



**ENVIRONMENTAL ASSESSMENT:
SUNSHINE COAST COMMUNITY FOREST**

Block Assessment AN15

FOR:

**Sunshine Coast Community Forest
c/o Warren Hansen
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BY:

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TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	OBJECTIVES	1
2	OVERVIEW OF AN15	2
3	METHODS	5
3.1	DESKTOP REVIEW	5
3.2	FIELD ASSESSMENT	6
4	RESULTS	8
4.1	DESKTOP REVIEW – POTENTIAL LISTED COMMUNITIES	8
4.2	FIELD RESULTS.....	9
4.2.1	WILDLIFE OBSERVATIONS	9
4.2.2	ECOSYSTEM ASSEMBLAGES	9
4.2.3	ASSESSMENT OF OLD OR SUFFICIENTLY ESTABLISHED COMMUNITIES USING LMH 72	9
5	DISCUSSION	13
6	CONCLUSION AND RECOMMENDATIONS.....	14
7	REFERENCES.....	16

LIST OF TABLES

TABLE 1: MAPPED ECOSYSTEMS WITHIN BLOCK AN15 ACCORDING TO CHAPMAN LANDSCAPE UNIT TERRESTRIAL ECOSYSTEM MAPPING (BAPID 4677)	8
TABLE 2: FOREST ATTRIBUTE SCORE (FAS) FOR EACH PLOT WITHIN AN15. SCORING IS BASED ON A POINTS SYSTEM AS DESCRIBED BY LAND MANAGEMENT HANDBOOK 72.....	10
TABLE 3: RESULTS OF A SELECTION OF TREES CORED WITHIN EACH PLOT.....	10
TABLE 4: OVERVIEW OF INFLUENCING FACTORS OF ECOLOGICAL INTEGRITY AND THEIR OVERALL RANKING BASED ON APPENDIX 7 OF LMH 72 FOR AN15.	14
TABLE 5: AREA BY AGE CLASS FOR THE CWH DM AND XM IN ANGUS/GRAY/CHAPMAN TENURE AREA.	14
TABLE 6: LEVEL OF PROTECTION REQUIRED FOR EACH BEC UNIT PER TENURE AREA WITH A 10% RESERVE DESIGN AS OUTLINED BY THE SUNSHINE COAST COMMUNITY FOREST.	15

LIST OF PHOTOS

PHOTO 1: OVERVIEW EAST AT PLOT SS012. LACK OF UNDERSTORY VEGETATION DEVELOPMENT AND HIGH CROWN CLOSURE TYPICAL OF AN15.....	B2
PHOTO 2: OVERVIEW WEST OF PLOT SS013. SLIGHTLY MORE DEVELOPED UNDERSTORY BUT OVERALL LACKING WITH VERY SIMPLE CANOPY COMPLEXITY.	B3
PHOTO 3: OVERVIEW SOUTH OF PLOT SS015. NO VETERAN OVERSTOREY TREES WERE NOTED DURING OUR ASSESSMENT.....	B3
PHOTO 4: OVERVIEW WEST OF PLOT SS016 LOCATED ON A SMALL KNOLL. THIS IS THE ONLY PLOT THAT CONTAINED A WELL-DEVELOPED UNDERSTORY.	B4
PHOTO 5: UPSTREAM VIEW OF THE S5 LOCATED ADJACENT TO PLOT SS011, SOME MINIMAL FLOWS WERE OBSERVED WITHIN THE S5 DURING THE TIME OF OUR ASSESSMENT – AFTER AN EXTENDED PERIOD OF DRY SUMMER WEATHER.	B4
PHOTO 6: UPSTREAM VIEW OF THE S5 LOCATED ADJACENT TO PLOT SS011, MINIMAL FLOWS WERE OBSERVED WITHIN THE S5 DURING THE TIME OF OUR ASSESSMENT, BUT CLEARLY THE WATERCOURSE HAS SIGNIFICANT FLOWS DURING MUCH OF THE YEAR.....	B5

PHOTO 7: OVERVIEW OF THE PACIFIC YEW TREE (ALMOST 50 CM DBH), LOCATED JUST NORTH OF
FALLING CORNER 6 B5

LIST OF FIGURES

FIGURE 1: LOCATION OF AN15 WITHIN THE ANGUS/GRAY/CHAPMAN TENURE AREA OF THE SUNSHINE
COAST COMMUNITY FOREST. 3

FIGURE 2: PROPOSED HARVEST PLAN OF AN15 AS PROVIDED BY SUNSHINE COAST COMMUNITY
FOREST ON JULY 2021. THE PROPOSED HARVEST PLAN MAY BE SUBJECT TO CHANGE BASED UPON
THE RESULTS OF THE ENVIRONMENTAL BLOCK ASSESSMENT BUT WAS USED AS AN INFORMATIVE
TOOL FOR ADAPATIVE MANAGEMENT. 4

FIGURE 3: FINDINGS FOR AN15 AND PLOT LOCATIONS OF FOREST ATTRIBUTE SCORES. 12

LIST OF APPENDICES

APPENDIX A – SPECIES & ECOSYSTEMS EXPLORER RESULTS.....A1

APPENDIX B – SITE PHOTOS.....B1

APPENDIX D - REVISED HARVEST PLAN FOR AN 15.....C1

APPENDIX D – REVIEW OF POTENTIAL COASTAL TAILED FROG HABITAT IN STREAMS NEAR OR ADJACENT TO
COMMUNITY FORESTS CUT BLOCKS AN03 AND AN15

ENVIRONMENTAL ASSESSMENT: SUNSHINE COAST COMMUNITY FOREST

Block Assessment AN15

1 Introduction

At the request of Warren Hansen, Operations Manager of Sunshine Coast Community Forest (SCCF), Madrone Environmental Services Ltd. (Madrone) conducted an ecosystem assessment for the proposed cutblock AN15 (the block) within the SCCF Tenure. The purpose of this assessment was to provide SCCF with a block level evaluation of the current ecological community, determine if Old Forests are present and discuss any red- and blue-listed plant communities (Listed Communities) that may be within the block. Depending on our findings, the ecological values and conditions of the planned block may be considered prior to final layout.

This block-level assessment was conducted while a tenure-wide assessment of Old Forest in the SCCF tenure was underway. The objectives of the latter project were to identify and characterize selected mature and Old Forest areas in the Coastal Western Hemlock very dry maritime, eastern (CWHxm1) and the Coastal Western Hemlock dry maritime (CWHdm) Biogeoclimatic (BEC) units so that they can be considered in a recruitment strategy for Ecosystem Based Management within the SCCF.

1.1 Objectives

The main objectives of this block level assessment were to:

- 1) Assess terrestrial ecosystems in the block by noting their status and documenting their ecological condition, and
- 2) Note instances of ecologically valuable resources in the stand, including any habitats for species of concern.

2 Overview of AN15

The block is south of Gray Creek in the Angus/Gray/Chapman Creek tenure area (Figure 1). It is easily accessible by Forest Service Road (FSR) 7575.18 off the Sechelt Dakota FSR. Figure 2 shows the proposed layout of AN15, as provided by SCCF in July 2021 prior to our assessment. Figure 2 may be subject to change based upon the results of the Environmental Block Assessment. (The block was subsequently updated, see Appendix C)



Study Area Overview
FIGURE 1: LOCATION OF AN15 WITHIN
THE ANGUS/GRAY/CHAPMAN TENURE
AREA OF THE SUNSHINE COAST
COMMUNITY FOREST.

