YUKON VEGETATION INVENTORY

MANUAL

Version 2.1

(December 2006)

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1.0 Background on Yukon Forest Inventories

The first forest inventories in the Yukon began in the 1950 and 1960's. These inventories were undertaken by the Department of Fisheries and Forestry. A total of 58,000 km^2 was mapped at a variety of scales for the purpose of providing forest maps and volume data for the planning and control of industrial activity. Additional studies, centred in the Teslin and Watson Lake areas were undertaken during the fiscal year of 1968-69. These studies updated earlier estimates and provided more detail for operations.

The Gairns report of 1968 provided the first reconnaissance inventory of the Territory south of 66 degrees latitude. This inventory was based on previous reports and reconnaissance flights. The derived area and volume figures were adjusted for use in the national inventory in 1976 and 1981.

In 1982, the Northern Affairs Program, Forest Resources Section evaluation identified, as a priority, the completion of a small scale reconnaissance inventory of the Yukon. In response to this, 1:250,000 forest cover maps were produced from medium scale photography (1:50,000-1:70,000) and satellite imagery. This inventory covered the entire Yukon and was completed by the Canadian Forestry Service and Forest Resources, DIAND with funding from the Energy From the Forest (ENFOR) program. The objectives of this inventory were to provide broad area, volume and biomass estimates for developing plans and policies; to identify areas for more intensive inventories; and to provide information for national inventory reporting. This inventory was completed between 1983 and 1986.

The 1982 program evaluation also identified more detailed management type inventories as a second priority. Between 1986 and 1995 Forest Resources completed the first management inventory at a scale of 1:50,000 covering Forest Management Units 1 to 7.

The southeast Yukon saw a boom in the logging industry in 1994 as prices in British Columbia reached new highs. Rising prices for forest products coupled with the crisis in the Yukon mining industry, put new pressures on the forests of the Yukon. An improved forest inventory was therefore required to provide the basis for land use decisions and sound forest management.

This Yukon Vegetation Inventory Manual is the basis for the new inventory completed between 1999 and 2004, for the southeast and central Yukon, and 17 mapsheets along the Porcupine River.

1.1 Vegetation Classification

Forest Resources' original forest classification methodology was developed in 1986 to guide the forest cover mapping program. This methodology was based on British Columbia's Ministry of Forests' Inventory Manual modified to suit the needs of the Yukon. Over the past few years the needs of forest inventory users have changed. In order to meet these changing needs, Forest Management Branch has revised its forest classification to become a broader based vegetation classification (Figure 1). The new classes described in this classification are intended to increase the utility of the inventory for ecosystem-based management decision-making.

1.2 General

The purpose of classification is to divide the land into recognizable homogeneous units based on well-defined criteria. In the Yukon, aerial photo interpretation for vegetation mapping utilizes 1:40,000 scale black and white aerial photography. Interpretation reflects a minimum polygon size of 25 ha which equates to an area of 1 cm^2 on the final vegetation map. Vegetation maps are produced at a scale of 1:50,000. Because 1:40,000 aerial photographs are used for vegetation interpretation, measurements are to a large extent obtained or estimated from several secondary sources including:

- ground samples
- air calls
- ground calls
- regeneration surveys
- LSP (large scale photography) samples
- PSP (permanent sample plot) measurements
- previous mapping projects

Where current 1:40,000 coverage is not available, the most recent photos are used.

1.3 Overview

The following document contains a description of classification criteria for vegetated and non-vegetated lands used by Forest Management Branch, Department of Energy, Mines and Resources. Section 2.0 details definitions and criteria for classifying lands. Section 3.0 provides guidelines for photo labelling, section 4.0 addresses photo interpretation quality control, section 5.0 addresses

field sampling and sections 6.0 to 8.0 detail how air photos are prepared for interpretation and how vegetation maps are produced.

