Vegetation Resources Inventory

Merritt TSA - Project Implementation Plan for Photo Interpretation

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Section 1 - Introduction

Background Information

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) has identified a need to complete a new photo interpreted inventory (Vegetation Resources Inventory [VRI], Phase 1) in the Merritt Timber Supply Area (TSA). The plan is to complete this inventory by March 2019. This document details the planning necessary for the project to commence.

The mountain pine beetle (MPB) has significantly affected the forest cover in the Merritt TSA. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, updated species compositions to reflect MPB mortality, and an estimate of the amount of dead volume in the TSA.

Significant concerns have been raised regarding the mid-term timber supply given the enormous impact of the MPB in this TSA. Recent uplifts of the allowable annual cut (AAC) have occurred in order to expeditiously harvest as much of the beetle-killed wood as possible before it exceeds its shelf-life. The Special Committee on Timber Supply summarized key messages from a series of local public hearings including the need to base decisions on an updated inventory.

First Nations and stakeholders attended a VRI Phase 1 inventory planning meeting on February 25, 2016 at the Merritt Fire Zone Office for an introduction to the project and to provide input regarding their needs and objectives. First Nations, stakeholders and government entities with representatives at the meeting included:

- 1 local First Nation (overlap with licencees)
- 4 forest licencees (some overlap with First Nations)
- 2 Cascades District staff
- 1 BC Timber Sales staff

A complete list of contact persons and attendees is available in Appendix A: First Nation and Stakeholders Meeting Attendance.

Document Objectives

This Vegetation Resources Inventory Project Implementation Plan (VPIP) is a working document that states the critical reasons and objectives for carrying out a Phase 1 VRI in the Merritt TSA. It includes details on the area to be inventoried, issues with the current inventory, objectives, and key steps required to be carried out for a successful completion of a photo interpretation project.

Overview of the VRI Process

The VRI provides a strategic inventory (as opposed to an operational inventory) at the management unit level (e.g., District, TSA or TFL) designed to answer two basic questions: where is the resource, and how much is there? The VRI consists of two phases: air photo interpretation (Phase 1) and ground sampling (Phase 2). These phases may be undertaken in combination or, in certain situations, individually.

Phase 1 involves acquisition of new photos, delineation of new polygons, and estimation of polygon attributes, with the final product being the corporate inventory. Phase 2 involves a network of forest growth monitoring plots established across the target unit, supplemented by ground sampling a random subset of the new polygons. This serves to verify the level of confidence

in the Phase 1 inventory, and to provide detailed information on stand characteristics (such as tree size distribution and condition) that is not available from the Phase 1 inventory.

The individual stages of a VRI Phase 1 project include the following:

- Image acquisition: Images used for VRI photo interpretation projects must be less than five years old. The photos for this project were acquired in the summer of 2015.
- Historical data source transfer: The existing data sources in the project area are evaluated and captured digitally if they are deemed to be useful for the current project.
- Delineation: New linework is delineated on the images. Polygon delineation is based on the B.C. Land Cover Classification Scheme (BCLCS). This land classification scheme includes both vegetated and non-vegetated cover classes. Polygons identified by the land classification scheme are further divided into similar vegetated or non-vegetated polygons based on mensurational attributes (species, age, height and crown closure) and/or ecological attributes where appropriate.
- Fieldwork: A series of calibration points are established for use by the interpreters. These calibration points are a combination of air calls via helicopter, and ground calls. The calibration program allows the interpreters to gain some familiarity with the project area, and the data acts as reference points while attributing neighbouring polygons.
- Attribute estimation: All delineated polygons are assigned attributes which describe the vegetative or non-vegetative characteristics of the polygon. A complete description of the attributes described is available in the *VRI Photo Interpretation Procedures*.

More details regarding the VRI process and the VRI procedures and standards are available at the Forest Analysis and Inventory Branch (FAIB) website: http://www.for.gov.bc.ca/hts/vri/index.html.

Merritt TSA "Target Area" Landbase

In recent years, VRI Phase 1 projects have typically been conducted for entire TSAs or Districts. The primary benefit of this is generating a consistent inventory product (both in qualities and vintage) to be used in timber supply analyses. This project is no exception. The Phase 1 project ("target") area contains all of the Merritt TSA with the exception of the partial mapsheets along the northern TSA boundary (Figure 1). These partial mapsheets were updated as part of the Kamloops TSA Phase 1 VRI project using 2011 digital photography and completed between 2012 and 2014. The project area extends beyond the east and west TSA boundaries to incorporate adjacent areas of the Okanagan, Fraser, and Lillooet TSAs. This reflects the recent practice of completing Phase 1 inventory projects using square edge boundaries (such as mapsheets) where logical. The project area stops in the south at the Canada/USA border, flanked by Manning Park and Cathedral Park.

Note that all tables in this section represent data based specifically on the project area, which does not include all of the Merritt TSA (for the reason discussed above), and does include portions of the other three neighbouring TSAs (Table 1).

Table 1. TSA breakdown for the Merritt VRI Phase 1 project area.

Timber Supply Areas	Area (ha)	% of Project Area
Merritt TSA (#18)	1,078,350	88.3%
Okanagan TSA (#22)	74,294	6.1%
Fraser TSA (#30)	48,175	3.9%
Lillooet TSA (#15)	20,810	1.7%