PROJECT:
Overview of Environmental Block
Assessment: AN15

CLIENT:
Sunshine Coast Community Forest





GEOGRAPHIC AREA:
Sunshine Coast, British Columbia

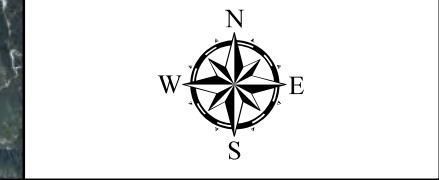
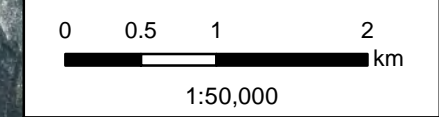
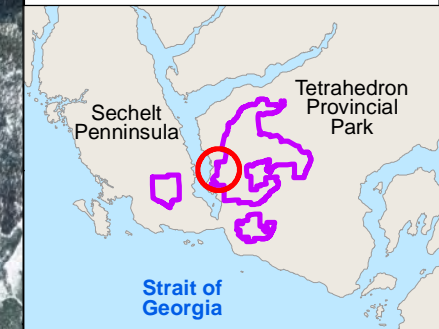
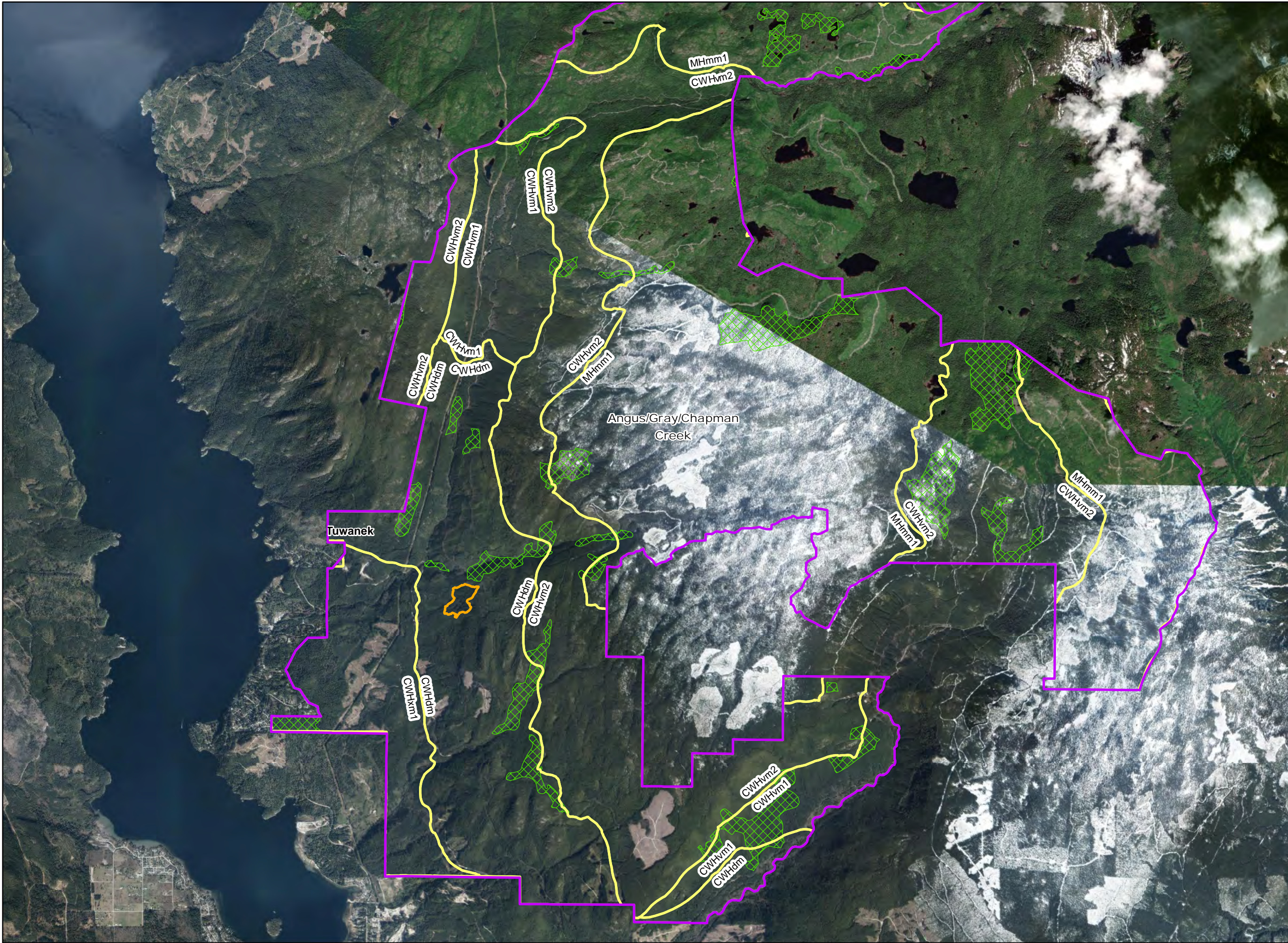
MAP SCALE:
1:50,000

MAPPING DATE:
7/22/2022

DOSSIER NO:
21.0131

DRAWN BY:
Anna Yuill

-  SCCF Tenure Area
-  AN15 Block
-  BEC Boundary based on TEM
-  Old Growth Management Areas

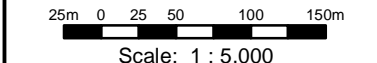


Management Areas

- Riparian Stream Class-FISH:
 - (S1/S4) Sampled -S2 -S2
 - (S1/S4) Gradient -S4 -S4
 - (Unknown) Gradient -S4 -S4
- Riparian Stream Class-NO FISH:
 - (S5/S6) Sampled -S6 -S6
 - (S5/S6) Gradient -S5 -S5
 - (Unknown) Gradient -S5 -S5
- Non-classified Drainage -S5 -S5
- Seepage -S5 -S5
- Stream Class, Reach Break -S5 -S5
- Riparian Lake (L1-L4) -S5 -S5
- Riparian Wetland (W1-W5) -S5 -S5
- Water Body ID # -S5 -S5
- Retention Patch (Engineered) -S5 -S5
- Retention Patch (Proposed) -S5 -S5
- Dispersed Retention Trees -S5 -S5
- Wildlife Tree Retention Area -S5 -S5
- Other Reserve -S5 -S5
- Road Right-of-Way -S5 -S5
- Riparian Reserve Zone -S5 -S5
- Riparian Management Zone (if different than SU prescription) -S5 -S5
- Ground-Based Yarding Area -S5 -S5
- Helicopter Harvest Area -S5 -S5
- Ground Based Area >35% Slope -S5 -S5
- Windthrow Management Area -S5 -S5
- Machine Free Zone -S5 -S5
- Special Management Zone -S5 -S5
- Park -S5 -S5
- Water Supply Intake -S5 -S5
- Previous Harvest -S5 -S5
- Community Forest Boundary -S5 -S5
- Community Watershed -S5 -S5
- OGMA -S5 -S5
- Surveyed Parcel -S5 -S5
- Private Property -S5 -S5
- First Nations Treaty Area -S5 -S5
- Stewardship Area -S5 -S5

Field Marking

- Falling Bdry: Orange Ribb. & Blazed Painted Orange
- Retention Patch: Orange Black Stripe Ribbon & Blazed Painted Orange
- Road Centre Line: Pink Ribb. & Blazed Painted Pink
- Road ROW: Orange Ribb. & Blazed Painted Orange
- Falling Corner: Blazed Painted Orange
- Dispersed Retention Trees: Orange Painted Dot Each Side & Base
- Special Mgt Zone: Orange Labelled Ribbon
- Fish Stream: Red White Stripe Ribbon
- Non Fish Stream: Blue White Stripe Ribb.
- Deflection Line: Green Ribbon
- Machine Free Zone: Red Ribbon
- Cruise Tree: Blue Painted Number

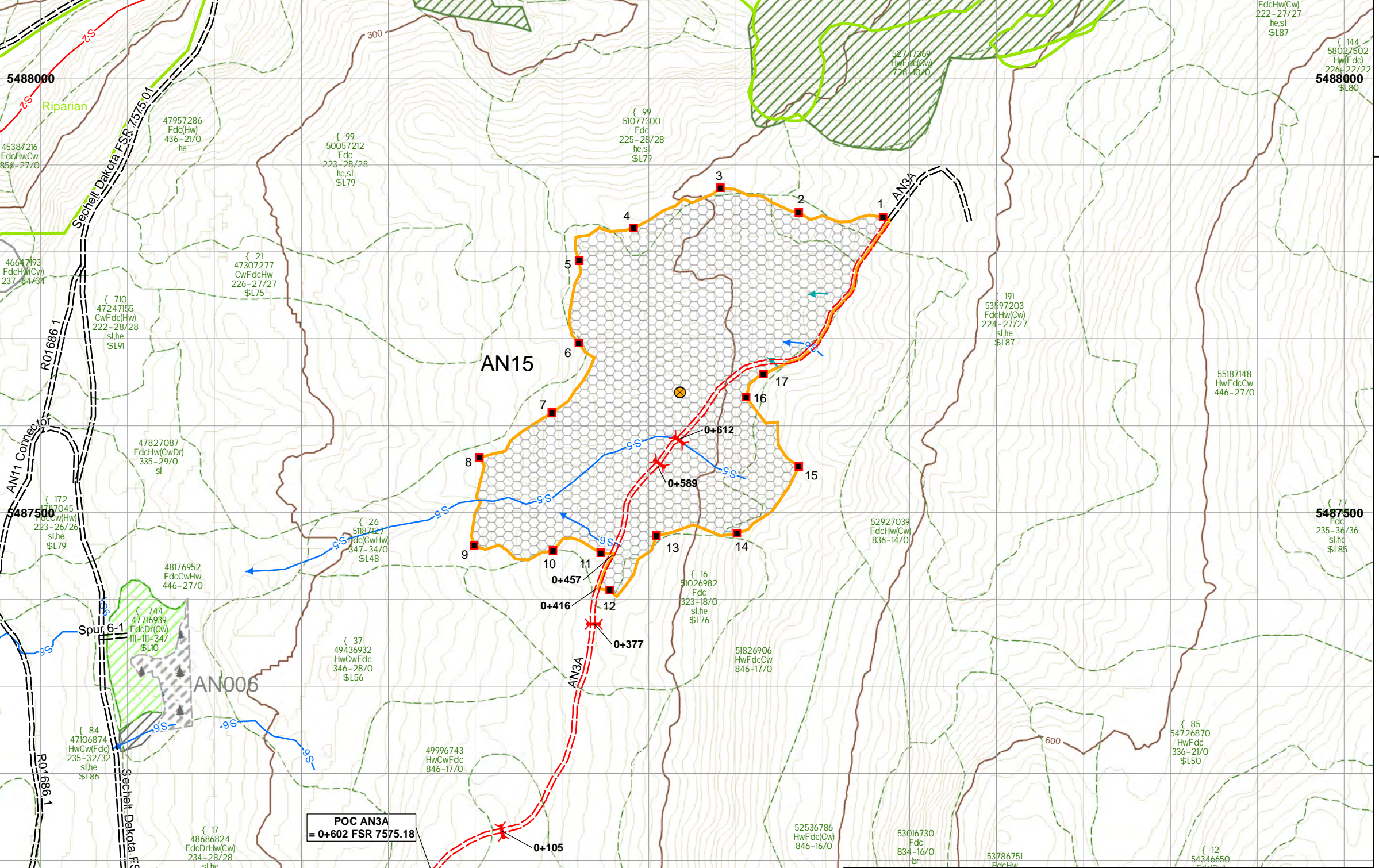


Project Number: 14-603
 Drawn By: JC
 Date: 2021-07-08

Harvest Plan / Road Construction Map Block AN15

DRAFT

Culvert Summary					
Road Number	Road Station	Culvert Type	Culvert Dimensions		Culvert Skew
			Diameter	Length	
AN3A	0+105	CMP	800		
AN3A	0+377	CMP	500	9	
AN3A	0+589	CMP	800		
AN3A	0+612	CMP	1200	9	



Block AN15

Scale: 1:5,000
 Region: RSC
 District: DSC
 Mapsheet: 92G052
 Location: Angus Creek
 UTM Zone: 10
 UTM Easting: 447436
 UTM Northing: 5487638
 Latitude: 49°32'20.64"N
 Longitude: 123°43'35.50"W
 TAUP (ha): 11.7

