

CAFR5364: Chugach Alaska Forest Carbon Project

Initial Offset Project Data Report, Version 3.5

29 April 2020

*Air Resources Board
Compliance Offset Protocol
U.S. Forest Projects
Adopted: June 25, 2015*

1-A. REPORTING PERIOD 1:

6/6/2017 – 6/6/2018

1-B. PROTOCOL VERSION:

Air Resources Board
Compliance Offset Protocol – U.S. Forest Projects
Adopted: June 25, 2015

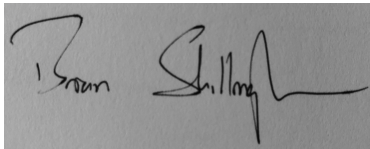
1-C. REGULATION VERSION:

April 2019

1-D. ATTESTATION

I certify under penalty of perjury under the laws of the State of California the GHG reductions and/or GHG removal enhancements for Chugach Alaska Forest Carbon Project from June 6, 2017, to June 6, 2018, are measured in accordance with the Compliance Offset Protocol U.S. Forest Projects, June 25, 2015, and all information required to be submitted to ARB in the Offset Project Data Report is true, accurate, and complete.

Name:



Digitally signed by Brian Shillinglaw
DN: cn=Brian Shillinglaw, o=New Forests Inc.,
ou=President,
email=bshillinglaw@newforests-us.com, c=US
Date: 2020.05.01 10:44:34 -07'00'

Title: President

Date: May 1, 2020

1-E. NOTE TO READER ON ATTACHMENTS TO THE OPDR

This version of the OPDR includes the necessary information required in attachments G, H, I, and K; thus, these attachments are not being provided separately. Attachments A, E, F and L are included as separate attachments to this document. Attachments B, C, D and J are not applicable to this project.

1-F. NOTE TO READER REGARDING DIFFERENCES BETWEEN OPDR AND LISTING DOCUMENTS

If there are differences between the listing documents and this OPDR, the differences are enumerated in the following table.

Table 1. Listing Documents to OPDR Changes

Line	Item	OPDR Location	Listing Documents	Description
1	Reporting Period	1-A: Reporting Period	Listing Form pg. 1	Reporting Period was extended.
2	APD contact information	7: OPO/APD Information	Listing Form pg. 1	Updated APD mailing address.
3	OPO contact information	7: OPO/APD Information	Listing Form pg. 1	Updated contact person information for OPO.
4	Project Area	8-C: Location & 8-D Vicinity Map	Listing Form pg. 2	Project Area changed; maps, acreage and other project information modified to reflect revised Project Area.
5	Assessment Areas	13-H: Identification of Supersections & Assessment Areas	Listing Form pg. 2 & 3	Acreages allocated to the Assessment Areas changed as a result of revisions to the Project Area.
6	Inventory	Various	Listing Form pg.3	Inventory changed due to updated project area and stratification.
7	Summary of onsite carbon stocks	11-H: Actual Onsite Carbon Stocks	Listing Form pg. 6	Onsite carbon stock estimates changed because of revised project area and carbon calculations.
8	Baseline carbon stocks	11-F: Final Baseline	Listing Form pg. 7	Baseline carbon stock estimates changed because of revised FVS modeling, updated project area, and revised carbon calculations.
9	Reversal risk rating	10-C: Project's risk reversal calculation	Listing Form pg. 8	Reversal risk rating changed based on ARB clarification
10	Species composition	Table 2	Attachment G	Species composition changed as a result of project area changes.

2. TABLE OF CONTENTS

1-A. Reporting Period 1:.....	ii
1-B. Protocol Version:	ii
1-C. Regulation Version:.....	ii
1-D. Attestation	ii
1-E. Note to Reader on Attachments to the OPDR	ii
1-F. Note to Reader Regarding Differences between OPDR and Listing Documents	iii
2. Table of Contents	v
3. List of Tables	x
4. List of Figures	xi
5. Offset Project Information	12
5-A. Offset Project Name	12
5-B. Offset Project ID.....	12
5-C. Offset Project Type	12
5-D. Commencement Date & Justification	12
5-E. Listing Date Completion	12
6. OPO/APD Information.....	13
6-A. Offset Project Operator.....	13
6-B. Authorized Project Designee	13
6-C. Submitted By.....	14
6-D. Technical Consultants.....	14
7. Land Ownership	16

7-A. Name & Mailing Address of All Forest Owners, including third parties with existing property interests	16
7-B. Name & Mailing Address of Parties with a Material Interest	16
7-C. Location	16
7-D. Location/Vicinity map of Property	17
7-E. Physical Address of Project Site (if available)	19
7-F. Qualified Conservation Easement(s)	19
8. Offset Project Area	20
8-A. Forest Conditions within the Project Area	20
i. Tree species & age-class distribution	20
ii. Management history	20
iii. Planned Management Activities	20
iv. Potential Risks to Tree Health	21
8-B. Project Area Governing Jurisdictions & Project Coordinates	21
8-C. Project Area Site Classes	21
8-D. Land Pressure(s) and Climate Zone Classification	21
8-E. Current & Historical Land Use	22
8-F. Current Zoning	22
9. Offset Project Eligibility	23
9-A. Canopy Cover	23
9-B. Broadcast Fertilization	23
9-C. Natural Forest Management Criteria	23
9-D. Regeneration Cut/Commercial Harvest	24

9-E. Sustainable Management	25
9-F. Age Class Requirement	25
9-G. Structural Elements (Standing & Lying Dead Wood).....	25
9-H. Management Activities Leading to Increased Carbon Stocks.....	26
9-I. Additionality: Legal Requirement Test	26
9-J. Additionality: Performance Standard Evaluation	26
9-K. Previous Registration as Forest Offset Project	26
9-L. Regulatory Compliance	27
10. Carbon Stock Inventory.....	28
10-A. Project Area Forest Vegetation Types	28
10-B. Project Boundary Delineation	28
i. Chugach Alaska Corporation Ownership	29
ii. Anadromous water body buffers excluded.....	29
10-C. Project’s Risk Reversal Calculation	30
10-D. Offset Project Boundary Description & List of Onsite Carbon Pools Included	30
10-E. Inventory Design and Sampling Process.....	33
i. Systematic Sample.....	33
ii. Plot Establishment.....	34
iii. Plot Measurements.....	34
iv. Tree Measurements.....	35
v. Inventory Equipment	35
vi. Plots on Project Boundaries.....	35
10-F. Updating/Replacing Sample Plots & Inventory	36

10-G. Data Management Systems & Processes	36
10-H. Quality Assurance/Quality Control (QA/QC) Procedures	37
Data collection	38
Data processing.....	38
Data management.....	38
10-I. Change Log of Inventory Methods or Volume & Biomass Equations.....	38
10-J. Procedures for Updating the Forest Carbon Inventory.....	39
10-K. Initial Above-Ground Standing Live Tree Carbon Stocks.....	40
10-L. Common Practice (CP) Value	40
i. Identification of Supersections & Assessment Area(s) by Area	40
ii. Common Practice Site Class Stratification.....	42
iii. Single Common Practice Value	42
iv. Common Practice Compared to Above-Ground Standing Live	42
v. Weighted-Average Above-Ground Standing Live Tree Carbon Stocks	44
10-M. Carbon Quantification Methods – Modeling Carbon Stocks.....	44
i. Biomass and Carbon Equations	44
11. Baseline and Project Models	47
11-A. Legal Constraints.....	48
11-B. Financial Constraints.....	53
11-C. FVS Modeling.....	53
11-D. FVS Prescriptions	54
11-E. Baseline Onsite Carbon Stocks	57
11-F. Final Baseline Incorporating All Required Onsite Carbon Pools.....	62

11-G. Baseline Carbon in Harvested Wood Products.....	63
11-H. Determining Actual Onsite Carbon Stocks	63
11-I. Determining Actual Carbon in Harvested Wood Products	66
11-J. Calculating Secondary Effects	66
12. Other Offset Programs.....	66
13. GHG Reductions and Removals	66
14. Attachment E	70
15. Attachment F	70
16. Appendix I: Inventory Manual	70
17. Appendix II: Python Libraries Used	70
18. References	71

3. LIST OF TABLES

Table 1. Listing Documents to OPDR Changes	iv
Table 2. Species composition	23
Table 3. Strata summary information	28
Table 4. Project contribution to the buffer account based on risk analysis.....	Error! Bookmark not defined.
Table 5. Carbon pools/sources that must be accounted for.....	30
Table 6. Project area by supersection and assessment area	42
Table 7. Common practice calculation	42
Table 8. Legal constraints to baseline model	48
Table 9. FVS Prescriptions	54
Table 10. Baseline Acreage Allocation by prescription and strata.....	57
Table 11. Carbon (CO ₂ e) Reported from the Baseline Harvest Schedule.....	58
Table 12. Forest Offset Protocol Table A.2 Summarizing Total Carbon by Carbon Pool and Stratum	64
Table 13. Forest Offset Protocol Table A.3 Summarizing Carbon Pools and Total MT CO ₂ e/acre by Carbon Pool.....	64
Table 14. Carbon (CO ₂ e) reported from the Project Activity harvest schedule	65
Table 15. GHG reductions and removals worksheet.....	67

4. LIST OF FIGURES

Figure 1. Vicinity map of property	18
Figure 2. Watershed boundary map of property	19
Figure 3. Supersection Map	41
Figure 4. Onsite Baseline Stocking as Modeled	60
Figure 5. Final Baseline Results Averaged	61

5. OFFSET PROJECT INFORMATION

5-A. OFFSET PROJECT NAME

Forest Offset Protocol §7.1.1(a)(1)

Chugach Alaska Forest Carbon Project

5-B. OFFSET PROJECT ID

Forest Offset Protocol §7.2.1(a)(2)

ARB Project ID: CAFR5364

Registry Project ID: CAR1264

5-C. OFFSET PROJECT TYPE

Forest Offset Protocol §7.1.1(a)(2)

Improved Forest Management

5-D. COMMENCEMENT DATE & JUSTIFICATION

Forest Offset Protocol §3.6(a)(2), §7.1.1(a)(16)

June 06, 2017: the date of listing documentation was submitted to the Offset Project Registry.

5-E. LISTING DATE COMPLETION

Forest Offset Protocol §7.1(a)

June 06, 2017

6. OPO/APD INFORMATION

6-A. OFFSET PROJECT OPERATOR

Forest Offset Protocol §7.1(a)(3)(A)

Name: Chugach Alaska Corporation

Contact Person: David Phillips

Phone: (907) 261-0345

Mailing Address: 3800 Centerpoint Drive, Suite 1200, Anchorage, AK99503

Physical Address: 3800 Centerpoint Drive, Suite 1200, Anchorage, AK99503

Email Address: dphillips [at] chugach.com

CITTS ID Number: CA2300

6-B. AUTHORIZED PROJECT DESIGNEE

Forest Offset Protocol §7.1(a)(3)(B)

Name: Forest Carbon Partners, LP

Contact Person: Brian Shillinglaw

Phone: 415-321-3305

Mailing Address: 235 Pine Street, Suite 1475, San Francisco, CA 94104

Physical Address: 235 Pine Street, Suite 1475, San Francisco, CA 94104

Email Address: bshillinglaw [at] newforests-us.com

CITTS ID Number: CA1403

6-C. SUBMITTED BY

Forest Offset Protocol §7.1(a)(3)(C)

Name: Forest Carbon Partners, LP

Contact Person: Brian Shillinglaw

Phone: 415-321-3305

Mailing Address: 235 Pine Street, Suite 1475, San Francisco, CA 94104

Physical Address: 235 Pine Street, Suite 1475, San Francisco, CA 94104

Email Address: bshillinglaw [at] newforests-us.com

6-D. TECHNICAL CONSULTANTS

Forest Offset Protocol §7.2.1(a)(4)(D)

Name: Chugachmiut

Contact Person: Nathan Lojewski

Phone: 907-562-4155

Mailing Address: 1840 Bragaw Street, Suite 110, Anchorage, AK 99508

Physical Address: 1840 Bragaw Street, Suite 110, Anchorage, AK 99508

Email Address: Nathan [at] Chugachmiut.org

Name: Steigerwaldt Land Services

Contact Person: Forrest Gibeault

Phone: 715-453-3274

Mailing Address: 856 North 4th Street, Tomahawk, WI 54487

Physical Address: 856 North 4th Street, Tomahawk, WI 54487

Email Address: forrest.gibeault [at] steigerwaldt.com

Name: SilviaTerra

Contact Person: Zack Parisa

Phone: 717-884-8733

Mailing Address: 2443 Fillmore St. #380-1418, San Francisco, CA 94115

Physical Address: 2443 Fillmore St. #380-1418, San Francisco, CA 94115

Email Address: zack [at] silviaterra.com

7. LAND OWNERSHIP

7-A. NAME & MAILING ADDRESS OF ALL FOREST OWNERS, INCLUDING THIRD PARTIES WITH EXISTING PROPERTY INTERESTS

(Forest Offset Protocol §7.1.1(a)(8))

The Chugach Alaska Corporation is the owner of fee title to the real property included in the Project Area. Based on a title review and inquiry with the Offset Project Operator, property interests held by other parties such as easements and rights of way will not affect the trees and the standing timber located within the Project Area.

