



Usal Redwood Forest IFM

Addendum to Application for Listing Form

Under

Air Resources Board

Compliance Offset Protocol – U.S. Forest Projects

Adopted: November 14, 2014

Prepared February 18, 2015

Offset Project Operator

**Redwood Forest Foundation, Inc.
330 N Franklin St., Suite 4
Fort Bragg, CA 95437**

Reporting Period

The reporting period for this Application is from 1/1/2015 to 12/31/2015.

Protocol Version

Air Resources Board
Compliance Offset Protocol – U.S. forest Projects
Adopted: November 14, 2014

Introduction

Usal Redwood Forest Company, LLC (“URFC”) manages the Usal Redwood Forest totaling approximately 49,571 acres; located in the Coast Range of Mendocino County. The Usal Redwood Forest is located approximately 25 miles due north of the city of Fort Bragg, primarily west of Highway 101.

URFC purchased approximately 50,526 acres in June of 2007. In October 2011, approximately 957 acres in the southwestern portion of the ownership were sold to the Save the Redwoods League resulting in the current configuration of the property. In conjunction with this sale in 2011, a Conservation Easement was granted to The Conservation Fund through a grant from the California Wildlife Conservation Board. The Usal Redwood Forest Project encompasses approximately 47,979 timbered acres of the larger property.

Usal Redwood Forest IFM is a CAR Improved Forest Management (IFM) Project that is seeking registration under the California Air Resources Board Compliance Offset Protocol – U.S. Forest Projects Adopted: November 14, 2014. The Usal Redwood Forest IFM project is an Early Action project that was initially listed under the Climate Action Reserve’s Forest Project Protocol Version 3.2. With this listing, the Usal Redwood Forest project is seeking to transition to the Compliance Offset Protocol following the registration of the Project as an early action project.

V.A.

The Project is located within the Northern California Coast Supersection, and the Coast Redwood/Douglas-fir Mixed Conifer Assessment Area. The Project area is classified as both “High” and “Low” Site Class within the Assessment Area.

V.B.

The Project Area is subject to the governing jurisdiction of the County of Mendocino, the State of California, and the United States of America.

V.C.

The Project Area boundary is derived from the gross property acreage after removing non-timbered areas, slope instability areas that are not capable of growing a crop of trees, large watercourse channels, and road acres. The Project Area is derived from a GIS stand layer which represents the most current depiction of the Usal Redwood Forest boundary. The final Project Area acreage of 47,979.24 acres. The Project Area has been determined based on the best available data representing the legal description described in the title report included as Attachment A. The Project Area boundary is described and represented by the maps included as Attachment E, and the GIS data supplied in a geodatabase as a part of this Project submission. For the purpose of calculating GHG stocks, the Project Area acreage is taken from the GIS data provided with the application.

V.D.

The existing land cover on the Usal Redwood Forest IFM Project Area is generally timberland with small areas of brush land, grasslands and rock outcroppings. The Usal Redwood Forest IFM property is zoned Timber Production (TP). The permitted uses on TP land are timber production, row crops (including vineyard) and one single-family residence per legal parcel.

V.E.

The following Wildlife Habitat Relationship (WHR) vegetation types occur on the Usal Redwood Forest IFM:

RDW	REDWOOD
DFR	DOUGLAS FIR
AGS	ANNUAL GRASS
COW	COASTAL OAK WOODLAND
MHW	MONTANE HARDWOOD
CRC	CHAMISE-REDSHANK CHAPARRAL

The majority of the Project Area is classified as the DFR “Douglas Fir” type. Primary conifer species are coastal redwood and Douglas-fir. The principal hardwood species is tanoak with a mixture of madrone, oak (i.e. *Quercus*), California laurel, and other California hardwoods.

On most sites redwood would likely dominate if vegetation succession were allowed to proceed naturally.

V.F.

The Usal Redwood Forest is generally characterized as moderate (site class III) to highly (site class II) productive timberland. The determination of site index for the purposes of growth and yield modeling is described within the Modeling Plan (Attachment K).

V.G.

The Usal Redwood Forest as well as much of the surrounding land is utilized for timber production, recreation, agriculture and rural residential uses. Land pressures associated with these uses are typically conversion of timberland to home sites and fragmentation of larger blocks into smaller tracts. The Usal Redwood Forest ownership has been merged into a single parcel, cannot be subdivided and the residential development rights have been extinguished. Any industrial, commercial, or residential use of any kind is prohibited, except for permitted forest management and as otherwise permitted in the easement. Prior to recordation of the Conservation Easement, the Usal Redwood Forest obtained Certificates of Compliance for the 92 separate legal parcels comprising the Project Area, thus allowing for the sale and development of these parcels to rural residential home and/or vineyard sites. Residential uses would involve the development of home sites while road use and human activity on the property would increase. Historically, increased human activity has resulted in the disruption and displacement of native plants and animals.

The Usal Redwood Forest area consists of both Maritime & Mediterranean climates influenced by the proximity to the Pacific Ocean and topography. Summers are warm and winters are mild and wet. The cooling pacific fog follows the path of the Eel River and Usal Creek onto the property where temperatures range from an average of low of 32 degrees F in January to an

average high of 85 degrees F in August. Average annual rainfall for the property is approximately 60 inches per year.