Legend

- Total Area Under Prescription (TAUP):
 - Falling Boundary —
 - External to Falling Bdy - - -
- Falling Corner ■
- SP Plot ●
- Standard Unit Boundary - - -
- Treatment Unit Boundary - - -
- Existing Road = = =
- Existing Trail - - -
- Proposed Roads:
 - Haul Road - - -
 - Designated Skid Trail - - -
 - Temporary (Rehab) X X
 - Backspar Trail - - -
 - Road Reconstruction = = =
- Road Chainage [0+200]
- Bridge (Existing) ()
- Bridge (Proposed) ()
- Culvert (Existing) =
- Culvert (Proposed) =
- Unclassified Road - - -
- Rock Outcrop Area []
- Designated Stream Crossing []
- Gravel Pit []
- Transmission Line []
- Utility Corridor []
- Permanent Structures []
- Slide []
- Gully []
- Rock Outcrop []
- Windfall/Snag []
- Marsh/Swamp []
- Index Contour and Label []
- Intermediate Contour []
- Landing/Temporary Landing []
- Dryland Sort/Water Sort []
- Log Dump/Helipad []
- Helicopter Drop Zone []
- Geographic Centre []

Logging Area Summary (ha)							
Block	Gross	Retention	WTRA	RP RoW	NP Nat.	Exist.Rd.	Net Harv
AN15	11.7	0.0	0.0	0.0	0.0	0.0	11.7

Harvest System Summary (ha)				
Block	Heli	Cable	Ground-Based	Total
AN15	0.0	0.0	11.7	11.7

Harvest System

- Ground Based →
- Skylines →
- High-lead →
- Harvest System Split Line - - -
- Yarding Split Line - - -

3 Methods

The assessment of AN15 included an office-based database search, followed by a field assessment by three qualified professionals with extensive knowledge of the local ecosystems; Anna Yuill (R.P.Bio), Amanda Girard (R.P.Bio, R.P.F), and Laurie Kremsater (R.P.Bio, R.P.F).

3.1 Desktop Review

A desktop review of the planned block and adjacent area was completed prior to the field assessment. The purpose of the review was to determine the potential presence of provincially red- and blue-listed plants and plant communities.

The desktop review included searching the following sources:

- BC Conservation Data Center (BC CDC: database for rare element occurrences).
- Terrestrial Ecosystem Mapping for the Chapman Landscape Unit (BABID Number: 4677).
- Sensitive Ecosystem Inventory of the Sunshine Coast and adjacent islands.
- Sunshine Coast Community Forest LiDAR Data – volume, height, and diameter models (2015).
- Vegetation Resource Inventory (2020).

The B.C. CDC has an assessment system for element occurrences (EO)¹ of ecological communities. The EO may represent a stand or patch of an ecological community, or a cluster of stands or patches of an ecological community (NatureServe, 2002). Ranks are assigned based on condition, size, and landscape context. Typically, old EO's (EO's) have higher scores for ecological integrity/quality. Younger examples are still considered Listed Communities but rank lower for ecological integrity/quality.

LMH 72 provides criteria to assess if young forests have sufficient structural attributes to be considered Sufficiently Established². It requires knowledge of the overall age of the stand, so we used the most recent VRI data to determine the age matrix of the block.

¹ Ecological Community Elements, the Element Occurrence may represent a stand or patch of an ecological community, or a cluster of stands or patches of an ecological community

² Sufficiently Established, *means any of the following: (a) a plant community occurrence within a stand that is ≥ 250 years old*²⁴; or (b) a plant community occurrence within a stand that is < 250 years and that meets the following criteria: i. exhibits a late mature vertical and horizontal structure (structural stage 6 or 7) and tree species composition, and often includes a veteran overstorey tree layer; and ii. has a patchy to well-developed understorey for the site series (excluding consideration of conifer regeneration and bryophytes); or (c) a low, mid, or high bench floodplain ecosystem (Banner et al. 2019. www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/LMH72.htm)

Our assessment focused on Listed Communities, but we also reviewed potential Species-at-Risk so that we were aware of species and habitats that may occur within AN15. A BC CDC database query for species and ecosystems at risk with potential to be in the area was conducted, producing several possible occurrences as a .csv file, which was then reviewed using professional knowledge and publicly available literature (Appendix A). We determined that the main species of concern within AN15 are the Western Screech-owl (*Megascops kennicottii*), Northern Goshawk (*Accipiter gentilis laingi*), red legged-frog (*Rana aurora*), and coastal-tailed frog (*Ascaphus truei*). Roosevelt Elk (*Cervus elphus roosevelti*) are ranked by the Conservation Data Centre (2015) as S3S4 (Vulnerable to Apparently Secure) and are provincially blue listed and identified as of Special Concern. Although they are considered recovered over much of the Sunshine Coast (BCMFLNRO 2015), the Rainy/Gray population is just at or perhaps still slightly below population targets, although populations are increasing. Key issues are maintaining riparian forests (Reynolds pers. Comm. 2021) and sufficient mature and old forest. Surveying for all possible SAR was beyond the scope of this assessment. However, we did consider the general habitat requirements of species listed in Appendix A during our field assessment.

3.2 Field Assessment

Following the completion of the background review, a field investigation was conducted to identify site-specific potential occurrences for Listed Communities. Ecological plot data was collected using the provincial standard Site Visit Forms (FS1333) and field methodology as described in Field Manual for Describing Terrestrial Ecosystems (BC MFOR and BC MOE 2010). The GPS position of each assessment plot was noted in the field and plotted on a map using an iPad and Avenza. Plots size for ecosystem classification was a fixed circle of 10m².

The following site variables were recorded at each plot:

- Location
- Slope
- Aspect
- Elevation
- DBH of veteran overstory trees (A1 layer) and DBH of understory trees (A2)
- Mensuration Data (core samples) were taken at various plots to gather information related to age
- Canopy closure %
- Vegetation identification and % composition
- Site Series
- Drainage
- Landscape Factors
- Structural Stage
- Photos of the site

In addition to completing the Site Visit Forms, we assessed if stands could be classified as a Sufficiently Established Listed Community under the Guidelines to Support Implementation of the Great Bear Rainforest Order with Respect to Old Forest and Sufficiently Established Listed Community (Banner et al. 2016 LMH 72). To determine if a stand is functioning as an Old Forest or could be identified as a Sufficiently Established Listed Community, we followed the methodology outlined in LMH 72. LMH 72 provides decision keys that incorporate minimum criteria for certain ecological features (e.g., presence of Coarse Woody Debris, Snags, and Veteran Overstory Trees) and provides an index that integrates a suite of ecological characteristics that reflect the complexity of older forests. To be considered a Sufficiently Established Listed Community a stand must be either an Old Forest or be greater than 80 years old and meet some basic structural and vegetation development requirements. The assessment procedure starts by completing an Old Forest decision key, then completing a Sufficiently Established (SE) plant community key and calculating a Forest Attribute Score (FAS) to determine the ecological condition of the plot. Both keys provide a decision (if protection would be required in the Great Bear Rainforest Order area) or direct the user to complete a FAS based on features typical of older forests. Although the block is not in the Great Bear Rainforest (GBR), this methodology provides a consistent, systematic approach to evaluate the block's structural attributes and ecological attributes. In the Great Bear Rainforest Order Area, a proportion of the old forest or Sufficiently Established Listed Communities must be protected; there is more flexibility in deciding to protect ecosystems that are not old and not SE. For the SCCF assessments, calculating the FAS provides a numerical score of how close a stand is to Old Forest/SE condition, thus allowing us to rank stands in relation to their usefulness for recruitment to Old Forest and suggest special management or conservation measures. Stands with higher FAS scores, even if not SE or old, may be the best opportunities left for recruitment to old forest.

Key attributes in the Old Forest and Sufficiently Established ecosystem assessments are stand age, number of veteran overstory trees and the FAS. We used a fixed-area plots of 0.2 ha (25-m radius) to assess the FAS. The following site variables were scored at each plot.

- Density of Veteran Overstory Trees (VOTs)³
- Snag Density
- Vertical Canopy differentiation
- Understory shrub and herb cover
- Coarse woody debris presence
- Disturbance history

³ VOTs are identified as being emergent trees that are at least 200 years old and have a minimum diameter (DBH) of either 50 cm on dry sites (relative soil moisture regime 2 or lower) or 70 cm on all other sites (Banner et al. 2019)

In conjunction with the plot level survey, we also walked the proposed block to assess stand characteristics in relationship to the entire block area. We noted areas of potential ecological considerations and areas of ecological heterogeneity.

4 Results

4.1 Desktop Review – Potential Listed Communities

Listed Communities that occur within the CWHdm BEC unit were obtained from the BC CDC database. To further refine our search, we used the existing TEM for Chapman Landscape Unit to determine the potential existing ecosystems (site series) within AN15 (Table 1). Site series 01 is the dominant ecosystem type with a small component of 05 in the CWHdm.

TABLE 1: MAPPED ECOSYSTEMS WITHIN BLOCK AN15 ACCORDING TO CHAPMAN LANDSCAPE UNIT TERRESTRIAL ECOSYSTEM MAPPING (BAPID 4677)

BEC Unit	Site Series	Ecosystem Name	Potential Listed Community ⁴
CWHdm	01	HwFd – Kindergia	Blue
	05	Cw – Sword fern	Red

Listed Communities are typically only considered good candidates for protection once they are in an old forest state, greater than 250 years old. However, LMH 72 provides criteria to assess if younger forests can have sufficiently developed attributes to be considered SE. Stands that are not SE can be considered for protection if they are the best quality left on the landscape. To determine the overall age and structure of the stand we used the most recent VRI data⁵. The stand includes Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) with minor components of western redcedar. AN15 appears to have been previously logged in one pass and is mainly 59 years old (PROJ_AGE_1). The fringes of the block range in age from as young as 31 and 45 years old to 167 years old according to VRI⁵.