Total	***1,221,629***	***100.0%***

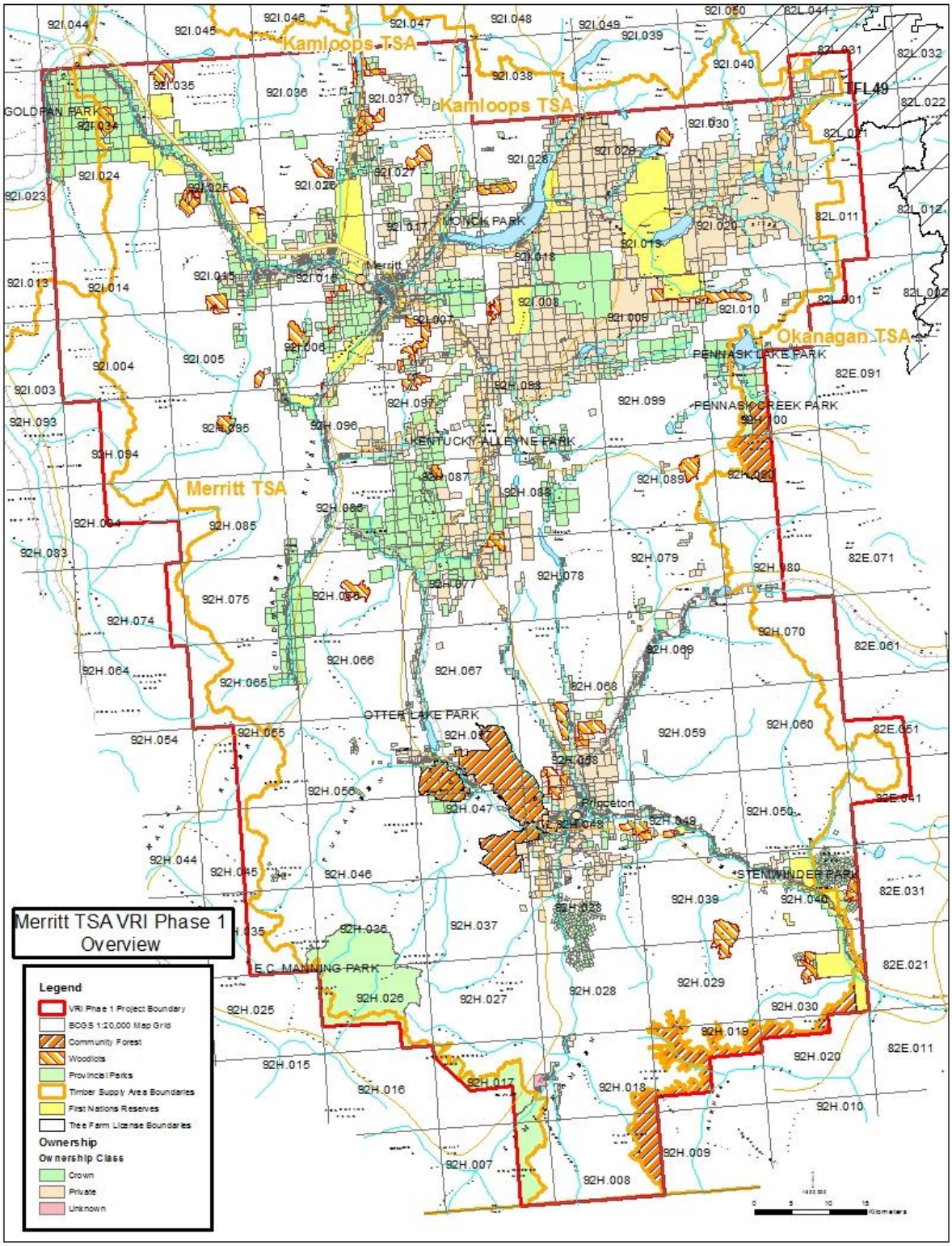

Figure 1. Overview of the Merritt VRI Phase 1 project area.

The Merritt TSA is located in the southwest interior of BC and covers approximately 1.13 million hectares. The project area is 1,221,739 ha. Approximately 23% of the entire project area is classed as private land, Indian reserves, parks, protected areas, tree farm licences, community forests, and woodlots (Table 2, Figure 1). Of the total TSA area, ~800,000 ha are available for timber harvesting (described as the Crown forest land base [CFLB]), with ~590,000 ha comprising the current timber harvesting land base (THLB).

Table 2. Land classification in the Merritt VRI Phase 1 project area.

Land Classification (Legal)	Area (ha)	% of Project Area
Project Area	1,221,739	100.0%
Private Land	155,012	12.7%
Indian Reserves	33,687	2.8%
Provincial Parks	24,020	2.0%
Protected Areas & Reserves	8,531	0.7%
Tree Farm Licences	6,004	0.5%
Community Forest Agreements	27,555	2.3%
Woodlots	22,725	1.9%
Netdown Subtotal	***277,534***	***22.7%***
Net Area Total	***944,204***	***77.3%***

The major population centers in the Merritt TSA are Merritt and Princeton. Smaller communities include Brookmere, Tulameen, Missezula Lake, Douglas Lake, Lower Nicola, Osprey Lake and Allison Lake.

There is a large First Nations population that lives within or immediately adjacent to the Merritt TSA; First Nations represent approximately 30% of the area population. Members of both the Nlaka'pamux and Okanagan Nations live within and adjacent to the TSA, and have interests that overlap large portions of it. Additionally, the Secwepemc Nation and Stl:Lo Nation have interests that overlap with the northern and southern portions of the TSA, respectively. First Nations play an active role in the management of forest resources having forest companies, resource based businesses and forestry consultation businesses.

The Merritt TSA presents a diversity of landscapes, including the mountainous terrain and steep river valleys of the Cascade Mountains in the west, the relatively dry, flat Thompson plateau in the east, the Nicola river system in the north, and the Similkameen river system in the south.

The forests of the Merritt TSA include Douglas-fir, spruce, ponderosa pine, and subalpine fir. Lodgepole pine is the dominant species in the TSA and lodgepole pine-leading stands occupy about half of the CFLB and about two-thirds of the THLB (Figure 2, Table 3). Note that this determination includes timber that shows as live pine in the current inventory database, but in reality is now likely dead due to MPB impact. Trembling aspen is also present in the TSA. The recent MPB outbreak has killed the majority of mature pine stands in the TSA, and accelerated harvest to salvage these beetle-killed stands has left a THLB that consists primarily of stands less than 30 years.

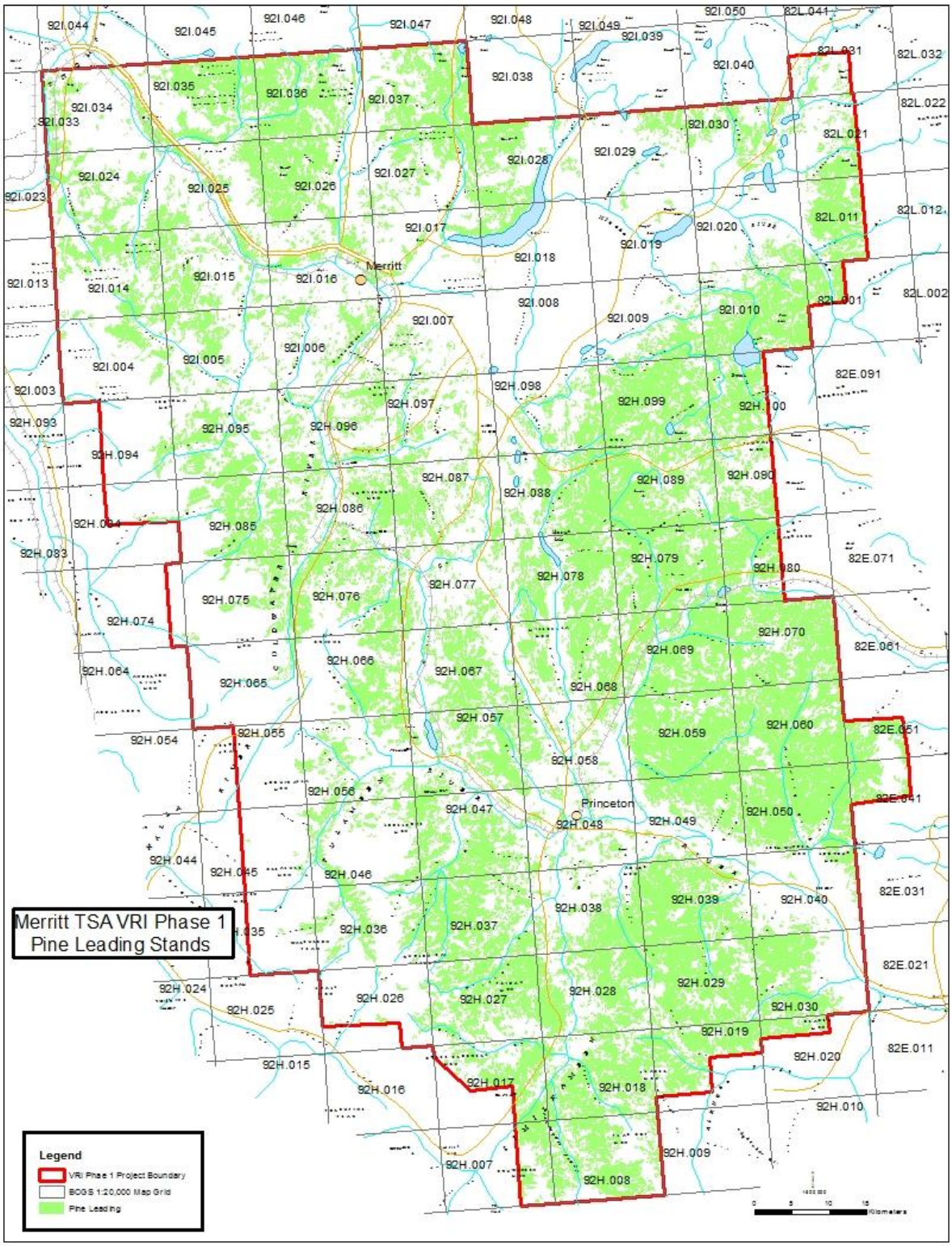

Figure 2. Distribution of pine leading stands in the Merritt VRI Phase 1 project area. Pine leading is defined as any polygon with species 1 being any pine species.

Table 3. Leading species in the Merritt VRI Phase 1 project area.