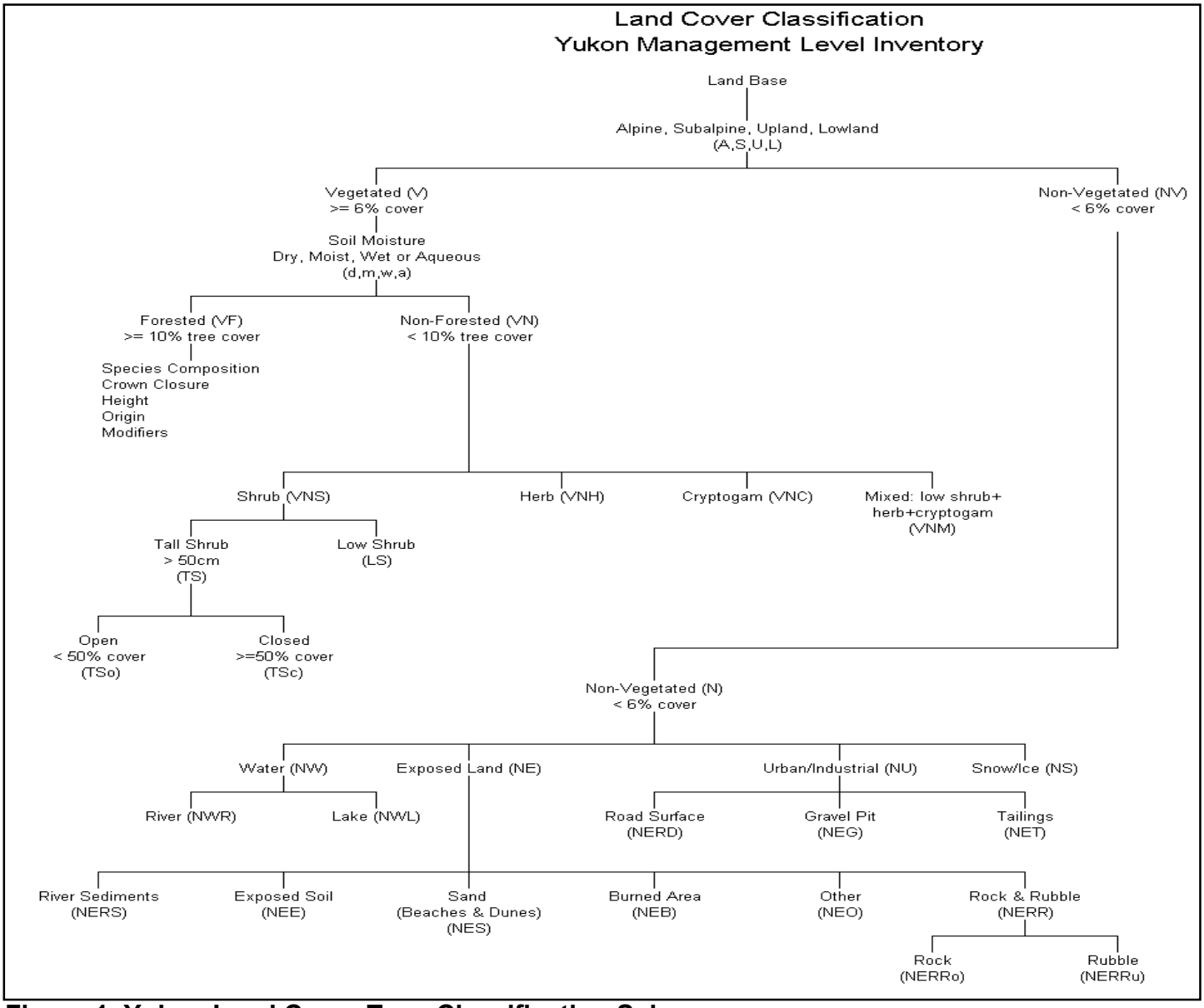

Figure 1 Yukon Land Cover Type Classification Scheme

2.0 Introduction

Attributes of the vegetation inventory can be classified into three groups:

i. General attributes - values assigned to all polygons based on reference information or requirements for data storage (ie. polygon number, reference year);

ii. Photo-interpreted attributes - values determined for each polygon from aerial photograph interpretation (ie. soil moisture regime, species composition), and;

iii. Derived attributes - values derived from the photo interpreted attributes (ie. site index, site class, polygon area).

2.1 General Attributes

2.1.1 Polygon Number

Polygon number is a unique number assigned to each polygon on a map sheet. In conjunction with the map sheet number this will uniquely identify every polygon in the inventory. This number is used to link the graphic and attribute files of the inventory. Procedures for assigning polygon numbers are described in section 7.1.2.

Polygon numbers are assigned to every polygon.

	Attribute Name
Polygon Number - number to uniquely identify each polygon on a map sheet	**FCOV-ID**

2.1.2 Reference Year

Reference year is the year of the information used to delineate and describe the polygon. For most polygons this will be the year in which the photography was flown.

Reference year is used to adjust stand ages to different points of reference (eg. stand origin).

Reference year is assigned for every polygon.

	Attribute Name
Reference Year - year of the information used to delineate and describe the polygon (eg. 1997)	**REF_YEAR**

2.1.3 Map Sheet Number

Map sheet number is the National Topographic Series (NTS) 1:50,000 map sheet reference number. The Yukon Vegetation Inventory utilizes these maps as it's base.

Map sheet number can be combined with polygon number to uniquely identify every polygon in the inventory.

Map sheet number is assigned for every polygon.

	Attribute Name
Map Sheet Number - National Topographic Series 1:50,000 map sheet number (eg. 105A/04)	**MAP**

2.2 Photo Interpreted Attributes

2.2.1 Landscape Position

Landscape position describes the location of a polygon on the landscape. Landscape position assists in the delineation of ecosystems and habitats.

Landscape position is interpreted for all polygons using the following classes:

Attribute: **LANDPOS**	Interpretation and Database Code
Alpine - The land area above the maximum elevation for tree species, dominated in the vegetated areas by shrubs, graminoids, forbs, bryophytes or lichens. Much of the alpine will be non-vegetated; covered primarily by rock and ice. The alpine is treeless by definition; however, there may be a few rare trees (<1% crown closure).	A
Subalpine - those areas with sparse tree cover, on upper slopes which are not alpine because of the tree cover, but usually do not have tree cover of 10% or greater. Other indicators are the presence of Alpine Fir and the proximity to the Alpine.	S
Upland - those areas at mid elevations where vegetation and processes are not affected by water table or surface water or else affected only for short periods so that riparian (hydrophilic) vegetation or processes do not persist.	U
Lowland - those areas at lower elevations where the vegetation and ecological processes are significantly impacted by the presence and availability of water.	L

Since much of the criteria for landscape position is determined by vegetation characteristics, the position of non-vegetated polygons should be determined by their position relative to other classified, vegetated polygons.

The delineation of lowlands should be guided by visible indicators such as proximity to water, obvious slope breaks, river meander scars and vegetation patterns.

2.2.2 Soil Moisture Regime

Soil moisture regime describes the available moisture supply for plant growth over a period of several years. Within a particular ecoregion the soil moisture will be relatively constant for any moisture regime class. However, between ecoregions with different climatic regimes the same moisture regime classes can represent different soil moisture contents. Soil moisture regime is influenced by precipitation, evapotranspiration, topography, insolation and soil particle size.

Soil moisture regime is used for estimation of site potential and to assist ecosystem classification.

Soil moisture regime is interpreted for all vegetated polygons, burned areas and exposed soil using the following classes:

Attribute: **SMR**	Interpretation and Database Code
Dry - rapidly drained substratum	d
Mesic - moderately well drained substratum	m
Wet - poorly drained to flooded where the water table is usually at or near the surface, or the land is covered by shallow water (e.g. sedge fens)	w
Aquatic - permanent deep water areas where the predominant growth medium is water and the vegetation is characterized by hydrophytic vegetation (emergent) that grows in or at the surface of the water (e.g. pond weeds, water-lily, etc.)	a

2.2.3 Cover Type

Although cover type is described here in the photo interpreted attributes section, the recording of the cover type value is something that is derived. This attribute is implicit when the cover type class or forest attributes are interpreted. Therefore, cover type is not labelled on photos, rather it is derived during the creation of the database.

