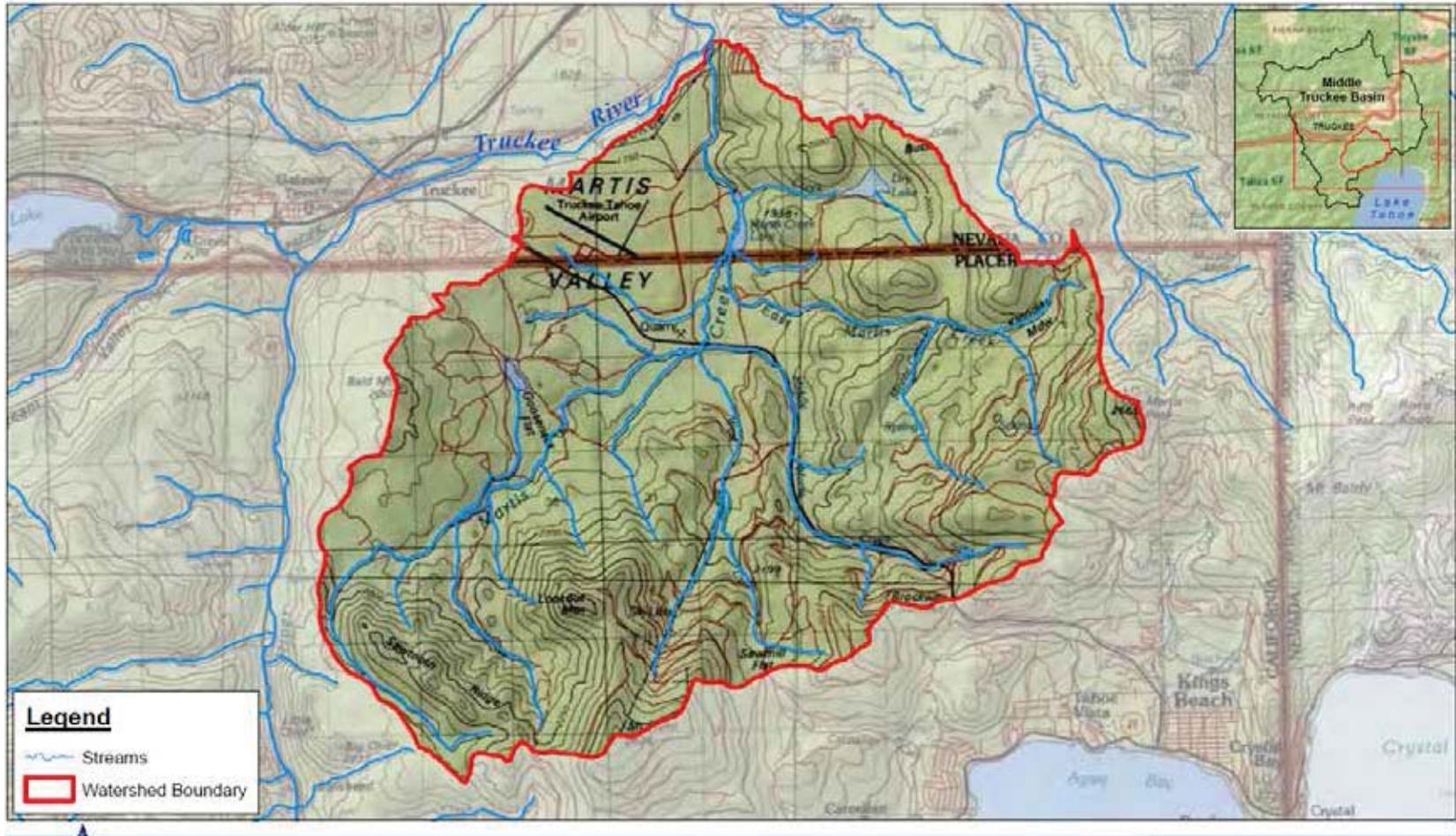
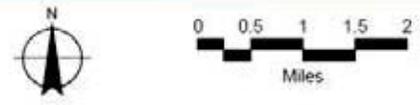


Figure 1. Overview Map - Martis Creek Watershed. The general project area is circled in red. See Figure 2 for an aerial of the project site.



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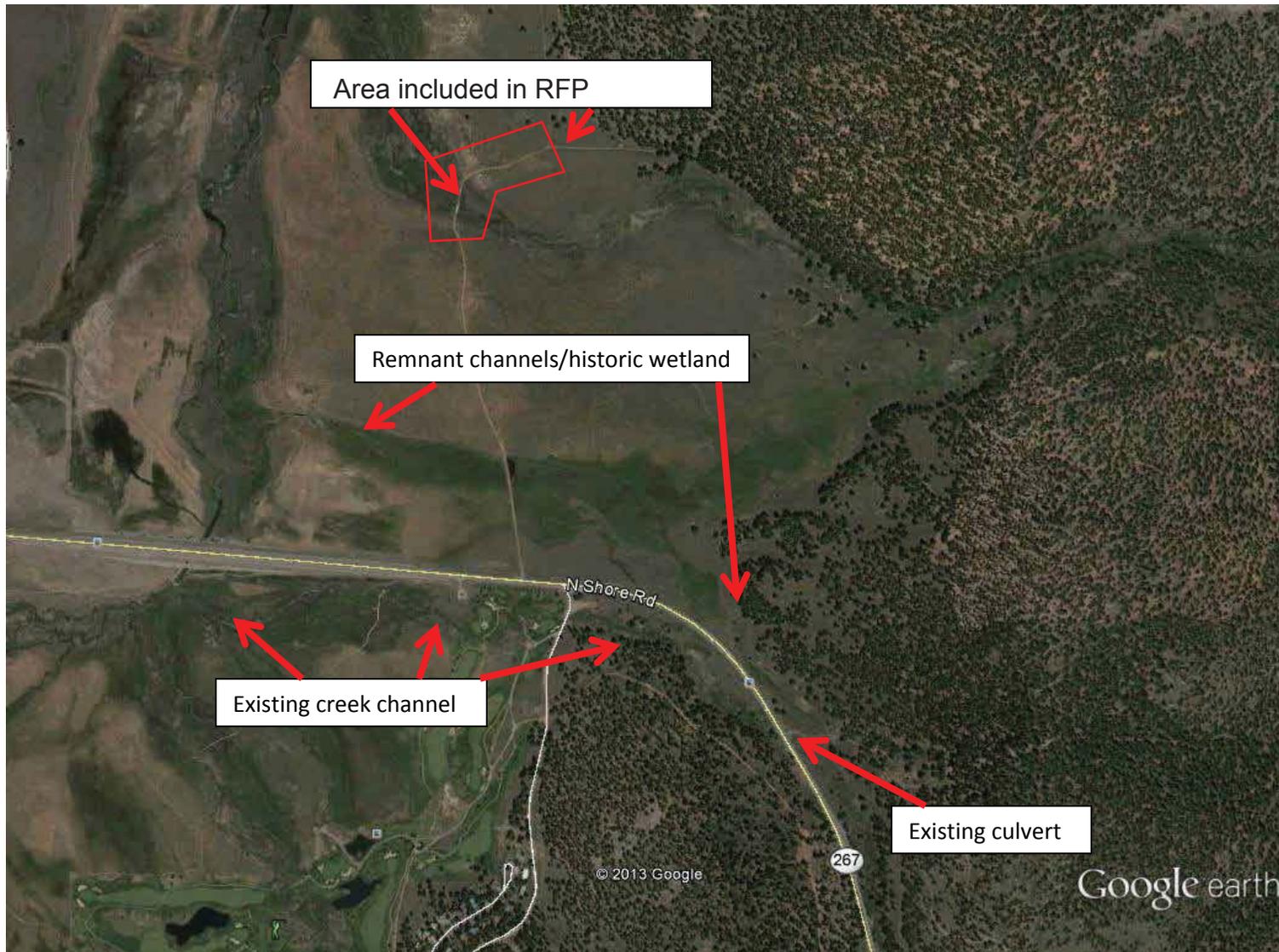
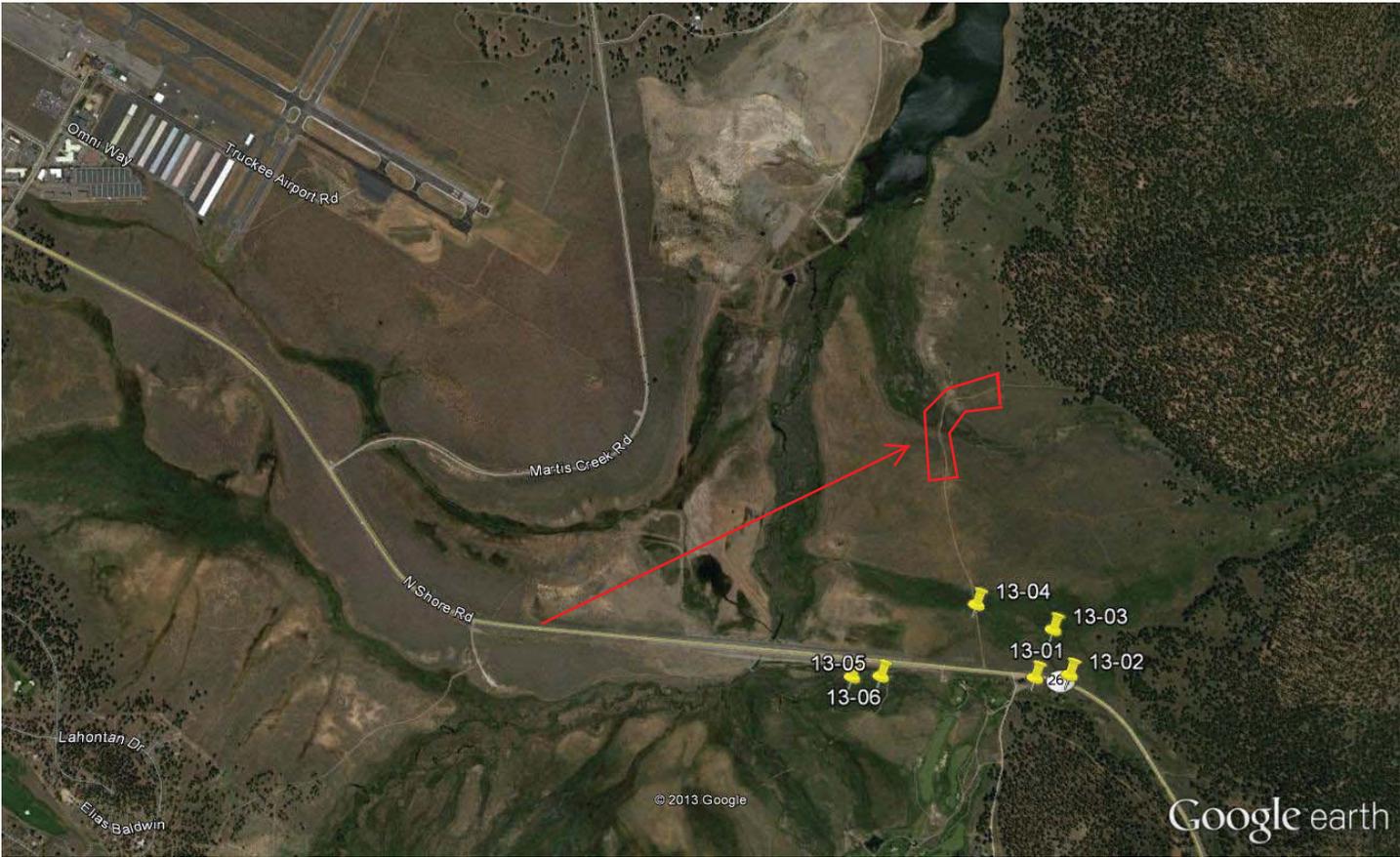


Figure 2. Project Area. Key project features are called out. The Concept Design (Attachment 1) does not include design recommendations for the northern portion of the Waddle Ranch road, shown near the top of the photo.



Red area outlined and indicated by arrow is the additional road areas being treated under the TRWC MidMartis RFP. Yellow pins are shallow monitoring wells installed in April 2013.

EXHIBIT D

WADDLE RANCH LONG TERM
FOREST MANAGEMENT PLAN

April 15, 2013



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I. Introduction to Waddle Ranch

A. Setting

Waddle Ranch Preserve is a 1,462 acre ownership located in the Martis Valley, near Truckee, California. The Preserve contains Jeffrey and Ponderosa Pine forests, sagebrush scrub, meadow, lake, and riparian areas. Elevations of the site range from 5900 feet to 6700 feet above sea level. Slopes are generally less than 30%, though select steep pitches up to 50% exist. The Preserve is generally oriented towards the west/northwest and southwest. Soils are volcanic in origin and typically sandy loams. Four ephemeral watercourses drain the ownership, and Dry Lake, a manmade feature, is a unique water resource present in the northeast corner of the Preserve. The site experiences large differences in seasonal temperatures and precipitation patterns. Average high summer temperatures reach 90 degrees farenheight in contrast to winter high temperatures of less than 40 degrees. The majority of precipitation on the Preserve falls as snow during the winter months. The Preserve is bound by State Route 267, and large parcels owned by the US Army Corp of Engineers and Sierra Pacific Industries.

B. History of Project and Land Uses

Native American use of the Waddle Ranch Preserve for hunting and fishing is thought to broach a 3000 year period (North et.al 2012). Of more recent history, the Preserve was utilized in part for cattle ranching until 1964, when the ownership was purchased by Fibreboard for industrial timberland management. The US Arch Corp of Engineers also acquired a portion of the ownership to provide for flood control , which is now held as the Martis Creek Lake National Recreation Area and the Truckee Tahoe Airport (North et.al 2012). The remaining 1,462 acre parcel was purchased in 2007 by the Truckee Donner Land Trust and the Trust for Public Land, with title being transferred to the Truckee Tahoe Airport District in 2009. A Conservation Easement if held on the property to prevent land uses that conflict with maintaining and restoring the natural resource values and attributes of the parcel.