Leading Species	Area (ha)	% of Project Area
Pine (PL, PLI, PJ)	465,194	38.1%
Douglas Fir (FD, FDI)	301,471	24.7%
Balsam (B, BL)	100,312	8.2%
Spruce (S, SW, SE, SX, SXW, SB, SS)	84,813	6.9%
Aspen (AT, AC, ACT)	19,515	1.6%
Hemlock (H, HW, HM)	2,547	0.2%
Tamarack (LT)	423	0.0%
Cedar (CW, YC)	193	0.0%
Birch (EP)	67	0.0%
Alder (D, DR)	49	0.0%
Total	***974,583***	***79.8%***

The interior Douglas-fir (IDF) zone is the predominant biogeoclimatic ecosystem classification (BEC) zone in the project area, occupying the low-lying areas surrounding Merritt and Princeton and the river systems they are centered on. The montane spruce (MS) and Engelmann spruce – sub-alpine fir (ESSF) zones occupy the higher elevation areas in the east and west of the TSA (Table 4, Figure **3**).

Table 4. Biogeoclimatic zones in the Merritt VRI Phase 1 project area.

Biogeoclimatic Zones	Area (ha)	% of Project Area
Interior Douglas-fir (IDF)	539,208	44.1%
Montane Spruce (MS)	348,003	28.5%
Engelmann Spruce - Subalpine Fir (ESSF)	232,041	19.0%
Bunchgrass (BG)	43,895	3.6%
Ponderosa Pine (PP)	30,418	2.5%
Interior Mountain-heather Alpine (IMA)	14,055	1.2%
Coastal Western Hemlock (CWH)	9,955	0.8%
Mountain Hemlock (MH)	3,838	0.3%
Coastal Mountain-heather Alpine (CMA)	224	0.0%
Total	***1,221,638***	***100.0%***

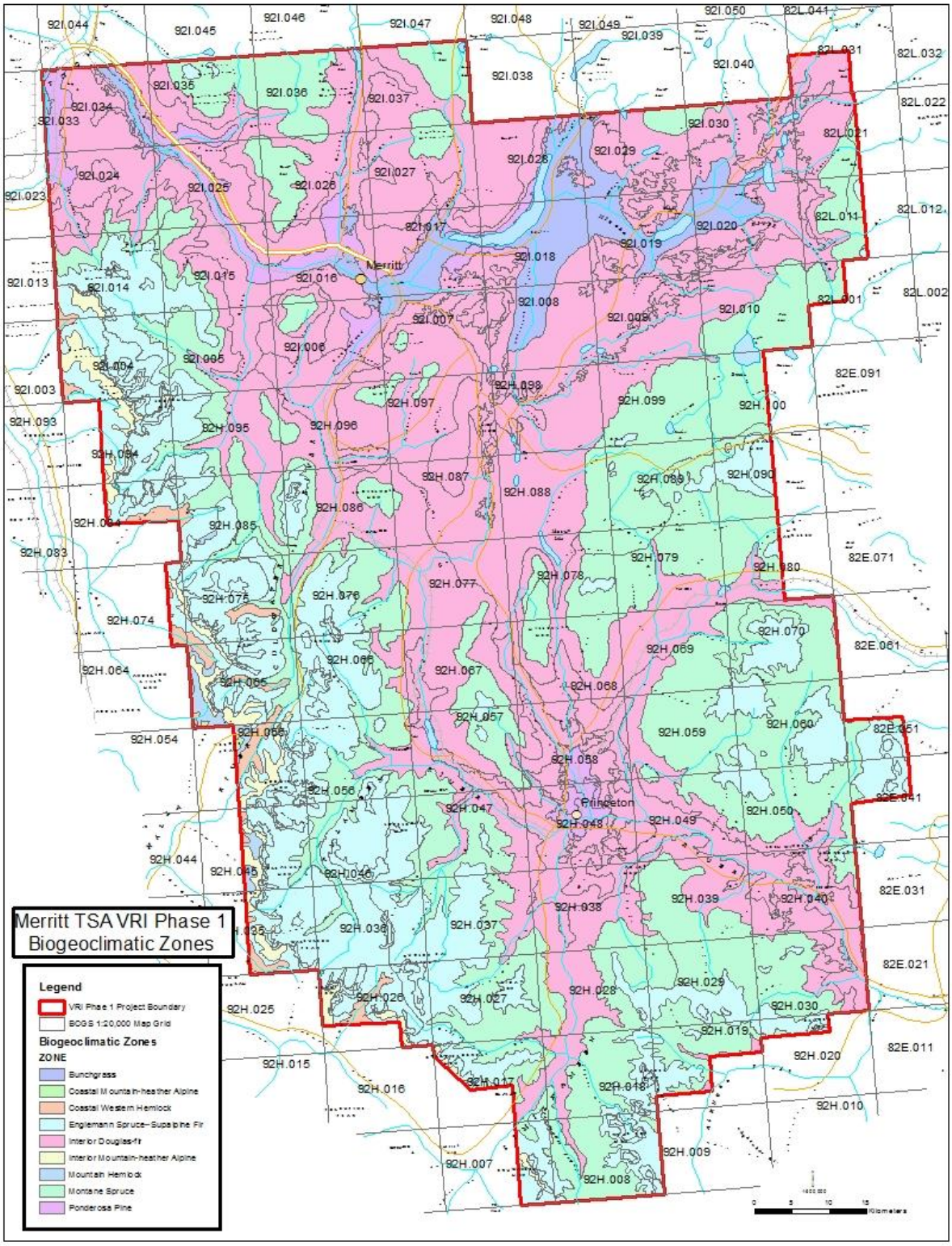

Figure 3. Biogeoclimatic zones in the Merritt VRI Phase 1 project area.

State of the Current Inventory

The forest cover attributes for the vast majority of the Merritt VRI Phase 1 project area conform to the older (pre-VRI) FIP inventory standard (F-records), which represent the last major inventory project for the TSA. The remainder of the area is comprised of either newer VRI polygons (V-records), or RESULTS-based polygons (I-records) (Figure 4). The majority of the project area was last re-inventoried in the early 1990s (Figure 5). The V-records originate with the VRI inventory in the Fraser TSA (late 1990s) and the Okanagan TSA (late 2000s). The I-records are generated via annual updates for depletions, regeneration, and free-growing declarations sourced from the RESULTS (REporting Silviculture Updates and Land status Tracking System) database since the last major re-inventory.

Depletion and regeneration updates to the inventory from the RESULTS database are current to December 2014. Assuming the annual inventory file data cut occurs after March 31, 2016, the provided inventory file will be updated to include all backlog fire disturbances, and will include the final MPB kill with fully adjusted attributes (including species composition, basal area, density, volume, etc.). The inventory file will be projected to 2015 after the above-mentioned updates have occurred.

There have been various inventory sampling programs within the Merritt TSA in recent years. VRI Phase 2 ground sampling was conducted in 1999 and 2000, and a young stand monitoring (YSM) program was initiated in 2005 to 2007. In 2013, a mature inventory audit and a young stand analysis were conducted, which saw some of these original samples remeasured, and new ones installed based on various sampling grids. Analysis of the mature inventory audit data showed that the only significant differences between the ground sample data and inventory data was for density and dead volume, both of which were greater for the ground data vs. the inventory. This is not surprising given the large beetle impact. The young stand analysis showed significantly higher values for the ground data vs. the inventory for age, height, density, basal area, merchantable volume, and gross volume. These differences can be explained, in part, by the presence of veteran trees, natural ingress, and dead volume on the ground. Growth projections were very close to observed growth for those samples with two measurements across time.