V.H.

Upon the acquisition of the property, URFC changed the management goals for the property to that of a working community forest whereby the property's environmental attributes will be maintained and restored over time while providing economic benefits to the local community in terms of jobs, property taxes and forest products.

Commercial harvesting is planned within the Project Area; and since 2007 commercial harvest activity has taken place in 2012, 2013, and 2014. The conservation easement places a restriction on the entire property limiting conifer harvest volume removals to no more than 2.9% of total standing conifer inventory volume on an annual average basis over the length of each consecutive, non-overlapping 5-year period. The conservation easement also requires that the Usal Redwood Forest to be managed under a third party, forest management certification program, such as that of the Forest Stewardship Council (FSC) standards and to transition from even-age to uneven-age management; however, the easement specifies a goal for even-age silviculture to be employed to replace tanoak dominated stands with a more desirable and productive ecological condition of mixed conifers and hardwoods within 61 years of easement recordation.

V.I.

The Usal Redwood Forest IFM Project Area is characterized by a mix of redwood, Douglas-fir, true fir, tanoak, true oak, madrone, and other native hardwoods and conifers. It is estimated that the Project Area is composed of approximately 28% Douglas-fir, 25% redwood, less than 0.2% other conifers, 36% tanoak, 7% pacifics madrone, and 2% other hardwoods by basal area. The Usal Redwood Forest Company intends to manage to reduce the hardwood component and increase the conifer component of redwood.

The timber stands that comprise the Project Area developed as the result of past harvesting activities including a mix of even-aged and uneven-aged harvest practices. These timber stands include stands of mixed age classes ranging from 10 to 80 years in age.

VI.A.

The Usal Redwood Forest IFM Project Area meets condition 1 under section 2.1.2 (page 10) of the Compliance Offset Protocol by maintaining greater than 10% tree canopy cover.

Compliance is substantiated by the Orthophoto map of the Project site, that may be found in Attachment F, clearly showing canopy closure for the Project Area and, will be substantiated by the results of the carbon stock inventory.

VI.B.1.

The Usal Redwood Forest IFM Project Area is characterized by a mix of redwood, Douglas-fir, true fir, tanoak, true oak, madrone, and other native hardwoods. Approximately 99.99% of the Project's biomass is in native species, and thus the Project meets the 95% criteria for carbon in native species. Regeneration activities proposed under the Project will utilize only native species.

VI.B.2.

The Usal Redwood Forest IFM Project Area is characterized by a mix of redwood, Douglas-fir, true fir, tanoak, true oak, madrone, and other native hardwoods and conifers. It is estimated that the Project Area is composed of approximately 28% Douglas-fir, 25% redwood, less than 0.2% other conifers, 36% tanoak, 7% pacifics madrone, and 2% other hardwoods by basal area. The Usal Redwood Forest Company intends to manage the timber stands to reduce the hardwood component and increase the conifer component of redwood while ensuring that the Project continues to meet the requirements for composition of native species under Table 3.2 (page 20) of the Compliance Offset Protocol by maintaining species' basal area percentage below 60%, the Species Diversity Index from the Assessment Area Data File.

VI.B.3.

- (a) The Usal Redwood Forest IFM meets condition 3 under Section 3.8.1 (page 18) of the Compliance Offset Protocol by employing uneven-aged silvicultural practices and maintaining canopy cover averaging at least 40% on all forestland owned by Usal Redwood Forest Company in this Assessment Area.
- (b) The project proposes to employ variable retention and uneven-aged management which will maintain no more than 40% of the Project's forested acreage in ages less than 20 years at a watershed scale up to 10,000 acres. As of 6/30/2014, productive timberland acreage in ages less than 20 years amounts to 4.0% of the project area, or approximately 1,910 acres.

As the Project Area is larger than 10,000 acres, the Project Area has been split by CALWATER planning watershed groups in order to determine compliance with the above requirement. The Project is located within 20 CALWATER planning watersheds comprising the South Fork Eel River and Usal Creek watersheds with a relatively small area drained by Cottaneve and Jackass Creeks. Currently no more than 40% of the forested area in each watershed described above is less than 20 years in age.

CALWATER Watershed	IDNUM	Project Acreage	Project Acreage < 20 Years Old	% of Acreage < 20 Years
Bear Pen Creek	1111.320404	3,764	28	0.7%
Big Dann Creek	1111.320203	4		0.0%
Bridges Creek	1111.320405	46		0.0%
Cedar Creek	1111.320204	8		0.0%
Cottaneva Creek	1113.120101	142		0.0%
Jackass Creek	1113.110200	215	5	2.2%
Low Gap Creek	1111.320202	1,944		0.0%
Lower Hollow Tree Creek	1111.320302	3,851	292	7.6%
Lower Indian Creek	1111.320504	5,918	515	8.7%
Lower Usal Creek	1113.110101	5,358	13	0.2%
McCoy Creek	1111.320505	187		0.0%
Middle Hollow Tree Creek	1111.320301	570		0.0%
Mill Creek	1111.320401	1,740	17	1.0%
Piercy Creek	1111.320502	2,096	316	15.1%
Red Mountain Creek	1111.320403	0		0.0%
Standley Creek	1111.320501	5,026	37	0.7%
Upper Indian Creek	1111.320503	2,956	523	17.7%
Upper Sproul Creek	1111.320703	11	1	4.8%
Upper Usal Creek	1113.110102	10,037	124	1.2%
Wildcat Creek	1111.320402	4,105	40	1.0%
Grand Total		47,979	1,910	4.0%