C. Conservation Strategy

As stated in the Conservation Easement held for the Waddle Ranch Preserve, the property possesses significant natural, ecological, and aesthetic values for conservation purposes. Further, the property holds scenic, open space, and non-motorized recreational values for the public at large. As such, current and future uses of the property are to be maintained in perpetuity in a manner that is consistent with the preservation and protection of the aforementioned conservation values.

Consistent with these values, the goals for the Waddle Ranch forests are to 1) Maintain the Preserve in a native condition, including conserving wildlife habitat, aesthetics, flora, fauna, soils, water quality, and historic/prehistoric cultural values, 2) Restore the forest preserve to a viable and sustainable old growth condition, 3) Provide open space and recreational opportunities for local residents and tourists, and 4) Sequester carbon from the atmosphere and prevent undue release of carbon through wildfire, undue harvest, insects, and disease. The proposed future forest management projects contained within this report are consistent with the Conservation Easement Values and Purposes, and have been developed to attain the aforementioned goals and desired future condition for Waddle Ranch.

D. The Role of the Management Plan

A Forest Management Plan should be a guiding document for a forest landowner. The Plan should provide sufficient historical and resource baseline data to provide all of the information needed to guide management decisions as they relate to forest health, longevity, and additional landowner objectives. The Plan should properly inventory the ownership in regards to site conditions, forest health issues, and habitat. From existing baseline data provided in previous Management Plan versions, and in conjunction with current inventory data and the best available science, the needs of the forest land can be determined.

Specific management activities proposed in the Plan will support landowner objectives and the needs of the forest. Ideally, management activities are ranked on a scale of priority, which is established collaboratively between the landowner, the forester, and other land managers involved with the ownership. The Plan should also present alternatives to management activities such that the management is adaptive instead of prescriptive, hence truly catered to the unique characteristics of the site. Further, these alternatives should also account for factors such as economic feasibility of each management action, products markets (if applicable), and cumulative impacts to the subject ownership and surrounding lands.

A Management Plan is visionary document, unique to the forest land it covers as well as the landowner. It ultimately provides a framework to the goals and objectives held by the landowner for their forest land.

II. Forests at the Waddle Ranch

A. Fire History

The Waddle forests have been subject to over a century of fire suppression, alike most Sierra Nevadan forests. Due to this lengthy suppression, fuel loads have reached dangerous levels, and stem density has proceeded uninhibited, resulting in excessive stand density. These forest conditions predispose the conifer stands to damage from pests, pathogens, and large-scale high intensity fires that can significantly alter ecosystem processes. Historically, eastern Sierra Nevadan Jeffrey Pine forests burned every 5-18 years (North et.al 2012). According to the US Forest Service's Fire Return Interval Departure system of classification, forests that miss two or more fire events are considered at moderate to high risk of wildfire, and the Preserve is consistent with that classification.

B. Forest Harvest History

The forests at Waddle were historically logged as part of the late 19th century mining and railroad industries. With purchase by an industrial timberland owner in 1964, the stands were selectively thinned for a period of approximately 30 years. Most recently, in 1997 approximately 5 million board feet of timber was harvested, followed by 378 acres of fuel reduction during 2009-2010 that removed many of the stand's suppressed and intermediate trees. Non-commercial forest management projects have also occurred on the ownership within the last 5 years, where mechanical mastication was applied.

C. Current Conditions

i. Results of 2008 Forest Inventory:

During preparation of the 2008 Long Term Forest Management Plan, an extensive inventory was conducted of current forest conditions. Given the fire suppressed nature of the untreated forests at Waddle, conifer growth is not expected to significantly change on an annual basis due to suppressed growth rates. As such, a reinventory of untreated stands is not necessary with this 2013 revision as substantial changes to conifer growth are not anticipated within the 5 year span since the Plan's first version was released.

During the preparation of the 2008 Waddle Ranch Long Term Management Plan, the ownership was stratified into 4 Management Units. The intent of this stratification was to provide a basis for the planning and

scheduling of future forest management projects according to the different stand types present within the ownership.

The aforementioned stratification, though simplified in relation to current science, yielded valuable information that should be considered along with science made recently available when making forest management recommendations. In summary, the 2008 stratification provided the following information:

- *Site Classification*: Though there are slight variations to site index within the 4 management units, it is not significant enough to alter site class from one stand to the next. Hence, site classification remains constant across the ownership.

- *Species Distribution*: The forests at Waddle Ranch are dominated by traditional eastside pine/Jeffrey pine with a White fir component comprising nearly 20% of the Ranch forests. Ponderosa is the largest component at 56% with Jeffrey Pine occupying 24% of the stands.

- *Conifer Regeneration*: During the 2008 forest inventory, 50% of the regeneration sample plots were stocked with seedlings. Regeneration inventory indicates there are 135 seedlings per acre. Of this amount, 64 are white fir, 54 seedlings are Ponderosa Pine, and 17 are Jeffrey Pine. The results of this inventory indicate that natural regeneration is sparse, and is significantly comprised of White fir, the least desirable species for forest resilience to fire, drought, and return of natural fire regime.

- *Basal Area and Number of Trees By Species*: The 2008 forest inventory indicated the forests of Waddle Ranch are most heavily occupied by trees 13" to 21" DBH. Any given forest has a maximum basal area, regardless of tree size, that it can sustain given the available water, nutrients, and sunlight of the site. The established theory of forest thinning is that a forest of small trees thinned below its maximum basal area capacity will, under ideal circumstances, recover by adding basal area to the remaining trees, resulting in a forest with a structure of fewer, but larger trees.

- *Dead Trees; Standing Dead and Stumps*: The 2008 forest inventory indicates that though the presence of standing dead trees and stumps is highly variable across the Waddle Ranch ownership, the average Above and Below Ground Biomass is not

highly variable between Management Units. Though this information is useful in the strategic planning of future fuels reduction projects, it does not indicate that any one unit should be given priority of treatment above any other based on this criterion alone.

- *Down logs*: Down woody debris greater than 3' in length and 3" in diameter was inventoried during the 2008 Waddle Ranch inventory. As with dead trees, down woody debris was highly variable across the ownership, largely due to the spotty nature of insect attack and disease kill and consequent blow down. As with dead trees, the inventory results do not indicate that any one unit should be given priority of treatment above any other based on this criterion alone. Rather, efforts are better spent controlling the damaging agents (insect and disease) that cause tree mortality and the subsequent dead and down material.

- *Understory Vegetation*: According to the 2008 forest inventory, shrub cover is rather evenly distributed amongst the Management Units, covering 21%-26% of a given unit. Bitterbrush (*Purshia tridentata*) was the most abundant shrub species, yet sagebrush (*Artemisia tridentata*) and Manzanita (*Arctostaphylos patula*), and squaw carpet (*Ceanothus prostrates*) also had presence within the Management Units. Average shrub height is approximately 1.9 feet tall.

Though the intent of the original 2008 stratification remains valid, new science has become available that encourages additional stratification in effort to better provide for wildlife habitat and ultimately restore an active fire regime, as described in this document.

ii. Results of 2012 Inventory of Treated Stands:

Analysis of current increment core samples from previously thinned stands indicate that tree growth increased immediately in response to the thinning. It can be inferred that dominant and codominant residual trees would continue to respond to the future thinnings in a similar manner. Such growth is an indicator of increased tree vigor, and is in consistent with the overall forest restoration goals for Waddle Ranch, which includes the attainment of old growth conditions.

The tree growth within untreated stands is significantly constrained due to the overstocked nature of the stands. Due to fire suppression, smaller

trees that would normally have been consumed by low intensity fire have remained in the stand, creating generally dense and overcrowded conditions for tree growth. These conditions adversely affect the overall stand vigor as the number of trees exceeds the available water, nutrients, and sunlight required for optimum conifer growth. Conifer growth will continue to be greatly reduced, or stagnant, in the absence of management activities that reduce the stand density to levels that which the site can support.

Table 1: Stand Conditions

STAND CONDITIONS – TREATED 2012									
Year	Stand Age	# Trees/Acre	BA (ft ² /acre)	SDI	CCF	Height	QMD	Accretion	Mortality
2012	0	73	101	154	32	69	15.9	138	3
2013	1	73	104	158	32	71	16.2	165	4
2023	11	137	140	227	44	87	13.7	186	5
2033	21	134	176	272	52	100	15.5	200	7
2043	31	131	210	311	59	111	17.1	201	28
2053	41	122	235	336	62	120	18.8	193	40
2063	51	113	255	353	65	127	20.3	N/A	N/A

BA = Basal area per acre, expressed in square feet per acre.

SDI = Stand Density Index, and numeric metric

CCF = Crown Competition Factor, expressed numerically on a scale of 0-100

Height = Tree Height, expressed in feet.

QMD = Quadratic Mean Diameter, expressed in inches; the diameter of the tree of mean basal area in the stand.

Accretion = Growth of trees in a given space during a stated time period, expressed in board foot volume per acre.

Mortality = Tree death expressed in stems per acre.

The summary of stand conditions above yields quantitative information on the following trends:

- a. Stand basal area, stand density, crown competition factor, tree height, and quadratic mean diameter all increase over time. The percentage of increase of these metrics within the treated stands well exceeds those of the untreated stands, and conifer growth has been enhanced by the process of thinning, which reduced intertree competition.
- b. The number of trees per acre starts to decline in 2033, which indicates that growth has been maximized at that point, and that competition is adversely affecting the stand. This reduction indicates a second thinning should occur at or prior to this time.
- c. Accretion also starts to decline in 2043. This reduction again reinforces the concept of maximized stand growth at this time, and suggests a management action, such as thinning to reduce stand density, is required at or prior to this time.

d. Mortality increases significantly by year 2043 as intertree competition begins to cause a significant reduction in overall stand vigor. As with the number of trees per acre and accretion, this trend in mortality must be addressed by a management action that will reduce the stand density to a level where growth and forest health are maximized.

iii. Forest Disease/Insect Presence:

As expressed in the 2008 Management Plan, the root disease *Fomes Annosus* is widespread across the ownership. Currently, the disease appears to reside in the stumps of trees previously thinned. Application of borax, and antifungal, is necessary in all future forest management projects where trees larger than 12" stump diameter area cut. Borax shall be applied within 2 hours of cutting at a rate of 1 pound borax per 50 square feet of stump surface.

Bark beetle activity remains present in the Waddle Ranch forests at endemic levels. Previous insect attack occurred beyond the endemic level, possibly in response to the drought of 1993-1994 coupled with ongoing *Fomes annosus* infestation. In the future, similar outbreaks can be anticipated in association with drought episodes, with overstocked stands being the most susceptible. The most effective method for protecting a stand from an insect outbreak is to reduce the overall stand density to a level where tree growth and vigor are optimal. In such instance, the weakest suppressed or intermediate trees are selected for removal, making increased water, nutrients, and sunlight available to the residual dominant and codominant trees. This selective thinning will increase the vigor of the remaining trees, making them more resilient to insect attack.

iv. Roads/Water Quality

Access into the Waddle Ranch ownership from Highway 267 has been problematic in the past due to the lack of adequate watercourse crossing facilities/structures, and unmitigated archaeological concerns. The Martis Watershed Assessment aptly describes the various problems present on the main access road to Waddle Ranch: undersized and failing culverts clogged with sediment, an ephemeral drainage that erodes road materials due to no crossing facility present at the crossing site, and lack of road surface drainage resulting in gullies that transport sediment to the lower reach of East Martis Creek. The lack of adequate watercourse crossings and surface drainage, coupled with the unresolved archaeological concern

on the road, allow for continued road and resource damage, and impede effective use of the road by vehicles. To facilitate the implementation of forest management projects, or in the event of fire suppression activities, it is of utmost importance to secure effective access into Waddle Ranch from Highway 267. Though one alternate route is available, use of this alternate road system has proven to be very costly. Specifically, the use of the alternate route for a one-time project has, in the past, cost approximately 50% of the total cost to upgrade the access road into the Preserve. Ideally, instead of continually paying to use alternate routes, that money should be invested in properly mitigating known archaeological, erosion, and watercourse issues on the main access road into the Preserve.

The Martis Watershed Assessment specifies 8 project sites of concern located within the Preserve or its main access road. These sites have been identified on the Waddle Ranch Road & Watercourse Crossing Map, and retained the same identifiers as the Assessment. Improved road drainage (waterbars/rolling dips), improved road surfacing, and/or replacement or upgrade of watercourse crossing facilities are the restorative practices needed at most of the sites, as listed below:

Site A – Replace crossing

Site B – Road surface drainage and road surfacing needed

Site C – Road surface drainage improvement needed

Site E - Road surface drainage and surfacing improvement needed

Site F – Road surface drainage and crossing upgrade needed.

Site G – Road surface drainage and road surfacing needed.

Site H, I – Replace crossing; Road surface drainage needed.