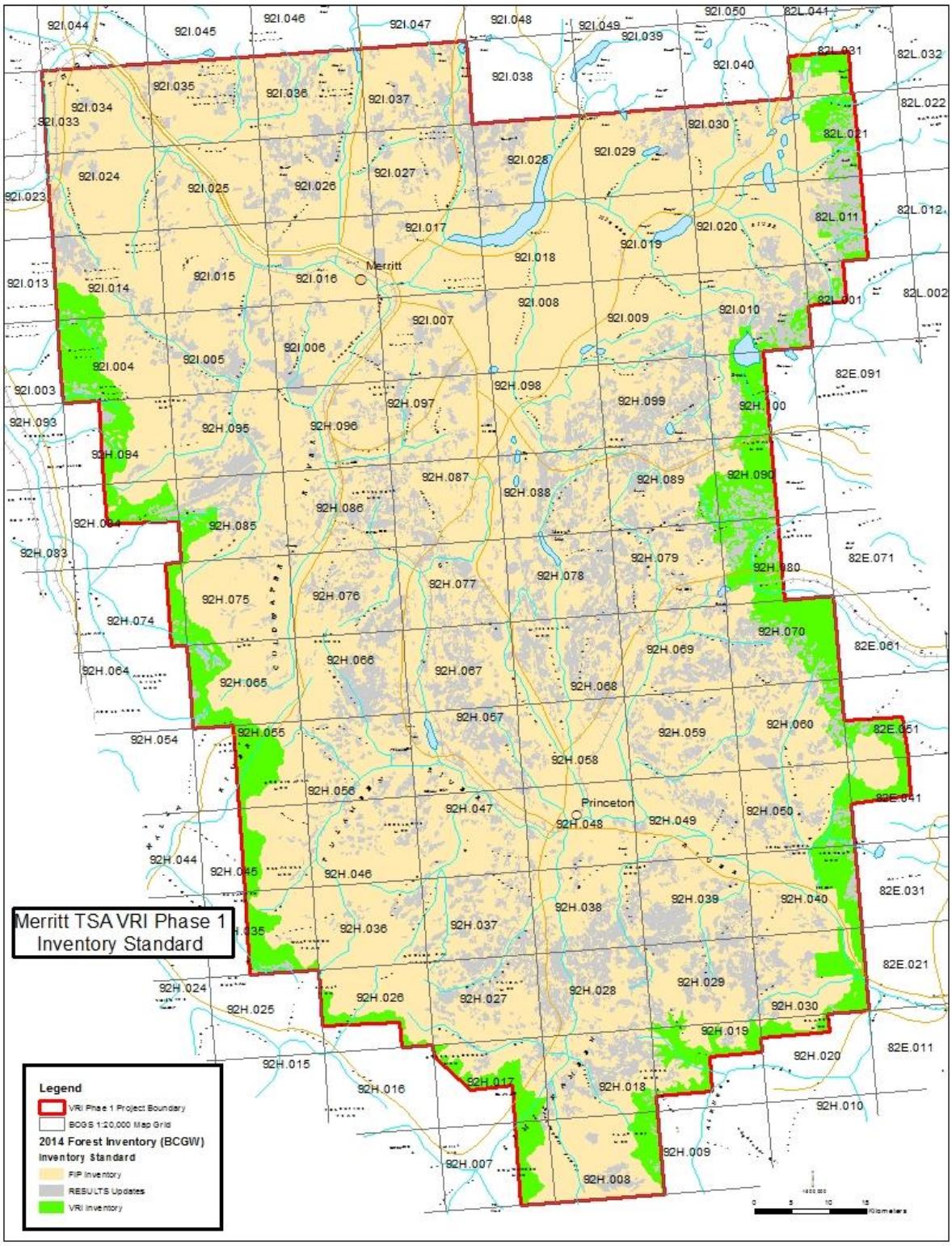

Figure 4. Inventory standard for the Merritt VRI Phase 1 project area.

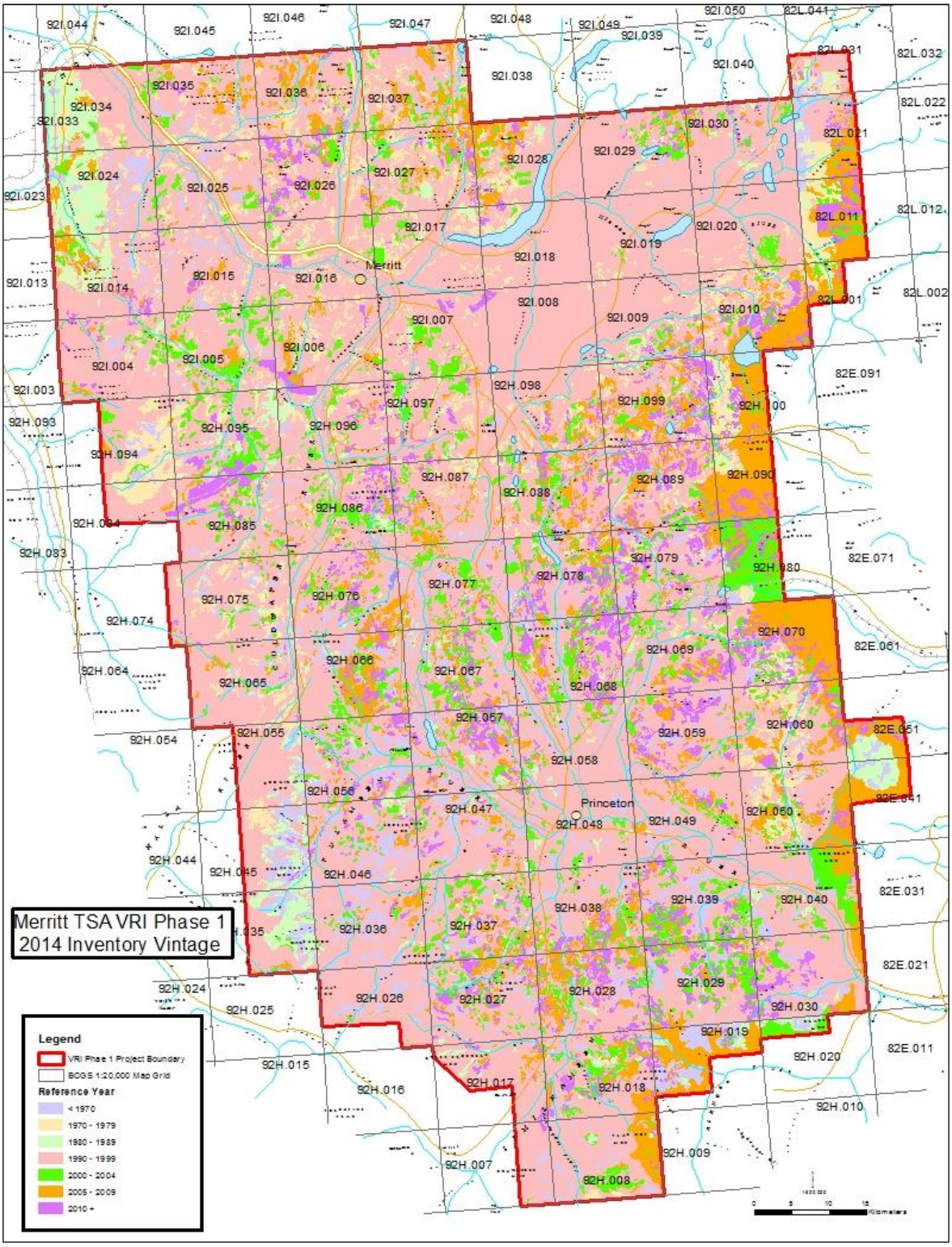

Figure 5. Inventory vintage (reference year) for the Merritt VRI Phase 1 project area.

Section 2 - Photo Interpretation Plan

Project Objectives

The overriding objective of this photo interpretation project is to produce a new photo interpreted inventory to account for the massive change due to MPB mortality, and subsequent harvesting, since the last inventory for this project area. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, update species compositions to reflect MPB mortality and harvesting, and provide an estimate of the amount of dead volume in the project area. One of the key outcomes of the project is to acquire improved information on the location of the MPB-killed stands and how much residual volume is left in these stands in order to better inform mid-term timber supply analyses.