One Sensitive Ecosystem Inventory (SEI) polygon intersects the southern portion of AN15. The SEI polygon is mapped as 100% Riparian (RI), fringe (ff), with varying structural stages, 70% structural stage 5 (young forest), 20% structural stage 2 (herb), and 10% structural stage 3 (shrub/herb). The remainder of the block has not been identified as a Sensitive Ecosystem (Figure 2).

⁴ As per the BC Conservation Data Center, 2021

⁵ VEG_COMP_LYR_R1_POLY_2020

4.2 Field Results

4.2.1 Wildlife Observations

We looked for Northern Goshawk nests but observed none. We did not do an evening owl census but have heard from a local naturalist that Western Screech-owls have not been heard nor observed in the area for many years. A few streams were noted throughout the block, a larger S5 with a braided stream and associated richer riparian ecosystem (05) bisects the southern portion of the block. We did not see any frog species, the streams were surveyed and sampled for eDNA in April of 2022 (see Appendix D), no frogs were found and. Signs of elk were scant and mostly in the young section of the stand.

4.2.2 Ecosystem Assemblages

The block is forested with a few small rocky outcrops and a mountain bike trail that bisects the block. Based upon the VRI and our field assessment, the forest is age class is slightly older than indicated in VRI, but still less than 80 years old in most places (Table 2). When we conducted the FAS scores, we conservatively put the block in the age class 5 category (81 – 100 years). The canopy is dominated primarily by Douglas-fir with western hemlock as a co-dominant and western red cedar in the sub-canopy layer. The understory/shrub layer is generally poorly developed due to high canopy crown closure. The shrub layer is broadly characterized by salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*) with very minor components of red huckleberry (*Vaccinium parvifolium*) and trailing blackberry (*Rubus ursinus*).

The herb layer is sparse due to the high canopy cover that shades out the understory. The herb layer typically consists of sword fern (*Polystichum munitum*). The moss layer is more prominent (5 - 10% ground cover) than the herb layer and is dominated by step moss (*Hylocomium splendens*), slender beaked-moss (*Kindbergia oregana*) and wavy-leaved cotton moss (*Plagiothecium undulatum*).

Based upon our plot assessment the forested ecosystem units observed in the block include:

- Site series 01 (mapcode AB): western hemlock – amabilis fir / blueberry (most common/dominant type in the block);
- Site series 05 (mapcode RS): western redcedar / sword fern (co-dominant in block); and
- Site series 03 (mapcode HS): western hemlock–western redcedar / salal (very small patches, <1ha, around rock outcrops/knolls).

4.2.3 Assessment of Old or Sufficiently Established Communities using LMH 72

Any listed community in an Old Forest condition is considered to warrant protection. Thus, the first step in identifying if the ecosystem is suitable for protection is to determine if the stand is considered an Old

Forest⁶. A stand \geq 80-year-old is considered Old Forest (and thus a SE listed community) if it has \geq 20 veteran overstory trees per hectare or has a well-developed understory and passed the FAS score (Banner et al. 2019).

We tried to subjectively put our plots in areas most likely to pass the FAS score, however, none of the seven plots fell within Old Forest nor was a Sufficiently Established Ecosystem. However, a FAS was conducted at each site to understand the stand’s potential landscape context. Overall, AN15 had a poorly developed understory apart from plot SS016 that had a well-developed understory. No VOTs were observed in AN15 and the canopy was largely simple with a few areas of moderate complexity. It should be noted that some subjectivity will always be required in any ecological field assessment to determine the FAS, thus we always erred on the side of caution making conservative decisions in our scoring of the plots.

Representative site photos of each plot can be observed in Appendix B.

TABLE 2: FOREST ATTRIBUTE SCORE (FAS) FOR EACH PLOT WITHIN AN15. SCORING IS BASED ON A POINTS SYSTEM AS DESCRIBED BY LAND MANAGEMENT HANDBOOK 72.

Plot	Density of VOTs	Density of Snags	Vertical Canopy Differentiation	Understory Shrub and Herb Cover	Coarse Woody Debris pieces	Disturbance History	Score	Pass/Fail
SS011	0	0	1	0	0.5	0	1.5	FAIL
SS012	0	0	0	0	0.5	0	0.5	FAIL
SS013	0	0	1	0	0.5	0	1.5	FAIL
SS014	0	0	1	1	1	0	3	FAIL
SS015	0	0	0	1	0.5	0	1.5	FAIL
SS016	0	0	0	2.5	1	0	3.5	FAIL
SS017	0	0	1	1	1	0	3	FAIL

In addition to conducting the FAS, we cored a small selection of trees at each plot to assess age of the stand and determine potential for VOTs. Trees cored were a combination of A2 (i.e., main tree canopy, codominant), and A3 canopy layer (sub-canopy trees), as the A1 (dominate trees that stand above the canopy) was noticeably lacking.

TABLE 3: RESULTS OF A SELECTION OF TREES CORED WITHIN EACH PLOT

Plot	Species	DBH	Height*	Age	Canopy Layer
SS011	Hw	54.5	-	75	A2
SS013	Cw	54.9	-	129	A2
	Fdc	59.5	-	60	A2
SS014	Cw	46	-	59	A2
	Fdc	60.4	-	59	A2
SS016	Fdc	49	-	55	A2

* At the time of our assessment the vertex was not working, no heights were taken.

⁶ Old Forest definition as per LMH 72

Based upon our field findings, known stand age and logging history of the area, the block is a second-growth stand with no observable clusters of VOTs (Figure 2).



FIGURE 3: FINDINGS FOR AN15 AND PLOT LOCATIONS OF FOREST ATTRIBUTE SCORES.

Forest Attribute Score for AN15

- FallingCorners
- Block Boundary: AN15
- Tenure Area
- Sensitive Ecosystem Inventory
- Old Growth Management Area
- Tenure Roads
- Watercourse

Forest Attribute Score (Pass/Fail)

- FAIL
- PASS

MAP DATE: 10/27/2021	DRAWN BY: Anna Yuill	
Assessed By: A. Yuill, A. Girard, L. Kremsater		
<p>0 0.0275 0.055 0.11 0.165 km</p> <p>1:2,500</p>		



5 Discussion

Listed Communities that are considered for protection typically include forested site series that have reached old ages (>250 years) as they reflect excellent conditions of an ecological community. Due to recent harvesting pressures and logging history, in many areas old forests are rare, especially at low elevations in the CWHxm1 and CWHdm where timber was more readily accessible. LMH 72 was created to provide a criterion to determine if stands younger than 250 years can be considered Old Forest or Sufficiently Established Listed Communities in the GBR. Even though the SCCF is not within the GBR, the methods and principals outlined by LMH 72 still hold merit and the FAS can provide a quantitative evaluation of the value of a stand as recruitment to Old Forest conditions.

Deciding if the whole block is worthwhile to set aside to protect or recruit to Old Forest requires knowing what other options are available to fill the amount of protection the SCCF wants to provide to the CWHdm. The tenure-wide assessment of potential recruitment areas is in development. We have developed a baseline understanding of the land base through the development of the tenure wide assessment. During the tenure wide assessment, six ecological communities within the Angus/Gray/Chapman Creek tenure area were visited and assessed. Of these two passed the FAS. AN15 contains one of the lowest FAS scores observed in the Angus/Gray/Chapman Creek tenure area.

Based upon the outcomes of our preliminary tenure assessment, prioritization of the area found within AN15 and surrounding area were not considered building blocks for the SCCFs future reserve system, largely due to stand age, and lack of notable heights and quadratic mean diameter as derived from the LiDAR data (Yuill 2017). We reviewed the Resources Inventory Standards Committee (RISC; 2006) Standard for Mapping Ecosystems at Risk in British Columbia⁷ and Appendix 7 of LMH 72 to understand the EO ranking of EW24 based upon draft materials from the BC CDC. AN15 is approximately 12 ha in size and surrounded by a mosaic of historically harvested areas: primarily young stands with a mature stand to the north. Overall, AN15 is not a good candidate area for a recruitment, as it is in Fair condition with good landscape context and a C rating for size (Table 4).

⁷ https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-data-centre/standard_for_mapping_ecosystems_at_risk.pdf

TABLE 4: OVERVIEW OF INFLUENCING FACTORS OF ECOLOGICAL INTEGRITY AND THEIR OVERALL RANKING BASED ON APPENDIX 7 OF LMH 72 FOR AN15.

Influencing Factors of Ecological Integrity	Overall Ranking
Condition	Fair
Landscape Context	Good
Size	C rating

6 Conclusion and Recommendations

The overall intent of our assessment was to evaluate terrestrial ecosystems in the block by noting their status, documenting their ecological condition, and recording any instances of ecologically valuable resources in the stand, including habitats for species of concern. We did this by determining if the block had areas of mature forests with adequate old structural attributes to contribute effectively to Old Forest values and function as Old Forests based on LMH72. We also assessed ecological assemblages and completed a high-level overview for potential habitat for species at risk.

Based upon our assessment, AN15 is not functioning as an Old Forest nor as a Sufficiently Established plant community, and no key habitats for species of concern were noted. Given the lack of VOTs noted throughout the block and age of the block (59) it is unlikely it will develop into an Old Forest nor Sufficiently Established Plant community within the next few decades, as it would require VOTs of at least 200 years of age. However, regardless of AN15 not being considered a building block for the SCCF recruitment strategy, there are some important features in the block that warrant stand level retention. Specifically, the S5 stream is an important ecological anchor, it is sometimes in a gully and sometimes in flatter areas where the stream braids. FRPA does not require a buffer on S5s, but we suggest at least a 20 m buffer as they move considerable water during winter and this one had flow even during dry conditions. As well, there is a large yew tree (49.7 cm DBH) that would not trigger protection under FRPA, but we suggest it be retained. Yews are an understory tree, so a retention patch would be appropriate. The yew is located just north of falling corner 6.

Angus Gray Chapman tenure area has considerable old forest at higher elevations, but none in the CWH dm and xm1 (Table 5). AN15 targets harvest in the 40 to 80 age class.