VI.B.4

URFC does not actively remove lying dead wood as a part of its stand management activities. It is expected that the accumulation of lying dead wood will be commensurate with recruitment from standing dead trees. URFC is committed to maintaining and increasing, the number of standing dead trees within the Project Area as a component of its forest management objectives. URFC has not recently conducted any salvage operations, nor does it intend in the future to actively pursue aggressive salvage operations on its timberlands. URFC may conduct

salvage harvesting in the future, but with the goal of maintaining a component of standing dead trees in the post treatment stands.

In the case of the Usal Redwood Forest IFM, the Project Area has not undergone any recent salvage harvesting. Therefore, all that must be demonstrated is that the greater of one metric ton of carbon per acre or 1% of standing live carbon stocks is present in standing dead wood, or that progress towards these targets is ongoing. The project currently contains an average of 0.93 Mg C per acre and 1.14% of standing live carbon stocks in standing dead wood. The project will continue to make progress towards the above mentioned standing dead wood target.

VI.C.

The Forest Owner intends to allow conifer and hardwood stocking levels to develop on the Project Area in excess of those defined by the baseline analysis which projects carbon stocks levels over time following a harvest scenario which impliments the minimum requirements of the California Forest Practice Rules as well as other financial and legal constraints. The Forest Owner intends to balance harvest with growth such that conifer board foot volume is maintained or increased over time.

Changes in Project carbon stocks over time will also be governed by economic decisions such that more or less carbon may be sequestered over any given period. Therefore, a combination of economic decisions by the Forest Owner as to whether or not to commercially harvest the Project Area combined with the constraints imposed by the California Forest Practice Rules, specific terms of the Forest Project Protocol, and the terms of the recorded Conservation Easement will guide carbon stock levels over time.

VII.A.

IFM-1 Standing Live:

Standing live carbon will be inventoried based on sample plots installed as part of a forest inventory conducted in 2015. The inventory specifications are included as Attachment L. The cruise design consists of the installation of sample points randomly selected from a systematic grid 5 chains by 5 chains in size anchored with a random starting location.

The sample design includes the installation of fixed area plots to measure both live and dead conifers and hardwoods. A 1/100th acre fixed area plot was installed at each sample point to sample conifer and hardwood trees 1" DBH to 3.5" DBH; a 1/50th acre fixed area plot was installed at each sample point to sample conifer and hardwood trees 3.6" DBH to 10.5" DBH; and, a 1/10th acre fixed area plot was installed at each sample point to sample conifer and hardwood trees 10.6" DBH and larger.

Attachment L describes the procedures for collecting field measurements, specific criteria pertaining to data collection, stratification rules, and documentation on quality assurance and quality control. Documentation of analytic methods and biomass equations used to translate field measurements into volume or biomass carbon estimates is included in Part B below.

Cruise data from field cards were reviewed for completeness and entered into an Access database. Plot data within the database was extensively sorted and queried to look for data entry errors. This process has resulted in a final data set for cruise processing. The Access database serves as the repository for inventory data and is accessed by the growth and yield model during growth and yield simulations.

As timber management activities take place on the Usal Redwood Forest IFM Project Area, or disturbances such as fire or mortality resulting from pathogens or other factors occur, plots installed in 2015 will be relocated and remeasured within areas that have been harvested, treated for hardwood reduction, or subject to disturbance. By 2027, all of the plots installed for the new inventory conducted in 2015 will have been remeasured

regardless of whether or not the plot had been harvested, treated for hardwood reduction, or subject to other disturbance. On this basis, Usal Redwood Forest IFM will maintain a forest inventory system that will meet the inventory specifications and requirements contained in Appendix A of the Protocol, with plots which are no more than 12 years old.

Updating the Project's carbon stocks from year to year will involve the following steps:

1. Any newly installed inventory plots will be incorporated into the inventory estimate for the stratum in which they are located.
2. Existing inventory plots will be updated using FORSEE as described in the modeling plan.
3. Updating the forest inventory for harvests or disturbances that have occurred during the previous year through the installation of new plots, or adjustments to previous plot data.
4. Where necessary, the inventory update process may result in restratification of portions of the timber strata.
5. Inventory updates following harvest or disturbance will be re-measured within 12 months of the harvest or disturbance.
 - a. Partial harvests, such as selections and thinnings are updated in two phases:
 - i. Phase1: within one month of harvest completion, the inventory is depleted by modeling removals such that:
 1. The inventory forester selects one of the stands underlying the harvest unit to represent the new stand.
 2. The inventory plots from the selected stand are projected from time-of-cruise to time-of-harvest.
 3. Based on the forester's prescription for the harvest, plots are 'thinned' by removing trees from the projected tree lists.
 4. The 'thinned' plots are aggregated to estimate a stand-level inventory for the thinned stand.