A secondary objective of this project is to provide additional data layers through the use of LiDAR in an area of the TSA (~200,000 ha) designated by the District, preferably where a need for specialized and/or more detailed forest inventory-type information has been identified. This data will not replace the standard VRI inventory data for this area, but rather provide additional data that can be overlaid with the VRI and used in various enhanced analyses as determined and conducted by any end-user.

Project Area

The entire Merritt VRI Phase 1 project area (Figure 1) will be photo interpreted, including all private land, Indian reserves, parks, protected areas, tree farm licences, community forests, and woodlots.

The total project area is 1,221,739 ha covering 87 individual BCGS 1:20,000 full and partial mapsheets. For Contractor planning purposes, this equates to 76.3 full mapsheet equivalents (FMEs) based on 16,012 ha/FME (Appendix B: Project Mapsheet Area & Land Cover Summary).

First Nation & Stakeholder-Identified Issues

Several issues with the current inventory are known and/or were identified at the First Nation and stakeholder meeting that should be taken into account, where practicable, when planning and implementing the project:

1. Identification of mid-term timber supply:
    - There have been significant impacts to timber supply due to MPB.
    - There have been significant AAC uplifts to deal with the dead MPB timber.
    - The ability to accurately locate the remaining mid-term timber supply will be of the utmost importance to minimize the impacts of the inevitable AAC fall down.

2. Accuracy of crown cover:
    - Crown cover is not always very accurate in the current inventory.
    - It is an important attribute to accurately determine what timber needs to be preserved for mule deer winter range, and what can be harvested, particularly in the face of the declining mid-term timber supply.
    - This is also a modeling issue, as VDYP does not project crown cover, making forecasting of snow interception cover difficult.
    - Can this attribute (including tree layers) be improved through the use of LiDAR?

3. Comparing and locating live vs. dead volume:
    - In the current inventory, live volume is reasonably accurate, but dead volume is low as compared to on the ground.
    - Locating stands of small dead pine is required for innovative timber sale licence (ITSL) opportunities.
    - Using the infrared images will allow photo interpreters to better differentiate the dead trees from live ones. Although these images may be able to indicate "distressed" trees apart from fully dead or healthy trees due to tonal differences, all trees must be classed as either live or dead only. A disturbance code for beetle attack can always be included.

4. Attributing lower-level dead component in forested polygons:
    - There are many stands with 15-25% dead stems (often due to the rising spruce beetle levels), and having insight on that dead volume will be critical in combating the spruce beetle and/or salvaging the wood.
    - Without a D-layer, the only attribute for dead wood is snags/ha.
    - Under the new 2016 procedures (basing the requirement for a D-layer on > 100 dead stems rather than > 30% by density), many more of these polygons will have the full attributes of a D-layer.

5. Incorrect data coming from the RESULTS database:
    - Some RESULTS polygons with an "insect" (I) disturbance code in the RESULTS database aren't actually what would be deemed a "beetle polygon". That code will be part of the data cut provided to the photo interpretation contractor.
    - However, the presence or absence of that code has no bearing on the new inventory, as the photo interpreter provides their own "disturbance type" code based on what they interpret.
    - Similarly, some stands will be reported as healthy and free growing in RESULTS, while they are in fact now red or grey attack stands. All RESULTS polygons (in particular free growing stands) have the opportunity to be photo interpreted, and if the images show beetle attack, that will supersede any RESULTS information.

6. Incorrect species identification:
    - The current inventory incorrectly shows some large areas of Pl that are actually Fd.
    - There are patches of whitebark pine (*P. albicaulis*) on the ground that have not been identified in the current inventory. This is a listed species that should be identified where possible. The District may have some spatial information related to this.

Aerial Photography

Digital frame camera imagery of the project area was acquired to GeoBC photo standards and specifications in the summer of 2015. Flight lines were oriented in an east/west direction and captured at 30 cm GSD (ground scale distance), approximately a 1:15,000 scale. Softcopy image sets will be available as RGBnIr 4-band 8-bit JPEG compressed TIF. This will allow for natural colour display of imagery as well as colour infrared display using the same image file and softcopy setup.

It is hoped that the use of the infrared display may make it easier for photo interpreters to identify live vs. dead trees in large areas of MPB mortality. It may also be able to help identify the presence of understory vegetation.

Generated supporting products include an ISSD Z\I project file in UTM, 10 m DEM in USGS DEM and LAS formats in UTM, ortho photos, and a photo index shape file with image names. There may be development issues with the new 10 m DEM, in which case the old 25 m TRIM DEM would be provided. No hardcopy set of the digital photos is being produced.

Historical Data Sources

Data sources are used as calibration points for improving the quality of air photo interpretation. Existing data sources include air calls, ground calls, permanent and temporary samples and observations distributed across the project area during previous inventories.

An estimated 12,059 air and ground calls have been established in the project area since the first forest inventory project there (Table 5). However, 31 (0.6%) of the FIP air calls and 27 (0.4%) of the FIP ground calls have no sample date and are therefore unusable. In addition, an unknown number of the established data sources will have been destroyed over the years through harvesting and other disturbances. The actual number of data sources still available will be determined at the data source transfer stage.

Table 5. Historical calibration points in the Merritt VRI Phase 1 project area.

Year	FIP Air Calls (X)*	FIP Ground Calls (XG)*	VRI Air Calls (18)	VRI Ground Calls (17)
Pre 1970	2,622	2,123		
1970 - 1979	1,730	2,014		
1980 - 1989	101	509		
1990 - 1999	777	1,898	21	15
2000 - 2009			143	106
Total	***5,230***	***6,544***	***164***	***121***

* 31 of the FIP air calls and 27 of the FIP ground calls do not have a sample date.

All data sources that were available in the last re-inventory project are recorded on the earlier document photos. A digital spatial location of these points will be made available to the Contractor in a shape file. All data sources will be reviewed by the Contractor to determine if they are still relevant before they are used. Those that are still relevant to a new inventory on the 2015 imagery will be transferred to a digital format provided by the Ministry.

Situations that would justify removal of existing data sources include a major disturbance (such as a large fire, harvesting or insect/disease damage), large stand structure changes, or as defined in the contract document. Data sources in MPB-impacted stands will have to be examined closely to determine how relevant they are.

Any data can be used as a calibration data source so long as it has X and Y coordinates. Permanent sample plots, cruise plots, timber recce information, terrestrial ecosystem mapping (TEM), predictive ecosystem mapping (PEM), and SIBEC plots are examples of other data that can be used. However, this data would first need to be determined and then assembled into a format that the Contractor could easily use.

Polygon Delineation

Polygon delineation is to be completed to VRI standards. Any deviation from these standards must be agreed to by the Ministry Project Manager.

The *VRI Photo Interpretation Procedures* now contain detailed procedures for dealing with dead stands and stands with significant amounts of dead trees resulting in a "dead" ("D") tree layer.

Due to the prevalence of large scale disturbances (i.e., fires and MPB) in the project area, no attempt should be made to "tie" to the older surrounding inventories; the amount of change on the landscape would make this practice prohibitively difficult. Polygon boundaries should be delineated based on what is interpreted on the current photos alone. The exception to this is where this project boundary abuts the Kamloops TSA Phase 1 VRI project from 2012 to 2014. The Kamloops inventory is new enough to allow all polygon delineation to tie to it with minimal issues anticipated.

Integrating RESULTS Information

The integration of the RESULTS spatial files and tree attribute data will be completed at the delineation and attribution stages of the project. The Contractor is required to incorporate RESULTS information for all non-free growing openings as it exists in the database. For free growing openings, photo interpreters may re-delineate and/or re-attribute the polygons if they do not agree with the RESULTS information. However, if the free growing survey information is recent, the data is typically accepted as is.

A PGDB file for the RESULTS openings found within the project area (Table 6, Figure 6) and the associated tree attributes will be provided to the bidders attending a mandatory project viewing session.

Table 6. Summary of RESULTS database openings for the Merritt VRI Phase 1 project area.