Name	Address	Interest
Chugach Alaska Corporation	3800 Centerpoint Drive, Suite 1200 Anchorage, AK 99503	fee interest in the land and standing timber

7-B. NAME & MAILING ADDRESS OF PARTIES WITH A MATERIAL INTEREST

Forest Offset Protocol §7.1.1(a)(9)

N/A

7-C. LOCATION

Forest Offset Protocol §2.2(b)(2), §3.1(a)(2), §7.1.1(a)(11), Regulation §95975(l)

The project takes place on private land located in the United States.

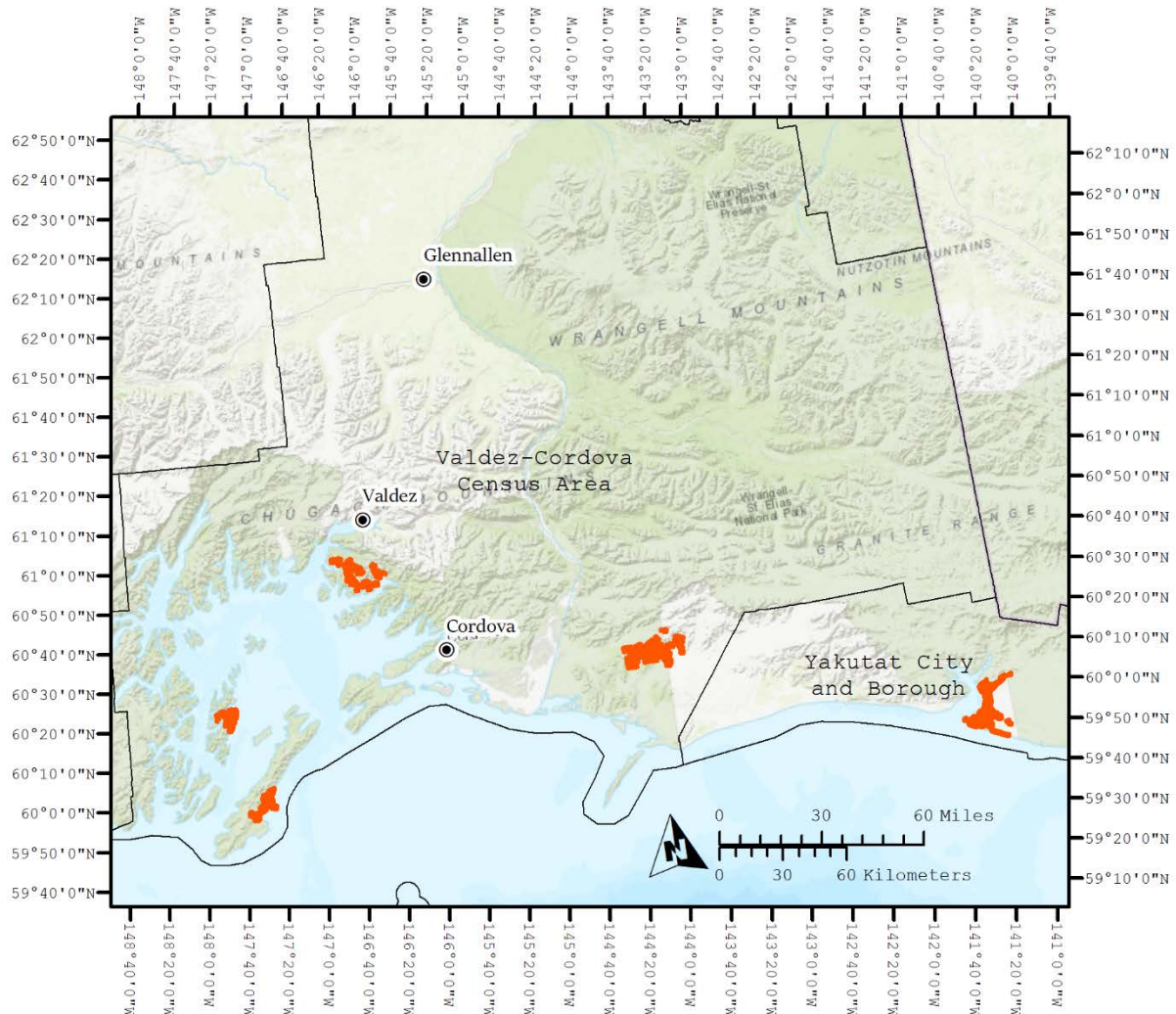
Figure 1. Vicinity map of property shows the vicinity and location of the property. Figure 2 shows the watershed boundaries within the project area. Detailed maps of the vicinity of the property including topography and watercourses are attached separately as Attachment E.

The property is held by the Chugach Alaska Corporation, which was formed in 1972 under the Alaska Native Claims Settlement Act to provide economic opportunity and preserve the culture and traditions of the native people of the Chugach region of Alaska. The Chugach Alaska Corporation land holdings include 8 tracts within the three Boroughs of Prince William Sound (Valdez-Cordova), Kenai Peninsula and Yakutat Borough, State of Alaska, USA.

Chugach Alaska Corporation is the sole private owner in fee of the offset project area. The offset project area is not located 1) on land that is owned by, or subject to an ownership or possessory interest of a Tribe, 2) on Indian Land as defined in 25 U.S.C. §81(a)(1), or 3) on land that is owned by any person, entity, or Tribe within the external borders of such Indian Lands.

7-D. LOCATION/VICINITY MAP OF PROPERTY

Figure 1. Vicinity map of property



Project Location Map

NewForests
FOREST CARBON PARTNERS

- Town
- Alaska Borough or Census Area
- Project Area

No representation or warranty of any kind is made as to the accuracy of this map. The maps and/or map data are not legal surveys or legal descriptions. These maps are created from multiple private, city, county, state, and federal sources and the source data may contain errors.
Map last published on 2019-06-10.

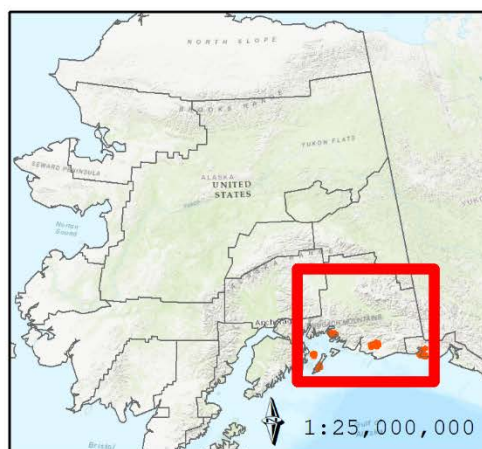
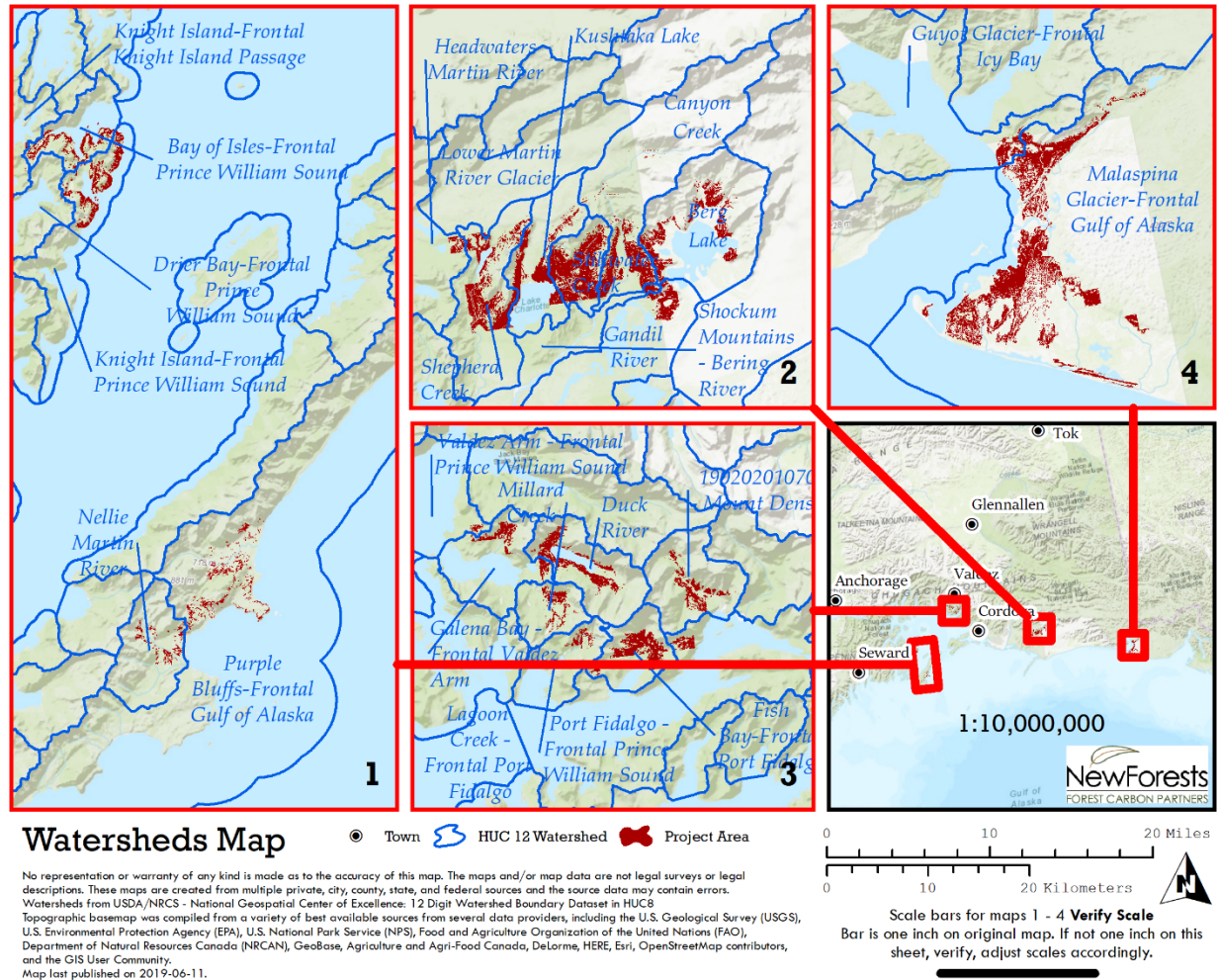


Figure 2. Watershed boundary map of property



7-E. PHYSICAL ADDRESS OF PROJECT SITE (IF AVAILABLE)

(Forest Offset Protocol §7.1.1(a)(10))

The Project Site has no physical address. It is located southeast of Anchorage, Alaska.

7-F. QUALIFIED CONSERVATION EASEMENT(S)

(Forest Offset Protocol §7.1.1(a)(20))

There is no conservation easement on the property.

8. OFFSET PROJECT AREA

8-A. FOREST CONDITIONS WITHIN THE PROJECT AREA

Forest Offset Protocol §7.1.1(a)(19), Appendix A(a)(8)

i. TREE SPECIES & AGE-CLASS DISTRIBUTION

Forest vegetation is coastal rainforest, primarily pure Sitka spruce or mixed spruce-hemlock stands. Willows, cottonwoods, and large shrubs such as Sitka alder intermingle in riparian areas adjacent to the project. The current age class distribution is a reflection of the harvests and disturbances that have taken place. Mature Sitka spruce stands have mixed ages and are dominated by 100-150-year-old trees, with some large trees that are hundreds of years old. Younger trees are present in areas that have been harvested in the past half-century.

ii. MANAGEMENT HISTORY

The project is located in rugged coastal mountains, fjords, and glacial valleys. The land cover is primarily coastal rainforest, with many salmon-bearing streams and a lush understory of shrubs and moss. Subsistence lifestyles have been practiced around the Project Area for thousands of years by Chugach Alaska Corporation shareholders and their ancestors. European traders and settlers arrived in the area in the 1700s.

Management history varies from clearcuts to old forest stands that have not been intensively treated. Although records are limited from earlier periods, there was likely land management by the Chugach people including use of trees and timber through the 1700s. Large old stumps suggest that some individual trees were cut for timber over the next several hundred years. Modern intensive forest management began in the 1960s when the land was controlled by the State of Alaska and the U.S. Forest Service. Further clearcuts accompanied by road building and natural or artificial reforestation were carried out when Chugach Alaska Corporation obtained title in the 1970s and continued intermittently through the 2000s.

iii. PLANNED MANAGEMENT ACTIVITIES

Commercial harvest will be greatly reduced over the project life compared to the baseline by harvesting less than annual growth on average in order to build carbon stocks. The planned land use is a combination of hunting, fishing, and non-timber forest product collection along with recreation, tourism and cultural uses. Timber stand improvement and harvest may occur in the future according to market conditions and shareholder priorities.

iv. POTENTIAL RISKS TO TREE HEALTH

The primary disturbance agents in the Chugach project area are Spruce Bark Beetle (*Dendroctonus rufipennis*), windthrow, and landslides. The project area consists of forest dominated by Sitka spruce with minor components of western hemlock, mountain hemlock and black cottonwood. Chugach is at the northern extreme of the Sitka spruce range and common insect pests such as the white pine weevil (*Pissodes strobe*) are not present in the project area or the northern range of the Sitka spruce. Throughout the Sitka spruce range fire is not a prominent cause of mortality (McClelland et al 1990).