The entire landbase is stratified according to the Yukon Land Classification Scheme (Figure 1, page 4).

The first stratification of the land base is to differentiate vegetated and non-vegetated polygons. Polygons with greater than or equal to 6% plant cover are considered vegetated. The interpretation and database codes for this level (ie. N or V) are recorded as the first character of the cover type code.

Cover type describes the dominant land cover within the interpreted polygons. This attribute is the first level of differentiation of land types. Polygons are vegetated if the plant cover is 6% or greater of the polygons area, non-vegetated polygons have less than 6% plant cover.

Cover type is derived for all polygons based on cover type class, for non-forest types, and the presence of forest attribute values, for forest types (ie. if a polygon is given a species composition it is vegetate, forested).

Attribute: **TYPE**	Interpretation and Database Code
Vegetated, Forested - lands with >= 6% plant cover and >=10% tree cover	VF
Vegetated, Non-Forested - lands with >= 6% plant cover and <10% tree cover	VN
Non-Vegetated, Water -lakes and rivers	NW
Non-Vegetated, Urban/Industrial -developed land: powerline, pipeline, road and rail right-of ways, mines, gravel pits, industrial sites and municipalities	NU
Non-Vegetated, Exposed Land - lands where the surficial materials have been exposed by natural erosional and depositional processes	NE
Non-Vegetated, Snow/Ice - lands covered year-round by snow or ice	NS

2.2.4 Cover Type Class

The cover type class is the first sub-division of the cover types. This is the level of classification which is most useful for land base analyses.

Cover type class is interpreted for all polygons, except vegetated, forested (VF) polygons (which are more fully described using other attributes).

	Attribute: **CLASS**	Interpretation and Database Code
Vegetated, Non-Forested (Type="VN")	**Shrub** - lands where >= 20% of the canopy cover is composed of shrubs or > 33% of the total vegetation cover is shrubs. Shrubs are further classified into height and density classes.	S
	Herb- lands where >= 20% of the canopy cover is composed of herbs or > 33% of the total vegetation cover is herbs and shrub cover is < 20%	H
	Cryptogam - vegetation cover is predominantly cryptogam (>50% cryptogam) and shrubs are < 20% and herbs are < 20%	C
	Mixed - sites which are not clearly dominated by shrubs, herbs or cryptogams	M
Non-Vegetated, Water (Type="NW")	**River**	R
	Lake	L
Non-Vegetated, Exposed Land (Type="NE")	**River Sediments** - silt, gravel and sand bars associated with former river channels and present river edges	RS
	Exposed Soil - any exposed soil not covered by other categories (e.g. areas of recent disturbance where vegetation cover is less than 5%)	E

	Sand - beaches and dunes	S
	Burned Area - land which has recently burned and has less than 5% vegetation cover	B
	Rock & Rubble - bedrock or fragmented rock	RR
	Other - none of the above applies	O
Non-Vegetated, Urban/ Industrial (Type=”NU”)	**Road Surface** - includes all weather and seasonal roads where the vegetation cover has been removed for the construction of the road	RD
	Gravel Pit - area exposed for the removal of sand and/or gravel	G
	Tailings - areas covered with the solid waste materials from mining and/or milling ore	T

2.2.5 Cover Type Class Modifier

The cover type class modifier is the second sub-division of the cover types. This level of classification provides additional information, when available, on some of the cover type classes.

Cover type class modifiers can be interpreted for shrubs, and rock & rubble.

Attribute: **CL_MOD**		Interpretation and Database Code
Shrub (Class="S")	**Tall Shrub** - Shrub types dominated by shrubs >50cm in height	TS
	Tall Shrub, Open - tall shrub types where the shrubs compose < 50% total cover	TSo
	Tall Shrub, Closed - tall shrub types where the shrubs compose > 50% total cover	TSc
	Low Shrub- shrub types dominated by shrubs <50cm in height	LS
Rock & Rubble (Class="RR")	**Rock** - unfragmented bedrock	Ro
	Rubble - fragmented rock broken away from bedrock and moved by gravity or ice	Ru

2.2.6 Forest Attributes

All of the attributes in this section are recorded for polygons classified as vegetated, forested.

2.2.6.1 Species Composition

Species composition is the percentage of each tree species within a forested polygon. Species are listed in descending order according to their contribution to crown canopy. This is determined by estimates to the nearest 10% from the photo and where possible checked by flight calls and/ or ground truthing. Types are separated if species compositions differ by 10% or more. The species composition for each forest stand must sum to 100%.

Eight tree species are presently found in the Yukon. A single, unique, upper case letter describes each genus, and an upper and lower case letter describes the genus and species. Tree species are to be recorded using the following codes:

Attribute: **SP1, SP2,SP3,SP4**	Interpretation and Database Code
Trembling Aspen - Populus tremuloides	A
Balsam Poplar - Populus balsamifera	B
Fir - Abies lasiocarpa	F
Larch - Larix laricina	L
Lodgepole Pine - Pinus contorta	P
Black Spruce - Picea mariana	SB
White Spruce - Picea glauca	SW
White Birch - Betula papyrifera	W

Species compositions are recorded on photo labels as a numeric subscript following the identified species. The subscript represents the percentage species composition divided by 10. For example, a stand composed of 80% white spruce and 20% lodgepole pine would be denoted by the label:

$$Sw_8\ P_2$$

The species composition recorded in the database is to be the actual percentage (ie. 10, 20,30...). Species composition is recorded in the attributes: **SP1PER**, **SP2PER**, **SP3PER**, **SP4PER**.