RESULTS Data	Area (ha)	% of Project Area	# of Op/Poly
RESULTS Free Growing (# of Openings)	148,798	12.2%	9,475
RESULTS Depletion/Regen (# of Openings)	180,715	14.8%	12,078
Total Disturbed Area without Opening ID	115,784	9.5%	7,765
Total	***445,297***	***36.4%***	***29,318***

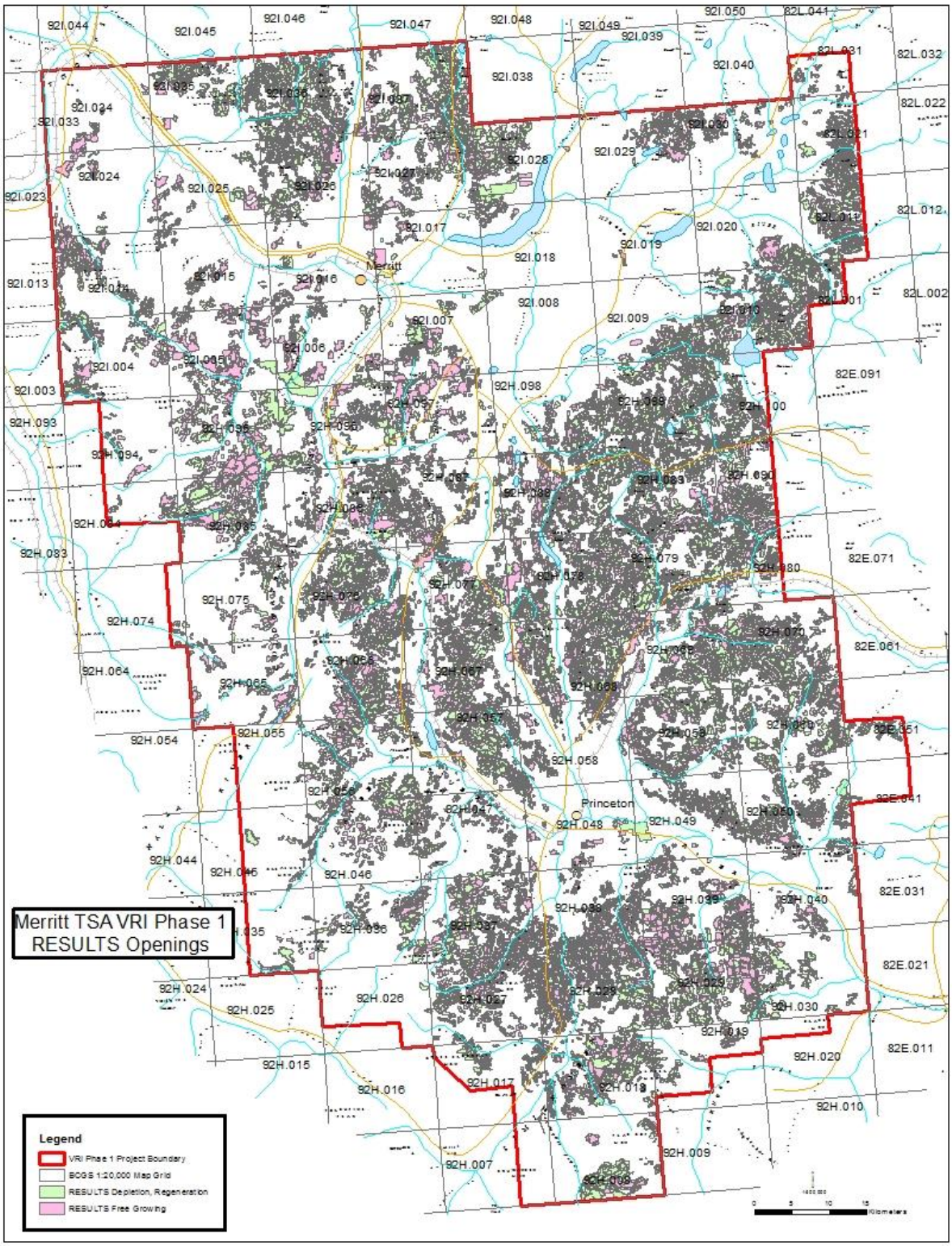

Figure 6. RESULTS polygons in the Merritt VRI Phase 1 project area.

Free growing updates and depletion/regeneration updates for the project area newer than December 2014 (~5800 and 500, respectively) are under a current contract. A data cut of the production database for these updates will be provided to the Phase 1contractor in VRIMS format. These contracted updates have already passed QA via the integration process, so they could in theory be copy-pasted from the production database cut into the new working Phase 1 inventory layer without significant review. Caution should be exercised, however, in that these contracted updates are being completed with older photos than those being used for the Phase 1 project.

Some openings found on the air photos won't be found in the RESULTS data cut. Attribution of harvested areas that are not identified in the RESULTS spatial files will be completed in accordance with the *Photo Interpretation Guidelines for Integrating RESULTS Information*.

Some older disturbed areas won't have a RESULTS record (i.e., no opening ID) because the disturbances pre-date the RESULTS records (Table 6). In many of these cases, disturbance dates exist in the old inventory. A data cut will be provided to the Contractor for these polygons, and the disturbance history must be transferred to the new inventory. This will maintain disturbance history through time, and also help to improve polygon ages.

New Data Sources

The fieldwork program calls for the establishment of air and ground calls to provide photo interpreters with actual ground data to use as calibration points. The current standard for distribution of calibration points is a minimum of 10 ground calls and 20 air calls per FME. Actual minimums for this project are still to be determined.

The ground call types will be a combination of 1-point and 3-point calls. The type of ground call established in each polygon is based on the species complexity as described in the *VRI Photo Interpretation Field Calibration Procedures*. The typical ratio of 1-point to 3-point ground calls in the Merritt TSA would be approximately 7:3.

The exact ratios of air calls to ground calls, and 1-point to 3-point ground call types will be determined before the project starts. This determination will be based on recommendations from other recent VRI Phase 1 projects in MPB-impacted areas and by reviewing the new aerial images.

Prior to the initiation of a field calibration program, a Field Calibration Plan is to be submitted to the Ministry Project Manager for approval. Documentation within this sampling plan must include a map of the project area indicating the general location and distribution of the calibration points.

As part of the deliverables, the Ministry requires a complete set of any new data sources be provided in a digital format determined by the Ministry, including the geographical locations (UTM coordinates) of these data sources as well as the complete set of field attribute data collected.

LiDAR Validation Ground Calls

Enhanced ground calls will be established for a portion of the Merritt TSA (~200,000 ha, specific area to be determined by Cascades District staff) and will be used for validation of LiDAR models. This will apply to all mapsheets identified in the contract as "LiDAR validation mapsheets."

In order to support this process, the standard VRI ground call procedures will apply with some modifications. The procedures are not finalized, but the key modifications will likely include:

- mandatory 3-point ground calls,
- measuring all heights and diameters, and identifying species, live/dead, and crown class,
- collecting waypoint-averaged GPS positions, and
- providing raw field data and data-entered data.

Attribute Estimation

This project will be undertaken in softcopy (digital photogrammetric) format.

Photogrammetric tree heights will be taken where suitable at the discretion of the photo interpreter.

The MPB infestation has caused significant change to the forested landscape in the Merritt TSA. The focus for the attribute estimation will be on getting accurate descriptions of the live component of the forest. This includes the residual component remaining in the overstory and, where visible, the understory. Note that understory can typically only be interpreted when crown closure of the overstory is very low and the understory trees are large enough to be resolved on the photos.

All polygon descriptions will be carried out to the standards of the most current version of the *VRI Photo Interpretation Procedures*. This now includes the capture of attributes on the "dead" ("D") layer for any polygons with more than 30% mortality, based on density.

Mapping

The Ministry has developed a format and database standards for the submission and storage of spatial and attribute data for VRI photo interpretation. All new projects must be completed to this standard and submitted to the Ministry Project Manager as per the delivery schedule.