8-B. PROJECT AREA GOVERNING JURISDICTIONS & PROJECT COORDINATES

Forest Offset Protocol §7.1.1(a)(15)(A)

The project is located in the State of Alaska, United States of America. The centroid of the project area is 60.34801 North, -144.6547 West.

8-C. PROJECT AREA SITE CLASSES

Forest Offset Protocol §7.1.1(a)(15)(I)

Site classes are productivity classes defined by ranges of site index. Site index is measured as the height of a tree at a given age (50 years is the typical standard base age used in the western US, although 100 years used to be more common). The commercial forest included in the project area has average site index values for the most common species, Sitka spruce, ranging from 47 to 68 feet tall at 50 years old based on inventory data. Site index equations were taken from Farr (1984), which is consistent with the FVS regional variant. More productive forests and soils are located on valley bottoms with deeper soils and milder weather.

Site class is not defined by forest practice regulations in Alaska and is not required for assessment areas in the region. For this reason, site class was not used in determining the common practice or baseline of the project.

8-D. LAND PRESSURE(S) AND CLIMATE ZONE CLASSIFICATION

Forest Offset Protocol §7.1.1(a)(15)(J), Appendix A(a)(5, 6)

The maritime climate of the Project Area has abundant precipitation in both rain and snow. Summer days are long, and daylight hours are short in winter. Land pressures include timber harvest, mining, and development of houses and tourism. The Project Area covers a wide range of elevations, aspects, and coastal exposure, which strongly influence the microclimate and vegetation.

8-E. CURRENT & HISTORICAL LAND USE

Forest Offset Protocol §7.1.1(a)(15)(K)

Subsistence lifestyles have been practiced around the Project Area for thousands of years by Chugach Alaska Corporation shareholders and their ancestors. European traders and settlers arrived in the area in the 1700s. Modern industrial timber harvest was conducted in the region from the 1960s through the 2000s. Current land use is a combination of hunting, fishing, and non-timber forest product collection along with recreation, tourism and cultural uses. Timber stand improvement and harvest may occur in the future according to market conditions and shareholder priorities.

8-F. CURRENT ZONING

Forest Offset Protocol §7.1.1(a)(15)(K)

The Project Area is located in the Prince William Sound (Valdez-Cordova) and Yakutat Boroughs of the State of Alaska, USA. These boroughs do not have zoning restrictions outside of municipal areas.

9. OFFSET PROJECT ELIGIBILITY

9-A. CANOPY COVER

(Forest Offset Protocol §2.2(b)(3), §7.1.3(1))

The project takes place on land that has greater than 10-percent tree canopy cover. Attachment F demonstrates greater than 10% canopy cover in the Project area.

9-B. BROADCAST FERTILIZATION

Forest Offset Protocol §3.1(b)(3), §7.1.1(a)(21)

No broadcast fertilization has been used in the Project Area since the Project Commencement Date and there are no plans to employ broadcast fertilization in the future in the Project Area.

9-C. NATURAL FOREST MANAGEMENT CRITERIA

Forest Offset Protocol §3.1, §7.1.1(a)(23)

Management activities that occur on the project area will be designed to improve natural ecosystem processes, enhance native tree species and adhere to the Natural Forest Management practices required by the Forest Offset Protocol.

The project must consist of at least 95% native species based on the sum of carbon in the standing live pool. One hundred percent of the project is comprised of native species based on the 2017 inventory. Table 2. Species composition shows that at least 95% of the carbon in the standing live carbon pool is composed of native species.

Table 2. Species composition

Species				Basal Area Per Acre (ft ²)	Comp by Basal Area (%)	Native species	Percent by Native
Common Name	Scientific Name	FVS Code	FIA Code				
Sitka spruce	<i>Picea sitchensis</i>	SS	98	86.8	40.9%	Yes	40.9%
western hemlock	<i>Tsuga heterophylla</i>	WH	263	61.9	29.2%	Yes	29.2%

mountain hemlock	<i>Tsuga mertensiana</i>	MH	264	49.1	23.1%	Yes	23.1%
black cottonwood	<i>Populus trichocarpa</i>	CW	747	14.4	6.8%	Yes	6.8%
Total				172.0	100.0%		100.0%

Source: Schedules workbook, Tables tab.

9-D. REGENERATION CUT/COMMERCIAL HARVEST

Forest Offset Protocol §7.1.1(a)(22)

When harvesting is planned or implemented, sustainable long-term harvesting practices must be demonstrated through one or a combination of the following options:

1. The forest owner(s) must be certified under the Forest Stewardship Council, Sustainable Forestry Initiative, or Tree Farm System certification programs. The terms of certification must require adherence to and verification of harvest levels which can be permanently sustained over time;
2. The forest owner(s) must adhere to a renewable long-term management plan that demonstrates harvest levels which can be permanently sustained over time and that is sanctioned and monitored by a state or federal agency; or
3. The forest owner(s) must employ uneven-aged silvicultural practices (if harvesting occurs) on all of the forest owner's landholdings within the assessment area containing the project and maintain canopy cover averaging at least 40 percent across all of the forest owner's landholdings within the assessment area containing the project as measured on contiguous 20 acre areas within the forest owner's landholdings found in any of these assessment areas, including land within and outside of the project area (areas impacted by significant disturbance may be excluded from this test);

Commercial harvesting is not currently planned or occurring within the project area. Also, no harvesting is planned elsewhere on the forest owner's landholdings. Therefore, the project meets the sustainable harvesting requirement.

9-E. SUSTAINABLE MANAGEMENT

Forest Offset Protocol §3.1(a)(1)

☒ Not applicable; no commercial harvesting is occurring within the Project Area.

9-F. AGE CLASS REQUIREMENT

Forest Offset Protocol §3.1(a)(1), Table 3.1

Field data collected during the 2017 inventory was used to analyze the distribution of age classes in the Project Area. Age class was based on gathering age from 55 potential site trees throughout the ownership. The distribution of site tree ages from 34 to 385 revealed that no stands could be considered to be less than 20 years old. Therefore, the project meets the requirement in Table 3.2 of the protocol that no more than 40% of the forested acres on a watershed scale are in age classes of less than 20 years.

9-G. STRUCTURAL ELEMENTS (STANDING & LYING DEAD WOOD)

Forest Offset Protocol §3.1(a)(1), Table 3.1

No salvage logging or active removal of down dead wood has occurred within the project area during the reporting period. Therefore, the project must maintain or demonstrate ongoing progress toward an average of at least:

- one (1) metric ton of carbon (C) in standing dead wood per acre; or
- 1% of standing live carbon stocks, in standing dead wood, whichever is higher.

The current standing dead wood stocks are 2.49 metric tons of carbon per acre, which is higher than 1% of standing live carbon stocks (0.68 mt C/ac) and is above the target of one (1) metric ton. Since the current carbon stocks in standing dead exceed the minimum requirements, the project must maintain an average of at least one (1) metric ton of carbon (C) in standing dead wood per acre, which is higher than 1% of standing live carbon stocks.

Standing dead wood was estimated by sampling standing dead trees in the inventory and applying the biomass estimates as described in the inventory calculation section.

9-H. MANAGEMENT ACTIVITIES LEADING TO INCREASED CARBON STOCKS

Forest Offset Protocol §7.1.1(a)(18)

The Project will produce reductions by managing the project forest for increased stocking and carbon sequestration when compared to the project baseline. This will be accomplished in the near term by allowing the forest to grow. If harvesting should occur in the future, carbon stocks will be maintained by harvesting less than annual growth on average. Overall stocks will never drop below the level of standing live carbon stocks at the initiation of the project. Stocks will be maintained at a level that assures all credited standing live carbon stocks are permanently maintained.

9-I. ADDITIONALITY: LEGAL REQUIREMENT TEST

Forest Offset Protocol §3.4.1, Regulation §95973(a)(2) & §95975(k)

The primary legal constraints to forest management on the Project Area is the Alaska Forest Resources and Practices Act. The national Endangered Species Act, Bald and Golden Eagle Protection Act, and Clean Water Act also apply. As a result, the baseline for this project was modeled using applicable provisions of state and federal law. These constraints are examined more closely in the Legal Constraints section of this document.

Since 1) the project activities are not legally required, and 2) modeling of the forest project's baseline carbon stocks reflects all legal constraints, the emission reductions or removals enhancements achieved by the forest project exceed those required by any law, regulation, or other legally binding mandate and thus the project satisfies the legal requirement test.

9-J. ADDITIONALITY: PERFORMANCE STANDARD EVALUATION

Forest Offset Protocol §3.4.2, Regulation §95973(a)(2)

An Improved Forest Management Project automatically satisfies the performance standard evaluation, since the project activities produce GHG emission reductions and GHG removal enhancements in excess of those that would have occurred under a conservative business-as-usual scenario (i.e. the baseline).

9-K. PREVIOUS REGISTRATION AS FOREST OFFSET PROJECT

Forest Offset Protocol §3.1(a)(5)

None of the land within the Project Area has ever been listed or registered with an offset project registry or program, nor have greenhouse gas emission reductions or removal enhancements associated with the Project Area been credited or claimed for the purpose of greenhouse gas mitigation or reduction goals, either in a voluntary or regulatory context.

9-L. REGULATORY COMPLIANCE

Forest Offset Protocol §7.2.1(a)(8)

Based on the best available information, the forest project and associated project lands have met and been in compliance with all local, state, or federal regulatory requirements during the reporting period. No notice of violation has been received during the reporting period.

10. CARBON STOCK INVENTORY

(Forest Offset Protocol §4.2, §7.1.1(a)(24, 27, 28, 31), Appendix A

10-A. PROJECT AREA FOREST VEGETATION TYPES

(Forest Offset Protocol §Appendix A(a)(2))

The forests within the Chugach Alaska Corporation ownership are comprised principally of Sitka spruce, with a small amount of hemlock and hardwoods in riparian areas. The project was post-stratified by stocking, which is generally correlated with forest size and density, in order to better identify the mature, commercially viable timberland for inclusion in the project. Inventory plots were grouped into the three strata such that within-stratum variance was minimized (Table 3).

Table 3. Strata summary information

Strata	Acres	Average onsite carbon (metric tonnes CO ₂ /acre)	Standard error	Plot Count
3	18,170	130.2	7.03	90
4	21,217	260.8	11.42	102
5	9,890	506.1	33.58	53
Total	49,278	261.87		248

Source: NF_Schedules, Statistics

10-B. PROJECT BOUNDARY DELINEATION

The project boundary was determined by delineating eligible timber stands within the property ownership of the Chugach Alaska Corporation. Anadromous water body buffer areas and areas encumbered by third-party mineral or timber rights were excluded from the project area.

The following steps were used to determine the project area boundary.

1. Map acreage owned by Chugach Alaska Corporation, organized by geographic tracts (pre-stratification).
2. Remove areas encumbered by easements and/or deeds controlled by third parties.
3. Remove no-cut anadromous water body buffers.

4. Remove area classified as non-forest based on a threshold of < 10 MG CO₂ equiv. per acre, which was determined to be the appropriate threshold value for differentiating forest from other lower-biomass woody vegetation (i.e., shrublands).
5. Remove two geographically distinct island tracts with difficult access.
6. Overlay stratification, grouping forest by density to minimize within-stratum variance (post-stratification).
7. Removing lowest stocked strata and retaining the three highest stocked strata, corresponding with the mature, commercially viable timberland for inclusion in the final project area.
8. Removed area that was deemed too steep and inaccessible based off a slope analysis of a DEM from USGS. The cut off was 108% slope.

i. CHUGACH ALASKA CORPORATION OWNERSHIP

Ownership was mapped using available BLM PLSS data in combination with legal descriptions in deeds and tile reports. Any easements and/or deeds encumbering the discretion of the Chugach Alaska Corporation to harvest or otherwise manage timber were delineated and excluded from the project.

ii. ANADROMOUS WATER BODY BUFFERS EXCLUDED

Anadromous water bodies with legal constraints that prohibit harvest were buffered and excluded from the Project area. The Alaska Forest Resources Practices Act (FRPA) organizes water body setback standards by region and stream type. An assessment of the FRPA regulations indicates that the property occurs within Region 1 (Coastal Sitka Spruce/Hemlock Unit) and includes Type 1-A and 1-B water body standards. All Type 1-A and 1-B anadromous water bodies have 66-foot buffers on all sides excluded from the project area. Non-anadromous streams were not buffered as the regulation does not require a no cut buffer. These water bodies need to be operationally protected for slope stability but cutting can occur to the stream edge and thus were not excluded from the project area (Table 8).