2.2.6.2 Stand Height

Tree height is estimated for the leading tree species in the canopy based upon an average of dominant and codominant tree heights. Height is recorded to the nearest metre (+/- 1 metre) on the photo label. A stand will be separated into two or more types where the range-of-heights are 2 m or more (unless such a separation violates the minimum type size limitation).

Tree heights are recorded on the photo as a single number for an even height stand or a range of heights with an average. The attributes for storing stand height information are as follows:

	Attribute Name
Average Height - average height ,in metres, of the dominant and co-dominant trees of the leading species	**AVG_HT**
Minimum Height -- minimum height ,in metres, of the dominant and co-dominant trees of the leading species	**MIN_HT**
Maximum Height - maximum height ,in metres, of the dominant and co-dominant trees of the leading species	**MAX_HT**

For example:

Sw•12•30•120 - a stand comprised of greater than 90% white spruce 12 metres tall (± 1 metre) with a crown closure of 30% and an average age of 120 years

Sw•12(10-14)•30•120 - a stand comprised of greater than 90% white spruce with heights ranging from 10 to 14 metres, an average height of 12 metres, a crown closure of 30% and an average age of 120 years.

2.2.6.3 Crown Closure

Crown closure is the percentage of ground area covered by the vertically projected tree crowns. This percentage is estimated from photos and where possible checked by air calls and/or ground truthing. Stands are separated if the difference in the crown closure is greater than 5%. Crown closure is recorded to the nearest 5% on the photo labels. Stands are labelled with species composition, height, crown closure and age only if the crown closure is greater than or equal to 10%.

	Attribute Name
Crown Closure - percentage of ground area covered by the vertically projected tree crowns of a stand	**CC**

2.2.6.4 Stand Age

Stand age is the average breast height age of the dominant and codominant trees for the leading species. Age is determined to the nearest year when practical, otherwise to the nearest 10 years. Homogeneous strata are defined by 20-year differences, that is, separation between types is made if the difference in age is 20 years or more.

When ground or history information is not available, ages are estimated using qualitative site estimates and heights together with Yukon site index curves for spruce and pine and B.C. MoF curves for other species.

	Attribute Name
Stand Age - average age of dominant and codominant trees of the leading species in years	**AGE**

2.2.7 Disturbance Code

Disturbance Codes are used to identify types of disturbance which have affected areas. Up to two disturbances can be identified for each polygon. The cause of the disturbance and the year, if known, are recorded.

	Attribute Name
Disturbance Code - disturbance type and year of occurrence	**DIST_CODE1** **DIST_CODE2**

CODE	DISTURBANCE
DB	Burn
DL	Logging
DW	Windthrow
DI	Insect
DD	Disease
DS	Slide
DF	Flooding

For example:

DB1959 - Area burned in 1959
DI1996 - Insect infestation in 1996

Note: It is anticipated that the use of these attributes for storing disturbance information will be temporary. Forest Management Branch' is developing other databases and systems for recording this information.

2.3 Derived Attributes

2.3.1 Cover Type

Cover type is fully described in section 2.2.3.

Cover type is derived for all polygons based on cover type class, for non-forest types, and the presence of forest attribute values, for forest types (ie. if a polygon is given a species composition it is vegetate, forested).

2.3.2 Site Index

Site index is an estimate of site productivity for tree growth. This attribute provides a common base for comparing the productivity of different sites.

Site index is derived for all forested polygons based on leading species, average height (or site tree height if available) and stand age. The reference age for site index is 100 years.

Site index base age 100 using the following equations:

$$H = b_1 S (1 - e^{b1A})^{b3}$$
$$S = H / b_1(1-e^{b2})^{Ab3}$$

where: H is total height in metres,
S is site index in metres at reference age 100 years,
A is age in years, and
b_1 , b_2 , b_3 are regression coefficients at reference age 100 years.

Genus/Species	Common Name	b_1	b_2	b_3
Abies Sp. (interior)	Balsam/Alpine	1.3832	-0.0155	1.3597
Betula papyrifera	Common Paper Birch	1.1580	-0.0175	0.7687
Larix sp.	Larch	1.1637	-0.0215	1.2243
Picea sp.	Spruce	1.2883	-0.0181	1.4177
Pinus contorta	Lodgepole pine	1.0236	-0.0465	2.4269
Populus balsamifera	Balsam poplar	1.1318	-0.0226	1.1233
Populus tremuloides	Aspen	1.2025	-0.0158	0.7994

2.3.3 Site Class

Site classes are groupings of site index values.

Site Class Code	Site Class	Site Index Range
L	Low	0-9.9
P	Poor	10-14.9
M	Medium	15-19.9
G	Good	20 +

2.3.4 Stratum Code

Stratum code is a derived code which summarizes the species composition, height, crown closure and age of vegetated, forested polygons.

Stratification of the forest is done using the species composition, height , crown closure and age of a stand. The stratum code summarizes these characteristics using a four digit number. The following table explains the purpose and values for each digit:

Stratification of Forested Types							
Growth Type (First Digit)		Height Class (Second Digit)		Crown Closure (Third Digit)		Stand Age (Fourth Digit)	
Code	Species Group	Code	Height	Code	Range	Code	Age
1	Spruce	1	0-4m	1	1-15%	1	1-20 yrs.
2	Pine	2	5-9	2	16-25	2	21-40
3	Hardwood	3	10-13	3	26-30	3	41-60
4	Spruce/Pine	4	14-16	4	31-35+	4	61-80
5	Spruce/Hardwood	5	17-19	5	36-45	5	81-100+
6	Pine/Spruce	6	20-24	6	46-55	6	101-120
7	Pine/Hardwood	7	25-30	7	56-75	7	121-150
8	Hardwood/Spruce	8	31+	8	76-100	8	151-180
9	Hardwood/Pine						

Notes:

- A pure stand is comprised of 81% or greater of one species.
- Hardwood includes aspen, balsam poplar and birch.
- Spruce includes white spruce, black spruce, alpine fir and larch.