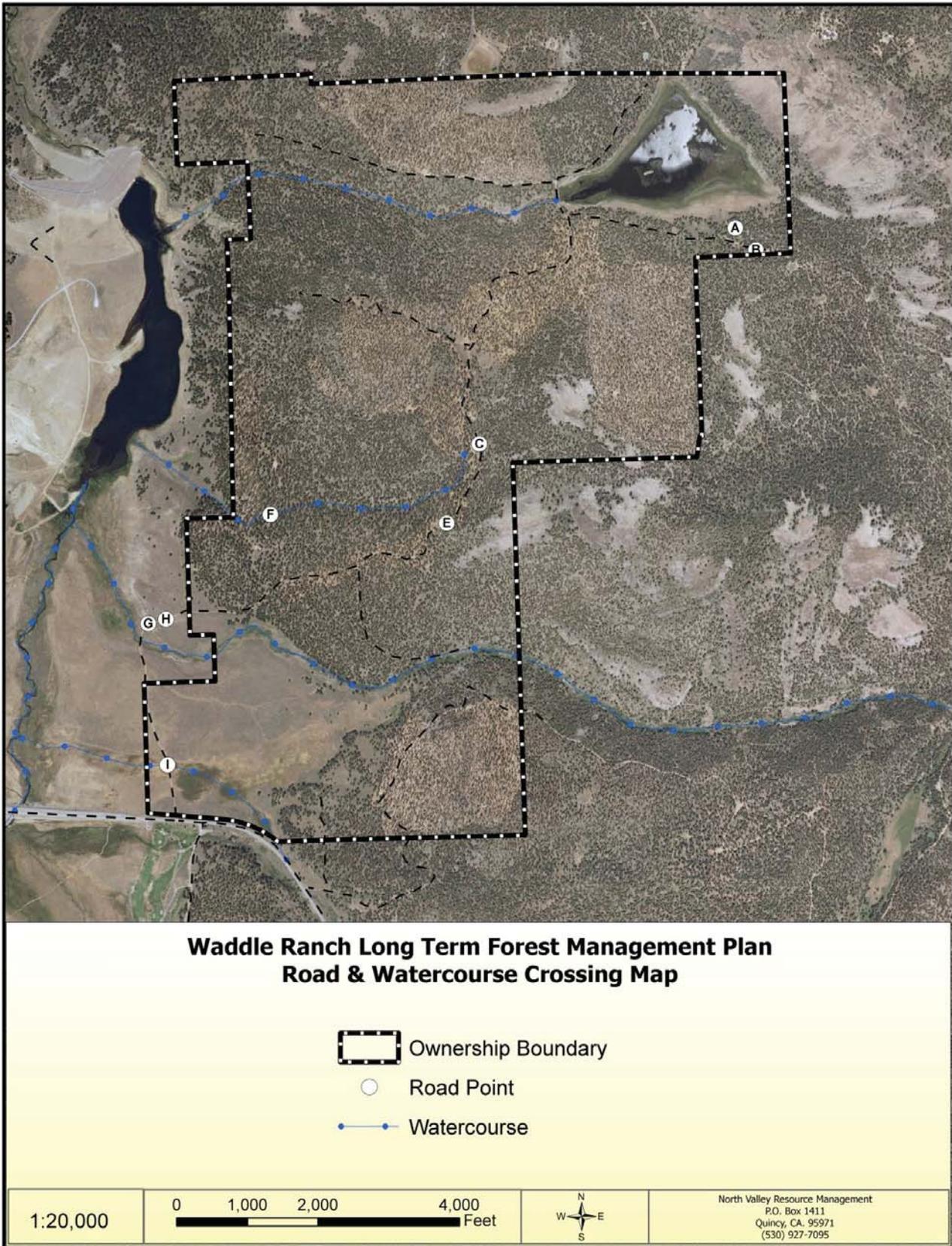
Project sites G and H are each located on land owned by the US Army Corp of Engineer (ACOE). Collaboration with the ACOE will be required to resolve these road issues. The goal of this collaboration would be ultimately upgrade the road to such condition that it provided safe ingress/egress, would not actively contribute sediment to area watercourses, contained properly functioning erosion control features, and provided watercourse crossings consistent with the permanent watercourse crossing standards of the California Forest Practices Act.

Mitigation of the adverse erosion impacts identified in these projects should be undertaken prior to or concurrent with forest management activities, especially mechanical operations where the equipment necessary to perform the mitigations may be readily available as part of management operations.



Figure 1: Rilling on the Waddle Ranch main access road following an August 2012 rainstorm.

Figure 2: Road and Watercourse Crossing Map



III. Best Available Science

A. Government Technical Reports 220 and 237

As Long Term Management Plans can span decades, it is necessary for each Plan revision to address new and current science, and incorporate such science where appropriate. Since the release of the last version of this Plan, a synthesis of the best available science has been made available through Government Technical Reports (GTR) 220 and 237 (North et al 2009). These Reports provide land managers with suggestions for managing forested landscapes that address the cumulative impacts of fuel reduction and management across the forest landscape versus the basic stand level. Specifically, this current research emphasizes a strategic approach to ecological restoration across the landscape, whereby different stand structures and densities will be prescribed across the landscape according to slope, aspect, and habitat considerations. Areas where fire would have burned less frequently or at lower intensity, such as north slopes, would retain higher density canopy cover, providing for wildlife. In contrast, southern-aspect slopes with drier conditions and lower site indices would retain a lower density of trees and increased residual tree spacing.

In contrast to the basic approach to fuel reduction, where a uniform diameter limit or target tree spacing are applied to all conifer stands regardless of slope and slope position, GTRs 220 and 237 suggest a more strategic approach. This approach first emphasizes a focus of what will be retained in a stand, and then suggests implementation of harvest practices to thin around retained forest features according to site specific thinning guidelines. This approach aims to restore the natural fire regime in Sierra Nevada forests, thereby providing for restoration of native species composition, fire resilience, and wildlife habitat.

Information contained in each of these Reports is especially applicable to management of the forests at Waddle Ranch Preserve, and has been incorporated into management recommendations contained within this Long Term Forest Management Plan. Specific applicable scientific principals gleaned from the GTRs that will be incorporated into management prescriptions and practices at Waddle include the following:

i. Increase forest heterogeneity at stand and landscape level using topography as a guide for varying treatments:

Often the implementation of fuel reduction projects occurs with an emphasis on stand-level forest characteristics. This emphasis is irrespective of a landscape level analysis of the impacts of such alteration of stand structure. With a heavy focus on reducing fire intensity and spread, fuel reduction treatment prescriptions often include standardized and uniform diameter limits and target tree spacing, without addressing ecological restoration of the forests and enhancement of wildlife habitat.

Current research on the ecological role of fire, forest resilience under changing climate conditions, and habitat requirements of forest wildlife species, all emphasizes the ecological importance of forest heterogeneity. A forest management strategy that accommodates and provides for enhancement of forest heterogeneity will improve wildlife habitat quality and landscape level connectivity. GTR 220 discusses that mixed conifer forests, under an active fire regime, had naturally clumped distribution containing a variety of size and age classes (North et.al 2009). Management techniques, such as separating trees by canopy strata and using microtopography as a template for determining the extent of thinning, can provide for vertical and horizontal heterogeneity.

For example, to enhance vertical heterogeneity, a group of trees located under the canopy of large overstory trees may be removed to reduce ladder fuels, but that same group of trees if located discretely may be lightly thinned to promote growth or left alone if the clump would not contribute to a hazardous continuity of fuels. This approach would produce within-stand vertical heterogeneity by retention of tree clusters, consistent with forest structure under a natural fire regime. Such approach would also provide for horizontal heterogeneity within a stand.

Using topography as a guide for thinning intensity can enhance horizontal heterogeneity by retaining microsite habitats. For example, limiting thinning to strictly ladder and surface fuels in cooler, wetter areas such as north slopes, seeps, and cold air drainages will retain the integrity of the microsite conditions while still providing for protection from high intensity fire. These areas generally have higher productivity, can support higher stem densities, and frequently have reduced fire effects.

Alternately, upslope areas where site conditions are often hotter and drier, and where fire can burn more intensely with a greater rate of spread, should be thinned to provide for lower stem densities and canopy cover. Tree retention in such areas should focus on retaining fewer, larger trees per acre to provide for more open forest conditions, which will provide not only for stand resilience to fire, but also for increased stand vigor through reduced intertree competition for water, nutrients, and sunlight.

Studies conducted in the Sierra Nevadas have found that mixed conifer structure and composition varied by fire patterns that were significantly influenced by slope position (North et.al 2009). Forests located higher on the slope and of more southwesterly aspect had fires of greater intensity, and hence exhibited more open forest conditions. GTR 220 discusses that topography's influence on fire frequency and intensity shapes the structural condition of Sierra Nevada's forests. Consistent with this principal, landscape level heterogeneity can be created by focusing on the forest conditions that would be created by the fire behavior and fire return interval that would be created by differences in slope position, aspect, and slope steepness. As best stated in GTR 220, *"In general, stem density and canopy cover would be highest in the drainages and riparian areas, and then decrease over the midslope and become lowest near and on ridgetops. Stem density and canopy cover in all three areas would be higher on northeast aspects as compared to southwest. Stand density would also vary with slope becoming more open as slope steepens."*

In conclusion, using the topography and site conditions as template for fuels treatment can provide for increased structural heterogeneity. Planning for enhancing vertical and horizontal heterogeneity will provide for improved habitat quality both within the stand and across the landscape level.

ii. *Actively integrate the provision of wildlife habitat and ecosystem restoration with fuels reduction; Manage for multi-species habitat*

As explained above, providing for heterogeneity within forested stands will provide for improved wildlife habitat. However, providing for wildlife habitat concurrent with fuels reduction will require due consideration of management of large forest structures such as large trees, snags, and downed logs, which provide for nesting, denning and resting sites (North et.al 2009). At Waddle Ranch, there are very few trees remaining that exceed 24" DBH. As such, retention of the largest trees in the preharvest

stand is critical as they provide for the next generation of large trees and eventually snags and down woody debris.

Additionally, fuels reduction treatments should encourage shrub growth as a key element of wildlife cover and forage. Often in fire suppressed stands, the shrub component is absent or significantly adversely affected by the low light and lack of growing space. Management techniques to enhance shrub habitat should protect what shrubs remain while increasing understory light conditions for shrub establishment and patch expansion. Management practices that provide for vertical and horizontal heterogeneity, such as those described above, will also provide for variability in shrub patch size and configuration, contributing to overall habitat heterogeneity.

Decadent, malformed, broken-topped, and similar trees are also an important component of wildlife habitat. These defect trees are often rare in stands that have been previously commercially harvested. However, fuel management strategies should consider retention of these defect trees where they do not pose a risk to overall stand health, and also consider recruitment of such features across the landscape.

Though little is known about how to spatially arrange the key habitat components discussed, GTR 237 described that in the absence of this information, a diligent approach would be to:

- 1) Increase the habitat elements that are currently rare or underrepresented as compared to active-fire forest conditions.
- 2) Avoid creating forest conditions that do not have a historical analog.
- 3) Emulate spatial heterogeneity of forest conditions that would have been created by topography's influence on fire frequency and intensity.

Ecosystem restoration is largely dependent on the use of fire as a fuel treatment tool. Historically, fire has been the primary force shaping the structure, composition, and function of mixed conifer forests (North et.al 2009). Many natural forest ecosystem processes have stalled due to the absence of natural, low intensity fire. Low intensity fire is a natural catalyst for forest ecosystem processes. Such fire consumes small fuels, forest litter, shrubs, and small trees, provides for flush of nutrients to enhance

regrowth of native species, prepares the seedbed for pine regeneration, and enhances plant diversity.

Fire suppressed stands often have to be treated, mechanically or otherwise, to reduce hazardous fuel levels before prescribed fire can safely be applied. Mechanical fuels reduction can be very effective at modifying stand structure, thereby reducing potential fire intensity, severity, and extent. In such instance, mechanical thinning is often the initial fuels treatment, with prescribed fire applied as a “follow-up” treatment to not only maintain the level of fuels reduction, but to provide for ecosystem restoration. Historically, eastern Sierra Nevada Jeffrey Pine forests had a 5 – 18 year fire return interval (North et.al 2012). To achieve a natural fire regime, prescribed fire should be applied within treated, priority areas at Waddle Ranch Preserve at an interval based on site specific conditions of each project area, such as slope position, aspect, and steepness of slope. Information regarding priority areas for prescribed burning can be found in section V(B) of this document, Treatment Methods, Prescriptions, Costs, and Timelines.

Forest Vegetation Simulator (FVS) software was utilized to compare fuel loading of a treated stand over a 50 year period, specifically comparing fuel loading of the stand if prescribed fire were applied. The results have been summarized below:

Table 2: Fuels Report

FUELS REPORT FOR 50-YEAR PERIOD, WITH AND WITHOUT PRESCRIBED FIRE												
Surface Fuels (Tons/Acre)						RX FIRE YEAR 2018	Surface Fuels (Tons/Acre)					
Dead Fuel					Surface Fuel Total		Dead Fuel					Surface Fuel Total
Year	Litter	0-3"	3-6"	>12"			Year	Litter	0-3"	3-6"	>12"	
2013	0.86	2.7	4.8	0.0	8.36	2013	0.86	2.7	4.8	0.0	8.36	
2023	1.37	3.1	4.1	0.1	8.67	2023	0.32	1.1	2.4	0.1	3.92	
2033	1.67	5.4	3.8	0.2	11.07	2033	0.69	0.52	1.9	0.1	3.21	
2043	1.80	7.4	3.9	0.3	13.4	2043	0.89	1.01	2.1	0.3	4.2	
2053	1.85	9.6	4.3	0.6	16.35	2053	1.13	1.90	2.4	0.5	5.73	
2063	1.91	12.0	4.9	1.3	20.11	2063	1.33	3.1	2.8	0.9	7.83	

The Fuels Report and associate FVS modeling yields quantitative information on the following trends:

- a. A single application of prescribed fire, in the form of broadcast burning, reduces surface fuel loading by over 40%.
- b. With the application of prescribed fire, approximately 85% of the Waddle Ranch Preserve will remain in a Fuel Model 8 as classified by Government Technical Report INT-122. Fires in stands of Fuel Model 8 are generally slow burning ground fires with low flame lengths. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards.
- c. Application of prescribed fire in 2018, 5 years following initial mechanical treatment, reduces flame length to less than 4 feet for a period of approximately 20 years.
- d. Application of prescribed fire also reduces potential conifer mortality by 46% over a 20 year period.
- e. Application of prescribed fire creates a fire resilient post-treatment stand that requires significant wind speeds during wildfire to result in torching and crowning.
- f. Application of prescribed fire increases the canopy to base height of conifers and maintains this increased height over a 20 year period.
- g. Application of prescribed fire results in increased conifer regeneration over the 50-year planning horizon. This regeneration is clearly portrayed in the FVS Stand Visualization diagrams, Figures 3-5.

iii. *Provide for “gap and cluster” arrangement:*

The concept of providing for clusters of trees according to canopy strata was discussed above as a means for providing for vertical heterogeneity. These clusters also provide for unique microhabitat conditions that provide for wildlife habitat. Clusters of trees can also be retained on the basis of what they provide for wildlife habitat, such as presence of large, old trees, or unique habitat attributes such as broken stems, evidence of heart rot organisms, mistletoe brooms (North et.al 2012).