TABLE 5: AREA BY AGE CLASS FOR THE CWH DM AND XM IN ANGUS/GRAY/CHAPMAN TENURE AREA.

BEC	Age Class							
	0 to 40		40 to 80		80 to 250		>250	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
CWHdm	304.3	22%	719.34	52%	306.3	22%	39.1	3%
CWHxm1	180.0	35%	198.7	39%	110.5	22%	0	0%

Areas of protection will eventually grow to be old forest, but levels of current protection in the CWH dm and xm1 in Angus Creek are below 10% (Table 6).

TABLE 6: LEVEL OF PROTECTION REQUIRED FOR EACH BEC UNIT PER TENURE AREA WITH A 10% RESERVE DESIGN AS OUTLINED BY THE SUNSHINE COAST COMMUNITY FOREST.

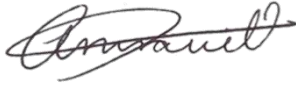
	Angus/Gray Chapman					
	CWHxm1	CWHdm	CWHvm1	CWHvm2	MHm1	blank
Area (ha)	510.41	1,375.78	619.69	2,405.95	3,625.55	18.49
Amount for 10% (ha)	51.04	137.58	61.97	240.60	362.56	N/A
Total Currently protect in OGMA (ha)	13.82	94.20	69.61	190.22	141.64	0.21
Surplus/Deficit	- 37.22	- 43.38	7.64	- 50.38	- 220.92	N/A

Close to 100 ha needs to be found in the dm and xm just to reach the 10% level. There are several areas outlined with better forest attributes and better landscape context than AN15. The retention areas around the S5 creek area and yew tree in AN15 are valuable for site level retention, however the block is not considered a high-quality building block for a reserve system.

7 References

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APPENDIX A

Species & Ecosystems Explorer Results

To identify species and ecological communities at risk, a search of the BC Species & Ecosystem Explorer was performed (June 2021). The results of that search were trimmed down based on expert knowledge and general literature. Results pertaining to ray-finned, fish, turtles, bivalves, and amphibians was removed from the search results due to a lack of watercourses noted throughout HM50. The following is a list of red- or blue- listed species and ecological communities that have some potential to overlap the block.

Vertebrates					
English Name	Scientific Name	Class (English)	BC List	Provincial FRPA	SARA Status
Big Brown Bat	<i>Eptesicus fuscus</i>	mammals	Yellow		
Californian Myotis	<i>Myotis californicus</i>	mammals	Yellow		
Fisher	<i>Pekania pennanti</i>	mammals	No Status	Y (Jun 2006)	
Grizzly Bear	<i>Ursus arctos</i>	mammals	Blue	Y (May 2004)	Special Concern
Hoary Bat	<i>Lasiurus cinereus</i>	mammals	Yellow		
Little Brown Myotis	<i>Myotis lucifugus</i>	mammals	Yellow		Endangered
Long-eared Myotis	<i>Myotis evotis</i>	mammals	Yellow		
Long-legged Myotis	<i>Myotis volans</i>	mammals	Yellow		
Long-tailed weasel, altifrontalis subspecies	<i>Mustela frenata altifrontalis</i>	mammals	Red		
Mountain Beaver	<i>Aplodontia rufa</i>	mammals	Yellow		Special Concern
Olympic Shrew	<i>Sorex rohweri</i>	mammals	Red		
Pacific Water Shrew	<i>Sorex bendirii</i>	mammals	Red	Y (May 2004)	Endangered
Roosevelt Elk	<i>Cervus elaphus roosevelti</i>	mammals	Blue		
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	mammals	Yellow		
Southern Red-backed Vole, occidentalis subspecies	<i>Myodes gapperi occidentalis</i>	mammals	Red		
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	mammals	Blue		
Townsend's Mole	<i>Scapanus townsendii</i>	mammals	Red		Endangered
Trowbridge's Shrew	<i>Sorex trowbridgii</i>	mammals	Blue		

Yuma Myotis	<i>Myotis yumanensis</i>	mammals	Yellow		
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	birds	Blue	Y (May 2004)	Special Concern
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	birds	Blue		Special Concern
Barn Owl	<i>Tyto alba</i>	birds	Red		Threatened
Barn Swallow	<i>Hirundo rustica</i>	birds	Blue		Threatened
Black Swift	<i>Cypseloides niger</i>	birds	Blue		Endangered
Black-throated Green Warbler	<i>Setophaga virens</i>	birds	Blue	Y (Jun 2006)	
Canada Warbler	<i>Cardellina canadensis</i>	birds	Blue		Threatened
Common Nighthawk	<i>Chordeiles minor</i>	birds	Yellow		Threatened
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	birds	Yellow		Special Concern
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	birds	Blue	Y (May 2004)	Threatened
Northern Goshawk, laingi subspecies	<i>Accipiter gentilis laingi</i>	birds	Red	Y (May 2004)	Threatened
Olive-sided Flycatcher	<i>Contopus cooperi</i>	birds	Blue		Threatened
Peregrine Falcon	<i>Falco peregrinus</i>	birds	No Status		Special Concern
Peregrine Falcon, anatum subspecies	<i>Falco peregrinus anatum</i>	birds	Red		Special Concern
Peregrine Falcon, pealei subspecies	<i>Falco peregrinus pealei</i>	birds	Blue		Special Concern
Purple Martin	<i>Progne subis</i>	birds	Blue		
Short-eared Owl	<i>Asio flammeus</i>	birds	Blue	Y (May 2004)	Special Concern
Spotted Owl	<i>Strix occidentalis</i>	birds	Red	Y (May 2004)	Endangered
Western Screech-Owl	<i>Megascops kennicottii</i>	birds	No Status		Threatened
Western Screech-Owl, kennicottii subspecies	<i>Megascops kennicottii kennicottii</i>	birds	Blue		Threatened

Invertebrates					
English Name	Scientific Name	Class (English)	BC List	Provincial FRPA	SARA Status
Dusky Fossaria	<i>Galba dalli</i>	gastropods	Blue		
Meadow Rams-horn	<i>Planorbula campestris</i>	gastropods	Blue		
Prairie Fossaria	<i>Galba bulimoides</i>	gastropods	Blue		
Puget Oregonian	<i>Cryptomastix devia</i>	gastropods	Red		Extinct
Pygmy Fossaria	<i>Galba parva</i>	gastropods	Blue		
Rocky Mountain Physa	<i>Physella propinqua</i>	gastropods	Blue		
Sunset Physa	<i>Physella virginea</i>	gastropods	Blue		
Threaded Vertigo	<i>Nearctula sp. 1</i>	gastropods	Blue		Special Concern
Western Thorn	<i>Carychium occidentale</i>	gastropods	Blue		
Widelip Pondsnaill	<i>Stagnicola traski</i>	gastropods	Blue		
Alkali Bluet	<i>Enallagma clausum</i>	insects	Blue		
Audouin's Night-stalking Tiger Beetle	<i>Omus audouini</i>	insects	Red		Threatened
Autumn Meadowhawk	<i>Sympetrum vicinum</i>	insects	Blue		
Black Petaltail	<i>Tanypteryx hageni</i>	insects	Blue		
Blue Dasher	<i>Pachydiplax longipennis</i>	insects	Blue		
Clodius Parnassian, claudianus subspecies	<i>Parnassius clodius claudianus</i>	insects	Blue		
Clodius Parnassian, pseudogallatinus subspecies	<i>Parnassius clodius pseudogallatinus</i>	insects	Blue		
Common Wood-nymph, incana subspecies	<i>Cercyonis pegala incana</i>	insects	Red		
Dun Skipper	<i>Euphyes vestris</i>	insects	Blue		Threatened
Emma's Dancer	<i>Argia emma</i>	insects	Blue		
Grappletail	<i>Octogomphus specularis</i>	insects	Red		
Hairy-necked Tiger Beetle	<i>Cicindela hirticollis</i>	insects	Blue		

Hoffman's Checkerspot	<i>Chlosyne hoffmanni</i>	insects	Red		
Indra Swallowtail	<i>Papilio indra</i>	insects	Red		
Johnson's Hairstreak	<i>Callophrys johnsoni</i>	insects	Red	Y (Jun 2006)	
Monarch	<i>Danaus plexippus</i>	insects	Red		Special Concern
Propertius Duskywing	<i>Erynnis propertius</i>	insects	Red		
Silver-spotted Skipper	<i>Epargyreus clarus</i>	insects	Blue		
Silver-spotted Skipper, californicus subspecies	<i>Epargyreus clarus californicus</i>	insects	Red		
Sinuuous Snaketail	<i>Ophiogomphus occidentis</i>	insects	Blue		
Vivid Dancer	<i>Argia vivida</i>	insects	Blue		Special Concern
Western Branded Skipper, oregonia subspecies	<i>Hesperia colorado oregonia</i>	insects	Red		
Western Pine Elfin, sheltonensis subspecies	<i>Callophrys eryphon sheltonensis</i>	insects	Blue		
Western Pondhawk	<i>Erythemis collocata</i>	insects	Blue		
Zerene Fritillary, bremnerii subspecies	<i>Speyeria zerene bremnerii</i>	insects	Red		
Amphibians					
English Name	Scientific Name	Class (English)	BC List	Provincial FRPA	SARA Status
Coastal Giant Salamander	<i>Dicamptodon tenebrosus</i>	amphibians	Blue	Y (May 2004)	Threatened
Coastal Tailed Frog	<i>Ascaphus truei</i>	amphibians	Yellow	Y (May 2004)	Special Concern
Northern Red-legged Frog	<i>Rana aurora</i>	amphibians	Blue	Y (May 2004)	Special Concern
Oregon Spotted Frog	<i>Rana pretiosa</i>	amphibians	Red		Endangered
Western Toad	<i>Anaxyrus boreas</i>	amphibians	Yellow		Special Concern