Examples:

Stratum Code	Stand Description
1323	- 81% or more Spruce - Average Height 10-13 metres - Crown Closure of 16-25% - 41-60 years old
6636	- Mixed Pine and Spruce stand - Average Height 20-24 metres - Crown Closure of 26-30% - 101-120 years old

2.3.5 Forest Cover Type

Forest cover type attribute is a “hangover” from the Original Yukon Forest Classification.

This attribute is easily understand by the general public and loggers and is most useful on the “Timber Type Label Maps” generated for public use.

This attribute is derived from the cover type and class codes, soil moisture regime, and disturbance codes.

Attribute: **FOR_TYPE**	Database Code
Forest -derived from cover type code VF	FOR
Not Sufficiently Regenerated -derived from cover type code VN with Disturbance Code	NSR
Non- Productive -derived from cover type code VN	NP
Urban -derived from cover type code NU	U
Rock - derived from cover type code NE with class code RR	R
Alpine - derived from Landscape position code A	A
River - derived from cover type code NW with class code R	RIV
Lake - derived from cover type code NW with class code L	L
Wetland - derived from cover type code VN with soil moisture regime code w or a	W

3.0 Photo Labelling For Hardcopy Method Only

Interpreted attributes form the components of the polygon labels to be used on the photographs. Derived attributes are generated during map production and database preparation. Photo labelling is to be done using the following guidelines.

Polygon Type	Labelling Requirements
All Polygons	Landscape Position
All Vegetated Polygons, Burned Areas, Exposed Soil	Soil Moisture Regime
Vegetated, Forested	Species Composition, Percent Stand Height Crown Closure Stand Age
Vegetated, Non-Forested	Cover Type Class Cover Type Class Modifier (if applicable) (if Cover Type Class Modifier is used, the label does not need to specify Cover Type Class)
Non-Vegetated	Cover Type Class Cover Type Class Modifier (if applicable) (if Cover Type Class Modifier is used, the label does not need to specify Cover Type Class)

Photo labelling should be done using black ink with a pen size of 0.3 or finer.

Labels will have two sections separated by a solid horizontal line. Type-specific attributes are written (ie. cover type class and modifier or forested attributes) above the line. Landscape position and soil moisture regime are written below the line.

Photo Label	Polygon Description
SW_6A_4 12-25-110 Um	-Vegetated, forested -60% white spruce, 40% aspen -average height 12 metres, crown closure 25%, 110 years old -Upland, mesic
SB_{10} 8(6-12)-20-80 Lw	- Vegetated, forested - pure black spruce - average height 8 metres, minimum height 6 metres, maximum height 12m, crown closure 20%, 80 years old - Lowland, wet
B Ud	- Non-vegetated, exposed land - burned area - upland, dry
R L	- Non-vegetated, water - River - Lowland
Ru A	- Non-vegetated, exposed land - Rubble - Alpine
RD L	- Non-vegetated, urban/industrial - Road surface - Lowland
TSo Am	- Vegetated, non-forest - Tall shrub, open - Alpine, mesic

4.0 Quality Control Standards For Photo Interpretation

It is required that interpretation be based on information gathered through ground and air calls as well as field plot information. Audit ground plots will be established by the project supervisor as required.

Quality control for interpretation will be conducted as follows. Six photos per map sheet will be randomly selected for audit. The polygons on the south portion of these photos will be numbered and audited for both the location of polygon as well as the assigned polygon attributes. Interpretation will be judged by the following criteria:

Species composition ± 10% actual
Height ± 1 metre actual
Crown Closure ± 5%actual
Age ± 10 years actual
Stand Structure – must always be correct
Vegetated, non-forested identification – must always be correct
Non-vegetated – must always be correct
Polygon size – must always be correct
Legibility – must be readable at all times

The acceptance accuracy from the photo interpretation audit must be ∃80%.

Interpretation and field survey audit - submission #1

Contractor: Interpreter: Date of Audit:

Attribute	Weight	NUMBER OF PHOTOS SAMPLED FOR AUDIT:																								Weighted (W)
		SUMMARY OF INTERPRETATION AUDIT Total number of polygons checked:																								
Species composition	3.0																									
Height	1.5																									
Crown Closure	1.5																									
Age	1.5																									
Stand Structure	1.0																									
Vegetated, non-forested identification	1.5																									
Non-vegetated identification	1.0																									
Polygon size	3.0																									
Legibility	3.0																									

Total # of polygons checked
Must be included with submission for acceptance. Comments:

Acceptance ∃ 80%

Plot #
Legibility
Increment cores
Correct age count
Tally sheets
Field plots

I hereby certify that this quality control audit has been completed and this work meets or exceeds the contract specifications.

Authorized Company Signing Official: _____ Date:

Increment cores gathered while field sampling will be recounted and field plot data will be checked for accuracy and completeness. Both will be compared to polygon attributes to ensure that the field data agrees with the interpreted attributes. If field data does not agree with interpretation, interpreted photos will be returned for editing.

Results of the audit will be tabled, summed and the work will be accepted or sent back to the contractor for correction based on the percentage correct. Interpretation will be accepted if the interpretation audit accuracy is 80% or greater.

Interpretation must extend 1/2 of an air photo past the 1:50,000 map sheet border both horizontally and vertically.

All submissions of interpretation will include a quality control audit form which will be signed by the project supervisor (See page 24, Interpretation and Field Survey Audit - Submission #1).

5.0 Field Sampling

Ground plots will be established in order to calibrate the photo interpretation. Depending on the amount of vegetation up to 20 field plots will be established within each map sheet to be interpreted. Actual number of plots will be determined on a map sheet by map sheet basis after consideration of access, potential helicopter landing sites and homogeneity of forest cover types.