Natural openings in a forested setting, referred to as “gaps” provide for high-light environments that favor regeneration of both shade-intolerant tree species as well as shrub patches. GTR 237 suggests that before fire suppression gaps were 0.1 to 0.5 acre in size. Fuels reduction practices should retain gaps where they exist, enhance their size if necessary to ensure higher light conditions, or create them. Areas currently lacking pine, and fir groups with evidence of root disease could be recognized as priority locations for gaps.

B. UC Davis Graduate Group In Ecology 2012 Waddle Ranch Management Plan

During June of 2012, a group of UC Davis students, led by Professor Malcolm North, created a management plan for Waddle Ranch as part of a Forest Ecology Management Planning and Field Techniques course. Using data from the 2008 Waddle Ranch Inventory and that collected on site during 2012, the student management plan identified three key objectives for Waddle Ranch: 1) increase future forest resilience to drought associated with changing climate conditions, 2) increase the size and abundance of large trees, and 3) effectively reduce burn intensity and severity while promoting the re-introduction of frequent fire.

The students utilized the Western Sierra Nevada variant of the Forest Vegetation Simulator, the standard modeling tool used by the US Forest Service to predict future forest conditions under potential management scenarios. FVS is a model that predicts the growth and mortality of individual trees based on variables including the size, height, and density of trees within an existing stand.

Management recommendations to achieve the aforementioned objectives were derived from the results of the FVS modeling. These recommendations were reviewed as a source of valid science since they were the result of a site specific, formalized study of the Preserve. The management recommendations include:

- 1) The forest directly north of Dry Lake and its outlet stream should be frequently maintained with prescribed fire. This treatment should be applied every 6 – 10 years to ensure that this buffer remains an effective barrier to wildfire movement.
- 2) Use biomass removal and mastication to promote the growth of large trees (increased growth through reduced stand density), especially in the northwest corner of the ownership and a small area along the east side of the parcel.
- 3) Prescribed fire is the most effective means for reducing potential crown fire, surface flame length, and stand density. Prescribed fire would also restore many key ecological processes that mechanical fuels reduction cannot provide, such

as soil nutrient cycling, increased microhabitat variability, and increased understory plant and shrub diversity (North et. al 2012).

These management recommendations are consistent with the principals gleaned from other current scientific sources, as previously described. Collectively, this information was reviewed, considered, and incorporated into the future forest management activities suggested herein.

IV. Forest Restoration Goals & Desired Future Condition

A. Forest Restoration Goals:

As described in the Conservation Easement, the goals for the Waddle Ranch forests are to 1) Maintain the Preserve in a native condition, including conserving wildlife habitat, aesthetics, flora, fauna, soils, water quality, and historic/prehistoric cultural values, 2) Restore the forest preserve to a viable and sustainable old growth condition, 3) Provide open space and recreational opportunities for local residents and tourists, and 4) Sequester carbon from the atmosphere and prevent undue release of carbon through wildfire, undue harvest, insects, and disease. The proposed future forest management projects contained within this report have been developed to attain the aforementioned goals and desired future condition for Waddle Ranch.

Incorporating the best available science discussed above, an additional and forest restoration goal would include 1) Restore the natural, active fire regime to provide for both increased fire resilience to wildfire, forest ecosystem restoration, and wildlife habitat.

B. Desired Future Condition:

Old growth Jeffrey pine forests of the Sierra Nevada with an active fire regime provide the model for desired future condition of Waddle Ranch. Such old-growth pine forests have survived hundreds of years due to low overall stand density, relatively large diameter trees that are fire resilient, and low surface fuels – all conditions achieved through naturally occurring, low intensity ground fires.

As stated in the 2008 Management Plan, the ideal future condition for Waddle Ranch would be a similar forest of widely spaced large trees, low stand density, and a low growing shrub component dominated by bitterbrush. Dead trees and downed logs would be retained in amounts suitable for providing habitat for cavity nesting birds, voles, wood rats, and other ground dwelling animals seeking refugia and nesting habitat. The forest would not present hazardous fuels conditions, and as such would not be susceptible to damaging wildfire or insect/disease epidemic. Deer populations would be

supported through the encouragement of bitterbrush. Bitterbrush is a fire adapted species that upon application of low intensity fire, stimulates sprouting. Low intensity fire increases the live biomass of bitterbrush and increases its palatability to ungulates. Bitterbrush is an important browse species due to its high nutrient content, upright form that makes it available during winter, and the fact that it produces leaves in the spring and fall, making it a dependable food supply during the winter months.

Sagebrush similarly regenerates through the application of low intensity fire, which stimulates seedling production. Sagebrush is an evergreen species which also provides for wildlife forage.

It is important to note, that a single forest condition, such as old growth, should not be prescribed for the entire ownership. Natural site factors such as slope, aspect, soil, and available moisture heavily influence variability of stand structure in natural forests. The most appropriate approach would be to enhance natural conditions, which would allow for a mosaic of forested stands with a variety of stand densities and species composition. Attainment of these conditions would have the dual effect of also reducing potential burn intensity and severity while achieving a more natural fire regime. Ultimately, such conditions would provide for the continued existence of the forest ecosystem as a whole.

Figure 3: Stand Visualization Diagram, 2013

Stand=Strata1 Year=2013 Beginning of cycle



Figure 4: Stand Visualization Diagram, 2033

Stand=Strata1 Year=2033 Beginning of cycle

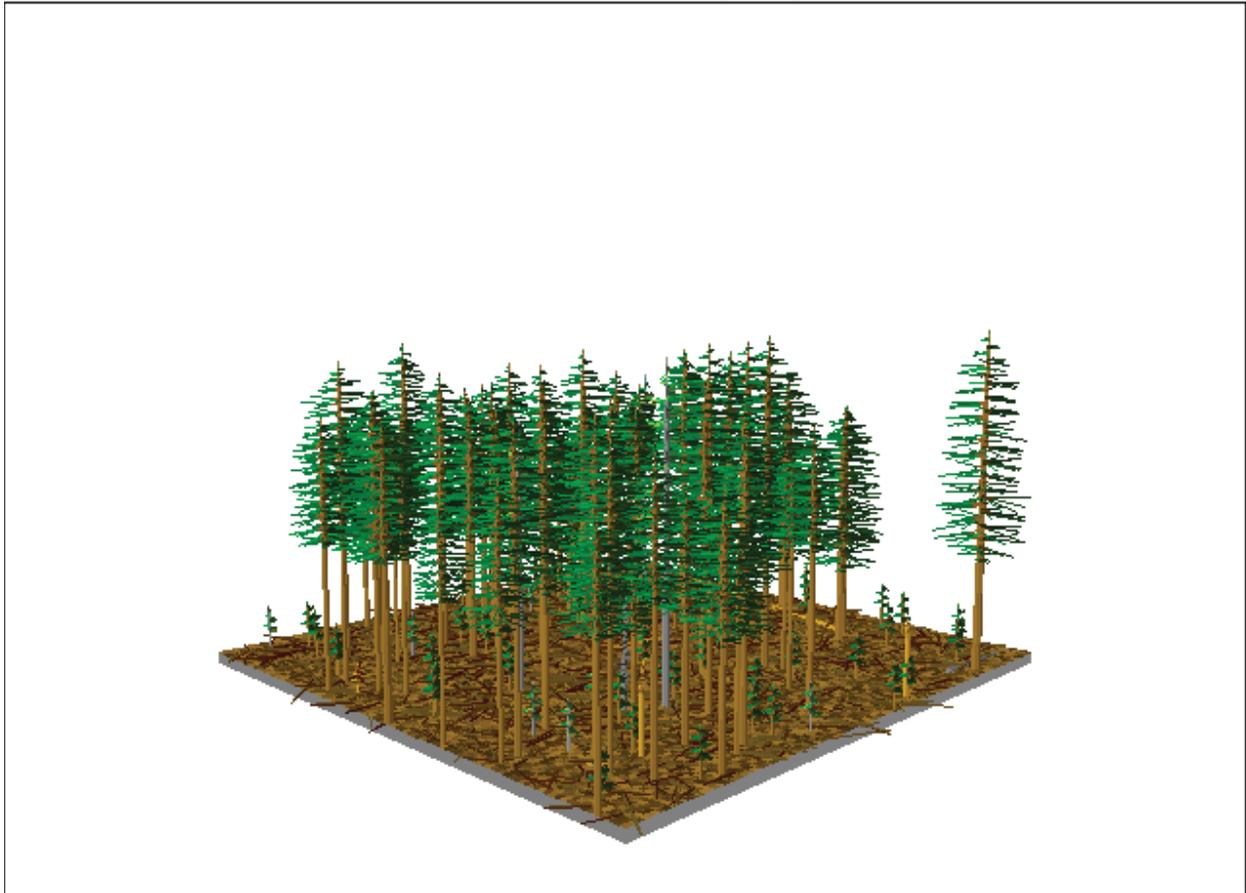


Figure 5: Stand Visualization Diagram, 2063

Stand=Strata1 Year=2063 End of projection



V. Treatment Methods, Prescriptions, Costs, and Timeline

A. Contemporary Forest Management Options at Waddle Ranch

A variety of treatment methods are available to implement forest management projects. Variables to consider when choosing the appropriate treatment methodology include size and volume of woody material to process, whether the woody material will be removed and if so in what form, arrangement of trees to be removed, topography of the project site, ingress/egress of the site, and resource protection concerns. The following treatment methods are commonly utilized in forest management and may be appropriately applied at the Preserve:

1. Mechanical Biomass Removal: Best suited for management activities that will result in the removal of commercial sawlogs and/or tree chips. Performed with mechanical equipment, this methodology removes wood product, and requires landing areas and access for log trucks and/or chip vans.

Approximate Cost Per Acre = \$1600

2. Mechanical Mastication: This method is applied to management activities where rearrangement of forest fuels is desired and/or acceptable. Undesirable trees and vegetation are masticated in place with the resulting chip material being broadcast on site by the power of the mechanical grinding head. This methodology is limited to areas that do not contain rocky substrate that may harm the mastication grinding head.

Approximate Cost Per Acre = \$1800

3. Hand Thin/Pile/Burn or Broadcast Chip: This methodology is best applied to areas that are inaccessible to equipment or otherwise contain resource concerns that constrain the use of equipment at the project site. Since cut vegetation is generally hand yarded to a pile location or into a chipper, the maximum tree size generally harvested with this method is 10"DBH. Gentle ground accessible by a tracked chipper may present the opportunity to chip the cut material and broadcast it on the forest floor. If broadcast chipping is not feasible, piling the cut material for burning is an option for abatement of slash created during operations.