10-C. PROJECT'S RISK REVERSAL CALCULATION

(Forest Offset Protocol Appendix D)

Table 4. Project contribution to the buffer account based on risk analysis

Risk Category	Risk Type	Contribution to reversal risk rating
Financial	Financial Failure	1%
Management	Illegal Forest Biomass Removal	0%
	Conversion	0%
	Over-harvesting	0%
Social	Social	0%
Natural Disturbance	Wildfire	4%
	Disease or Insect Outbreak	3%
	Other Catastrophic Events	3%
Appendix D Calculation: $=1-((1-0.01)*1*1*1*1*(1-0.04)*(1-0.03)*(1-0.03))$		10.6%

10-D. OFFSET PROJECT BOUNDARY DESCRIPTION & LIST OF ONSITE CARBON POOLS INCLUDED

Forest Offset Protocol Appendix A(b)(1)

The project consists of all required carbon pools within the Project Area. No optional pools have been included. The pools are specified in the table below.

Table 5. Carbon pools/sources that must be accounted for

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
Primary Effect Sources, Sinks, and Reservoirs			
IFM-1 Standing Live Carbon (living trees)	Included	Included	Mandatory pool for measurement – Baseline modeled using initial field inventory measurements; Project measured by field measurements and updating forest carbon inventory.

Table 5. Carbon pools/sources that must be accounted for

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
Primary Effect Sources, Sinks, and Reservoirs			
IFM-2 Shrubs and Herbaceous Understory	Excluded	Excluded	NA
IFM-3 Standing dead carbon (carbon in all portions of dead, standing trees)	Included	Included	Mandatory pool for measurement – Baseline modeled using initial field inventory measurements; Project measured by updating forest carbon inventory.
IFM-4 Lying dead wood carbon	Excluded	Excluded	NA
IFM-5 Litter and duff carbon (carbon in dead plant material)	Excluded	Excluded	NA
IFM-6 Soil Carbon	Included/ Excluded	Excluded	It is not necessary to quantify soil carbon in this project in accordance with the Protocol, as deep ripping, furrowing, plowing, soil disturbance exceeding 25% of the project area and mechanical site preparation not on contour will not be permitted on the project area.
IFM-7 Carbon in in-use forest products	Included	Included	Baseline estimated from modeled harvesting volumes. Project estimated from measured harvest volumes.
IFM-8 Forest product carbon in landfills	Included or Excluded	Included	Excluded when project harvesting exceeds baseline. Included when project harvesting is below baseline. Baseline estimated from modeled harvesting volumes. Project estimated from measured harvest volumes.
Secondary Effect Sources, Sinks, and Reservoirs			
IFM-9 Biological Emissions from site preparation activities	Included/Excluded	Excluded	Biological emissions from site preparation activities are not quantified separately, but rather are captured by measuring changes in included carbon reservoirs.
IFM-10 Mobil combustion emissions from site preparation	Excluded	Excluded	N/A

Table 5. Carbon pools/sources that must be accounted for

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
Primary Effect Sources, Sinks, and Reservoirs			
activities			
IFM-11 Mobile combustion emission from ongoing project operation and maintenance	Excluded	Excluded	N/A
IFM-12 Stationary combustion emissions from ongoing project operation and maintenance	Excluded	Excluded	N/A
IFM-13 Biological emissions from clearing of forestland outside of the Project Area	Excluded	Excluded	N/A
IFM-14 Biological emission/ removals from changes in harvesting on forestland outside the project area.	Included/ Excluded	Included	Not estimated for baseline. Estimated for project by using a default 20% “leakage” factor applied to the difference in harvest volume relative to baseline.
IFM-15 Combustion emissions from production, transportation, and disposal of forest products	Excluded	Excluded	N/A
IFM-16 Combustion emission from production, transportation, and disposal of alternative materials to forest products	Excluded	Excluded	N/A
IFM-17 Biological emissions from decomposition of	Included	Included	For baseline, quantified as a component of calculating carbon stored for 100 years in wood products (SSR #IFM-7) and landfills

Table 5. Carbon pools/sources that must be accounted for

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
Primary Effect Sources, Sinks, and Reservoirs			
forest products			(SSR #IFM-8) For project, quantified as a component of calculating carbon stored for 100 years in wood products (SSR #IFM-7) and landfills (SSR #IFM-8)

10-E. INVENTORY DESIGN AND SAMPLING PROCESS

Types of Sample Plots, Plot Layout, Plot Location, and Plot Monumenting Description
Forest Offset Protocol §7.1.1(a)(24), Appendix A(3)(4)(5)

Forest carbon quantification is based on a systematic random sample of plots measured across the project area, with consideration given for statistical accuracy at the tract level.

i. SYSTEMATIC SAMPLE

Potential plot locations were laid out on a 12-chain (792-ft) grid, and plots were allocated using a line grid approach. The number of plots and distance between plot lines were decided at the tract level and were based on the size of the anticipated project area within that tract and its estimated forest heterogeneity. Tracts with larger plot areas and more heterogeneous tracts had more plots assigned to adequately capture the variability in carbon stocking. The number of plots was adjusted by changing the spacing between the plot lines. Plot lines were oriented either as mainly east-west or north-south lines, to be perpendicular to the main slopes in the area (i.e., plot lines were oriented so plots in a line crossed elevational gradients).

A post-stratification system was created based on density derived from remote sensing data. The pre and post stratification were overlaid to create “mashup” strata. These were used to calculate the acre per plot values and compute weights to be applied to each plot. These weights were applied to all analysis involving the plot data including the sampling error. The post stratification system was used for analysis and reporting.

ii. PLOT ESTABLISHMENT

The inventory included the establishment of fixed radius 1/20th acre or 1/10th acre (Icy Bay tract) continuous forest inventory (CFI) plots, along with a nested 1/200th acre micro plot. All trees 5.0-inches DBH and greater were measured on the CFI plot, while all live trees less 1.0-inch DBH and greater were measured on the micro plot.

Plots were established based on GPS location using field computers and external sub-meter GPS. The cruisers set plot locations using the following procedure; as the cruiser traversed within 10-meters of plot center and the field computer/GPS triggers a chime alarm, then the cruiser zoomed in on the GPS until the distance guide in the bottom right hand corner read 80 feet. The cruiser navigated towards the plot until the location icon on the GPS was directly over plot center point. Plot center was established at the front of the cruiser's left boot. The plot locations were monumented and set with rebar that was painted orange with an orange cap placed on top. All measured in-trees were marked with blue numbered tree tags. Trees just out of the plot had the word "OUT" painted on the bole facing plot center. Flagging is tied on the rebar and hung above plot center. Plot and tree level information was recorded at the plot locations per the specifications outlined in the Inventory Manual. A GPS point was logged at each plot, using a sub-meter GNSS GPS antenna with ± 60 centimeter accuracy. On a subset of the plots, the internal GPS with 2 to 5 meter accuracy (see inventory equipment section below) was employed due to sub-meter GPS malfunction. Additionally, a photo was captured at the south end of each plot looking north.

iii. PLOT MEASUREMENTS

Details of the plot data methodology are contained in the Inventory Manual, which was provided to each crew that installed inventory plots. Five witness trees were recorded at all plot locations. recording tree number, slope distance, azimuth, and slope from breast height at plot center to breast height at the tree facing plot center.

iv. TREE MEASUREMENTS

Tree measurements detailed in the inventory database include; tree tag number, present tree status, species, diameter, defect, total height, angle of lean, height to break, diameter inside bark at break, length method, crown class, compacted crown ratio, and decay class. Standard timber cruising tools were used, including diameter tapes for measuring diameter at breast height (DBH) and laser range finders (TruePulse 200) for measuring distances and tree heights. Site trees were recorded on every fourth plot. Live trees were recorded if they were 1.0 inch or larger, while dead trees were recorded if they were 5.0 inches or larger, had an actual height of 15.0 feet or greater and were leaning no more than 45 degrees from vertical. Tree diameter was rounded down to the nearest 1/10th inch at 4.5 feet above the root collar to allow for more consistent and accurate measurements in a region greatly influenced by stilted roots (refer to Inventory Manual).

v. INVENTORY EQUIPMENT

Field computers and paper tally were used for this inventory. Field hardware included units manufactured by F4 Tech and Geneq SxPad and operate on a Windows Mobile operating platform. The F4 Tech models used for this inventory are the Forge Echo O.S. 1.0.0 and Flint O.S. 1.0.1. Inventory data was recorded using TCruise Pocket Pro inventory software. Custom parameters were set in TCruise to collect the project specific data. Maximum and minimum values were set for most measurements to reduce errors and guide data entry in the field. At the end of each day, cruisers would download TCruise inventory data files from their field computer to a desktop computer (inventory files were also backed-up via ruggedized external hard drives in the field camps). Paper tally sheets were designed with the same data entry fields as the TCruise program. The tally sheets were entered into Microsoft Excel.

The field computers were also used for GPS navigation, using ESRI ArcPad software. Due to the poor satellite coverage in the region, Arrow 100 GPS external antenna were used to allow the field computers to utilize GLONASS satellites for sub-meter accuracy for navigation.

vi. PLOTS ON PROJECT BOUNDARIES

Plots bisected by clear project boundaries such as ocean shoreline were noted during field inventory. The percent of the plot overlapping the boundary was recorded. Edge effect was not modeled for plots that appear to occur on project boundaries in GIS but did not have a distinct boundary discernible in the field. The percent boundary overlap was used to weight edge plots for FVS modeling and carbon quantification if they met the criteria of (1) occurring near a project boundary line and (2) having a distinct boundary in the field that was recorded by the inventory installation crew.

10-F. UPDATING/REPLACING SAMPLE PLOTS & INVENTORY

Forest Offset Protocol Appendix A(6)

Annual monitoring of the Project is required to ensure up-to-date estimates of project carbon stocks and provide assurance that GHG reductions achieved by the project have not been reversed. A re-inventory will comply with the requirement that no field inventory data will be more than 12 years old; as such the project plots will be re-inventoried no later than 2029. Because the plots are permanently located, it is anticipated that re-measurement efforts will use the existing plot locations as the basis for establishing future project stocks. For future measurements, the inventory methodology may be updated to include new and improved specifications. In particular, remote sensing may be used for inventory and/or stratification. In addition, plot density may be reduced in future years. In such case, plots will be dropped in an unbiased manner such that the inventory continues to meet sampling error requirements. At the initial inventory there were 4 plots that were deemed temporary hazardous plots. These plots were included in the ICS numbers as zeros. These plots will be measured before the next verification and the carbon stocks will be added to update the strata averages.

10-G. DATA MANAGEMENT SYSTEMS & PROCESSES

*Analytic Methods, Calculation Methodologies, Volume & Biomass Equations and Models
Forest Offset Protocol Appendix A(7)*

All planning and analyses, including inventory, growth and yield modeling, and harvest scheduling required for this report had oversight by Dr. Timothy Robards, CF #2015 and Emily Warms, CF ID #60970 of New Forests, Inc. In addition, Emily Warms oversaw all other elements of the OPDR. Thus, this report has been prepared with the oversight of a Professional Forester as required in Section 7.2(e) of the Protocol.

The data were analyzed in Microsoft Excel, SQLite, PostgreSQL with PostGIS spatial extension, the Python programming language (see Appendix II: Python Libraries Used), and the Forest Vegetation Simulator (FVS) SE Alaska variant (Keyser 2018). The Suppose user interface for FVS V2.08 (Crookston 1997) was used as well. The FVS model runs were run using OpenFVS¹ version (AK FVS VARIANT -- RV:20180108).

All data, growth and yield simulation results, and carbon calculations remain stored on personal computers and cloud and physical storage back-up drives.

10-H. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

Assessing & Insuring Data Quality, Transfer & Archiving of Field Data, Data Entry & Analysis Procedures, Data Maintenance & Archiving, Other Relevant Procedures
Forest Offset Protocol Appendix A(8)

Quality was assessed at every step of the data collection, processing and reporting process during initial project development. Going forward, these or similar procedures will be used as inventory plots are re-measured to update the inventory and monitor and report on carbon stocks over time.

¹ The Forest Vegetation Simulator (FVS) is a widely used forest growth model developed by the USDA Forest Service. This open-fvs project makes the source code and related files available so that university, private, and other government organizations who wish to participate in enhancing FVS can do so without the impediments caused by restricted access to the Forest Service's internal repository.
(<https://sourceforge.net/projects/open-fvs/>)

DATA COLLECTION: inventory plot installation was conducted by trained inventory crews to the specifications and tolerances described in the Inventory Manual and the previous sections of this document. Data was recorded on field computers using custom parameter files that aided in data collection quality control and automated plot identification link to the data collection software. Check cruising was conducted on roughly 18 percent of the plots according to the parameters in the Inventory Manual to ensure quality measurements and feedback to field crews during data collection. Any tree data edits were corrected within the final dataset used in all modeling and analysis. For future re-measurements, if the crews conducting inventory re-measurements have not utilized the inventory methodology before, check cruising will be conducted on at least 5 percent of the plots. If applicable, timely on-site feedback of the issues found on each of the checked plots will be provided to the cruisers, and the corrected plot data will be used in all modeling and analysis.