The Contractor will adhere to the most current version of the *VRIMS Personal Geodatabase Structure and Use* and the *VRIMS Vegetation Cover Polygon Validation Rules* published by the Forest Analysis and Inventory Branch.

TRIM Base

A TRIM (NAD 83) format base file will be supplied to the Contractor.

The Contractor will be responsible for updating TRIM roads as part of the project. There will be no changes made to TRIM features unless significant changes have occurred to polygonal features such as lakes and double-line rivers. The contractor must maintain a record of any TRIM changes and submit all changes to the Project Manager in an approved format. The changes will be passed on to GeoBC to include in future TRIM updates.

Section 3 - Project Implementation

Project Pre-Work Meeting

A project pre-work meeting is mandatory. The purpose of this meeting is to bring together the Ministry Project Manager, VRI Phase 1 Contractor, MFLNRO representatives and Quality Assurance personnel prior to project start-up. This meeting will ensure that an efficient communication network is established, identify individuals responsible for all aspects of the project, allow discussion of any issues before project work commences, and establish timelines for deliverables and data flow. Minor changes to the contract to complete the Phase 1 activities may be identified at this meeting.

A project pre-work checklist, signed off by all parties attending, will be used to organize and guide the meeting.

Scheduling

The project will progress over three fiscal years, commencing in 2016/17, with approximately 33% of the photo estimation work (25 FMEs) completed during this first fiscal (). The second fiscal (2017/18) will see ~40% (30 FMEs) completed, with the remaining 27% (21 FMEs) completed in 2018/19. This schedule may change in order to meet the Ministry's needs. Field calibration is to coincide with subsequent attribution of associated blocks.

Table 7. Proposed coarse project schedule for the Merritt VRI Phase 1 project.

Calendar Year	Fiscal Year	Fiscal Quarter	Prime Activity	Data Available
2016	2015/16	Q4 (Jan - Mar)	VPIP	
	2016/17	Q1 (Apr - Jun)	Contract award	
		Q2 (Jul - Sep)	Delineation	
		Q3 (Oct - Dec)	Field work	
2017		Q4 (Jan - Mar)	Attribution	
	2017/18	Q1 (Apr - Jun)	Delineation	
		Q2 (Jul - Sep)	Field work	
		Q3 (Oct - Dec)	Attribution	
2018		Q4 (Jan - Mar)	Attribution	Year 1 (33%)
	2018/19	Q1 (Apr - Jun)	Delineation	
		Q2 (Jul - Sep)	Field work	
		Q3 (Oct - Dec)	Attribution	
2019		Q4 (Jan - Mar)		Year 2 (40%)
	2019/20	Q1 (Apr - Jun)		
		Q2 (Jul - Sep)		
		Q3 (Oct - Dec)		
2020		Q4 (Jan - Mar)		Year 3 (27%)

A delivery schedule outlining progressive delivery of products will be set by the Ministry, in consultation with the Contractor, for each fiscal. The format of the delivery schedule will be agreed to at the project pre-work meeting.

Project Manager

The Ministry Project Manager for the Merritt TSA Phase 1 VRI project will be determined at the start of the project. Responsibilities include the following: coordinating the project; monitoring and communicating project progress with the local stakeholders; ensuring all contractors are qualified and certified; overseeing photo-interpretation activities; ensuring quality assurance is complete and delivered at each stage; and assisting in coordinating technical expertise where required.

Personnel

All VRI photo interpretation work must be completed by or directly supervised by a VRI Certified Photo Interpreter. At least 50% of the photo interpreters working on the project must be certified for VRI photo interpretation. All uncertified photo interpreters are to be directly supervised by a Certified Photo Interpreter working on that project. There may be a limit of 4-5 photo interpreters approved to work on the project; this would help maintain consistency across the project.

Quality Assurance

An independent third-party quality assurance (QA) will be completed on all stages of the project (historical data source transfer, delineation, calibration fieldwork, and attribution) in accordance with the *VRI Photo Interpretation Quality Assurance Procedures and Standards*.

QA for digital map production will be conducted by the Ministry. Contractors will utilize "VEGCAP for Contractors" validation software to perform QA on data files.

All QA findings and re-work instructions are communicated to the VRI Contractor by the Ministry Project Manager.

Deliverables

The VRI photo interpretation project deliverables for each stage of the photo interpretation project are outlined in the *VRI Photo Interpretation Procedures* and the *VRI Field Calibration Procedures for Photo Interpretation*.

The deliverables schedule will be determined by the Ministry, in consultation with the Contractor, at the start of the project. Deliverables are required to be spread out evenly across the entire term of the contract. Deliverables required in a particular fiscal year must be submitted by the end of February to provide sufficient time for completion of independent third-party QA and Ministry in-house GIS QA.

Submission of all final deliverables will be signed-off by a qualified ABCFP registered Forest Professional.

Roles & Responsibilities

MFLNRO

The Ministry Project Manager is the point of contact for the Ministry and provides overall communication of project activities with contractors and Cascades District staff and stakeholders.

VRI Contractor

The VRI Contractor works with the Ministry Project Manager to ensure the planning, coordination and execution of project activities are consistent with the VPIP and contract requirements.

VRI QA Contractor

The VRI QA Contractor works with the VRI Contractor and Ministry Project Manager to ensure that Quality Assurance reporting meets the VRI prescribed standards.

References for Inventory Standards and Procedures

All work will be carried out in accordance with the following British Columbia Government specifications, current at the time of contract signing.

- *Vegetation Resources Inventory Photo Interpretation Procedures*
- *Vegetation Resources Inventory Photo Interpretation Quality Assurance Procedures and Standards*
- *Vegetation Resources Inventory Field Calibration Procedures for Photo Interpretation*
- *Photo Interpretation Guidelines for Integrating RESULTS Information* (contained within the *VRI Photo Interpretation Procedures, Appendix A*)
- *Vegetation Resources Inventory – The B.C. Land Cover Classification Scheme and addendum*
- *VRIMS Personal Geodatabase Structure and Use*
- *VRIMS Vegetation Cover Polygon Validation Rules*
- *Vegetation Resources Inventory – Preparing a Project Implementation Plan for Photo Interpretation, Appendix D*

Project Sign-Off Sheet

Merritt Timber Supply Area Vegetation Resources Inventory
Photo Interpretation Project Implementation Plan

I have reviewed and approved the Merritt Timber Supply Area Vegetation Resources Inventory Photo Interpretation Project Implementation Plan.

Original signed by Pat Martin, March 30, 2016

_____

Pat Martin Date
Manager, Forest Inventory Section
Forest Analysis and Inventory Branch
Ministry of Forests, Lands and Natural Resource Operations

Appendix A: First Nation and Stakeholders Meeting Attendance

Table 8. Invitations sent to First Nations, and attendees present, for the First Nation and stakeholder meeting regarding initiation of the Merritt TSA Phase 1 VRI, held at the Merritt Fire Zone office on February 25, 2016.