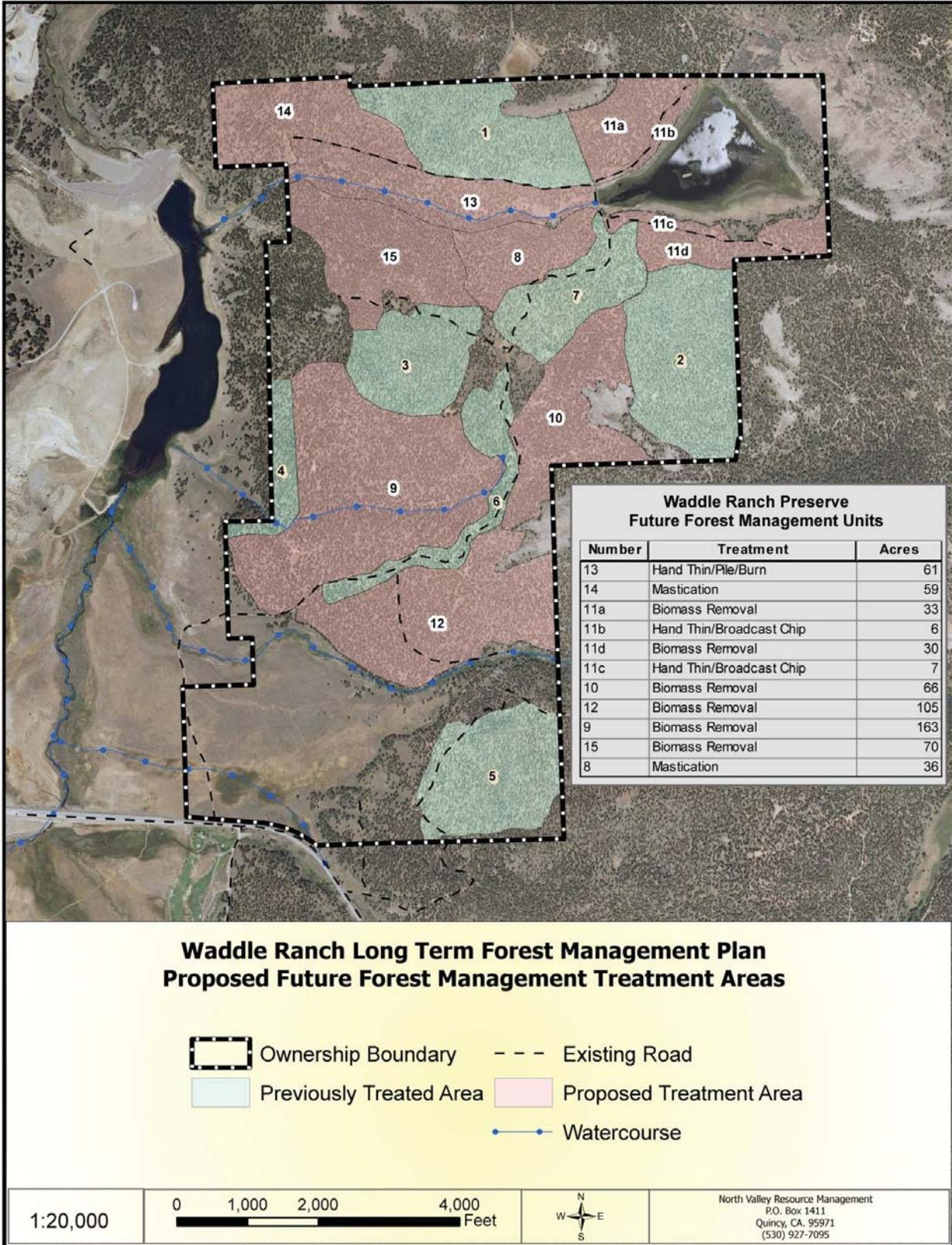
Approximate Cost Per Acre: \$1500

4. Prescribed Fire: Prescribed fire is a tool for reducing smaller forest fuels such as light surface litter, shrub cover, and small trees. This tool is not directly applicable to all stands, especially untreated stands containing excessive fuel loads and/or arrangements that would support higher than desired fire intensity, spread, duration, and flame length. Applied to in the appropriate setting, prescribed fire is an excellent tool to maintain conditions created through initial mechanical fuels reduction, reduce surface fuels, decrease the danger of fire escape into undesired areas, and provide for ecosystem restoration.

Approximate Cost Per Acre = \$1500

Treatment unit boundaries were determined with emphasis placed on creating logical management units in regards to size, treatment method, access, and presence of landings. Utilizing the stratification maps, the aspect(s) and slope(s) within each unit were analyzed to aid in determination of treatment type, vegetation targeted for treatment, and appropriate residual basal area. Treatment unit locations are shown on the Forest Management Unit Map, Figure 6, following. This map includes a table indicating unit size and tentative management activity implementation dates for each unit. Additional information regarding treatment costs and timelines can be found in Table 5, Management Unit Treatment Summary Table and Table 6, 13-Year Forest Management Activity Project Tracking and Cost Summary. Treatment cost by year has been indicated in Figure 9, Forest Management Treatment Cost By Year (graph).

Figure 6: Proposed Future Forest Management Treatment Area



B. Treatment Prescriptions

Treatment prescriptions will be based on aspect, slope steepness, and slope position, with due consideration given to habitat value and microhabitats. This approach first required stratification of the Waddle forests according to the priority variables, aspect and slope, as indicated on the Stratification Maps:

- i. Aspect: E, N, NE, NW, S, SE, SW, W, Flat.
- ii. Slope: 0-15%, 16-30%, 30-45%, 46-60%

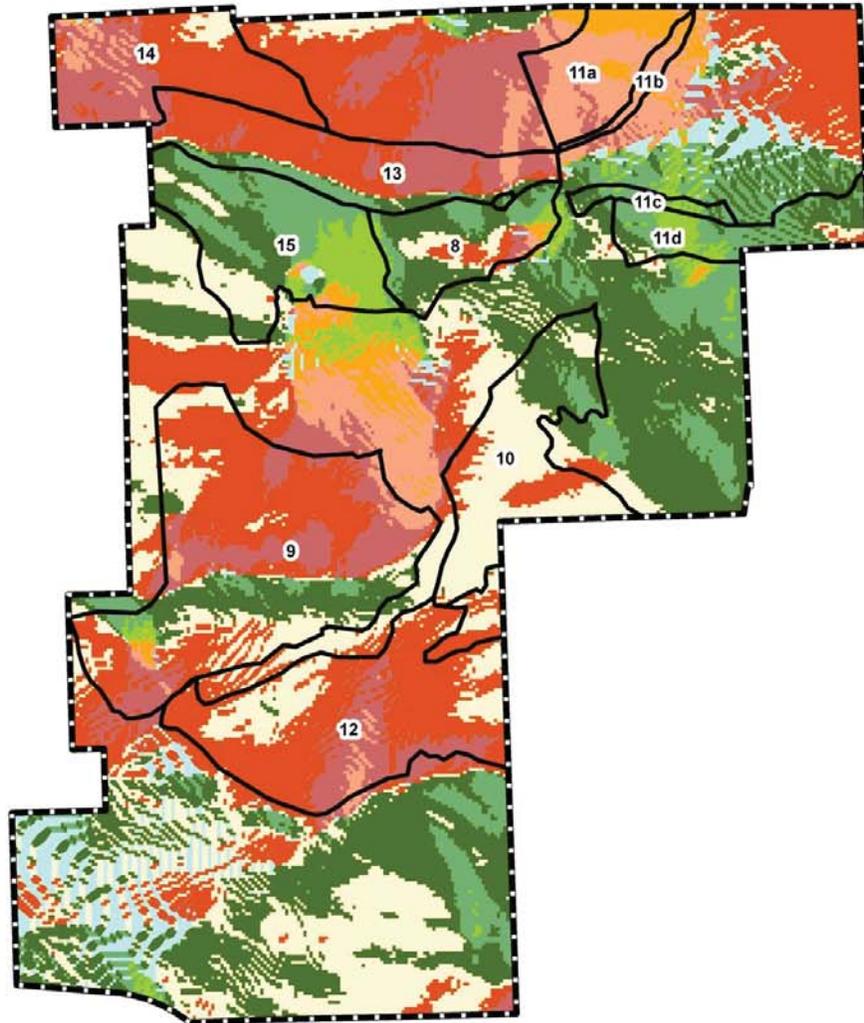
Information regarding slope position (valley, draw, midslope, upslope, ridgetop) was gathered from analysis of standard USGS topographical maps. A summary of stratification results has been provided in Table 4, Management Unit Prescription Summary Table.

From this analysis and known minimum stocking standards vetted within the California Forest Practice Rules, the following general treatment specifications will be incorporated into all forest management activities at Waddle Ranch Preserve, depending on site conditions of each unit:

Table 3: General Forest Management Treatment Guidelines

GENERAL WADDLE RANCH PRESERVE FOREST MANAGEMENT TREATMENT GUIDELINES		
ASPECT	RESIDUAL BASAL AREA/ACRE, FT ²	ADAPTIVE MANAGEMENT PROVISIONS
N/NW,NE, W	120 - 140	<ul style="list-style-type: none"> - Retain greater canopy cover - Retain higher number of stems per acre - Focus on surface and ladder fuel removal - Longer prescribed fire interval (Every 8-10 years)
S, SE, SW, E	75	<ul style="list-style-type: none"> - Reduce continuity of canopy fuels - Reduce surface and ladder fuels to reduce rate of fire spread and intensity - Retain minimum stocking to provide for “open” stand conditions - Maximize tree spacing on steepest slopes, at and near ridgetops - Maximize tree spacing in units that abut private residential parcels - Shorter prescribed fire burn interval (Every 5 years)
ADAPTIVE MANAGEMENT PROVISIONS, ALL UNITS:		
<p>1. “Gap and cluster” treatment methodology shall be applied within all treatment units, with the exception of those units which abut private residential parcels, where residual tree spacing shall provide for maximum protection for adjacent residences. The matrix between gaps and clusters can be thinned to more uniform tree spacing guidelines provided minimum stocking is met immediately following timber operations.</p> <p>2. Microhabitats (concave pockets, drainages, etc) in all units should be identified and treated to retain the integrity of the microclimate conditions, such as retaining a given microhabitat as a “clump” or treating for reduction of surface fuels only; Treatment standards will be unique to the site conditions of each microhabitat.</p> <p>3. Where present, standing snags exceeding 16” DBH will be retained at a rate not to exceed 3 per acre, provided such retention does not pose a risk to public safety or wildfire.</p> <p>4. “Defect” trees shall be retained where present, up to a rate of 3 per acre, including broken topped trees, trees with excessive branching due to mistletoe, etc. To protect forest health, this provision is not applicable to tree showing active or recent insect attack.</p> <p>5. Species shall be retained in the following order of preference: Sugar Pine, Ponderosa/Jeffrey Pine, Lodgepole Pine, White fir.</p> <p>6. Tree removal shall target trees 24” Diameter Outside Bark as measured at 8” above the ground. This diameter restriction shall not apply to trees that are heavily infested or otherwise indicating their ability to perpetuate damaging biotic agents through the ownership.</p> <p>7. Prescribed fire application and interval of application shall occur with continued monitoring of treated stands such that post treatment conditions will dictate the extent and scope of the use of fire. Prescribed fire intervals mentioned herein are estimations based on historical fire frequency and departure from the natural fire regime. The suggested intervals may be revised according to post treatment conditions.</p>		

Figure 7: Stratification Map - Aspect



**Waddle Ranch Long Term Forest Management Plan
Stratification Map - Aspect**



1:20,000



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Figure 8: Stratification Map - Slope Steepness