Preferred distribution of field plots within a 1:50,000 map sheet is as follows:

% of Map sheet Forested	Number of Plots Required
61+ %	20
41-61	12+
21-40	8+
0-20	4+

Field plots are to be established in the following manner:

i. The selected tie point is to be flagged with two colours of flagging (orange and blue). The plot number, distance and bearing to the plot and the date are to be written on the flagging with indelible marker.

ii. The route into the plot is to be flagged sparingly with orange flagging.

iii. The plot centre is to be marked with a stake, a minimum of 1m in length, and flagged with two colours (orange and blue). The plot number is to written on the flagging. Location of plot centre and plot number is captured using differentially corrected GPS.

iv. All field plots are to be variable radius plots. The basal area factor is to be selected so that a minimum of 7 trees are in the plot.

v. The following information is to be recorded about the plot:
- basal area factor
- forest management unit
- NTS map sheet number
- plot number
- date
- stand number
- stratum
- UTM coordinates
- aerial photograph number
- ecoregion
- crew names
- distance and bearing from the tie point to the plot

Note: stand number and stratum code must be added after vegetation map has been produced and stratum codes have been generated.

vi. The following information is to be recorded for the trees in the plot:
- tree number
- species
- diameter breast height
- height (all trees in plot to be measured)
- pathological remarks
- crown class
- ocular estimate of crown closure
- age and ten year growth increment for two co-dominant and one

dominant of the leading species or site tree

Forest Management Branch field tally sheets are to be used. Tally sheets are to be completed neatly and legibly in full.

Increment cores obtained during field data collection are to be retained and delivered to the project supervisor upon completion of classification. Individual increment cores are to be delivered in a straw or glued to the wood mount, that clearly identifies tree number, plot number, 1:50,000 map sheet, latitude and longitude. Increment cores collected must be included with each interpretation submission. All increment cores must be counted to within +/- 5 years of actual.

Field plot locations and plot numbers will be labelled on the NTS maps by the contractor.

Pin holes are made through the photos at each field plot location, and the plot number is recorded on the front and back of the photo. Plot numbers are consecutive eight digit numbers with the first four digits being the year and the following four digits being the plot number (eg. '19951001'). Forest Management Branch will provide a series of plot numbers to be used. These numbers are to be inked in black on the base adjacent to a black "x". A standardized tally sheet is used to record field measurements. It is essential that the tally sheet be completed in full for each plot.

5.1 Field Sampling Standards

No trees in the plot may be blazed or cut; all tree marking will be done with paint.

Tree Measurement

Species identification	•	All trees must be identified correctly
Breast height	•	± 5 cm of the true breast height
Diameter at breast height	•	(1.3 metres above the ground on the uphill side of the tree). A dbh stick should be used to ensure an exact determination of breast height. Diameter will be record to the nearest 1 mm. Maximum permissible error on any tree is ± 3mm.
Total height of Tree	•	Total height of tree must be recorded to the nearest 0.1 metre. The maximum permissible error ± 1.0 metre for trees 19 metres in height and taller, and ± 5% for trees less than 19 metres tall.
Age	•	Ages are measured to the nearest 1 year.
Ten Year Growth	•	Measure and record the radial increment of the last 10 years to the nearest millimetre.
Crown Closure	•	± 10% for ground measurements

Mapping

Bearing	•	± 2 degrees when using a staff compass or ± 4 degrees when using a Silva compass.
Distance	•	± 2% of the true horizontal distance.

Audits on field work must show accuracy of ∃90% for acceptance.

6.0 Preparation of Photos and Production of Forest Inventory Maps For Hardcopy Method Only

6.1 Photo Preparation

1. Orient photos. Mark each photo with north arrow indicating direction of true north
2. Mark principal (pp) and conjugate points (cpp) on each photo.
3. Delineate area to be interpreted on every other photo (see 6.2).
4. Stereoscopically transfer and extend type boundaries from adjacent photos to ensure consistent typing.

6.2 Delineation of Photo Effective Area

1. Draw straight vertical line through the right hand conjugate principal point on starting photo.
2. Stereoscopically transfer this vertical line to left side of the next photo to be interpreted (every other photo is interpreted working in an east to west line).
3. Draw a straight horizontal line on the north side of the air photo half way between the borders of and the sidelap of the adjacent lines. Transfer this line stereoscopically to the south portion of the adjacent photo.

6.3 Photo Interpretation Steps

1. Draw flight lines on the airphotos to be interpreted and on the 1:250,000 NTS map sheet covered by the air photos.
2. Make preliminary flight along flight lines checking vegetation types. Stands will be ground truthed at photo interpreters discretion.
3. Begin interpretation by delineating stand boundaries and assigning polygon attributes.
4. Draw new flight lines if needed on photos and accompanying 1:250,000 NTS map sheet.
5. Ground truth and re-fly area, checking accuracy of stand boundaries and stand attributes.
6. Edit photos.

6.4 Production of Forest Inventory Maps

1. Transfer data from 1:40,000 interpreted photos to 1:50,000 base map using transfer technology acceptable to Forest Management Branch.
2. Prepare map for digitizing and assigning of attributes by editing line work, eliminating all unnecessary detail and clutter.
3. Enter polygon attributes into database using Forest Management Branch's specifications.
4. Digitize 1:50,000 base map with transferred polygons into digital form.
5. Join digital data with attribute database.
6. Print final mylar copy of 1:50,000 forest inventory map.

7.0 Photogrammetric Transfer

7.1 Map Preparation

Information from 1:40,000 aerial photos must be transferred onto a 1:50,000 NTS base with corrections made for displacement due to relief. The Kail radial arm plotter is presently used in house by Forest Management Branch and has been accepted to date - however where feasible, a method of transferring data from the airphotos directly into a computer map base for GIS may be acceptable, subject to conditions controlling suitable accuracy. All final digital products must be in Arc/INFO format.