-
5. Based on the stand-level inventory estimate, the stand is evaluated against the stratification rules, and is assigned a strata.
 - ii. Phase 2: within one year of completion, the harvested stand is resampled. Resampling will include a random selection of plots within the harvested area.

IFM-3 Standing Dead:

As described above, and in Attachment L, standing dead trees will be sampled in conjunction with standing live trees.

IFM-6 Soil (if applicable):

Excluded because the conditions in Table 5.2 of the Protocol that would require inclusion of this pool (site preparation involving deep ripping, furrowing, or plowing where soil disturbance exceeds 25 percent of the Project Area over the Project Life, or mechanical site preparation activities not conducted on contours) are not planned.

IFM-7 Carbon in in-use forest products:

Carbon in in-use forest products has not been generated by the Project as no harvesting has occurred since the Offset Project Commencement Date. Part B below will include documentation of analytic methods and biomass equations used to translate future harvest volumes delivered to the mill into appropriate carbon in in-use forest products values.

IFM-8 Forest product carbon in landfills (if applicable):

Carbon in landfills is a component of carbon related to forest products. No forest products have been generated by the Project as no harvesting has occurred since the Offset Project Commencement Date. Part B below will include documentation of analytic methods and biomass equations used to translate future harvest volumes delivered to the mill into appropriate forest products carbon in landfill values.

IFM-9 Biological emissions from site preparation:

As IFM-6 is an excluded carbon pool, IFM-9 is also an excluded pool.

IFM-14 Biological emissions/removals from change in harvesting on forestland outside Project Area:

Part B below will include documentation of analytic methods and biomass equations used to translate future harvest volumes delivered to the mill into appropriate values for the calculation of this carbon pool.

IFM-17 Biological emissions from decomposition of forest products:

This is quantified as a component of IFM-7 and IFM-8 per Appendix C of the Protocol.

VII.B.

IFM-1 Standing Live:

Above-ground standing live carbon in trees 1" DBH and larger were calculated using the appropriate biomass equation by species taken from the Compliance Offset Protocol U.S. Forest Offset Projects page on ARB's website. The current biomass equation documentation provided by ARB is included as Attachment M . The equations referenced below are not reproduced here for the sake of minimizing redundancy. These equations are used to generate biomass estimates for the above-ground portion of standing live trees, and hard snags. These equations will be referred to as the "FIA equations" herein.

Each species can have as many as three FIA equations in order to calculate tree biomass.

The FIA equations used by species are as follows:

Species	Bole Cubic Ft Volume	Bark Biomass	Live Branches Biomass
Redwood	Equation 24	Equations 13 & 17	Equation 10
Douglas-fir	Equation 3	Equation 8	Equation 6
Grand fir	Equation 23	Equation 2	Equation 1
Western Hemlock	Equation 6	Equation 15	Equation 12
California Nutmeg	Equation 8	Equation 13	Equation 10
Other Conifer	Equation 17	Equation 21	Equation 17
Tanoak	Equation 34	None	None
Pacific madrone	Equation 40	None	None
Live oak	Equation 43	None	None
California laurel	Equation 33	None	None
Golden chinkapin	Equation 32	None	None
Bigleaf maple	Equation 37	None	None
Red Alder	Equation 26	Equation 20	Equation 16
Willow	Equation 40	None	None
Eucalyptus	Equation 31	None	Equation 28
Other hardwood	Equation 41	None	None

Tonnes of standing live biomass per sample plot are calculated as follows:

For equations that use total tree height in meters, tree height is calculated by multiplying the trees total height in feet by 0.3048. Trees per hectare are calculated by multiplying trees per acre by 2.471. Tree diameter at breast height (“DBH”) in centimeters (cm) is calculated by multiplying its DBH by 2.54.

Bole Biomass:

The Cubic foot volume of each tree is calculated as the volume of the total stem from ground to tip (includes the top and stump). FIA refers to this value as CVTS. Bole biomass is calculated by multiplying the cubic volume by the wood density, and then dividing by 2.20462 to calculate weight in kilograms (kg). Above-ground biomass in kilograms (Kg) per acre is calculated by multiplying the FIA calculated kg per tree by each tree’s per acre value.

Bark and Live Branches Biomass:

The above referenced FIA equations produce biomass in kg for the various parts of the above-ground portion of each tree. Above-ground biomass in kilograms (Kg) per acre is calculated by multiplying the FIA calculated kg per tree by each trees per acre value.

Total percent carbon defect of each tree is defined as the total percent cubic foot defect of a bole both inside and outside the board foot scaling cylinder from and including the stump to the tip. It is recorded as a percentage of missing portions of the entire bole. The total rebuilt heights of trees with broken tops were estimated by the cruisers and then used to estimate percent missing volume based on table 4-7 (Forest Data Collection Procedures and Standards included in Attachment L) which provided percent stem cubic volume by 16-foot log segment. The total percentage of the bole that is missing was multiplied by the total biomass (including various biomass components of the tree) as calculated above to calculate the net biomass of the tree. By applying this percent missing volume estimate to all portions of the tree, it is felt that the resulting net biomass value is conservative.