DATA PROCESSING: inventory data underwent extensive internal review by qualified foresters while it was being entered and processed. All plot data was combined in Excel to perform error checking and ensure consistency in coding and formatting. Further data quality checking was done while formatting the data for processing by FVS and while creating the silvicultural prescriptions within FVS. Going forward, similar procedures will be utilized for future re-measurements, and a QAQC checklist will be implemented to minimize the risk of missed steps or inadvertent errors throughout data processing and transfer.

DATA MANAGEMENT: all data files used for reporting calculations within the OPDR follow standardized naming and dating conventions to allow for data tracing and version control. All digital files are stored in a digital filing system and backed up on multiple remote servers for data archiving and security. Physical files will also be maintained and stored. As per ARB regulation, documents used to prepare the OPDR will be retained for a minimum of 15 years following issuance of ARB offset credits.

10-I. CHANGE LOG OF INVENTORY METHODS OR VOLUME & BIOMASS EQUATIONS

Forest Offset Protocol Appendix A(9)

If changes to inventory methods or volume and biomass equations occur they will be reported in Annual OPDRs.

10-J. PROCEDURES FOR UPDATING THE FOREST CARBON INVENTORY

Documented Procedures to Account for Harvest, Growth, Mortality, Disturbance, Incorporating New Inventory & Plot Data, Retiring Older Sample Plots, Changes in Modelling, Appropriate Confidence Deduction
Forest Offset Protocol Appendix A(10)

For reporting stocks on an annual basis until the next inventory, when no harvesting is expected, the inventory update procedure will rely on growth projections from FVS. If any timber harvesting occurs in the project area, the timber harvest area will be re-inventoried within 3 years of completion of the harvest. A simulation of the harvest to update the inventory may be utilized in the interim. Timber harvests in the project area shall be designed to treat plots the same as the surrounding stand. Effort will be made to limit knowledge of exact plots locations from the foresters designing and implementing timber harvests, so that the risk of bias is minimized during harvest planning. In addition, a post-harvest review of recent harvested areas shall be conducted by a forester and if a plot appears, based on professional judgment, to no longer be representative of the surrounding stand due to being treated differently than prescribed in the harvest plan, then the plot will be moved to a random distance and direction within a 2.5-acre area around the original plot.

Disturbance events will be monitored as part of normal management activities, as well as through an annual review of aerial imagery and local and state disturbance reports (e.g. fire maps) if available and applicable. At the occasion of a disturbance event other than planned timber harvest, such as fire or windthrow, that appears to alter a significant portion of the project acreage, or results in a reversal under the protocol (e.g. reduction is greater than annual growth if project is verified annually) then the plots in the affected area will be re-measured. If the disturbance appears to meet the specified threshold but does not affect any of the permanent plots in the inventory, new plots will be established in the affected area in sufficient quantity and distribution to account for the disturbance.

The newly measured plots will be installed consistent with the Inventory Manual used to establish the original inventory; any improvements or changes to inventory methods or calculations would be documented and justified in the change log. Once the plot data has been gathered, a new calculation of the Actual On-Site Carbon Stocks will be completed in order to revise the GHG Reductions and Removals as well as a new calculation of the confidence deduction. The effects of disturbances on the carbon stocks of the project area will be estimated by monitoring the acreage affected utilizing the average per acre carbon stocks for the applicable strata. If the disturbance affects a significant portion of the strata acreage, then a new stratum will be delineated and the project stocks and confidence deduction calculated using the new strata. If, in the process of re-measuring plots, the plots cannot be relocated, new plots will be established in the same locations as the old plots. The replacement plot data will replace the old plot data for the purposes of calculating project carbon stocks.

10-K. INITIAL ABOVE-GROUND STANDING LIVE TREE CARBON STOCKS

Forest Offset Protocol §5.2.1(b)

Based on the preliminary estimates of forest carbon inventory for the Project Area, the initial carbon stocks (ICS) of the aboveground live tree component are estimated to be 202.74 tonnes CO₂e per acre.

10-L. COMMON PRACTICE (CP) VALUE

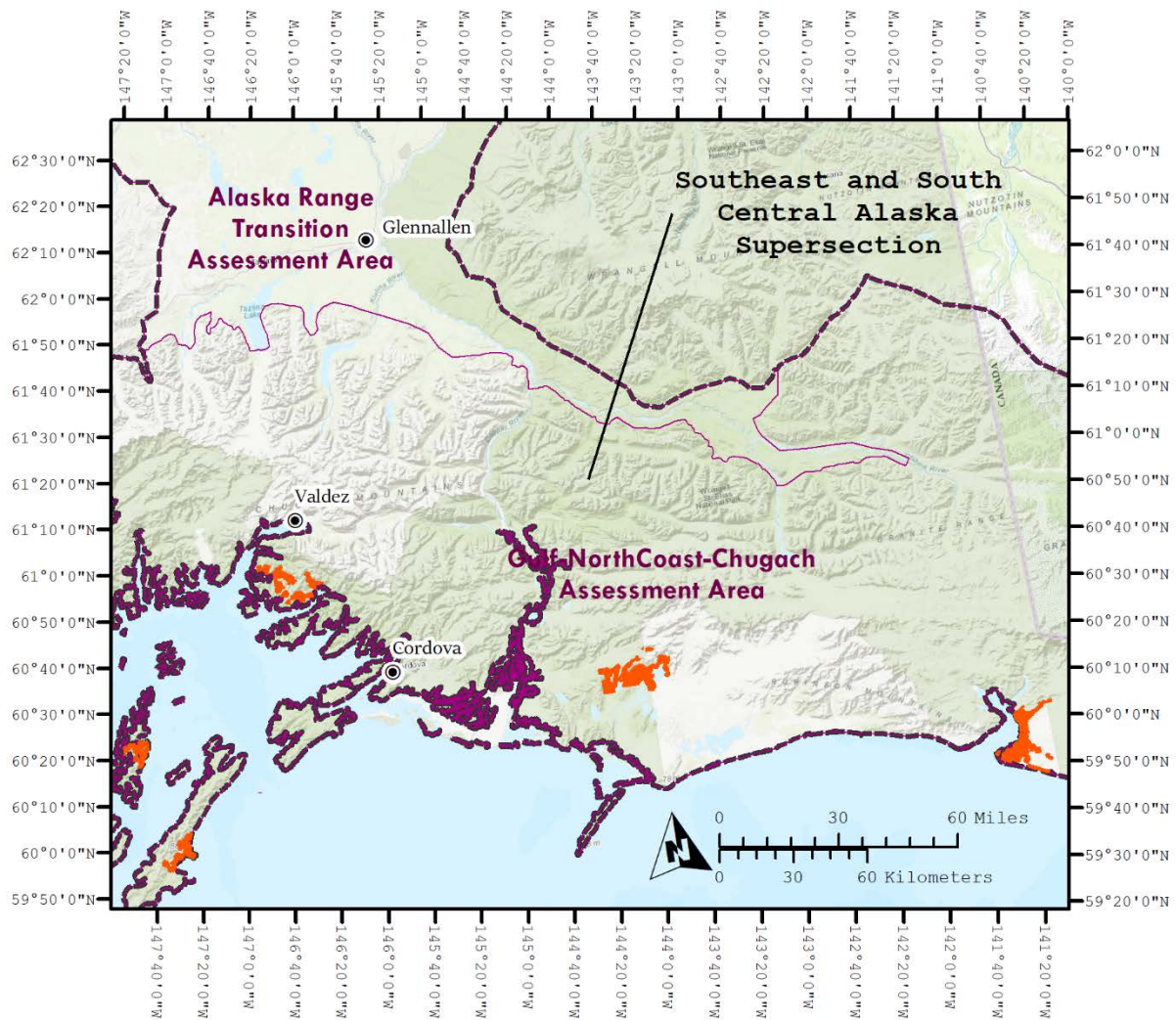
Forest Offset Protocol §5.2.1(c), Appendix F

i. IDENTIFICATION OF SUPERSECTIONS & ASSESSMENT AREA(S) BY AREA

Forest Offset Protocol §7.1.1(a)(14), Appendix F(a-c)

The project area is located entirely within the Southeast and South Central Alaska Supersection and the Gulf-NorthCoast-Chugach Assessment Area (Figure 3).

Figure 3. Supersection Map



Supersections Map

NewForests
FOREST CARBON PARTNERS

- Town
- ⊗ Project Area
- ▭ Alaska Assessment Area
- ▭ Alaska Supersection

No representation or warranty of any kind is made as to the accuracy of this map. The maps and/or map data are not legal surveys or legal descriptions. These maps are created from multiple private, city, county, state, and federal sources and the source data may contain errors.
Map last published on 2019-06-11.

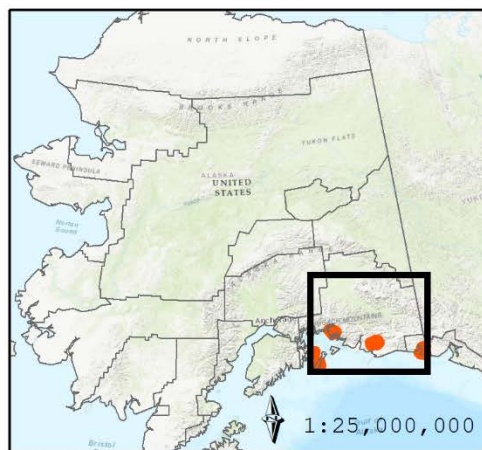


Table 6. Project area by supersection and assessment area

Supersection	Assessment Area	Site Class	Area (acres)
Southeast and South Central Alaska	Gulf-North Coast-Chugach Assessment Area	All	49,278
Total Area			49,278

ii. COMMON PRACTICE SITE CLASS STRATIFICATION

Forest Offset Protocol Appendix F(d-f)

Since the assessment area is not divided into High and Low site class, no stratification was necessary to determine the Common Practice.

iii. SINGLE COMMON PRACTICE VALUE

Forest Offset Protocol Appendix F(h)

Table 7. Common practice calculation

Supersection	Assessment Area	Site Class	Area (acres)	Common Practice Above-ground CO ₂ e (tonnes/ac)	Common Practice Above-ground CO ₂ e (tonnes)
Southeast and South Central Alaska	Gulf-North Coast-Chugach Assessment Area	All	49,278	84.9	4,183,675
Total Area			49,278	84.9	4,183,675

iv. COMMON PRACTICE COMPARED TO ABOVE-GROUND STANDING LIVE

Forest Offset Protocol §5.2.1(d)

When ICS is above CP, which is the case for this project, it is not necessary to estimate the High Stocking Reference (HSR).

When the OPDR for this project was originally submitted at the start of verification, the logical management unit (LMU) was primarily defined as any area within the Chugach Alaska Corporation ownership that contained a minimum stocking level to distinguish it as forestland with at least 10% canopy cover from shrubland. This LMU was appropriate as it delineated forestland that could be commercially managed from non-forestland. However, under normal circumstances, the APD would have undergone a process of analyzing the project inventory data, growth and yield output and model results to determine whether the LMU should be more appropriately defined as a subset of the forested ownership, following guidance in the Forest Protocol. This is a common step in offset project development, particularly on large, non-contiguous ownerships that encompass different geographies and varied terrain where there could be multiple logical management units.

In the case of this project, the analysis required to make a determination regarding a more refined LMU was not done prior to the start of verification due to the need to begin the site visit as quickly as possible. In coastal Alaska—particularly around Prince William Sound where this project is located—the window of time for conducting fieldwork with relatively consistent and predictable weather is extremely short. Therefore, the project was submitted before a more refined analysis of the LMU could be conducted so that the site visit could proceed quickly and avoid unnecessary and costly weather delays. The timing constraints also curtailed detailed review of the FVS modelling, and during the verification it was discovered that a transcription error had occurred in the scripts governing the growth and yield modelling (the misplacement of a single value in the script), and instead of harvesting at the intended minimum stocking threshold for financial feasibility, the prescriptions were simulating harvest at a lower minimum stocking threshold. To correct this error, the APD was required to re-run the baseline harvest prescriptions for the project and in doing so, carefully reviewed the data and outputs to ensure that harvests were being correctly modelled. Upon further examination, it was discovered that two of the original project strata would have to be managed differently from the other three strata due to their stocking and composition. As a result, the decision was made to redefine the LMU as only three rather than five strata in order to more appropriately group strata that could be managed together with logical consistency. The project area was therefore re-defined as all well-stocked forestland of commercial sizes and densities within distinct geographical units owned by the forest owner and subject to the same legal constraints. The project area is considered its own Logical Management Unit (LMU) based on biological (size class and density), geographic (certain non-contiguous areas excluded), and management criteria (areas available and accessible for commercial timber harvest).

Because the LMU and the project area are one and the same, the weighted average above-ground standing live tree carbon stocks per acre within the LMU (WCS) equals the initial above-ground standing live carbon stocks per acre within the project area (ICS) and thus $MBL = CP$.