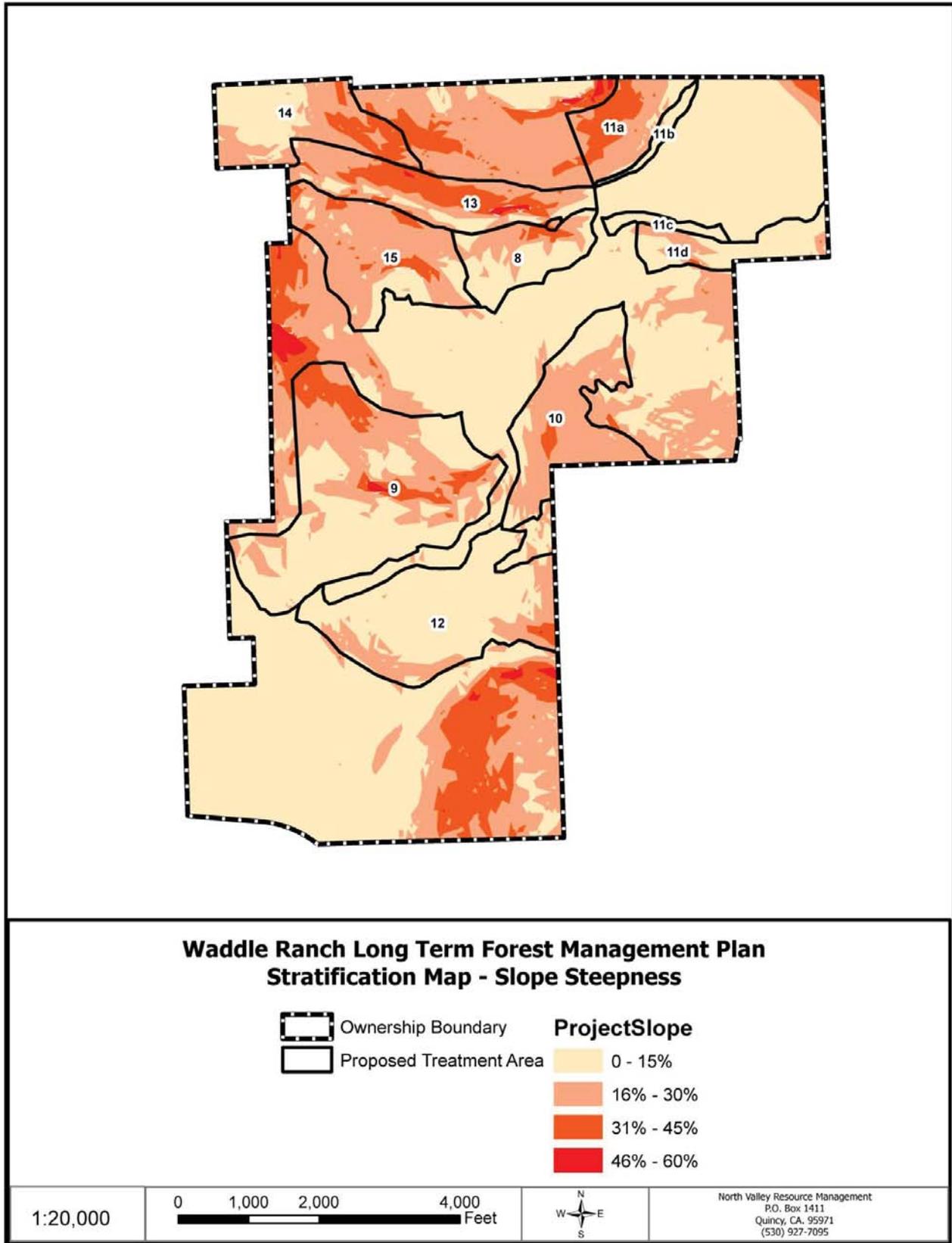


Table 4: MANAGEMENT UNIT PRESCRIPTION SUMMARY TABLE

UNIT#	ACRES	SLOPE (%ACRES/ % SLOPE)	ASPECT (%ACRES BY DIRECTION)	RESIDUAL STOCKING TARGET (FT²BAI/ACRE)	FOREST STRUCTURE/HABITAT CONSIDERATIONS	ESTIMATED PRESCRIBED FIRE APPLICATION INTERVAL (Years)
6A	61	30%/31-45% 70%/0-30%	90% S/SW 10% N/NW	150 point count on S/SW slopes; 300 point count on N slope w/habitat corridor emphasis	On N slopes, emphasize canopy cover retention for habitat corridor; retain select dead and down where located outside residual conifer drip line and arranged in isolated fashion (not concentrated).	5 years (Entire Unit burned in year 2018; Thereafter north side of Dry Creek burned every 5 years (46 acres), south side of Dry Creek burned every 8 years (15 acres)).
6B	59	90%/0-30% 10%/31-45%	90% S/SW/SE 10% W	75ft ² /acre	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity.	5 years
7	70	90%/15-30% 10%/0-15%	90% N/NW/W 10%NE	125 ft ² /acre; transition to 75 ft ² /acre near/at ridge top	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity.	5 Years following initial treatment; 8 years thereafter
8	36	60%/0-15% 40%/15-30%	90% N/NW/W 10% SW	125 ft ² /acre on N slopes; 75 ft ² /acre on S slopes	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity.	5 Years following initial treatment; 8 years thereafter
9	163	60%/0-15% 40%/16-30%	60% S/SW 40% N/NW/W	75 ft ² /acre on S slopes; 125 ft ² /acre on N/W slopes;	Emphasize presence of clumps along meadow edge; Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity. Perform hand treatment within the watercourse buffer zone; retain select dead and down where located outside residual conifer drip line and arranged in isolated fashion (not concentrated).	Entire Unit burned 5 years following initial treatment; Thereafter: S/SW acres burned every 5 years; N/NW/W acres burned every 8 years
10	66	80%/16-30% 20%/0-15%	95% W/NW 5% SW	125 ft ² /acre; reduce to 75 ft ² /acre approaching natural gap located along east edge of unit.	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity. Reduce stocking to 75 ft ² /acre approaching edge of natural opening along east boundary of unit to enhance gap.	Entire Unit burned 5 years from initial treatment; 8 Years thereafter

11A	33	70%/16-30% 30%/31-45%	90% SE 10% N	75 ft ² /acre	Maintain low stand density and open tree spacing to provide maximum protection to homes that abut northern property line.	5 Years
11B	6	100%/0-15%	100% SE	75 ft ² /acre	Retain select dead and down where located outside residual conifer drip line and arranged in isolated fashion (not concentrated).	5 Years
11C	7	100%/0-15%	100% N/NW	125 ft ² /acre	Consider canopy cover retention for habitat corridor; retain select dead and down where located outside residual conifer drip line and arranged in isolated fashion (not concentrated).	Entire Unit burned 5 years from initial treatment; 8 Years thereafter
11D	30	70%/0-15% 30%/16-30%	90% N/NW 10% NE	125 ft ² /acre	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity. Emphasize canopy cover retention for habitat corridor; retain select dead and down where located outside residual conifer drip line and arranged in isolated fashion (not concentrated).	Entire Unit burned 5 years from initial treatment; 8 Years thereafter
12	105	90%/0-15% 10%/16-30%	85% S/SW 15% W	75 ft ² /acre;	Gap and cluster as appropriate to maintain residual stocking target and stand heterogeneity. Emphasize presence of clumps along meadow edge; Do not treat north edge of watercourse buffer zone to provide for habitat corridor – south side lacks conifer overstory.	5 years

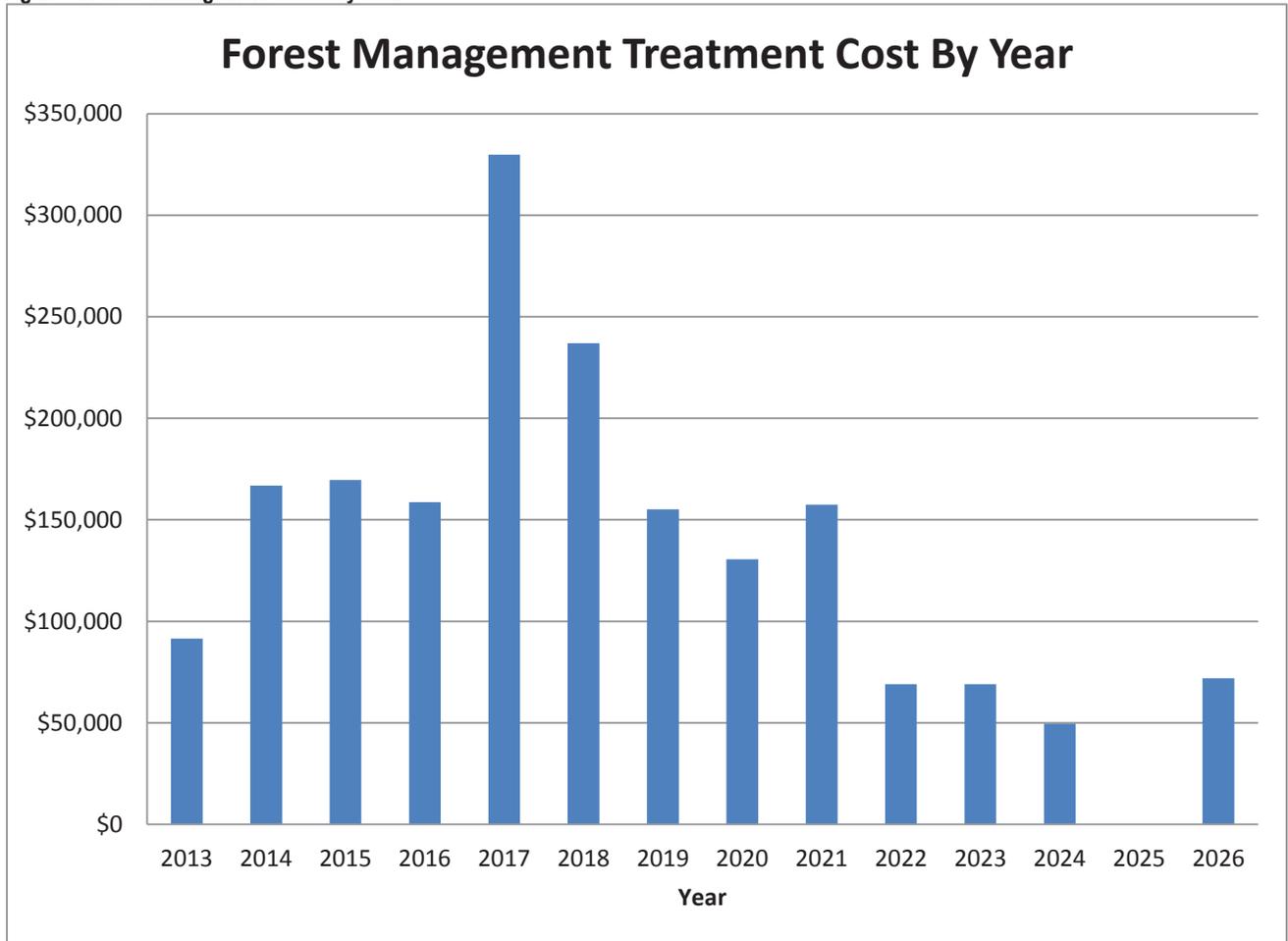
Table 5: Management Unit Treatment Summary Table

UNIT	ACRES	TREATMENT METHOD	ESTIMATED COST	PERMIT REQUIRED	IMPLEMENTATION DATE	YEAR OF RX FIRE APPLICATION	RX FIRE COST Per Application (@ \$1500/ac)
1	70	Previously Treated	N/A	N/A	N/A	2014	\$105,000
2	87	Previously Treated	N/A	N/A	N/A	N/A	\$0
3	47	Previously Treated	N/A	N/A	N/A	2017	\$70,500
4	20	Previously Treated	N/A	N/A	N/A	N/A	\$0
5	72	Previously Treated	N/A	N/A	N/A	N/A	\$0
6	35	Previously Treated	N/A	N/A	N/A	2018	\$52,500
7	48	Previously Treated	N/A	N/A	N/A	2020	\$72,000
8	36	Biomass Removal	\$57,600	Yes	2015	2020, 2028	\$54,000
9	163	Biomass Removal	\$260,800	Yes	2017	N/A	\$0
10	66	Biomass Removal	\$105,600	Yes	2019	N/A	\$0
11A	33	Biomass Removal	\$52,800	Yes	2014	2019, 2024	\$49,500
11B	6	Hand Thin/Broadcast Chip	\$9,000	No	2014	N/A	\$0
11C	7	Hand Thin/Broadcast Chip	\$10,500	No	2020	N/A	\$0
11D	30	Biomass Removal	\$48,000	Yes	2020	N/A	\$0
12	105	Biomass Removal	\$168,000	Yes	2018	N/A	\$0
13	61	Hand Thin/Pile/Burn	\$91,500	No	2013	2018, 2023 (46ac S slope only)	\$69,000
14	59	Mastication	\$106,200	No	2016	N/A	\$0
15	70	Biomass Removal	\$112,000	Yes	2015	N/A	\$0

Table 6: 13-Year Forest Management Activity Tracking and Cost Summary

13-YEAR FOREST MANAGEMENT ACTIVITY TRACKING AND COST SUMMARY															
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	20-year Treatment Cost By Unit
Unit															
1		\$105,000							\$105,000						\$210,000
2															\$0
3					\$70,500					\$70,500					\$141,000
4															\$0
5															\$0
6				\$52,500					\$52,500						\$105,000
7								\$72,000						\$72,000	\$144,000
8			\$57,600					\$54,000							\$111,600
9					\$260,800										\$260,800
10								\$105,600							\$105,600
11A		\$52,800						\$49,500				\$49,500			\$151,800
11B		\$9,000													\$9,000
11C								\$10,500							\$10,500
11D								\$48,000							\$48,000
12						\$168,000									\$168,000
13	\$25,000					\$69,000					\$69,000				\$229,500
14				\$106,200											\$106,200
15			\$112,000												\$112,000
Total Treatment Cost, All Units, All Yrs	\$25,000 \$29,500 obstruction	\$166,800	\$169,600	\$158,700	\$331,300	\$237,000	\$155,100	\$184,500	\$157,500	\$70,500	\$69,000	\$49,500	\$0	\$72,000	\$1,009,300
Estimated Road Repair Costs	\$20,000	\$80,000													\$100,000
Estimated Permitting Cost	\$20,107														\$90,000
Total Cost	\$94,607														\$1,199,300
Average Total Cost, Per Year															\$92,254
KEY:															
Initial Treatment Cost															
Rx Fire Cost															

Figure 9: Forest Management Costs by Year



C. Schedule of Proposed Forest Treatments, Cost of Treatments

Five fuels reduction projects have previously occurred on 378 acres at Waddle Ranch. One of the objectives of the updated Forest Management Plan is to reevaluate the current stand conditions on the Ranch, and provide direction for future forest management projects. Though the previously implemented fuels reduction projects have provided for increased protection from wildfire in strategic locations, additional fuels reduction treatments will be required in the portions of the ownership that remain untreated. Hence, a primary goal of future forest management projects on the Ranch is to increase the efficacy of what has already been treated, or essentially “connect the dots” from one treated area to another.

Connecting fuels treatment projects will provide for increased protection from wildfires driven to the northeast portion of the ownership by the prevailing southwest wind. Treatments will focus on reducing the vertical and horizontal continuity of fuels such that forest conditions would support a ground fire of four-foot flame lengths or less. Such low intensity fires are less likely to cause detriment to forest resources, and can more effectively be suppressed and controlled by traditional fire fighting techniques.

Reduction of forest fuels will include thinning suppressed, intermediate, and select co dominant conifers, as well as conifer regeneration that provides a fuel ladder. Removal and/or rearrangement of down woody debris will also be necessary to reduce the continuity and concentration of surface fuels currently present in many of the untreated stands. The benefits of this “thinning from below” are numerous, and include increased vigor of residual trees, increased stand resilience to wildfire, insect attack, and pathogen, promotion of increased growth rates, and ultimately hastening the development of old growth stand conditions.

As indicated in Table 5 and Figure 9, there is a high initial expenditure related to implementation of initial treatment of the management units. This cost, though possibly partially offset with revenue from forest product, is largely due to the significant volumes of vegetation to be processed and transportation of woody product to processing facilities. However, as also seen in Figure 9, upon conclusion of initial treatments (estimated in year 2020), treatment costs decrease significantly. At this point, annual treatment costs will include the cost of prescribed burning performed in priority areas as a maintenance treatment, which is important to protect the investment of initial treatment. Units 1, 3, 6, 7, 11a, and 13 were identified as “priority” areas for prescribed fire due to their presence near/adjacent to private residential parcels, proximity to crucial ingress/egress routes, and/or topographical influence of fire behavior such as presence of ridge tops and/or drainages. The Tracking Summary itemizes a 13-year planning period as this was the length of time allowed to complete two prescribed burn cycles in each of the priority treatment areas. With ongoing monitoring, the 5-7 year prescribed fire interval may be able to be lengthened depending on site conditions.

In the 13-Year Activity Tracking and Cost Summary, an average annual treatment cost of \$92,254 is reflected. This average includes leveraging the cost of road repair and harvest permits over the 13-year planning horizon. This rationale was applied in the absence of detailed information regarding the actual type of permit(s) to be sought, which will heavily influence permit cost and the timeline for road work to be completed.