Affiliation	Contact(s)	Attendee(s)
Adams Lake	Chief Robin Billy and Council	
Ashcroft Indian Band	Chief Greg Blain and Council	
Bonaparte Indian Band	Chief Ryan Day and Council	
Boothroyd Indian Band	Chief Mike Campbell and Council	
Boston Bar First Nation	Chief Delores O'Donaghey and Council	
Chawathil First Nation	Chief Ruth Peters and Council	
Coldwater Indian Band*	Chief Lee Spahan and Council	
Cooks Ferry Indian Band*	Chief David Walkem and Council	
Esh-kn-am Cultural Resources Management Services	Brenda Walkem, Manager	
Kanaka Bar Indian Band	Chief Patrick Michell and Council	
Lower Nicola Indian Band*	Chief Aaron Sam and Council	
Lower Similkameen Indian Band	Chief Keith Crow and Council	
Lytton First Nation	Chief Janet Webster & Council	
Neskonlith Indian Band	Chief Judy Wilson and Council	
Nicola Tribal Association	Executive Director	Lennard Joe
Nicomen Indian Band*	Chief Ursula Drynock and Council	
Nlaka'pamux Nation Tribal Council	Chief Robert Pasco, Chair	
Nooaitch Indian Band*	Chief Marcel Shackelly and Council	
Okanagan Indian Band	Chief Byron Louis and Council	
Okanagan Nation Alliance	Chair	
Oregon Jack Creek Indian Band	Chief Robert Pasco and Council	
Penticton Indian Band	Chief Jonathan Kruger and Council	
Seabird Island First Nation	Chief Clement Seymour and Council	
Shackan Indian Band*	Grand Chief Percy Joe and Council	
Siska Indian Band*	Chief Fred Sampson and Council	
Spuzzum First Nation	Chief James Hobart and Council	
Stk'emlupsemc te Secwepemc Nation	Chief Seymour, Chief Ignace, Don Ryan and Councillors	
Sto:lo Nation	President Joe Hall and Board of Directors	
Upper Nicola Band*	Chief Harvey McLeod and Council	
Upper Similkameen Indian Band*	Chief Charlotte Mitchell and Council	
Westbank First Nation	Chief Robert Louie and Council	
Yale First Nation	Chief Ken Hansen and Council	

* The First Nation is also a forest licencee but was contacted only once (as the First Nation).

Table 9. Invitations sent to forest licencees, and attendees present, for the First Nation and stakeholder meeting regarding initiation of the Merritt TSA Phase 1 VRI, held at the Merritt Fire Zone office on February 25, 2016.

Affiliation*	Contact(s)	Attendee(s)
Aspen Planers Ltd.	Jerry Canuel	Scott Fiddick
BC Timber Sales, Cascades Field Unit	Christian Guay	Jennifer Reid
Forsite Consultants Ltd.	?	
Hu'Kwa Resources Inc.	?	
Princeton & District Community Forest Corp.	?	
Princeton Forest Products Ltd.	Jason Carmichael	
Princeton Post and Rail Ltd.	?	
Princeton Wood Preservers Ltd.	Jerry Canuel	
Skulqalt Forestry Ltd.	Ryan Clark	
Stuwix Resources Ltd.	Frank J. Lennard Joe Shaun Kuzio Dennis M. Craig S.	Lennard Joe Shaun Kuzio
Sungate Timber Ltd.	Don Brimacombe	
Tolko Industries Ltd., Nicola Valley Division	Erica Doyon Michelle Evdokimoff Shaun Hales Ryan Potter Rene Thomsen	Jamie Skinner
Weyerhaeuser Company Limited	Jason Carmichael Kevin Hargrave	Jason Carmichael Robin Dack
FLNRO, Cascades District	Open invite	Martin Ponsioen Bruce Walter

* Forest licencees who are also a First Nation were contacted only once (as the First Nation). See Table 8 for identification of those First Nations who are also forest licencees.

Appendix B: Project Mapsheet Area & Land Cover Summary

Table 10. Area and land cover summary for mapsheets included in Merritt VRI Phase 1 project area.

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)*	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
082E041	4,356	0.27	537	164	0
082E051	4,325	0.27	326	521	0
082L001	2,778	0.17	66	822	13
082L011	9,277	0.58	623	2,193	346
082L021	9,257	0.58	1,197	2,321	221
082L031	4,503	0.28	738	1,156	209
092H007	5,026	0.31	310	70	0
092H008	16,259	1.0	1,503	2,000	461
092H017	10,271	0.64	373	687	41
092H018	16,226	1.0	1,327	2,398	285
092H019	9,880	0.62	95	746	8
092H020	2,207	0.14	183	214	0
092H026	12,584	0.79	3,977	403	0
092H027	16,194	1.0	435	1,862	49
092H028	16,194	1.0	480	1,794	244
092H029	16,194	1.0	248	2,664	186
092H030	16,194	1.0	1,054	2,418	5
092H035	10,099	0.63	1,288	1,562	170
092H036	16,161	1.0	1,513	1,747	519
092H037	16,161	1.0	348	1,776	247
092H038	16,161	1.0	2,816	1,721	511
092H039	16,161	1.0	606	1,250	123
092H040	16,161	1.0	3,154	2,666	116
092H045	10,079	0.63	2,950	1,059	40
092H046	16,129	1.0	2,254	1,654	129
092H047	16,129	1.0	459	1,246	295
092H048	16,129	1.0	6,031	4,874	500
092H049	16,129	1.0	3,117	1,229	160
092H050	16,129	1.0	532	1,393	65
092H055	10,059	0.63	3,333	1,936	13
092H056	16,096	1.0	1,320	1,438	296
092H057	16,096	1.0	1,001	2,765	384

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)*	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
092H058	16,096	1.0	4,371	5,415	650
092H059	16,096	1.0	368	2,369	194
092H060	16,096	1.0	438	2,503	47
092H065	16,064	1.0	4,270	2,757	553
092H066	16,064	1.0	2,414	2,930	997
092H067	16,064	1.0	1,227	3,135	462
092H068	16,064	1.0	868	3,414	172
092H069	16,064	1.0	702	4,119	550
092H070	16,064	1.0	71	2,885	81
092H074	2,336	0.15	103	442	0
092H075	16,031	1.0	3,864	1,054	252
092H076	16,031	1.0	1,037	1,892	505
092H077	16,031	1.0	2,071	3,306	524
092H078	16,031	1.0	879	3,546	192
092H079	16,031	1.0	666	3,287	157
092H080	8,685	0.54	51	1,977	65
092H084	5,265	0.33	1,018	1,311	50
092H085	15,998	1.0	872	1,936	294
092H086	15,998	1.0	1,051	2,350	485
092H087	15,998	1.0	2,587	3,821	92
092H088	15,998	1.0	1,120	2,550	322
092H089	15,998	1.0	804	2,856	195
092H090	8,667	0.54	143	1,684	8
092H094	10,642	0.66	2,624	1,186	240
092H095	15,966	1.0	662	2,676	1,439
092H096	15,966	1.0	1,770	3,413	999
092H097	15,966	1.0	2,136	3,865	1,240
092H098	15,966	1.0	5,705	6,307	194
092H099	15,966	1.0	1,284	4,012	159
092H100	8,650	0.54	682	2,308	155
092I004	15,933	1.0	2,311	1,818	351
092I005	15,933	1.0	1,198	495	249
092I006	15,933	1.0	2,101	2,416	98
092I007	15,933	1.0	5,572	5,099	269
092I008	15,933	1.0	13,496	13,145	35

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)*	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
092I009	15,933	1.0	8,361	8,830	302
092I010	15,933	1.0	1,486	3,240	57
092I014	15,900	1.0	2,078	1,386	402
092I015	15,900	1.0	2,211	1,520	273
092I016	15,900	1.0	4,079	3,471	557
092I017	15,900	1.0	7,914	6,792	383
092I018	15,900	1.0	11,711	9,723	56
092I019	15,900	1.0	11,905	11,002	3
092I020	15,900	1.0	10,091	3,819	186
092I024	15,867	1.0	1,342	384	95
092I025	15,867	1.0	1,215	973	137
092I026	15,867	1.0	1,431	1,822	245
092I027	15,867	1.0	1,653	2,653	401
092I028	15,867	1.0	5,305	6,652	70
092I029	15,867	1.0	8,318	8,249	67
092I030	15,867	1.0	7,899	7,985	326
092I034	15,834	1.0	3,907	3,291	183
092I035	15,834	1.0	560	1,706	24
092I036	15,834	1.0	1,572	2,842	89
092I037	15,834	1.0	1,556	4,135	221
Totals:	***1,221,739***	***76.3***	***209,327***	***249,500***	***21,988***
% of Total Area:			***17.1%***	***20.4%***	***1.8%***

* FME calculation based on an average of 16,012 ha/mapsheet in the project area.