V. WEIGHTED-AVERAGE ABOVE-GROUND STANDING LIVE TREE CARBON STOCKS

Equation 5.5

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

10-M. CARBON QUANTIFICATION METHODS – MODELING CARBON STOCKS

Forest Offset Protocol §5.2.1(e), §7.1.1(a)(25, 26, 27), Appendix B

Carbon in individual trees (live and standing dead) was calculated for all plots using the ARB-approved equations using a python script. Plot level live and standing dead carbon was derived as the summation of carbon in all trees on a given plot. Belowground live and dead carbon was derived using the stipulated equation (Cairns et al. 1997) based on the total aboveground (live + standing dead). Belowground live and dead carbon was derived by applying the ratio of aboveground live to aboveground standing dead.

i. BIOMASS AND CARBON EQUATIONS

a) ABOVEGROUND STANDING LIVE

The above ground standing live tree portion was calculated using the approved species-specific regional biomass equations as required by ARB (Alaska Biomass Equations). For broken top trees, net bole biomass was deducted to account for the missing volume of the broken top. This method assumes that 10%, 25%, and 65% of the tree volume is in the top, middle and bottom third of the tree, respectively. This missing biomass was then subtracted from the gross intact bole volume of the tree as if the tree were not broken.

All calculations for live trees were done through a series of scripted Python queries. These queries were applied to the individual tree records at each 5-year time period for the 100-year projection period for each strata/prescription/timing choice combination.

b) ABOVE GROUND STANDING DEAD

Above ground standing dead wood was estimated using the snag data collected in the inventory for all standing dead trees greater than 5" DBH and 15' in height. Carbon was quantified using the approved species-specific regional biomass equations as required by ARB (Alaska Biomass Equations). For broken top trees, net bole biomass was calculated to account for the missing volume of the broken top. This method assumes that 10%, 25%, and 65% of the tree volume is in the top, middle and bottom third of the tree, respectively. This missing biomass was then deducted from the gross intact biomass calculated as if the tree were not broken. Biomass deductions were also applied for percent defect and decay class using density reduction factors from Harmon et al. (2011).

c) BELOW GROUND STANDING LIVE AND DEAD

The same approach for calculating tree, plot and project level biomass and carbon was used on initial inventory and model year projections from the output of growth and yield model runs.

Tree level live and dead biomass and carbon calculations were done using the equations specified in the COP (2015). Plot level aggregate aboveground live and dead values served as input into the Cairns equation calculating total belowground live and dead biomass. The total belowground biomass was divided between live and dead based on the ratio between alive and dead above ground. Plot level measures were expanded to per acre values using the trees/acre (TPA) in the FVS output database.

Below ground standing live and dead tree biomass was estimated by using the protocol stipulated equation (Cairns et al. 1997). This equation uses plot-level above ground biomass density in tonnes per hectare to predict the below ground biomass in tonnes per hectare. Per guidance from ARB, the Cairns equation was applied to the sum of live and dead aboveground biomass by plot to calculate live and dead belowground biomass. This was then converted to CO₂e and subsequently divided into live and dead belowground carbon pools by applying the proportion of live or dead aboveground carbon to total aboveground carbon to total belowground carbon. Thus, the carbon pools could be represented by total live and total dead carbon independently, as required by the Protocol.

All biomass estimates were converted to carbon by multiplying by 0.5 and to CO₂e by multiplying by 3.667, which are the conversion factors specified in the Protocol.

d) *HARVESTED WOOD PRODUCTS*

Harvested wood products pools require an estimate of the average amount of carbon that remains stored in wood products over a 100-year period. This was done according to the steps outlined in Appendix C of the protocol, which utilize the average DOE (2007) wood products factors for accounting for the long-term storage of wood products. The procedure begins with an estimate of the total harvested carbon that will be delivered to a mill to be turned into wood products (row 11 of the Offset Credit calc worksheet); but note that due to the lack of a hardwood wood products market the hardwood wood storage was ignored. Next, the series of worksheets from Appendix C in the Protocol were used to determine the amount transferred to wood products, the amount stored in in-use wood products, and the amount stored in landfills. The carbon stored in wood products and landfills are summed to determine the total average annual carbon storage in wood products over 100 years.

For the calculation of secondary effects, the above and belowground carbon of all harvested live trees is determined using the same equations and methods for determining standing live tree carbon over time. This was done by running the biomass calculation used for live trees on the tree list output tables for all harvested live trees for each strata/prescription/timing choice combination.

11. BASELINE AND PROJECT MODELS

The baseline above-ground standing live carbon stocks were determined by modeling above-ground standing live carbon stocks through a series of growth and harvesting scenarios over 100 years and averaging the model results over the 100-year timeframe, so that the baseline is expressed as a single (average) value for above-ground standing live carbon stocks per acre in every year. The baseline simulation incorporates all legal and financial constraints. Consideration was given to financial, legal, and regulatory constraints by eliminating any geographic area that could not be harvested legally or financially.

11-A. LEGAL CONSTRAINTS

Forest Offset Protocol §3.4.1(c)(2), §5.2.1(e)(1), §7.1.1(a)(25)

The silvicultural prescriptions modeled in the baseline include thinning and clearcutting with various rotation lengths and timing choices. Modeling incorporated all legal constraints including the Alaska Forest Resources and Practices Act the national Endangered Species Act, Bald and Golden Eagle Protection Act, and the Clean Water Act.

Table 8. Legal constraints to baseline model

Regulation	Description	Geographic Range	Agency	Narrative of Effect on Forest Management	Modeling
Zoning	The project area is zoned as "rural," therefore land use is not restricted.	Borough Jurisdictions	Boroughs	None	No constraints.
Alaska Forest Resources and Practices Act and The Federal Clean Water Act	I-A Water Bodies "An anadromous water body that meets the follow criteria: (A) is a stream or river of any size having an average gradient of eight percent or less, with banks held in place by vegetation, channels that are not incised, and a substrate composed of rubble, gravel, sand, or silt; (B) consists of wetlands and lakes, including their outlets; (C) is an estuarine area delimited by the presence of salt-tolerant vegetation"	Region I Alaska Forest Resources & Practices	Alaska Department of Natural Resources, Division of Forestry	"Harvest of timber may not be undertaken within 66 feet of the water body."	Addressed by removing 66' no cut buffer from project area.

Regulation	Description	Geographic Range	Agency	Narrative of Effect on Forest Management	Modeling
Alaska Forest Resources and Practices Act and The Federal Clean Water Act	I-B Water Bodies "An anadromous water body that does not meet the definition of a Type I-A water body."	Region I Alaska Forest Resources & Practices	Alaska Department of Natural Resources, Division of Forestry	"Harvest of timber may not be undertaken within 66 feet of the water body or to the break of the slope, whichever area is smaller."	Addressed by removing 66' no cut buffer from project area.
Alaska Forest Resources and Practices Act and The Federal Clean Water Act	I-C and I-D Water Bodies "A water body that is not anadromous, that is a tributary to a Type I-A or Type I-B water body."	Region I Alaska Forest Resources & Practices	Alaska Department of Natural Resources, Division of Forestry	No prohibition on commercial logging that would constrain baseline modeling. "Where prudent, retain low value timber within 25 feet of the water body, or within 100 feet of the water body or to the break of the slope, whichever area is smaller, if the water body is greater than 13 feet at the ordinary high water mark or greater than eight feet at the ordinary high water mark if the channel is incised."	No constraints.

Regulation	Description	Geographic Range	Agency	Narrative of Effect on Forest Management	Modeling
Federal Endangered Species Act	Several federally threatened or endangered marine species may potential be near the project area. The Steller's Eider and Short-tailed Albatross are both marine birds that would most likely not be affected by logging. If the Steller's Eider was found in the project area, logging would have seasonal restrictions. The Northern Sea Otter can also be found in marine waters near the project area, but would not impose any restrictions on logging.	See source for range map.	US Fish and Wildlife Service	Steller's Eider: Potential seasonal restrictions if found Albatross: None Northern Sea Otter: None	No constraints.
Federal Endangered Species Act	Alaska has two endangered whales species and one endangered sea loin species. Their protection does not impose restrictions on logging.	Alaska's Marine Waters	National Oceanic and Atmospheric Administration	None	No constraints.

Regulation	Description	Geographic Range	Agency	Narrative of Effect on Forest Management	Modeling
Bald and Golden Eagle Protection Act	Bald eagle nests likely occur within the project area but have not been spatially mapped. Timber harvest restrictions around nesting areas exist. If needed, a take permit to remove nests can be obtained.	National	US Fish and Wildlife Service	Clear cutting and removing overstory trees within 330 feet of the nest should be avoided. During the breeding season timber harvesting should be avoided within 660 feet of the nest.	Addressed by removing riparian buffers from project area and allocating acres to thin Rx that retains overstory trees in line with the regulation.
Alaska Forest Resources and Practices Act	"To the fullest extent practicable, harvested forest land shall be reforested naturally or artificially, so as to result in a sustained yield of merchantable timber from that land." "Timber harvesting is limited to areas where data and information demonstrate that natural or artificial reforestation techniques will result in the production of a sustained yield of merchantable timber from that area."	Alaska	Alaska Department of Natural Resources Division of Forestry	Planting, regeneration monitoring maybe required post-harvest.	Addressed by modifying sprouting and planting settings to simulate activities in line with the regulation.

Regulation	Description	Geographic Range	Agency	Narrative of Effect on Forest Management	Modeling
Archaeological Resources Protection Act	This law protects archaeological sites on Federal and Tribal Lands. The project area is considered to be privately owned, therefore this law has no impact on forest management in the project area. The Alaska Historic Preservation Act protects archaeological sites on state lands, which also has no impact on forest management in the project area.	National	National Park Service U.S., Department of the Interior	None	No constraints.

11-B. FINANCIAL CONSTRAINTS

Forest Offset Protocol §5.2.1(e)(2)(B), §7.1.3(4), Appendix A(a)(10)

Option B was chosen to demonstrate that the proposed baseline is financially feasible. As stated in the protocol, Option B provides “evidence that activities similar to the proposed baseline growth and harvesting regime have taken place within the past 15 years on at least three other properties within the forest projects assessment area”. Please see Attachment L for more information.

11-C. FVS MODELING

The Southeast Alaska variant of the Forest Vegetation Simulator (FVS) was used to model forest growth, mortality and harvest over time (Keyser 2018). FVS is an ARB-approved growth and yield model designed for these sorts of applications. FVS is an individual tree growth model that accepts direct input of the inventory data, including measured diameter and height data.

The large tree growth models of the FVS-AK variant were calibrated for local use based on FIA data for the same geographic region and species as the CAC Forest Carbon Project. Calibration factors were developed for 4 species by comparing the annual growth of re-measured FIA plots to the annual growth predicted by the FVS variant. Only diameter growth was calibrated as height growth uses diameter growth as a predictor.

11-D. FVS Prescriptions

The silvicultural prescriptions used in FVS modeling are described in the table below.

Table 9. FVS Prescriptions

Strata	Rx ID	Rx Description	Minimum Commercial Harvest Volume	Criteria	Regeneration	Sprouting (on/off)
ALL STRATA	GROW	Let grow with no treatments				
ALL STRATA	CC2022_RL70_M08_NB	Clearcut on 70-year rotation, years of harvest specified, first harvest in first decade	Minimum 8 MBF/Acre	Year = 2022 for first cut, Year = 2092 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2022_RL80_M08_NB	Clearcut on 80-year rotation, years of harvest specified, first harvest in first decade	Minimum 8 MBF/Acre	Year = 2022 for first cut, Year = 2102 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2032_RL70_M08_NB	Clearcut on 70-year rotation, years of harvest specified, first harvest in second decade	Minimum 8 MBF/Acre	Year = 2032 for first cut, Year = 2102 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2032_RL80_M08_NB	Clearcut on 80-year rotation, years of harvest specified, first harvest in second decade	Minimum 8 MBF/Acre	Year = 2032 for first cut, Year = 2112 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2042_RL70_M08_NB	Clearcut on 70-year rotation, timing based on age of stand, first harvest in third decade	Minimum 8 MBF/Acre	Year = 2042 for first cut, Year = 2112 for second cut	Natural regeneration of seedlings using FVS native establishment model	On

ALL STRATA	CC2042_RL80_M08_NB	Clearcut on 80-year rotation, timing based on age of stand, first harvest in third decade	Minimum 8 MBF/Acre	Year = 2042 for first cut, Year = 2122 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2052_RL70_M08_NB	Clearcut on 70-year rotation, timing based on age of stand, first harvest in fourth decade	Minimum 8 MBF/Acre	Year = 2052 for first cut, Year = 2122 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2072_RL50_M08_NB	Clearcut on 50-year rotation, timing based on age of stand, first harvest in sixth decade	Minimum 8 MBF/Acre	Year = 2072 for first cut, Year = 2122 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	CC2082_RL50_M08_NB	Clearcut on 50-year rotation, years of harvest specified, first harvest in seventh decade	Minimum 8 MBF/Acre	Year = 2082 for first cut, Year = 2132 for second cut	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	TB2022_NoBAI_CY10_M01	Thin from below every year there is harvest starting in the first decade	Minimum 1 MBF/Acre	Year = 2022 for first thin, must harvest at least 1 MBF/Acre, Basal Area must be above a certain threshold	Natural regeneration of seedlings using FVS native establishment model	On
ALL STRATA	TB2032_NoBAI_CY10_M01	Thin from below every year there is harvest starting in the second decade	Minimum 1 MBF/Acre	Year = 2032 for first thin, must harvest at least 1 MBF/Acre, Basal Area must be above a certain threshold	Natural regeneration of seedlings using FVS native establishment model	On

ALL STRATA	TB2042_NoBAI_CY10_M01	Thin from below every year there is harvest starting in the third decade	Minimum 1 MBF/Acre	Year = 2042 for first thin, must harvest at least 1 MBF/Acre, Basal Area must be above a certain threshold	Natural regeneration of seedlings using FVS native establishment model	On
---------------	-----------------------	---	-----------------------	---	---	----

Source: Schedules workbook, RX tab

11-E. BASELINE ONSITE CARBON STOCKS

Forest Offset Protocol §5.2.1, Appendix A

The results of the baseline harvest schedule are shown in the table and figures below. Onsite carbon pools reported are graphically represented by the bar graphs in Figure 4. The harvested carbon pools are represented in Figure 5 where the static horizontal lines represent 100 year averages for those pools. Table 11 below shows the carbon pools by 10 year period for the baseline simulation.