VI. ADDITIONAL RESOURCE CONSIDERATIONS

A. Rare and Threatened Plant Species and Their Protection

Consistent with Federal and State laws pertaining to the protection of rare, threatened, and endangered species, prior to implementation of each forest management activity, a scoping and survey process should be conducted. This process will aid in identification of any wildlife and botanical species of status that may find suitable habitat within the proposed project area or within the vicinity of such project. Suggested scoping sources include the California Natural Diversity Database (CNDDDB), the California Native Plant Society (CNPS), and the California Wildlife Habitat Relationship (CWHR). A map of current CNDDDB records has been included herein in Figure 10, Waddle Ranch California Natural Diversity Database Map, April 2013.

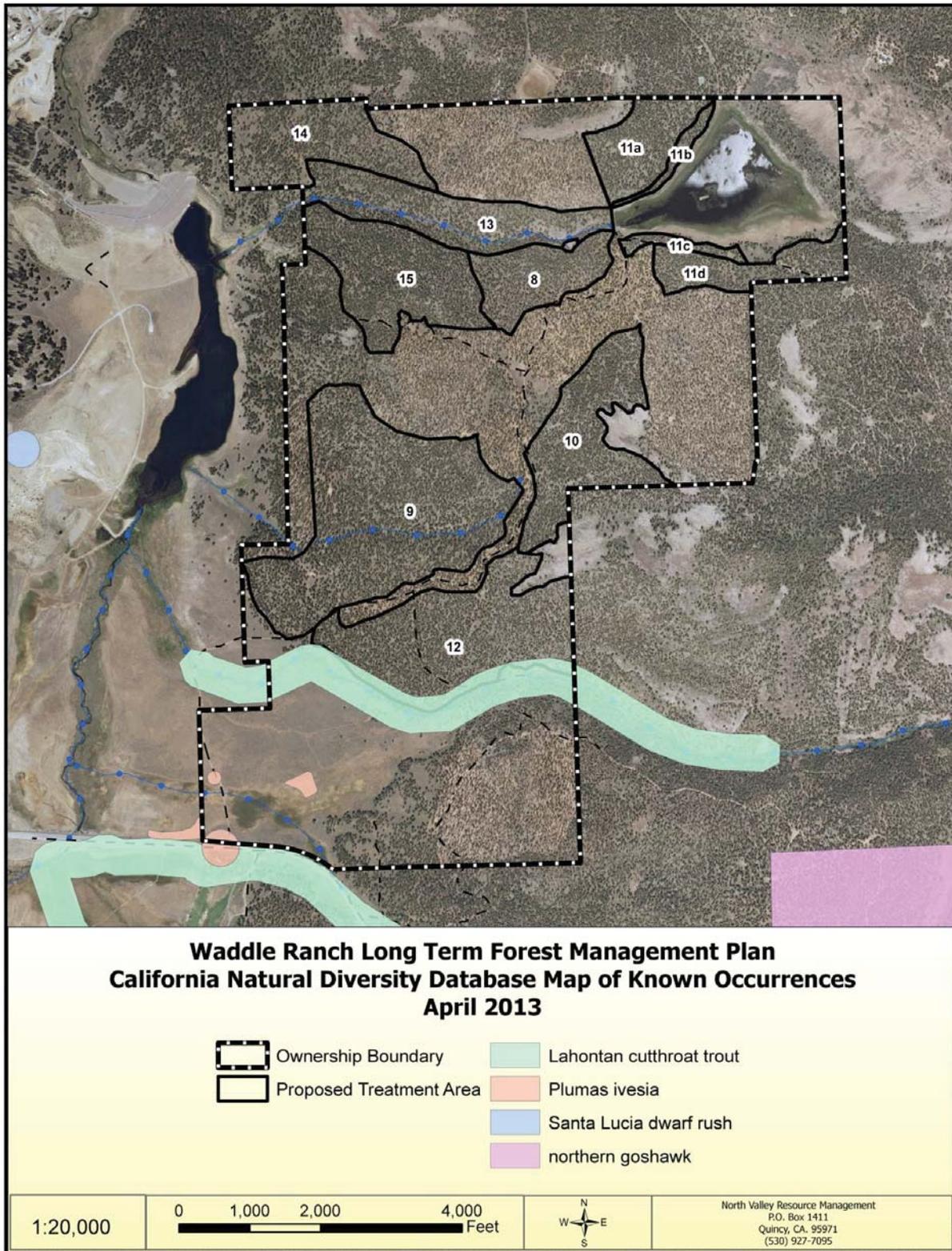
The current CNDDDB indicates the presence of Plumas Ivesia within the Waddle Ranch, specifically adjacent to the Preserve's main access road. Any potential impacts to this species that may occur with road use or upgrades will require collaboration with the California Department of Fish and Game.

Prior to the 2009 forest management activities, a "Biological Survey for Threatened, Endangered and Sensitive Plant and Wildlife Species and Noxious and Invasive Weeds" was conducted on Waddle Ranch Preserve by a professional botanist. This report established baseline data regarding the biological attributes of the Preserve, including habitat types and presence/absence of current listed species of status. Should there be significant revisions to the current listed species of status as compared to the 2009 listed species, a new survey and assessment may be necessary within the area of potential effect to properly mitigate any adverse impacts to biological resources.

B. Cultural and Historic Resources

Prior to any forest management activities, a current North Central Information Center Records Check Request must be conducted to determine the presence of any known cultural or archaeological resources within or adjacent to the project area(s). Such Records Checks have occurred in the past as part of previous harvest operations, and are available for reference when planning future projects. However, for future projects requiring a Cal Fire harvest document, a current Records Check Request and archaeological survey must be performed prior to permit submittal. As matter of Best Management Practices, the same protocol should be followed for any forest management activity, regardless of permit required, to ensure protection of archaeological or cultural resources that may be located within the project area.

Figure 10: California Natural Diversity Database Map of Known Occurrences



C. Recreation and Public Access

One of the tenants of the Conservation Easement for the Preserve emphasizes the importance of Waddle in providing open space and non motorized recreation for the public. Maintenance of the integrity of the current trail system should be a priority during forest management activities. The forested “feel” and unique ambience of these trails is easily retained through implementation of the aforementioned management prescriptions. Forest thinning operations will retain the largest trees in the stand, reduce suppressed trees, and thereby provide increased “through forest” views for trail users. Forests will have increased inter-tree spacing, offering an improved view of natural topography and forest attributes previously unseen due to excessive stem density, such as large trees, rock outcrops, and natural openings.

Future implementation of forest management projects should occur in consultation with the Truckee Donner Land Trust to ensure adverse impacts to recreational users of the Preserve are minimized.

D. Visual Aesthetics/Viewshed Maintenance

Potential impacts of forest management activities to the area viewshed are an important consideration of project planning. The forest management projects suggested within this Long Term Management Plan proposes thinning of the remaining untreated forest stands within the Preserve. As these stands will remain forested, only a slight alteration of their current appearance may be noted by those viewing the Preserve from a distance. As management techniques will emphasize retention of the largest trees in the preharvest stand, positive benefits to aesthetics can be expected as treated stands will resemble well spaced forests of larger trees. This will allow for enhanced views of the natural topography as seen through a forested environment.

For Waddle Ranch, Highway 267 is the vantage point of the largest number of people. From the Highway, the majority of the proposed forest management projects will not be visible due to natural topographical barriers to the line of sight. The Waddle Ranch Project Visibility Maps indicate the line of sight for eastbound Highway 267 travelers as well as Martis Lake Recreation Area users. As indicated from these maps, projects 9, 10, and 12 have the greatest amount of visibility from these vantage points. However, the post-treatment stands will appear as thinned forests that are fully stocked, and as such adverse impacts to visual resources are not anticipated as a result of project implementation.

Figure 11: Project Visibility Map: Eastbound Hwy 267

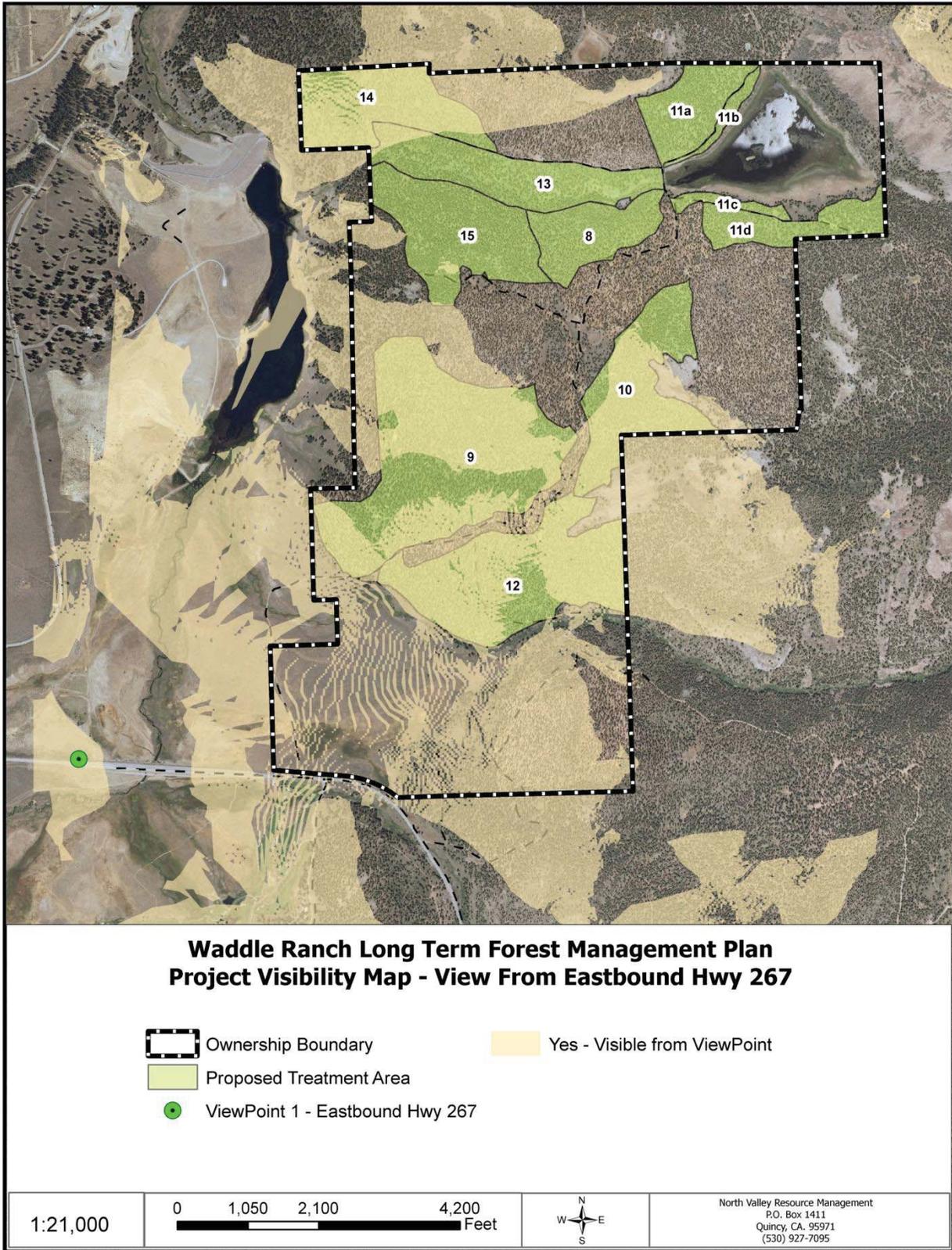
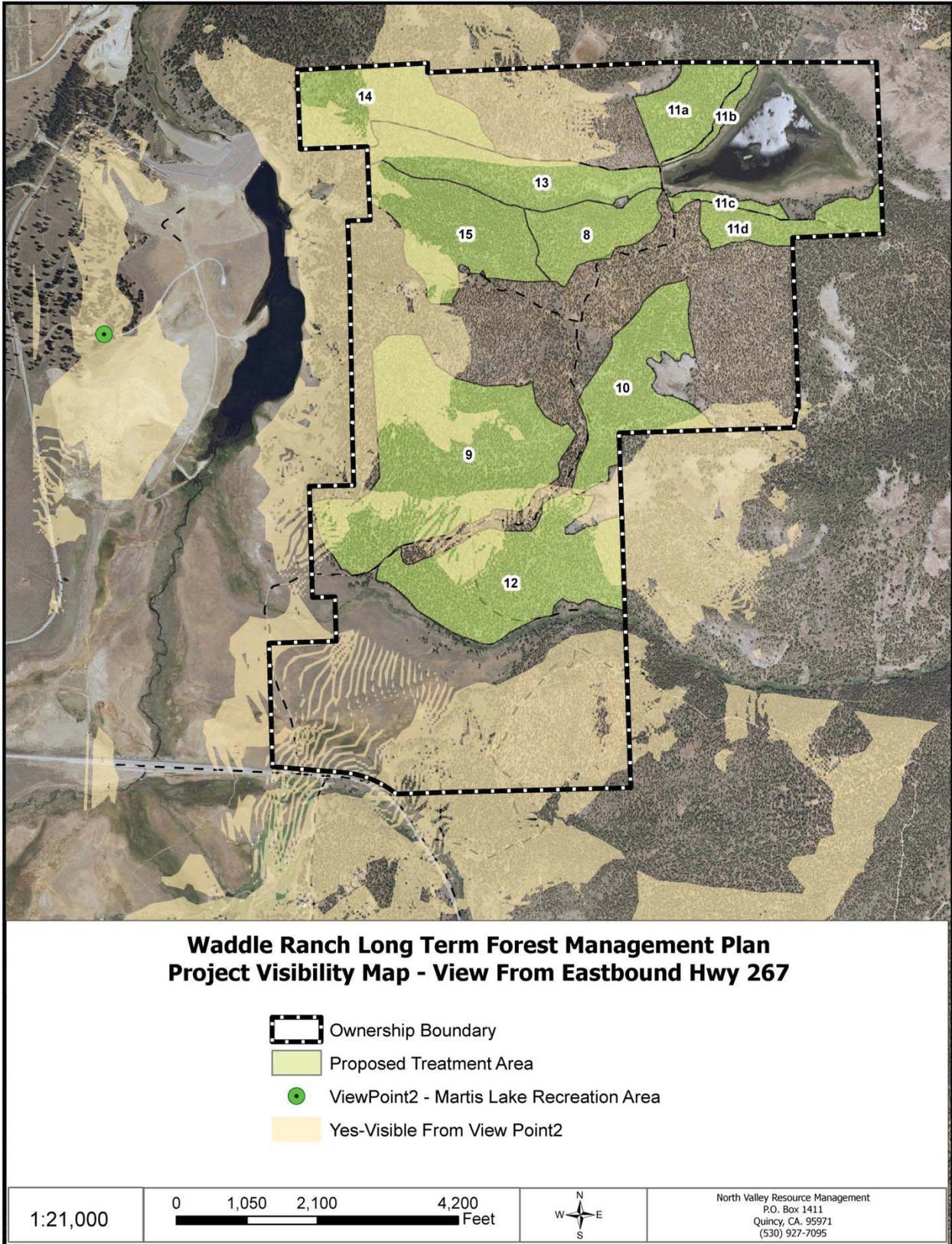