The following information must be transferred from photos onto a 1:50,000 NTS basemap: trails, forest cover polygons together with complete forest cover polygon attributes, field plot centres with label and air photo centres with roll and photo number. If a direct method of transfer is used, the contractor must complete coding sheets containing all forest cover polygon attributes and polygons must be numbered directly on air photos using red ink.

Once information has been transferred from the air photos onto a map base it is then necessary to prepare the maps for digitizing and assigning of attributes. The maps must be made as simple and presentable as possible by eliminating all unnecessary detail and clutter without sacrificing the information or accuracy required for a 1:50,000 inventory.

7.1.1 Map Simplification And Clean Up

a. Eliminate all polygons less than 1 cm^2 (except for small lakes and map edge polygons) and join areas to the most similar adjacent polygon. Polygons less than 1 cm^2 which exist along the neat lines will remain and be assigned a polygon number only if the polygons width is greater than 2mm. Polygons less than 2mm wide will be pulled onto the adjacent map sheet and closed off.

b. Join any polygons with the same or very similar forest cover by eliminating lines or bridging small gaps between polygons.

c. Reduce map clutter by simplifying lines.

d. Clean up map lines by ensuring there is a 2 mm gap between all polygon forming lines (eg. forest type lines, double line rivers, lakes, and neat lines).

e. Correct line transfer mistakes, such as omitted lines or incorrect polygon shapes.

7.1.2 Polygon Numbering

a. Polygons are created by forest cover type lines, double line rivers, lakes, and neat lines.

b. Each polygon within each map sheet must be assigned a unique number. Always start with the photo in the northwest corner and numbering from one, work photo by photo through the map sheet.

c. Number polygons consecutively and in a sequential manner so that it is easy to follow the numbering. Use square brackets and an arrow to number small or narrow polygons.

d. Each map sheet will have a progress chart attached to the right hand margin. See APPENDIX C Margin Progress Chart. This chart must be completed in full.

e. Polygons numbered out of order on the basemap must be listed on the margin progress chart together with an identifying locator polygon which is in sequence.

f. Unused polygon numbers and last number used must be documented on margin progress chart

g. When numbering and attributing has been completed, initial and date the lower right hand corner and mark off the progress chart accordingly.

7.2 Final Products for Photogrammetric Transfer

The following products must be submitted to Forest Management Branch by the contractor in a complete and legible format:

- One original copy of each completed NTS base map utilizing NAD 83 data with complete transfer of labelled polygons, air photo centres, and plot centres at 1:50,000 scale.

- Each original copy shall have one photo copy accompanying it to be used for quality checking by Forest Management Branch.

- The method of transferring interpreted data from air photos to a base map shall be approved by Forest Management Branch prior to awarding the contract.

- a method of transferring data from the air photos directly into a computer map base for G.I.S. may be acceptable, subject to conditions controlling suitable accuracy. Final digital product must be in Arc/INFO format.

- If a direct method of transfer (from air photos directly into digital format) is used the contractor must provide Forest Management Branch with completed coding sheets containing all forest cover polygon attributes and polygons must be numbered directly on air photos using red ink.

7.3 Photogrammetric Transfer Quality Control

Polygons selected for audit of interpretation will also be audited for quality control of line transfer.

All polygon boundaries will not have a displacement greater than 1 mm (50 metres ground distance), measured perpendicularly to the polygon line and the extent of the displaced line should not exceed 1/3 of the polygon line. The polygon line is defined as the portion of the polygon boundary between two

adjacent line connections.

Accuracy of polygon boundaries shall be within 1.0 mm equalling ± 50 metres at 1:50,000 scale measured perpendicularly to the polygon line. The extent of the displaced polygon line must be no greater than 1/3 of the line segment length.

Polygon boundaries will also be edge checked with polygon boundaries of adjacent maps. A polygon will not be accepted if tie-in lines with adjacent map sheets are off by more than 1mm.

Field plot centres, photo centres and annotations concerning photo lines (photo number) must be correct at all times.

Minimum size polygon of 25 ha does not apply along map borders (ie. polygons smaller than 25 ha or 1 cm^2 may exist along map border). However, if a transferred polygon border lies less than 2 mm from the neatline the polygon's border must be pulled and closed off on the adjacent map sheet.

Polygon numbering will be completed according to procedures outlined in 2.1.1 Polygon Numbering. Polygon numbering is unacceptable if a polygon:

- has been assigned two or more different polygon numbers;
- has not been assigned a polygon number;
- has been assigned a duplicate polygon number (ie. two polygons on one map sheet with the same number);
- has been assigned an illegible polygon number.

A progress chart must be attached to the right hand margin of all base maps (see Appendix C). **Progress chart must be completed in full.**

All submissions of completed line transfer bases will include a quality control audit form (see page 35 Table 1: Photogrammetric Transfer and Attribute Database Work Audit - Submission #2) signed by the contractor manager.

The audit process will include 15% of the polygons on each 1:50,000 map sheet. These polygons will be the same polygons selected for audit of interpretation. These polygons will be examined for the following discrepancies:

- polygon boundary, polygon number, field plot centre, air photo centre, and tie-in with adjacent photo base when necessary.

A polygon considered unacceptable will be assigned a "1" in the appropriate row/column on the audit form. A weight is assigned to each class of discrepancy.

The percent accuracy on each map sheet will be calculated as:

$$\text{Accuracy} = \left[1 - \frac{\text{Total weighted discrepancies}}{\text{Total \# of checked polygons}}\right] * 100$$

Photogrammetric transfer - acceptance accuracy ∃ 90%. Map sheets with accuracy below 90% will be sent back to the contractor to be corrected. Base map labelling accuracy is 100% for acceptance.