Plants					
English Name	Scientific Name	Class (English)	BC List	Provincial FRPA	SARA Status
British Columbia bugseed	<i>Corispermum hookeri</i> var. <i>pseudodeclinatum</i>	dicots	Unknown		
leafless wintergreen	<i>Pyrola aphylla</i>	dicots	Blue		
Texas toadflax	<i>Nuttallanthus texanus</i>	dicots	Blue		
two-edged water-starwort	<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	dicots	Unknown		
dwarf red fescue	<i>Festuca rubra</i> ssp. <i>mediana</i>	monocots	Yellow		
Ecological Communities					
English Name	Scientific Name	Class (English)	BC List	Provincial FRPA	SARA Status
arbutus / hairy manzanita	<i>Arbutus menziesii</i> / <i>Arctostaphylos columbiana</i>		Red		
Sitka sedge - Pacific water-parsley	<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>		Blue		
Roemer's fescue - junegrass	<i>Festuca roemeri</i> - <i>Koeleria macrantha</i>		Red		
Douglas-fir / sword fern	<i>Pseudotsuga menziesii</i> / <i>Polystichum munitum</i>		Red		
Douglas-fir - western hemlock / salal Dry Maritime	<i>Pseudotsuga menziesii</i> - <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> Dry Maritime		Red		
Wallace's selaginella / reindeer lichens	<i>Selaginella wallacei</i> / <i>Cladina</i> spp.		Blue		
western redcedar / sword fern Dry Maritime	<i>Thuja plicata</i> / <i>Polystichum munitum</i> Dry Maritime		Red		
western redcedar / sword fern Very Dry Maritime	<i>Thuja plicata</i> / <i>Polystichum munitum</i> Very Dry Maritime		Red		
western redcedar / salmonberry	<i>Thuja plicata</i> / <i>Rubus spectabilis</i>		Red		

western redcedar / three-leaved foamflower Dry Maritime	<i>Thuja plicata / Tiarella trifoliata</i> Dry Maritime		Blue		
western redcedar / three-leaved foamflower Very Dry Maritime	<i>Thuja plicata / Tiarella trifoliata</i> Very Dry Maritime		Blue		
western hemlock / flat-moss	<i>Tsuga heterophylla / Buckiella undulata</i>		Blue		
western hemlock - Douglas-fir / Oregon beaked-moss	<i>Tsuga heterophylla - Pseudotsuga menziesii / Eurhynchium oreganum</i>		Red		
western hemlock - western redcedar / deer fern	<i>Tsuga heterophylla - Thuja plicata / Struthiopteris spicant</i>		Red		



APPENDIX B

Site Photos



PHOTO 1: OVERVIEW EAST AT PLOT SS012. LACK OF UNDERSTORY VEGETATION DEVELOPMENT AND HIGH CROWN CLOSURE TYPICAL OF AN15.



PHOTO 2: OVERVIEW WEST OF PLOT SS013. SLIGHTLY MORE DEVELOPED UNDERSTORY BUT OVERALL LACKING WITH VERY SIMPLE CANOPY COMPLEXITY.



PHOTO 3: OVERVIEW SOUTH OF PLOT SS015. NO VETERAN OVERSTOREY TREES WERE NOTED DURING OUR ASSESSMENT.



PHOTO 4: OVERVIEW WEST OF PLOT SS016 LOCATED ON A SMALL KNOLL. THIS IS THE ONLY PLOT THAT CONTAINED A WELL-DEVELOPED UNDERSTORY.



PHOTO 5: UPSTREAM VIEW OF THE S5 LOCATED ADJACENT TO PLOT SS011, SOME MINIMAL FLOWS WERE OBSERVED WITHIN THE S5 DURING THE TIME OF OUR ASSESSMENT - AFTER AN EXTENDED PERIOD OF DRY SUMMER WEATHER.



PHOTO 6: UPSTREAM VIEW OF THE S5 LOCATED ADJACENT TO PLOT SS011, MINIMAL FLOWS WERE OBSERVED WITHIN THE S5 DURING THE TIME OF OUR ASSESSMENT, BUT CLEARLY THE WATERCOURSE HAS SIGNIFICANT FLOWS DURING MUCH OF THE YEAR.

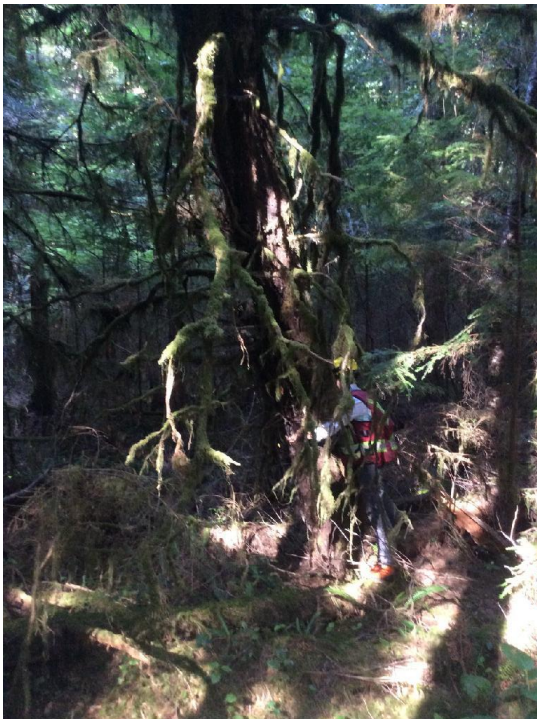


PHOTO 7: OVERVIEW OF THE PACIFIC YEW TREE (ALMOST 50 CM DBH), LOCATED JUST NORTH OF FALLING CORNER 6.



APPENDIX C

Revised harvest plan for AN15

Harvest Plan / Road Construction Map Block AN15

DRAFT



Block AN15

Scale: 1:5,000
 Region: RSC
 District: DSC
 Mapsheet: 92G052
 Location: Angus Creek
 UTM Zone: 10
 UTM Easting: 447457
 UTM Northing: 5487637
 Latitude: 49°32'20.62"N
 Longitude: 123°43'34.47"W
 TAUP (ha): 8.5

Management Areas

- Riparian Stream Class-FISH: S1, S2, S3, S4 (Red line with 'S2')
- Unknown (Red line)
- Riparian Stream Class-NO FISH: S5, S6 (Blue line with 'S6')
- Unknown (Blue line)
- Non-classified Drainage (Green line)
- Seepage (Dashed blue line)
- Stream Class, Reach Break (SS1, SS6)
- Riparian Lake (L1-L4) (Blue oval)
- Riparian Wetland (W1-W5) (Blue wavy line)
- Water Body ID # (A1)
- Retention Patch (Engineered) (Green hatched)
- Retention Patch (Proposed) (Green diagonal lines)
- Adjacent Retention Patch (White hatched)
- Dispersed Retention Trees (Green tree icon)
- Wildlife Tree Retention Area (Green tree icon)
- Adjacent Wildlife Tree Retention Area (WTRA) (Green tree icon)
- Road Right-of-Way (Grey rectangle)
- Riparian Reserve Zone (Pink rectangle)
- Riparian Management Zone (if different than SU prescription) (Pink rectangle)
- Ground-Based Yarding Area (Green hatched)
- Helicopter Harvest Area (Yellow hatched)
- Ground Based Area >35% Slope (Red diagonal lines)
- Windthrow Management Area (Black diagonal lines)
- Machine Free Zone (MFZ) (Black box)
- Special Management Zone (SMZ) (Green box)
- Park (Green box)
- Water Supply Intake (Blue circle)
- Previous Harvest (NSR, SR, GU)
- Community Forest Boundary (Red line)
- Community Watershed (Blue line)
- Old Growth Mgmt. Area (Purple hatched)
- Ungulate Winter Range (Brown hatched)
- Private Land (Orange hatched)
- First Nations Treaty Area (Green dashed line)

Field Marking

- Falling Bdry: Orange Ribb. & Blazed Painted Orange
- Retention Patch: Orange Black Stripe Ribbon & Blazed Painted Orange
- Road Centre Line: Pink Ribb. & Blazed Painted Pink
- Road ROW: Orange Ribb. & Blazed Painted Orange
- Falling Corner: Blazed Painted Orange
- Dispersed Retention Trees: Orange Painted Dot Each Side & Base
- Special Mgt Zone: Orange Labelled Ribbon
- Fish Stream: Red White Stripe Ribbon
- Non Fish Stream: Blue White Stripe Ribb.
- Deflection Line: Green Ribbon
- Machine Free Zone: Red Ribbon
- Cruise Tree: Blue Painted Number