Table 10. Baseline Acreage Allocation by prescription and strata

Strata	Prescription	Acres
3	CC2032_RL70_M08_NB	8,949
	CC2042_RL80_M08_NB	9,221.45
	Subtotal	18,170
4	CC2022_RL70_M08_NB	12,110
	CC2032_RL70_M08_NB	9,107
	Subtotal	21,217
5	CC2022_RL70_M08_NB	7,890
	TB2022_NoBAI_CY10_M01	2,000
	Subtotal	9,890
Total		49,278

Table 11. Carbon (CO₂e) Reported from the Baseline Harvest Schedule

Year	AG Live Tree	BG Live Tree	Standing Dead	Cut-All	Cut-Merch
2017	9,990,802	2,323,605	450,612	-	-
2027	4,983,262	1,204,402	450,612	4,127,849	2,423,806
2037	2,006,000	494,293	450,612	1,709,631	1,028,831
2047	567,749	150,431	450,612	816,079	513,711
2057	1,439,772	388,963	450,612	-	-
2067	3,322,097	866,250	450,612	-	-
2077	5,664,485	1,424,006	450,612	-	-
2087	7,942,677	1,934,848	450,612	-	-
2097	5,371,087	1,294,745	450,612	2,283,701	1,442,899
2107	2,157,989	519,193	450,612	1,546,709	983,919
2117	2,574,506	608,649	450,612	3,107	1,701

The following figures show the final baseline modeling and resulting average onsite and harvested pools. Figure 4 displays the total onsite CO₂e tonnes per period for the baseline harvest schedule. The pattern over time is largely a function of the periodicity of the harvests modeled. The harvest schedule meets all legal and economic feasibility tests and is a likely scenario under a no-carbon-project scenario. The horizontal lines in Figure 5 are the annual averages across the planning period, which are used in the carbon credit calculations. Modeling the baseline stocking with legal and financial constraints yields an average onsite above ground standing live tree stocking of 4,183,675 total tonnes of CO₂e for the 100 year baseline modeling scenario, or 84.9 tonnes CO₂e per acre, which is equal to the CP value and thus does not fall below the MBL as required by the Protocol.

Figure 4. Onsite Baseline Stocking as Modeled

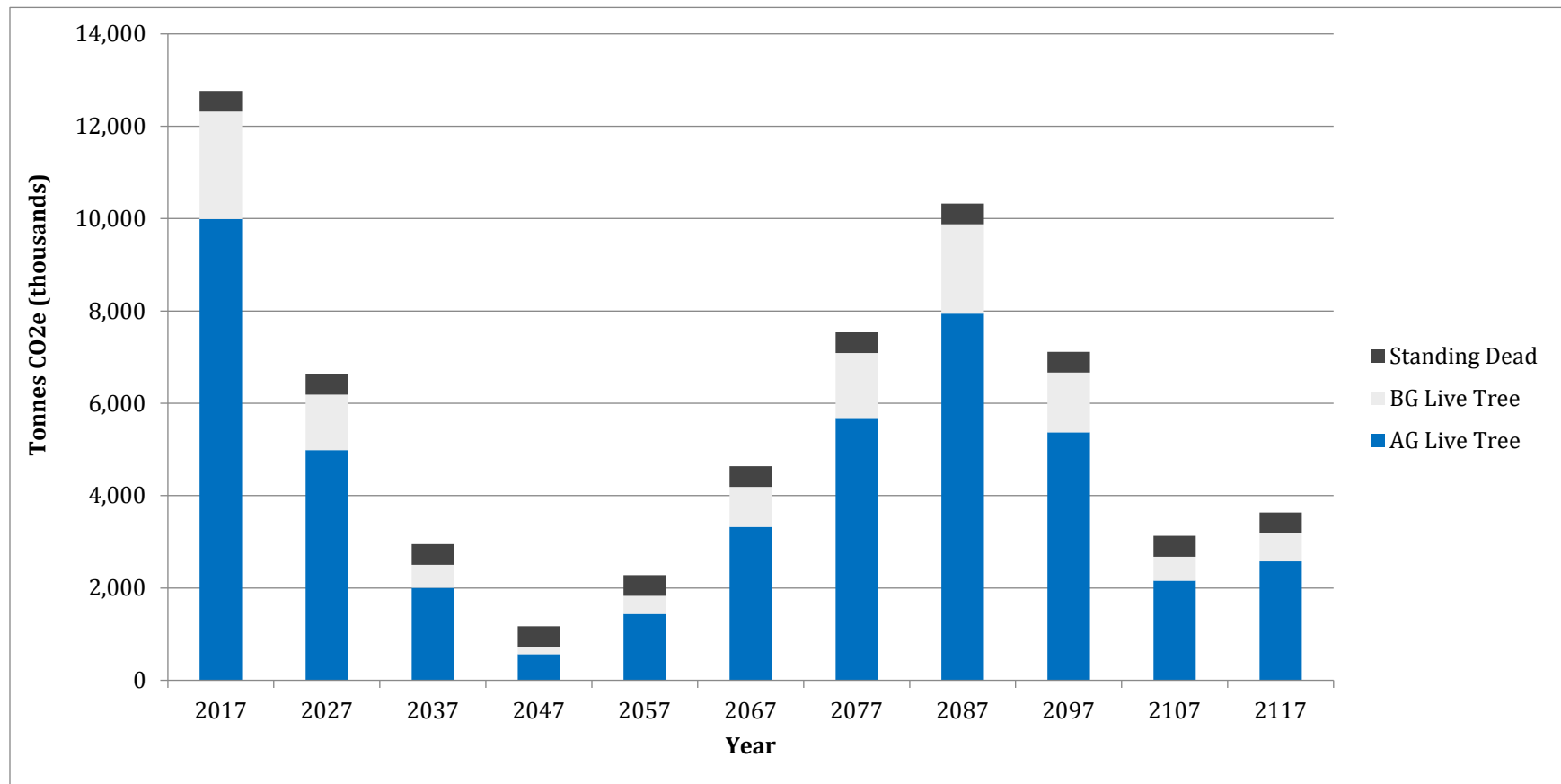
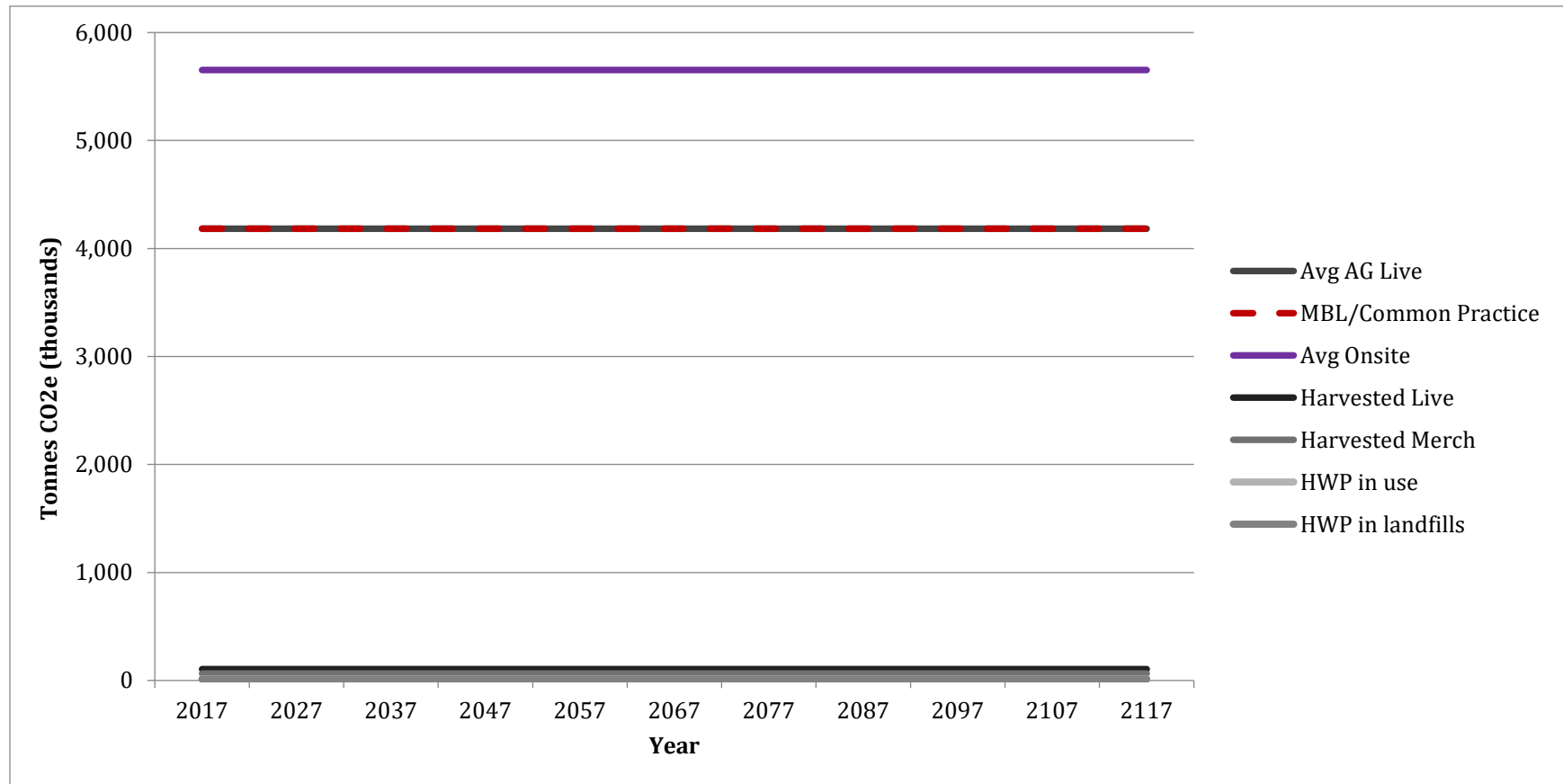


Figure 5. Final Baseline Results Averaged



11-F. FINAL BASELINE INCORPORATING ALL REQUIRED ONSITE CARBON POOLS

Forest Offset Protocol §5.2.1(g)

There are no optional carbon pools in this Project. Standing live (IFM-1), standing dead (IFM-3), and in-use forest products carbon (IFM-7) are required pools. Forest products carbon stored in landfills (IFM-8) is also required when baseline harvesting exceeds project harvesting. In order to determine the amount of carbon stored in harvested wood products (HWP) the cut trees are further divided into Harvested Live and Harvested Merch.

Harvested Live is defined as the carbon in all portions of live trees removed from the project during a harvest (including belowground carbon). Harvested Merch is defined as the carbon in the merchantable portions (bole without bark) of the commercially harvested trees that are sent to mills to be processed into wood products. These values are used in Row 9 and Row 11 respectively of the Offset Credit calculation worksheet. The average annual value of the relevant baseline carbon pools are:

- Standing Live (IFM-1) – 5,202,710 tonnes CO₂e
- Standing Dead (IFM-3) – 450,612 tonnes CO₂e
- Harvested Live – 104,871 tonnes CO₂e
- Harvested Merch – 63,949 tonnes CO₂e
- HWP in-use (IFM-7) – 15,628 tonnes CO₂e
- HWP in landfills (IFM-8) – 11,354 tonnes CO₂e

11-G. BASELINE CARBON IN HARVESTED WOOD PRODUCTS

(Forest Offset Protocol §5.2.3, Appendix B)

The average amount of merchantable carbon harvested each year was calculated from the baseline modeling. This was done by using the harvest yields from FVS for each strata/prescription/timing choice combination. Appendix C of the Protocol requires a different methodology for calculating the carbon in harvested wood than it does for live trees. First, the merchantable dry biomass of all species that will be delivered to a mill are selected from the harvest yields. Harvested wood biomass excluding bark was calculated for softwood and hardwood, sawtimber and pulp. The minimum merchantable DBH for hardwood was 11" DBH and the minimum merchantable DBH for softwood was 9 inches DBH as described in the FVS variant documentation. Biomass was converted to CO₂ equivalent multiplying by 0.5 to convert to carbon. A weighted average mill efficiency value was used to arrive at the total carbon transferred into wood products based on the regional factors for Alaska by sawlog/pulpwood/export categories as provided from the ARB website, weighted by the percentage of merchantable carbon in these categories. To be conservative, 100% of the weighting was allocated to the softwood sawlog category, resulting in a mill efficiency value of 0.628 (62.8%). Next, the table C.2 worksheet was used to calculate the long-term carbon storage in In-Use wood products. Long-term storage in landfills was determined using the table C.3. Worksheet and also used the same default product class percentages.