The net kg per acre value of each tree on the plot is summed to derive above-ground live biomass kg per acre for the plot. This value is used to calculate the respective below-ground live biomass component for the plot. Total standing live carbon values presented herein are for trees 1" DBH and larger.

The net Kg per acre value of each tree on the plot is summed to derive above-ground live biomass Kg per acre for the plot. This value is used to calculate the respective below-ground live biomass component for the plot.

Below-ground live carbon is calculated at the plot level using the model provided by Cairnes et. al. specified on page 89 of Appendix A of the Protocol. The formula has as its input, above-ground live biomass in Mg per hectare, and outputs below-ground biomass in Mg

per hectare. Total net above-ground live carbon in Kg per acre for each plot is converted to Mg of biomass per hectare by multiplying by 2.471, and then dividing by 1000. After calculating the below ground component in Mg per hectare using the Cairnes model, the results are converted to Kg per acre by multiplying by 1000 and dividing by 2.471.

Total standing live biomass for each plot is the sum of the above-ground and below-ground live biomass Kg per acre. Mg of carbon (Mg C) per acre per plot is then calculated by multiplying by 0.5 to estimate carbon biomass. Mg C per acre is converted to CO₂-equivalent by multiplying by 3.664.

IFM-3 Standing Dead:

Data on standing dead trees will be collected as a part of the 2015 Willits Woods inventory. In general, the amount of carbon stored in a standing dead tree is based on the proportion of the tree remaining standing, and the condition of the tree, or its decay class. The standing dead carbon pool includes trees 5" DBH and larger, with a minimum height of 15'.

Standing dead trees from the inventory data are classified into five decay classes based on descriptions contained in Research Paper NRS-15 (Harmon et al, 2011). These decay classes are generally described as follows:

Class 1 All limbs and branches are present; the top of the crown is still present; all bark remains; sapwood is intact, with minimal decay; heartwood is sound and hard.

Class 2 There are few limbs and no fine branches; the top may be broken; a variable amount of bark remains; sapwood is sloughing with advanced decay; heartwood is sound at base but beginning to decay in the outer part of the upper bole.

-
- Class 3 Only limb stubs exist; the top is broken; a variable amount of bark remains; sapwood is sloughing; heartwood has advanced decay in upper bole and is beginning at the base.
- Class 4 Few or no limb stubs remain; the top is broken; a variable amount of bark remains; sapwood is sloughing; heartwood has advanced decay at the base and is sloughing in the upper bole.
- Class 5 No evidence of branches remains; the top is broken; <20 percent of the bark remains; sapwood is gone; heartwood is sloughing throughout.

Biomass for standing dead trees includes the bole and bark components calculated using the FIA biomass equations described above and following the same procedures as for live trees other than the manner in which missing volume is calculated.

Total percent carbon defect of each tree is defined as the total percent cubic foot defect of a bole both inside and outside the board foot scaling cylinder from and including the stump to the tip. It is recorded as a percentage of missing portions of the entire bole. The total rebuilt heights of trees with broken tops were estimated by the cruisers and then used to estimate percent missing volume based on table 4-7 (Forest Data Collection Procedures and Standards included in Attachment L) which provided percent stem cubic volume by 16-foot log segment. The total percentage of the bole that is missing was multiplied by the total biomass (including various biomass components of the tree) as calculated above to calculate the net biomass of the tree. By applying this percent missing volume estimate to all portions of the tree, it is felt that the resulting net biomass value is conservative.

The net kg per acre value of each tree on the plot is summed to derive above-ground live biomass kg per acre for the plot. This value is used to calculate the respective below-

ground live biomass component for the plot. Total standing live carbon values presented herein are for trees 1" DBH and larger.

Once the net biomass of each tree has been calculated, a relative density is applied by species and decay class. The relative density is in relation to the green density of sound wood, or the tree's wood density. The table below lists the relative densities applied by species and decay class taken from Differences Between Standing and Downed Dead Tree Wood Density Reduction Factors (Harmon et al, 2011).

Relative Density by Species and Decay Class:

Species	Decay Class (DC)				
	DC1	DC2	DC3	DC4	DC5
Redwood	0.994	0.951	0.902	0.605	0.605
Douglas-fir	0.892	0.831	0.591	0.433	0.433
Grand fir	1.013	0.966	0.855	0.574	0.574
California Nutmeg	0.994	0.951	0.902	0.605	0.605
Western Hemlock	1.040	1.080	0.848	0.525	0.525
Other Coastal Conifers	.990	0.980	0.830	0.598	0.598
California-laurel	0.982	0.793	0.618	0.525	0.525
California live oak	1.02	0.841	0.705	0.591	0.591
Pacific madrone	0.982	0.793	0.618	0.525	0.525
Bigleaf maple	0.979	0.766	0.565	0.450	0.450
Tanoak	0.982	0.793	0.618	0.525	0.525
Eucalyptus	0.982	0.793	0.618	0.525	0.525
Golden Chinkapin	0.982	0.793	0.618	0.525	0.525
Red alder	1.030	0.903	0.535	0.393	0.393
Willow (spp)	0.982	0.793	0.618	0.525	0.525
Other Coastal Hardwoods	1.020	0.700	0.858	0.591	0.591

Below-ground standing dead carbon is calculated at the plot level using the model provided by Cairnes et. al. specified on page 89 of Appendix A of the Protocol. The formula has as its input, above-ground biomass in Mg per hectare, and outputs below-ground biomass in Mg per hectare.