Scale: 1 : 5,000



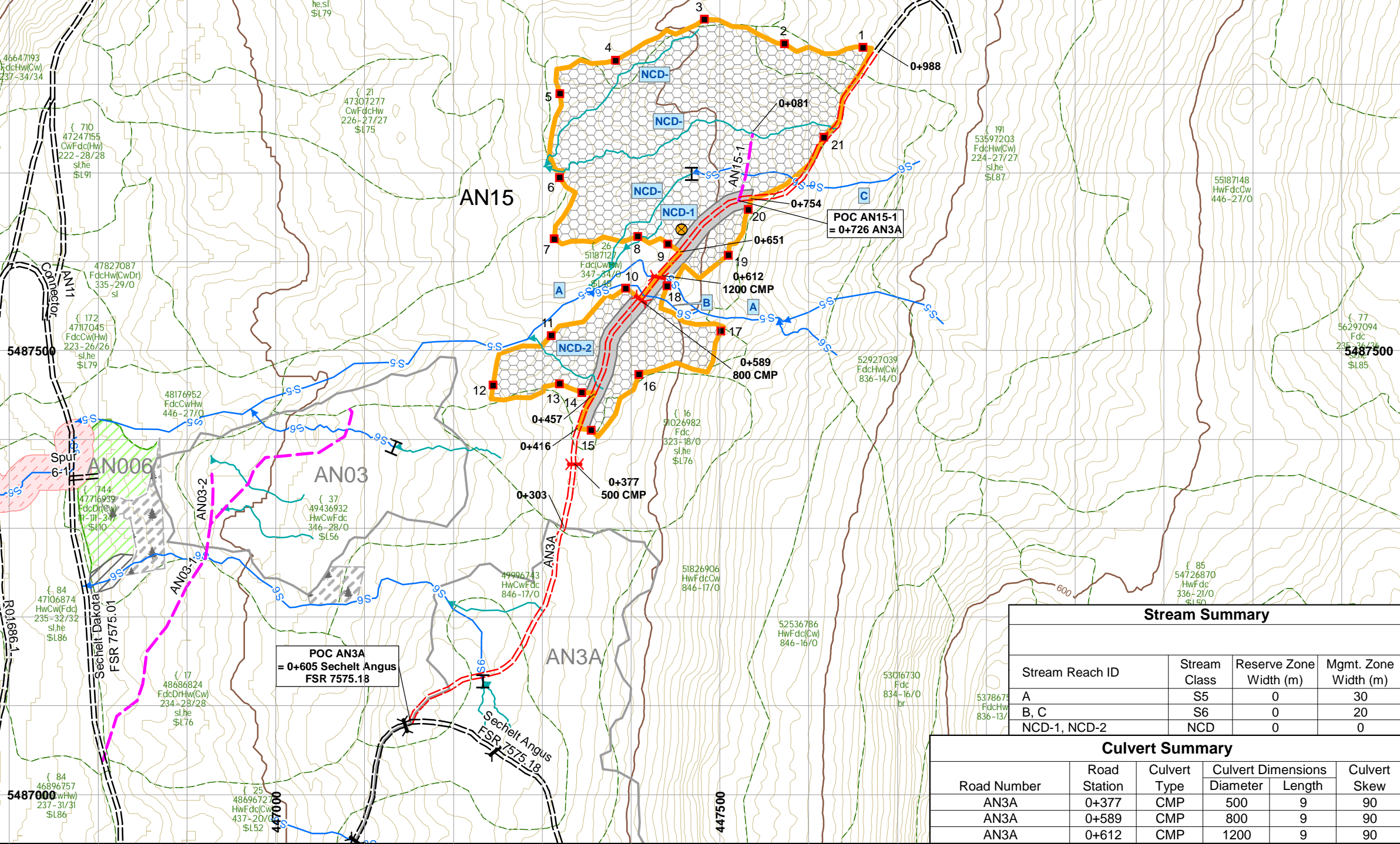
Project Number: 21-610
 Drawn By: JC
 Date: 2021-11-30

Logging Area Summary (ha)							
Block	Gross	Retention	WTRA	RP RoW	NP Nat.	Exist.Rd.	Net Harv
AN15	8.5	0.0	0.0	0.0	0.0	0.5	8.0

Harvest System Summary (ha)				
Block	Heli	Cable	Ground-Based	Total
AN15	0.0	0.0	8.0	8.0

Road Re-Construction Summary	
Road Section	Length (km)
AN3A (0+303 - 0+988)	0.685
Total Roads	0.685

Road Construction Summary	
Road Section	Length (km)
AN15-1	0.081
Total Roads	0.081



Legend

- Total Area Under Prescription (TAUP):
- Falling Boundary (Orange line)
 - External to Falling Bdy (Dashed orange line)
 - Falling Corner (Red square)
 - SP Plot (Purple circle)
 - Standard Unit Boundary (Red dashed line)
 - Treatment Unit Boundary (Black dashed line)
 - Existing Road (Double line)
 - Existing Trail (Dashed line)
 - Proposed Roads:
 - Haul Road (Pink dashed line)
 - Designated Skid Trail (Orange dashed line)
 - Temporary (Rehab) (Pink X-X line)
 - Backspar Trail (Purple dashed line)
 - Road Reconstruction (Red double line)
 - Road Chainage (Black line with '0+200')
 - Bridge (Existing) (Black line with arch)
 - Bridge (Proposed) (Black line with arch)
 - Culvert Proposed/Existing (Black line with arch)
 - Survey Route (Black line with arrow)
 - Unclassified Road (Black line)
 - Rock Outcrop Area (Black hatched)
 - Proposed / Designated Stream Crossing (Blue diamond)
 - Gravel Pit (Black square with 'SP')
 - Transmission Line (Black line with crossbar)
 - Utility Corridor (Black line with crossbar)
 - Permanent Structures (Black square)
 - Slide (Black line with 'S')
 - Gully (Black line with 'G')
 - Rock Outcrop (Black hatched)
 - Windfall/Snag (Black line with 'S')
 - Marsh/Swamp (Black line with 'M')
 - Index Contour and Label (Brown line with '100')
 - Intermediate Contour (Brown line)
 - Landing/Temporary Landing (Black diamond)
 - Dryland Sort/Water Sort (Black circle with 'DS'/'VS')
 - Log Dump/Helipad (Black circle with 'LD'/'H')
 - Helicopter Drop Zone (Black circle with 'DZ')
 - Geographic Centre (Black circle with 'X')

Stream Summary			
Stream Reach ID	Stream Class	Reserve Zone Width (m)	Mgmt. Zone Width (m)
A	S5	0	30
B, C	S6	0	20
NCD-1, NCD-2	NCD	0	0

Culvert Summary					
Road Number	Road Station	Culvert Type	Culvert Dimensions Diameter	Culvert Length	Culvert Skew
AN3A	0+377	CMP	500	9	90
AN3A	0+589	CMP	800	9	90
AN3A	0+612	CMP	1200	9	90

Harvest System

- (Yarding Direction)
- Ground Based (Black arrow)
 - Skylines (Black arrow with 'SL')
 - High-lead (Black arrow)
 - Harvest System Split Line (Green dashed line)
 - Yarding Split Line (Green dashed line)



APPENDIX D

Review of Potential Coastal Tailed Frog Habitat in Streams near or adjacent to Community Forests Cut Blocks AN03 and AN15



May, 2, 2022

Our File No.: FSCI-22-0014

Callum Fallis
Chartwell Resource Group Ltd
2123-5710 Teredo Street
Sechelt, BC, V0N 1V6

Sent via email: cfallis@crql.ca

Re: Review of Potential Coastal Tailed Frog Habitat in Streams near or adjacent to Community Forests Cut Blocks AN03 and AN15

Dear Callum:

As requested, I reviewed Streams A and D located in, or adjacent to, Blocks AN03 and AN15. The purpose of the review was to evaluate the existing habitat and provide an opinion on the likelihood these streams support Coastal Tailed Frog (*Ascaphus truei*) (CTF) and Coastal Cutthroat trout (*Oncorhynchus clarkii clarkii*)

Tailed frog is a regionally important species that is currently listed as a species of "Special Concern". Permanent streams (streams with year around flows) with suitable benthic conditions in the area where AN03 and 15 are located have documented presence of CTF.

Tailed Frog habitat is unique when compared to other frogs found locally. The larval or tadpole develops over a long period (up to 4 years) and requires clean cool water with continuous flows throughout the year. They also have a narrow, preferred temperature range, require larger substrates with minimal fines and higher stream velocity.

Survey methods for detection of both Cutthroat trout and CTF can be seasonally influenced. Colder water temperatures and higher flows can make detection using electrofishing (trout) or timed constrained searches (CTF) difficult and inconclusive. In order to provide an opinion on the likelihood of trout and/or CTF being present, a foot survey was conducted to assess the habitat present and collect water samples for eDNA analysis.

Information provided by you also suggested these streams dry of have minimal flows in the summer. The lack of water would influence the distribution of both these species.

Environmental DNA (eDNA) is simply defined as genetic material, shed exogenously into the surrounding environment. Aquatic species shed this material where it can be collected in water samples, filtered out and detected using assays. The advantage to using eDNA is that detection of specific species may be possible without direct observation. In this case electrofishing in fast moving waters and/or deeper habitats or TCS surveys may not result in confirmation of presence, where the addition of eDNA results may support non-detection conclusions and aid in providing greater certainty in final presence/absence opinions.

In order to run the eDNA assays duplicate, one-litre samples were collected from near the thalweg of both Stream A and D at two locations; above and below the proposed blocks. The water sample was sealed in clean, disinfected Nalgene bottles, marked with date, time and location then, once returned to the office, was processed following provincial guidelines¹. Samples were then shipped to the DNA Services Lab of Bureau Veritas in Guelph Ontario and analyzed using qPCR probes specific for Coastal Cutthroat trout (*Oncorhynchus clarkii*) and Coastal Tailed Frog

A total of 4 technical replicates were run after sample amplification. Results were then forwarded back to us for interpretation.

The results of the field survey found poor habitat for trout both streams with limited holding or rearing locations. Assuming that these streams dry in the summer, this area would likely not provide suitable rearing for non-anadromous coastal cutthroat trout. The proposed classification (S5-Stream A and S6-Stream D) was supported by lack of fish presence.

In addition to poor salmonid rearing habitat, the habitat observed for CTF was also limited or poor (**Photo 1 and 2**). Stream A had some areas where CTF might find suitable habitat conditions but Stream D was dominated by organics, fines and limited flows. Also, lack of summer flows would limit CTF habitat.

Results of the eDNA analysis supported the observations in the field. There was no Cutthroat of CTF eDNA detection at sample locations on Stream A or D, suggesting these areas do not support trout of CTF. This is consistent with the lack of habitat and reported summer non-flows. While lack of eDNA is not definitive, it provides a greater level certainty when included with observed habitat, that these streams do not support salmonids or CTF within these targeted reaches.

¹ Hobbs, J. and Helberg, C. 2021. Environmental DNA Protocol for Freshwater Aquatic Ecosystems. Version 3.0. BC Ministry of Environment. Victoria, BC.



Photo 1: Example of habitat observed in Stream A on April 4, 2022. Water levels were high. Substrates was dominated by cobble and fines. Evidence of channel drying. Top photo was at road crossing.