Figure 12: Project Visibility Map: Martis Lake Recreation Area



The impact of visual resources as seen from the Waddle Ranch recreational trails was also considered during project design. In collaboration with Truckee Donner Land Trust, it was determined that areas adjacent to the trails should not be excluded from fuels reduction, provided trail and trail alignment is protected during operations, openings are not created that would adversely impact shade or decrease the immediate forested “feel” to trail users. Analyzing trail location in regards to project unit locations and treatment type, incorporation of mitigations to address trails concerns will not impede project implementation or efficacy of the final treatment.

VII. PERMITS

In California, any land management project wherein wood product is traded, bartered, or sold, the California Forest Practices Act is triggered. Several of the forest management projects, as described above, propose the sale of wood chips, which means compliance with the California Forest Practices Act must occur through the submittal and approval of a Cal Fire harvest document. A variety of Cal Fire harvest documents are available, depending on the wood product realized, and the scope, size, and objective of the timber harvest.

A variety of Cal Fire “Exemptions” exist that provide for a streamlined method to obtain a harvest document in a shortened timeframe, usually 15 days or less. These Exemptions are restrictive in scope, size, and applicability, and typically are specific to the purpose of the harvest. For example, the “Forest Fire Prevention Exemption” is used where fuel reduction activities will be implemented, and the “Dead, Diseased, Dying Exemption” may be utilized when only such trees will be harvested at very light intensities. All exemptions require adherence to a very specific set of restrictions, and practices outside of the specific restrictions are not allowed. Exemptions are not applicable to each and every stand, as some stands may present site conditions not feasibly managed within the required restrictions. Adaptive management is a challenge with Exemptions as the stand treatment must meet an established set of restrictions, instead of treatment prescriptions being created based on site conditions. However, if the stand presents site conditions that can effectively be managed within the restrictions of the Exemption, then the Exemption offers a streamlined way to obtain a Cal Fire harvest document in a relatively short time frame. Exemptions are valid for a period of one year.

Alternatively, the “Timber Harvest Plan” or “THP” is a comprehensive document that is the functional equivalent of an Environmental Impact Report (EIR) and allows for adaptive management based on site specific conditions. A THP must be written by a Registered Professional Forester (RPF), and allows the RPF to “explain and justify”

their proposed treatments of the subject forests, so long as such proposed prescriptions comply with the California Forest Practice Rules. Hence, the THP allows for greater flexibility in how various stands on the ownership are treated. THPs are reviewed by Cal Fire, the lead agency, with interagency review occurring from other responsible agencies including but not limited to the California Department of Fish and Game, and the California Regional Water Quality Control Board. A THP typically takes 45 to 60 days to be approved, and upon approval, is valid for maximum of 7 years.

A THP covers all aspects of forest management required for a given harvest, including road construction and maintenance, watercourse crossings, biological resources, and archaeological resources. The THP requires analysis of all aspects of land management required for the harvest of wood product(s) from the site. All site conditions that need to be mitigated prior to harvest – such as road improvements – are done under the umbrella of the THP, typically concurrent with forest management operations, and under the jurisdiction of Cal Fire. In comparison, the restrictions of the Exemption do not allow for such a comprehensive approach to forest management, as mitigation(s) of problematic site conditions is not allowed.

A THP contains a Cumulative Impacts Assessment, required at the watershed scale, similar to other guiding land management documents such as the Martis Creek Watershed Assessment. This required Assessment ensures that the THP, when considered with the past, present, and anticipated future impacts elsewhere in the watershed, does not cause significant adverse environmental impacts. This Assessment is not required of Exemptions, and thereby further illustrates how the full THP is the preferred document for forest management as it analyzes any impacts of the proposed project, and requires mitigation to reduce any such impacts. Further, due to the 5 year valid term, the THP is a document that provides greater flexibility in regards to project implementation since it allows landowners to have an approved Cal Fire document ready as project funding becomes available, or as market conditions become favorable, within the 5 year period.

The “Non-Industrial Timber Management Plan” or “NTMP” is another permit option available for forest management at Waddle Ranch. The NTMP has very similar baseline requirements to the THP, still requires the watershed level analysis, and requires interdisciplinary review. However, the NTMP differs from a THP in a few key aspects. First, the NTMP must address growth and yield of the forests for which it covers. The growth and yield information forms the basis of sustainable harvest levels that are stated in the NTMP and must be adhered to during the life of the NTMP. NTMPs restrict a landowner to conducting only sustainable and unevenage harvests, meaning a landowner cannot harvest more than is growing in any one harvest and must maintain an unevenage stand structure. However, the NTMP remains valid in perpetuity – given stand conditions remain the same and harvests remain sustainable - unlike a THP

which is valid for only 7 years. This allows increased flexibility for landowners to take advantage of market conditions over time, and to plan future harvests over a much longer timeframe than any other harvest document. Last, the NTMP follows the ownership, so should title to the ownership change, the document remains in place and functional provided the new owner notifies the Cal Fire of his/her assumption of the NTMP.

Permit costs are a valid concern for any land manager. Permit costs vary depending on the amount of tree marking required, stand density, results of biological and archaeological surveys, and other variables. Since up to six of the proposed future forest management projects for Waddle Ranch may require a Cal Fire document, the combined cost for the six Exemptions would be comparable to the cost of a full THP or NTMP. A THP or NTMP would ultimately be a more comprehensive forest management document that would provide mitigations for all aspects of forest management, would allow for adaptive forest management based on site specific conditions, and would provide the landowner with a minimum of four additional years of being covered under an approved Cal Fire document.

Future Forest Management Projects at Waddle Ranch can be permitted two ways: 1) With an Exemption for each project requiring a permit (a project-by-project basis), or 2) with a full THP or NTMP, where all projects would be covered under one permit. Recall that Exemptions are advantageous in terms of the expedited approval period, typically less than 15 business days. However, considering the road improvements that need to occur to allow for improved access, reduced sediment transport, and watercourse crossing upgrades, it is appropriate to consider a full THP or NTMP for Waddle Ranch. The full THP or NTMP would allow for all road improvements and mitigation of all other resource concerns to be addressed as part of Cal Fire review, under that agency's jurisdiction, and approved as part of one document, all at the same time. Treatment of the entire ownership would be considered along with any resource concerns, and all valid concerns would be mitigated as part of treatment activities. This is a far more comprehensive option, versus the "piecemealing" that often occurs when projects are only considered on a project-by-project basis.

Regarding the proposed road improvements, please note that in the absence of a Cal Fire harvest document, alteration of any watercourse bed, bank, or channel requires a "1600 Permit" through the California Department of Fish and Game. Under a THP or NTMP, the 1600 Permit is part of the Plan, and DFG reviews the permit as part of the interdisciplinary review of the THP or NTMP, with Cal Fire as lead agency. Similarly, mitigation of archaeological concerns could be addressed and properly mitigated under the jurisdiction of Cal Fire as part of THP/NTMP review and approval.

VIII. Monitoring, Adaptive Management and Management Plan Updates

New information regarding forestry sciences is continually becoming available. This plan should be modified to incorporate new science into the overall management strategies and recommendations. Results of ongoing monitoring should also be incorporated in the Plan. Every 8 -10 years, this plan should be revised or updated to meet the long-term goals of the conservation easement and to ensure the management strategies are in sync with the best available science.

Re-inventory of the forest will need to occur with each plan revision to provide a current assessment of overall stand health and growth. Each re-inventory should include an updated estimate of forest composition and stocking, conifer regeneration in treated units, shrub/forb growth in treated units, standing dead trees, down woody debris, and understory vegetation in each Treatment Unit.

As stands become treated, a valid method of periodic inventory would be to establish permanent sample plots in each unit following treatment (pre-treatment conditions were already thoroughly inventoried as part of the 2008 Management Plan, and due to the slow growth associated with overstocked conditions, significant changes to this inventory are not anticipated annually). A systematic sample performed each decade would yield valuable information regarding stand vigor, growth, regeneration, and habitat attributes.

Additionally, the 2009 Biological Survey of Waddle Ranch Preserve indicated the presence of the following invasive plant species: Cheatgrass (*Bromus tectorum*), Woolly mullen (*Verbascum thapsis*), Herb Sophia (*Descurainia sophia*), and bull thistle (*Cirsium vulgare*). The report specified that none of these species were present in amounts that were replacing native species. However, as it is possible that these species may spread into disturbed soils following forest management activities, ongoing monitoring of the Preserve should include that of noxious/invasive weeds. Annual monitoring can be of simplified fashion, performed ocularly with the primary emphasis to detect any insect and/or disease issue occurring beyond endemic levels, or presence/perpetuation of noxious/invasive weed. This annual inventory will ensure damaging biotic agents, if present, are captured and mitigated as soon as reasonably feasible.

IX. Funding and Grants Available

A variety of grant funds may be available to offset the cost of some of Waddle's forest management activities, as well as proposed road improvements and/or watercourse crossing upgrades. The five most valid such programs are listed below.

1. *California Forest Improvement Program (CFIP)/Prop 40 Fuels Management Program:*

Funding source is California Proposition 40 funds, which are currently available to non-industrial timberland owners of less than 5000 acres of timberland in California. Eligible practices include non-commercial forest management activities and administration of such activities. Participants are required to pay a cost share of 25% of total project cost as determined by current CFIP cap rates for eligible practices. Grant applications are currently being accepted.

Contact: Jeff Dowling, (530) 277-7822

2. *Natural Resource Conservation Service (NRCS):*

Funding source is generally the federal Farm Bill which is currently available to non-industrial timberland owners. Practices eligible for funding include non-commercial land management activities. There is no ownership acreage limitation with NRCS funds. Grant applications are generally due November annually for work to be completed the following year. NRCS prefers to fund forest management projects 60 – 100 acres in size, generally award \$1000 - \$1200 per acre for fuels work and the funds are awarded under a 3-year contract.

Contact: Mike Brenner, (530) 885-6505

3. *Sierra Nevada Conservancy (SNC):*

Funds a variety of land management projects through California Proposition 84 funding. The fiscal year 2013 grant window has closed. The Request for Proposals typically occurs in June each year, depending on availability of grant funds.

Contact: <http://www.sierranevada.ca.gov/other-assistance/sncgrants>

4. State Water Resources Control Board “Supplemental Environmental Projects” (SEP)

Funded as part of an administrative civil liability (ACL) against a discharger, SEP projects enhance the beneficial uses of the waters of the State, provide a benefit to the public at large, and are included in a ACL action. Any public or private party may submit a SEP proposal to the Water Board for inclusion on the SEP list. All SEPs approved by the Water Board must be chosen by the discharger, either through the Water Board’s SEP list, or on their own.

Contact: Scott Ferguson, sferguson@waterboards.ca.gov

5. *Cal Trans Environmental Enhancement and Mitigation Program:*

The Environmental Enhancement and Mitigation Program (EEMP) was offers a total of \$10 million each year for grants to local, state, and federal governmental agencies and to nonprofit organizations. Eligible projects must be directly or indirectly related to the environmental impact of the modification of an existing transportation facility or construction of a new transportation facility.

EEMP Grants are awarded in four categories:

Highway Landscaping and Urban Forestry Projects are designed to offset vehicular emissions of carbon dioxide through the planting of trees and other suitable plants.

Resource Lands Projects are for the acquisition, restoration, or enhancement of resource lands (watersheds, wildlife habitat, wetlands, forests, or other significant natural areas) to mitigate the loss of or detriment to such lands within or near the right of way for transportation improvements.

Roadside Recreation Projects provide for the acquisition and/or development of roadside recreational opportunities.

Mitigation Projects Beyond the Scope of the Lead Agency responsible for assessing the environmental impact of the proposed transportation improvement.

EEMP call for grant applications have generally occurred during the fall, with application due near January 1st annually.

X. Professionals and Agencies Partners Consulted

- Jeff Dowling, Cal Fire, Nevada, Placer, Yuba Unit.
- Beth Stewart, Vegetation Management Services
- Joe Barron, Northstar Fire Department
- Lorna Dobrovolney, California Department of Fish and Wildlife
- Douglas Cushman , Lahontan Regional Water Quality Control Board
- John Svahn, Truckee Donner Land Trust

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