Total standing dead biomass for each plot is the sum of the above-ground and below-ground standing dead biomass Mg per acre. Mg of carbon (Mg C) per acre per plot is then calculated by multiplying by 0.5 to estimate carbon biomass. Mg C per acre is converted to CO₂- equivalent by multiplying by 3.664.

IFM-6 Soil (if applicable):

Excluded because the conditions in Table 5.2 of the Protocol that would require inclusion of this pool (site preparation involving deep ripping, furrowing, or plowing where soil disturbance exceeds 25 percent of the Project Area over the Project Life, or mechanical site preparation activities not conducted on contours) are not planned.

IFM-7 Carbon in in-use forest products:

Wood products delivered to the mill in any period is calculated beginning with the cubic volume of harvested conifer trees 10" DBH and larger. Conifers smaller than 10" DBH are not included as they are too small to be delivered to the mill. The dry weight of wood products in pounds is calculated by multiplying the wood density in lbs/cubic foot by the cubic volume for each softwood species harvested based on the CVTS values derived from the FIA equations listed above. Bark and branch biomass are not included in the volume harvested. The wood densities utilized are those for the Douglas-fir forest type and are included in Table C.1 of Appendix C of the Protocol. The dry weight is multiplied by 0.5 to convert the weight to carbon weight only. The weight of carbon in lbs is divided by 2,204.6 to get the carbon weight in metric tonnes (Mg).

Mg of carbon is then multiplied by 0.675 to account for mill efficiencies, taken from the Compliance Offset Protocol U.S. Forest Offset Projects page on ARB's website.

The resulting Mg carbon value after accounting for milling efficiencies is then passed to the wood products worksheets for calculating long-term in-use wood products storage. The wood products carbon is separated into product classes and multiplied by the respective

100-year average storage factor. The tables below list the assignment of wood products by class per the most current Assessment Area Data File taken from the Compliance Offset Protocol U.S. Forest Offset Projects page on ARB's website, as well as the 100-year average storage factors applied to each wood product class per table C.2 of Appendix C of the Protocol.

Wood Products by Class

% Softwood Lumber	97.067%
% Hardwood lumber	0.002%
% Softwood Plywood	1.874%
% Oriented Strandboard	0.000%
% Non Structural Panels	0.244%
% Miscellaneous Products	0.095%
% Paper	0.717%

100-year Storage Rates Average Values from Appendix C, In-Use Table C.2

Softwood Lumber	0.463
Hardwood lumber	0.250
Softwood Plywood	0.484
Oriented Strandboard	0.582
Non Structural Panels	0.380
Miscellaneous Products	0.176
Paper	0.058
Weighted Average	0.310

Average carbon stored in in-use wood products is calculated using equation C.1. Carbon is converted to CO₂-equivalent by multiplying by 3.664. This value is combined with IFM-8 using equation C.3 to represent $WP_{total, y}$ for the reporting period.

$WP_{total, y}$ for the reporting period represents $AC_{wp, y}$ in equation 6.1. Average in-use wood products produced by the baseline analysis ($BC_{wp, y}$) are deducted from actual wood products produced each reporting period ($AC_{wp, y}$) in equation 6.1 and the resulting calculation is multiplied by 80% to account for the "Market Response".

IFM-8 Forest product carbon in landfills (if applicable):

Wood products delivered to the mill in any period is calculated beginning with the cubic volume of harvested conifer trees 10" DBH and larger. Conifers smaller than 10" DBH are not included as they are too small to be delivered to the mill. The dry weight of wood products in pounds is calculated by multiplying the wood density in lbs/cubic foot by the cubic volume for each softwood species harvested. The wood densities utilized are those for the Douglas-fir forest type and are included in Table C.1 of Appendix C of the Protocol. The dry weight is multiplied by 0.5 to convert the weight to carbon weight only. The weight of carbon in lbs is divided by 2,204.6 to get the carbon weight in metric tonnes (Mg).

Mg of carbon is then multiplied by 0.664 to account for mill efficiencies, taken from the Compliance Offset Protocol U.S. Forest Offset Projects page on ARB's website.

The resulting Mg carbon value after accounting for milling efficiencies is then passed to the wood products worksheets for calculating long-term landfill wood products storage. The wood products carbon is separated into product classes and multiplied by the respective 100-year average storage factor. The tables below list the assignment of wood products by class per the most current Assessment Area Data File taken from the Compliance Offset Protocol U.S. Forest Offset Projects page on ARB's website, , as well as the 100-year average storage factors applied to each wood product class per table C.3 of Appendix C of the Protocol.