Photo 2: Example of habitat observed in Stream D on April 4, 2022. Water was high. Substrate was dominated by organics and fines sands. Poor and unsuitable salmonid and CTF habitat.

While the stream segments sampled may not provide suitable salmonid or CTF habitat, it should be noted that suitable habitat(s) may exist downstream. Therefore, harvest planning should include a level of protection for Stream A and D to ensure water quality and channel stability is not impacted. This may involve machine free zones, protection of the channel integrity from timber extraction (fall away) and a stable vegetated buffer. This will help ensure protection of the lower reaches.

In summary, it is my opinion that, based on field observations and eDNA results that stream A and D are appropriately classified. While these stream reaches adjacent to AN03 and 15 did not appear to support salmonids or CTF, it should be noted that the presence of these species further downstream is possible. This uncertainty (unknown) should factor into site planning and an effort to maintain channel integrity and quality of both Stream A and D is encouraged.

If you have any questions or concerns, please feel free to contact me as soon as possible.

Sincerely

A handwritten signature in black ink, appearing to read "Dave Bates", with a stylized flourish at the end.

Dave Bates, PhD, RPBio
Habitat Biologist

/db

Attach.



**BUREAU
VERITAS**

Attention: Dave Bates
FSCI Biological Consultants
8-5520 McCourt Road
Sechelt, BC
Canada, V7Z 0K7

Client Project #: N/A
Site Location: JERV
C.O.C. #: 20220412
Quote #: N/A
PO#: N/A

Report Date: 2022/04/19
Report #: FS20220419
Version: 1

ENVIRONMENTAL DNA - CERTIFICATE OF ANALYSIS

BV JOB #: E20220412

Received: 2022/04/12, 10:23 AM

Methodology for Sample Analysis

Samples received to the laboratory are entered into the Laboratory Information Management System (LIMS) upon receipt. Samples were inspected and assessed for amount of silica beads, silica bead saturation level, coin envelope condition and number of coin envelopes in each bag. Samples were stored in freezer until processing in the laboratory. Sample analysis is completed within 10 or 15 business days (as indicated by the client on the COC) following receipt of samples by the testing laboratory.

eDNA isolation is completed using the DNeasy Blood & Tissue Kit™ (QIAGEN). A negative control is included as a blank filter sample with each batch of eDNA isolation to monitor for potential laboratory contamination during the eDNA isolation process.

Following eDNA isolation (150µL) from a quarter of filter, the IntegritE-DNA™ assay¹ is used to avoid the potential of a false negative (Type II error) during target species or genera testing. The IntegritE-DNA™ assay evaluates the integrity of eDNA for suitability for qPCR and for presence of qPCR inhibitors which may reduce the effectiveness of the qPCR assay for target species or genera. This assay evaluates the quality of eDNA to assess whether it is amplifiable using a qPCR assay that targets the chloroplast genome derived from plants/algae that are ubiquitously found in fresh water systems. Four technical replicates per eDNA sample, four technical replicates of negative control (Ultrapure water), and two technical replicates of positive control are used for the IntegritE-DNA™ assay. The cut-off Ct (qPCR cycle threshold) value for the IntegritE-DNA™ assay is 27 due to inhibition. If the IntegritE-DNA™ assay produces a positive detection frequency of ≥ 2 of the 4 technical replicates, this indicates that the eDNA for the target taxa is likely to be of sufficient quality to be detected (if present) with the target assay. If the IntegritE-DNA™ assay produces a positive detection frequency < 2 of the 4 technical replicates (eDNA is degraded or qPCR inhibitors are present), then sample cleanup is completed using the OneStep PCR Inhibitor Removal Kit™ (ZYMO Research) to remove potential qPCR assay inhibitors from the isolated eDNA. Subsequent to inhibitor removal, the IntegritE-DNA™ assay is repeated to re-assess whether the eDNA is of sufficient quality for qPCR. If a sample fails at the IntegritE-DNA™ assay (Ct Value over 30) for the second time the client will be informed that the quality of the sample is insufficient for the qPCR assay. eDNA indicator (IntegritE-DNA™) in the sample suggests that degradation has taken place and therefore the target species assay may be ineffective. Once a sample passes the IntegritE-DNA™ assay, then the target species or genera assay is performed. Eight technical replicates per eDNA sample, eight technical replicates of the negative control (Ultrapure water), and two technical replicates of positive control (total DNA or synthetic DNA) are used for the target species or genera assay to assess the detection or non-detection of DNA of the target species or genera. The cut-off Ct value for target species assay is 50.

¹ Hobbs J, Round JM, Allison MJ, Helbing CC (2019) Expansion of the known distribution of the coastal tailed frog, *Ascaphus truei*, in British Columbia, Canada, using robust eDNA detection methods. PLOS ONE 14(3): e0213849.

BECKY HENDERSON

Senior Customer Service Representative, Bureau Veritas Laboratories, DNA Services
Email: becky-a.henderson@bureauveritas.com
Phone #: (519) 836 2400 Ext. 7067714

Please direct all questions regarding this Certificate of Analysis to your Customer Service Representative above.

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For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages: 2



BV JOB #: E20220412
 Report Date: 2022/04/19
 Report #: FS20220419

Client Name: FSCI Biological Consultants
 Client Project #: N/A
 Site Location: JERV
 Sampler Initials: JW



RESULTS

Client Sample ID	BV Case ID	Sampling Date	Preservation Type	IntegritE-DNA™ Positive detection (Ct≤27) ¹		Cleanup required	IntegritE-DNA™ Positive detection (Ct≤30) ¹ after cleanup		Analytical Method (qPCR Primer/Probe set)	Target Species eDNA Positive detection (Ct≤50) ²	
				QC Batch	QC Batch		QC Batch	QC Batch			
ANG03 Stream A-1A	FS20220016	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4 ⁵	0/8	220418Q1
ANG03 Stream A-1B	FS20220017	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	0/8	220418Q1
ANG03 Stream A-2A	FS20220018	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	0/8	220418Q1
ANG03 Stream A-2B	FS20220019	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	0/8	220418Q1
ANG03 Stream D-1A	FS20220020	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	0/8	220418Q1
ANG03 Stream D-1B	FS20220021	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	0/8	220418Q1
ANG03 Stream D-2A	FS20220022	2022/04/04	Silica	0/4 ³	220413Q2	Yes ³	4/4	220414Q2	eONCL4	0/8	220418Q1
ANG03 Stream D-2B	FS20220023	2022/04/04	Silica	0/4 ³	220413Q2	Yes ³	4/4	220414Q2	eONCL4	0/8	220418Q1
Twin Creek Site 1A	FS20220024	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eONCL4	N/A	220418Q1
Twin Creek Site 1B	FS20220025	2022/04/07	Silica	4/4	220413Q2	No	N/A	N/A	eONCL4	2/8	220418Q1
Twin Creek Site 2A	FS20220026	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eONCL4	N/A	220418Q1
Twin Creek Site 2B	FS20220027	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eONCL4	N/A	220418Q1
Twin Creek Site 3A	FS20220028	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eONCL4	N/A	220418Q1
Twin Creek Site 3B	FS20220029	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eONCL4	N/A	220418Q1
ANG03 Stream A-1A	FS20220016	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4 ⁶	0/8	220418Q2
ANG03 Stream A-1B	FS20220017	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	0/8	220418Q2
ANG03 Stream A-2A	FS20220018	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	0/8	220418Q2
ANG03 Stream A-2B	FS20220019	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	0/8	220418Q2
ANG03 Stream D-1A	FS20220020	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	0/8	220418Q2
ANG03 Stream D-1B	FS20220021	2022/04/04	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	0/8	220418Q2
ANG03 Stream D-2A	FS20220022	2022/04/04	Silica	0/4 ³	220413Q2	Yes ³	4/4	220414Q2	eASTR4	0/8	220418Q2
ANG03 Stream D-2B	FS20220023	2022/04/04	Silica	0/4 ³	220413Q2	Yes ³	4/4	220414Q2	eASTR4	0/8	220418Q2
Twin Creek Site 1A	FS20220024	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eASTR4	N/A	220418Q2
Twin Creek Site 1B	FS20220025	2022/04/07	Silica	4/4	220413Q2	No	N/A	N/A	eASTR4	1/8	220418Q2
Twin Creek Site 2A	FS20220026	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eASTR4	N/A	220418Q2
Twin Creek Site 2B	FS20220027	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eASTR4	N/A	220418Q2
Twin Creek Site 3A	FS20220028	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eASTR4	N/A	220418Q2
Twin Creek Site 3B	FS20220029	2022/04/07	Silica	0/4 ³	220413Q2	Yes ³	0/4 ⁴	220414Q2	eASTR4	N/A	220418Q2

¹ IntegritE-DNA™ Assay: Four technical replicates were assayed for each eDNA sample. Field samples: The cut-off Ct value for IntegritE-DNA™ assay is 27 based on previous observation and due to presence of inhibitors. Post clean-up and field blank samples: The cut-off Ct value for IntegritE-DNA™ assay is 30. Results are reported as the number of positive detections (n) out of a total of 4 technical replicates, n/4.
² Target Species Assay: Eight technical replicates were assayed per eDNA sample. The cut-off Ct value for target species assay was 50. Results are reported as the number of positive detections (n) out of a total of 8 technical replicates, n/8.
³ The IntegritE-DNA™ assay failed. Clean-up is required.
⁴ The IntegritE-DNA™ assay failed after clean-up. Quality of sample is insufficient for the eONCL4 and eASTR4 qPCR assays.
⁵ eONCL4: qPCR primer/probe assay to assess the presence of Cutthroat Trout (*Oncorhynchus clarkii*) eDNA
⁶ eASTR4: qPCR primer/probe assay to assess the presence of Pacific (Coastal) Tailed Frog (*Ascaphus truei*) eDNA

GENERAL COMMENTS

eDNA is extracted (150 µL) from a quarter of filter, and 2 µL is used as a template for each technical replicate.
 Twin Creek samples are possibly indicative of high level DNA degradation.
 Results relate only to the items tested.