11-H. DETERMINING ACTUAL ONSITE CARBON STOCKS

(Forest Offset Protocol §5.2.4)

No harvesting has occurred between the start of the project and the end of the initial reporting period. The carbon inventory was collected in 2017 at the beginning of the reporting period. Data was grown forward one year from the beginning to the end of the 12-month reporting period.

A summary of the required carbon pools at the end of the reporting period is as follows:

- Standing Live (IFM-1) – 12,453,531 tonnes CO₂e
- Standing Dead (IFM-3) – 450,612 tonnes CO₂e
- HWP in-use (IFM-7) – 0 tonnes CO₂e
- HWP in landfills (IFM-8) – 0 tonnes CO₂e

The results of the volume and biomass queries discussed earlier in this OPDR were analyzed to calculate the statistics for live and standing dead carbon pools for each stratum.

The sampling error at the 90% level is calculated by multiplying the standard error by the t value of 1.645. The standard error was determined using a stratified random sample formula.

The following table summarizes the inventory data and statistics for each of the strata and the pooled sampling error for all the strata combined.

Table 12. Forest Offset Protocol Table A.2 Summarizing Total Carbon by Carbon Pool and Stratum

Stratum Name	No. of Plots	Carbon (CO ₂ /acre)			Acres	Carbon (CO ₂) Total	Percentage Carbon (CO ₂) Total
		Avg	Std. Dev	Std. Error			
3	90	130.2	66.9	7.06	18,170	2,365,037	18.3%
4	104	260.8	116.4	11.42	21,217	5,534,185	42.9%
5	54	506.1	246.8	33.58	9,890	5,004,921	38.8%

Sampling Error at 90% level = 5.5%

Confidence Deduction = 0.5%

<i>Table 13. Forest Offset Protocol Table A.3 Summarizing Carbon Pools and Total MT CO₂e/acre by Carbon Pool</i>		
Carbon Pool	Source	Gross MT CO ₂ e per Acre
Standing Live Tree Above- and Below-ground Carbon Stocks	From sampling results of trees	252.72
Standing Dead Tree Above- and Below-ground Carbon Stocks	From sampling results of standing dead biomass	9.14
Shrubs and Herbaceous Understory Carbon (if required)	From sampling results of shrubs and herbaceous understory	0

Soil Carbon (if required)	From sampling results of soil	0
Sum of MT CO ₂ e from Required Pools		261.87

The following table shows the carbon pools by 10 year period for the project simulation.

<i>Table 14. Carbon (CO₂e) reported from the Project Activity harvest schedule</i>					
Year	AG Live Tree	BG Live Tree	Standing Dead	Cut-All	Cut-Merch
2017	9,990,802	2,323,605	450,612	-	-
2027	11,126,967	2,578,693	450,612	-	-
2037	12,564,750	2,883,201	450,612	-	-
2047	13,954,970	3,172,761	450,612	-	-
2057	15,312,288	3,451,706	450,612	-	-
2067	16,612,899	3,715,467	450,612	-	-
2077	17,861,145	3,966,023	450,612	-	-
2087	19,026,474	4,197,692	450,612	-	-
2097	20,122,822	4,413,905	450,612	-	-
2107	21,139,137	4,612,943	450,612	-	-
2117	22,074,758	4,795,002	450,612	-	-

11-I. DETERMINING ACTUAL CARBON IN HARVESTED WOOD PRODUCTS

(Forest Offset Protocol §5.2.5)

The FVS simulation of project activity was used to estimate the wood products carbon for the next 100 years. Since all project acres were allocated to the “let grow” scenario, no harvest is currently projected for the 100 year period. If any harvesting does occur at some point in the future, the actual harvested amount will be reported and used as determined from truck or scale tickets. Reported hauling weights can be converted to carbon using the methodology in Protocol Appendix C (C.1). The calculation for the wood products storage is identical to the methods used for the baseline but will be based on these actual harvested amounts rather than projections.

For the initial reporting period, there was no harvest, and thus no estimate of merchantable harvest volume or associated carbon in harvested wood products, as demonstrated in the table and the credit calculation worksheet copied below.

11-J. CALCULATING SECONDARY EFFECTS

(Forest Offset Protocol §5.2.6)

Secondary effects include changes in emissions due to unintended changes in regional carbon stocks that may result from the Forest Project, and are always negative. Secondary effects include activity shifting leakage that results from changes in forest management activity resulting from the Forest Project activity. The calculation itself is 20% of the difference between actual and baseline carbon in harvested wood. For the first year of the project this is $20\% \times (0 - 104,871) = -20,974$ tonnes CO₂e.

12. OTHER OFFSET PROGRAMS

(Forest Offset Protocol §7.1.1(a)(33 – 34)

No GHG emission reductions associated with land within the project area have ever been listed or registered by another registry or program, credited or claimed by another registry or program, or sold to a third party prior to listing.

13. GHG REDUCTIONS AND REMOVALS

(Forest Offset Protocol §5)

Equation 6.1 was used for estimating the first reporting period GHG reductions and removals. This was implemented using a modified version of the Forest Project calculation worksheet provided by the Climate Action Reserve and is provided along with the project input data. This process included the changes in onsite stocks, long-term average wood product storage, and secondary effects.

Table 15. GHG reductions and removals worksheet

Type of Project:		
<i>Improved Forest Management</i>		
Reporting Periods	Commencement Date	1
Offset Project Commencement Date	6-Jun-17	
Reporting Period Begin Date		6-Jun-17
Reporting Period End Date		6-Jun-18
Reporting Date		6-Aug-18
Calculating GHG Reductions/Removals for Onsite Carbon Stocks - All Project Types - all data should be entered as the end of the Reporting Period		
Initial Carbon Stocking Value	9,990,802	
Sampled Onsite Carbon Stocks (metric tons CO ₂ e)		12,904,143
Confidence Deduction		0.5%
Adjusted Sampled Onsite Carbon Stocks (adjusted for confidence deduction) (metric tons CO ₂ e)		12,839,623
Soil Carbon Emissions		-
Increment in Actual Onsite Carbon Stocks (metric tons CO ₂ e)		12,839,623
Baseline Onsite Carbon Stocks (metric tons CO ₂ e)	9,990,802	5,653,322
Increment in Baseline Onsite Carbon Stocks (metric tons CO ₂ e)		
Quantified GHG Reductions / Removals for Onsite Carbon Stocks (metric tons CO ₂ e)		7,186,301
Calculating Carbon Stored in Wood Products Including Market Effects and Leakage - All Project Types - all data should be entered as the end of the Reporting Period		
Actual Carbon in Trees Harvested for Wood Products (metric tons CO ₂ e)		-

Baseline Carbon in Trees Harvested for Wood Products (metric tons CO2e)		104,871
Actual Carbon in Harvested Wood Delivered to Mills (metric tons CO2e)		-
Baseline Carbon in Harvested Wood Delivered to Mills (metric tons CO2e)		63,949
Actual Carbon Stored Long-term in Wood Products (tonnes CO2e) - Excl Landfill		-
Actual Carbon Stored Long-term in Wood Products (tonnes CO2e) - Incl Landfill		-
Baseline Carbon Stored Long-term in Wood Products (tonnes CO2e) - Excl Landfill		15,628
Baseline Carbon Stored Long-term in Wood Products (tonnes CO2e) - Incl Landfill		26,982
Diff Between Actual and Baseline Carbon in Harvested Wood (tonnes CO2e) - Excl Landfill		(15,628)
Difference Between Actual and Baseline Carbon in Harvested Wood (tonnes CO2e) - Incl Landfill		(26,982)
Difference in Actual and Baseline Carbon Stored in Wood Products (tonnes CO2e) - Landfill Adj		(26,982)
GHG Reductions / Removals for Carbon Stored in Wood Products (tonnes CO2e) w/ mkt response		(21,586)
Calculating Other Secondary Effects - Improved Forest Management Projects		
Difference Between Actual and Baseline Carbon in Trees Harvested for Wood Products (metric tons CO2e)		(104,871)
Other Secondary Effects Emissions (shifting activities/materials) IFM Projects (metric tons CO2e)		(20,974)
Quantified GHG Reductions and Removals		

Annual GHG Reductions/Removals Net of Discounts and Secondary Effects (metric tons CO2e)		7,143,741
Cumulative GHG Reductions/Removals; not incl.neg. carryover or reversals (metric tons CO2e)		7,143,741
Cumulative Negative Carryover from Prior Year (metric tons CO2e)		
Offset Credits Issued - Net of Negative Carryover, bef. adjust for Reversals (metric tons CO2e)		7,143,740
Calculation of Buffer Pool Contribution - all data should be entered as end of Reporting Period		
Project Specific Reversal Risk Rating		10.6%
Buffer Pool Contribution		757,236
Accounting for Reversals - all data should be reported as sum during Reporting Period		
Annual Reversals (metric tons CO2e)		-
Total "Intentional Reversals" to be compensated by the Offset Project Operator (metric tons CO2e)		
Compensating for Intentional Reversals - all data should be reported as sum during Reporting Period		
"Intentional Reversals" compensated by retirement of Offset Credits in the Offset Project Operator's CITSS Account (metric tons CO2e)		
Carryover "Intentional Reversals" which need to be compensated by Offset Project Operator (metric tons CO2e)		-
Offset Credits Issued to Offset Project Operator		
Annual Offset Credits Issued to Offset Project Operator (metric tons CO2e)		6,386,504
Vintage I-Calendar year of Reporting Period end date (Vintage)		2018
Cumulative Offset Credits Issued to Offset Project Operator (metric tons CO2e)		6,386,504

14. ATTACHMENT E

(Forest Offset Protocol §7.1.1(a)(15))

Relevant maps and shapefiles generated in ArcGIS are available for distribution to the Verification Body and the Offset Project Registry.

15. ATTACHMENT F

(Forest Offset Protocol §7.1.1(a)(15))

Relevant maps and shapefiles generated in ArcGIS are available for distribution to the Verification Body and the Offset Project Registry.

16. APPENDIX I: INVENTORY MANUAL

Provided as a separate file.

17. APPENDIX II: PYTHON LIBRARIES USED

Provided as separate files.

18. REFERENCES

- Alaska Biomass Equations. Version 11/15/02. Source: ARB 2015 Protocol Website.
<https://www.arb.ca.gov/cc/capandtrade/protocols/usforest/2015/alaskabiomassequations.pdf>
- Cairns, M.A., S. Brown, E.H. Helmer, and G.A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. *Oecologia* 111:1-11.
- Crookston, N. L. 1997. Suppose: an Interface to the Forest Vegetation Simulator, in R Teck, M Moeur, and J Adams eds., *Proceedings: Forest Vegetation Simulator Conference*. Fort Collins, CO, USDA Forest Service Intermountain Research Station, Intermountain Research Station INT-GTR-373, p. 7-14.
- Crookston, N.L., D.L. Gammel, S. Rebas, D. Robinson, and C.E. Keyser. 2011. User's guide to the database extension of the Forest Vegetation Simulator version 2.0. USDA Forest Service, Forest Management Service Center. 56 p.
- DOE. 2007. Technical guidelines, voluntary reporting of greenhouse gases (1605(b)) program. Office of Policy and International Affairs, US Dept. of Energy. 280 p.
- Farr, W. A. Site Index and Height Growth Curves for Unmanaged Even-Aged Stands of Western Hemlock and Sitka Spruce in Southeast Alaska [Report]. - [s.l.] : USDA Forest Service, Research Paper PNW-326, 1984.
- Harmon, M.E., C.W. Woodall, B. Fasth, and J. Sexton. 2008. Woody detritus density and density reduction factors for trees species in the United States: A synthesis. USDA Forest Service Northern Research Station General Technical Report NRS-29:90.
- Harmon, M. E., C. W. Woodall, B. Fasth, J. Sexton, and M. Yatkov. 2011. Differences between standing and downed dead tree wood density reduction factors: A comparison across decay classes and tree species. Res. Pap. NRS-15. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 40 p.
- Keyser, Chad E. comp. 2008 (revised September 24, 2018). Southeast Alaska and Coastal British Columbia (AK) Variant Overview – Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 40p.
- McClellan, M.H. B.T. Bormann, and K. Cromack, Jr 1990. Cellulose decomposition in southeast Alaskan forests: effects of pit and mound microrelief and burial depth. *Canadian Journal of Forest Research* 20:1242-1246