Wood Products by Class

% Softwood Lumber	97.067%
% Hardwood lumber	0.002%
% Softwood Plywood	1.874%
% Oriented Strandboard	0.000%
% Non Structural Panels	0.244%
% Miscellaneous Products	0.095%
% Paper	0.717%

100-year Storage Rates Average Values from Appendix C, In Landfill Table C.3

Softwood Lumber	0.298
Hardwood lumber	0.414
Softwood Plywood	0.287
Oriented Strandboard	0.233
Non Structural Panels	0.344
Miscellaneous Products	0.454
Paper	0.178
Weighted Average	0.199

Average wood products carbon stored in landfills is calculated using equation C.2. Carbon is converted to CO₂-equivalent by multiplying by 3.664. This value is combined with IFM-7 using equation C.3 to represent $WP_{total, y}$ for the reporting period.

$WP_{total, y}$ for the reporting period represents $AC_{wp, y}$ in equation 6.1. Average in-use wood products produced by the baseline analysis ($BC_{wp, y}$) are deducted from actual wood products produced each reporting period ($AC_{wp, y}$) in equation 6.1 and the resulting calculation is multiplied by 80% to account for the “Market Response”.

IFM-9 Biological emissions from site preparation:

As IFM-6 is an excluded carbon pool, IFM-9 is also an excluded pool.

IFM-14 Biological emissions/removals from change in harvesting on forestland outside Project Area:

The Protocol refers to this carbon pool as Secondary Effects which are calculated using equation 6.10 of the Protocol. Secondary Effects of harvesting less than the average wood products produced by the baseline growth and yield analysis are calculated by subtracting the average carbon in harvested trees prior to delivery to a mill (PDM) generated by the baseline analysis from the actual carbon in harvested trees prior to delivery to a mill, and then multiplying the difference by 20%. As Secondary Effects are only calculated in years when actual wood products produced are less than the annual average under the baseline analysis, the resulting calculation is either zero, or a negative number.

The PDM calculation each annual reporting period will be calculated based on a ratio between the average volume of wood delivered to the mill generated by the baseline analysis, and the average PDM value generated by the baseline analysis. Each reporting period, this ratio will be applied to the actual volume of wood delivered to a mill.

IFM-17 Biological emissions from decomposition of forest products:

This is quantified as a component of IFM-7 and IFM-8 as described above.

VII.C.

IFM-1 Standing Live: This carbon pool will be calculated each year as described in parts A and B above. A preliminary estimate of the current standing live carbon pool is 14,234,060 MgCO₂e.

IFM-3 Standing Dead: This carbon pool will be calculated each year as described in parts A and B above. A preliminary estimate of the current standing dead carbon pool is 162,910 MgCO₂e.

IFM-6 Soil (if applicable): N/A

IFM-7 Carbon in in-use forest products: This carbon pool will be calculated each year as described in parts A and B above. No harvesting is planned during the initial reporting period.

IFM-8 Forest product carbon in landfills (if applicable): This carbon pool will be calculated each year as described in parts A and B above. No harvesting is planned during the initial reporting period.

IFM-9 Biological emissions from site preparation: N/A

IFM-14 Biological emissions/removals from change in harvesting on forestland outside Project Area: This carbon pool will be calculated each year as described in parts A and B above. A preliminary estimate of biological emissions/removals due to this leakage is 22,189 MgCO₂e annually.

IFM-17 Biological emissions from decomposition of forest products: This is quantified as a component of IFM-7 and IFM-8 as described above.

VII.D.

Stratified random sampling formulas taken from Shiver and Borders (1996) will be used to calculate the sampling error for the Usal Redwood Forest IFM Project once mean standing live and standing dead pools have been determined for the new 2015 inventory. Preliminary estimates of the inventory confidence statistics, based on the confidence statistics as of 06/03/2014, are as follows:

Mean standing live and standing dead pools	81.76	Mg C per acre
SE of mean	0.49	Mg C per acre
SE of mean as %	0.599%	0.49 ÷ 81.76
Sampling Error of 90% CI	0.985%	(0.599%) * 1.645
Inventory Confidence Deduction	0%	0.985% - 5.0%

VII.E.

The risk ratings shown on the next page assume that the Project will not employ a Qualified Conservation Easement.

Project Area Reversal Risk Rating:

Risk Category	Contribution to Reversal Risk Rating
Financial Failure	5.0%
Conversion	2.0%
Over-harvesting	2.0%
Social	2.0%
Wildfire	4.0%
Disease/Insect	3.0%
Other Catastrophic	3.0%
Total Buffer Pool Contribution	19.2%

The Project's reversal risk rating is calculated as follows:

$$100\% - (((1-0.05)*(1-0.02)*(1-0.02)*(1-0.02)*(1-0.04)*(1-0.03)*(1-0.03)*100)) = 19.2\%$$

VIII.A.5.

Following the calculation methodologies described in section VII B above, the baseline modeling presented in the Modeling Plan (Attachment K) generates an average annual value for each of the above described wood products carbon pools. Actual wood products values for In-use, Landfill, and Prior to Delivery to the Mill ("PDM") are calculated based on a flow of wood products over the 100-year planning period. The table below presents an estimate of the average wood products stored long-term values that will be generated by the baseline analysis.

Woods Products Class	Mg C/ acre	Total Mg CO2e
Average Annual Carbon 100-year In-Use	0.156	21,484.68
Average Annual Carbon 100-year Landfill	0.101	17,756.91
Average Annual Carbon in Harvested Trees Prior to Delivery to the Mill	1.260	221,892.68

VIII.B.5.

The average baseline model results must not fall below a minimum baseline level (MBL). Because the Project's initial above-ground standing live carbon stocks were above Common Practice, the MBL is determined using Equation 6.5 in the Forest Project Protocol:

$$MBL = \text{MAX} (CP, \text{MIN} (ICS, CP+ICS-WCS))$$

Where,

MBL = Minimum baseline level (above-ground standing live carbon stocks)

CP = Common Practice (as determined above)

ICS = Initial above-ground standing live carbon stocks per acre within the Project Area (see Section 7 above)

WCS = The weighted average above-ground standing live carbon stocks per acre for all Forest Owner (and affiliate) landholdings within the same logical management unit (LMU) as the Project Area.

WCS is calculated using Equation 6.7:

$$\text{If } \left| 1 - \frac{ECS}{ICS} \right| \leq 0.2, \text{ then } WCS = ICS$$
$$\text{If } \left| 1 - \frac{ECS}{ICS} \right| > 0.2, \text{ then } WCS = \frac{ICS \times PA + ECS \times EA}{PA + EA}$$

Where,

WCS = Same as described above

ICS = Same as described above

PA = Size of the Project Area in acres

ECS = Above-ground standing live carbon stocks per acre within the LMU but excluding the Project Area (EA), as determined from existing inventory data

EA = Size of the LMU in acres, excluding the Project Area

A “logical management unit” or “LMU” is defined as all land that the Forest Owner and its affiliate(s) either own in fee or hold timber rights on, and which it or they manage as an explicitly defined planning subunit. LMUs are generally characterized by having unique biological, geographical, and/or geological attributes, are generally delimited by watershed boundaries and/or elevational zones, and contain unique road networks.

The Usal Redwood Forest IFM has been identified as one LMU, and no commercial forestland¹ within the LMU has been excluded from the Project Area. The LMU has been defined as all lands where the forest owner currently own in fee within the same Assessment Area(s) covered by the Project Area.

The Usal Redwood Forest IFM’s variables are as follows:

CP = 166.32 Mg CO₂e per acre

ICS = 192.06 Mg CO₂e per acre

PA = 47,979.24 acres

ECS = 0 Mg CO₂e per acre

EA = 0 acres

Since ECS = 0, the first if-then expression of equation 6.7 is not true, and the second if-then expression must be evaluated. Since ECS and EA are equal to 0, the second if-then expression reduces to:

WCS = ICS , or,

WCS = 192.06 MgCO₂e per acre

Equation 6.5 then becomes:

MBL = MAX (166.32, MIN (192.06, 166.32 + 192.06-192.06))

MBL = MAX (166.32, MIN (192.06, 166.32))

¹ The Project Area excludes non-timbered lands such as grass, brush, water, and areas where slope stability issues preclude the growing of trees. URFC owns the timber rights on approximately 60 acres of timber land in the northwest quarter of section 15 T23N R17W; however, these rights expire in less than 100 years, and as such URFC has not included them in the Project Area. URFC would be unable to ensure that GHG reductions claimed from these timber rights could be maintained for 100 years.

MBL = MAX (166.32, 166.32)

MBL = 166.32 MgCO₂e per acre

The averaged modeled baseline results, expressed as above-ground standing live carbon stocks per acre, must not fall below the MBL of 166.32 MgCO₂e per acre.

VIII.B.8.

In modeling the baseline for standing live carbon stocks, the Forest Owner must incorporate financial constraints that could affect baseline growth and harvesting scenarios. The Usal Redwood Forest - Compliance Project utilized a financial analysis of the baseline harvesting regime that captures all relevant costs and returns, taking into account all legal, physical, and biological constraints. This financial analysis has been included as Attachment J of this listing application. Cost and revenue variables included in the financial analysis are based on documented costs and returns for the Project Area, and on other properties in the Assessment Area. This financial analysis illustrates that the baseline harvest scenario is financially feasible.

X Attachments

The following attachments are included as a part of this application for listing:

Attachment A - Title Report.

Attachment E – Map of the Project Area, including an ESRI Geodatabase that represents the Project Area.

Attachment F – Orthophoto Map of the Project Area.

Attachment G – A Graph Portraying the Project’s Baseline.

Attachment H – A Diagram of the Project’s Baseline.

Attachment J – Financial Analysis of the Baseline Scenario

Attachment K –Modeling Plan

Attachment L –Inventory Specification

Attachment M – Volume and Biomass Equations

Attachment N - Legal Constraints Affecting Forest Management Activities on the Project Area