Table 1: Photogrammetric transfer and attribute database work audit - submission # 2

Contractor: Interpreter: Date of Work:

Number of polygons on mapsheet: Number of polygons checked on this mapsheet (sample intensity. 15%): Mapsheet:				Total Discrepancies Weighted (d)
PHOTO DETAIL TRANSFER TO BASE	Weight	Polygon Number - Discrepancy Noted/Counted		
Polygon boundaries	1.5			
Polygon numbering	1.5			
Field plot centre	1.0			
Photo Centre	1.0			

BASE MAP LABELLING	Value	Audit Score	Accuracy = [1 - _____d_____] 100 = % d total # of checked polygons Acceptance =. 90%
Photo roll number	10		
Photo line number	10		COMMENTS:
Photo print numbers	10		
Omitted/additional poly #'s	10		
Forest Polygon labels	10		
Tie-in to adjacent bases	10		
Interpreter's name	10		
Company's name	10		
Interpretation date	10		
Mapsheet boundaries	10		
100 required for approval **Total Value**			

Quality Control - Creation of Digital Data Base

Accuracy = [1 - ___# of errors___] x 100 = %
# of polygons on mapsheet

Acceptance =. 99%

I hereby certify that this quality control audit has been completed and this work meets or exceeds the contract specifications.
Authorized company Signing Official: _____ Date:_____

8.0 DIGITAL MAP PRODUCTION

8.1 Map Elements

The following coverages must be included in the final digital product:

Description	Arc/INFO Coverages Required	Coverage Type
Water bodies	FWAT_A	area
Water courses	FWAT	line
Wetland	FWET	area
Snow and Ice	FICE	area
Transportation and other access	FTRN	line
Elevation contours	FCON	line, point
Water secondary features	FHYD	line, point
Water secondary features	FHYD_A	area
Cultural features	FCUL	line, point
Cultural features	FCUL_A	area
Vegetation - forest	FVEG	area
Misc. Physiographic features	FPHY	line, point
Misc. Physiographic features	FPHY_A	area
Place names (Toponomy)	FTOP	point
Yukon Vegetation Inventory	FYVI	area
Forest Management Units	FFMU	area
Sample Plots	FPLOT	point
Air Photo Centres	FAIR	point

8.2 Forest Management Branch Database Descriptions

8.2.1 Vegetation Inventory Database Structure

Coverage Name: FYVI
Coverage Type: area

Field	Field Name	Description	Type	Width	Decimals
1	FCOV-ID	Polygon Number	Numeric	5	0
2	AREA	Polygon area	Numeric	12	3
3	MAP	NTS 1:50,000 series map number	Character	6	
4	LANDPOS	Landscape position	Character	1	
5	SMR	Soil moisture regime	Character	1	
6	TYPE_IND	Land cover type	Character	2	
7	CLASS	Land cover class	Character	2	
8	CL_MOD	Land cover class modifier	Character	3	
9	SP1	Species 1	Character	2	
10	SP1_PER	Species 1 percent composition	Numeric	3	0
11	SP2	Species 2	Character	2	
12	SP2_PER	Species 2 percent composition	Numeric	3	0
13	SP3	Species 3	Character	2	
14	SP3_PER	Species 3 percent composition	Numeric	3	0
15	SP4	Species 4	Character	2	
16	SP_4PER	Species 4 percent composition	Numeric	3	0

17	AVG_HT	Average height (m)	Numeric	2	0
18	MIN_HT	Minimum height (m)	Numeric	2	0
19	MAX_HT	Maximum height (m)	Numeric	2	0
20	CC	Crown closure (%)	Numeric	3	0
21	AGE	Age (years)	Numeric	3	0
22	REF_YEAR	Reference year	Numeric	4	
23	SITE_CLASS	Site class	Character	1	
24	SITE_INDEX	Site index	Numeric	2	0
25	STRATUM	Stratum code	Character	4	
26	DIST_CODE1	Disturbance Code	Character	6	
27	DIST_CODE2	Disturbance Code	Character	6	
28	FIELD__PLT	Field Plot	Character	8	
29	TYPE_FOR	Forest Cover TYPE	Character	3	

8.2.2 Sample Plot Database Structure

Coverage Name: FPLOT
Coverage Type: point

Field	Field Name	Description	Type	Width	Decimals
1	PLOT_ID	Sample number	Character	8	
2	TYPE	Sample type	Character	3	
3	METHOD	Method of collecting data	Character	16	

Two codes used to identify sample types are:

CODE	PLOT TYPE
PSP	Permanent Sample Plot
TSP	Temporary Sample Plot

Sample plot numbers are assigned by Forest Management Branch for new plots and will be provided for existing plots.

Three codes used to identify sample methods for TSP ‘s are

TYPE	METHOD
TSP	Air call
TSP	Prism Plot
TSP	Sample Tree

8.2.3 Aerial Photo Database Structure

Coverage Name: FAIR
Coverage Type: point

Field	Field Name	Description	Type	Width	Decimals
1	Roll	Aerial photo roll number	Character	6	
2	Photo	Aerial photo number	Character	3	

8.3 Final Products for Digital Forest Cover Map Production

- Digital maps must be in ARC/INFO format provided on media compatible with Forest Management Branch's hardware.

- Maps must be vector clean with documentation of quality control to Forest Management Branch specifications (edge checked, polygons numbered sequentially one number per polygon, all numbers unique to map sheet) and must utilize NTS 1:50,000 NAD 83 series base map information. Map must also contain attached databases in Forest Management Branch specified format completed to Forest Management Branch Specifications, including areas generated during polygon formation.

- Maps must contain all coverages specified in section 8.1

- Hardcopy final maps must be plotted.

- All aerial photography must be returned with active area identified, delineated stand boundaries, labels, polygon numbers, principle points and conjugate principle points using pen size 0 (.35).

- Field plot notes, increment cores and map of field plot locations must be submitted.

8.4 Digital Map Production Quality Control

A minimum of two audits will be conducted during the completion of this work:

1. Digital database attribute database - acceptance accuracy ∃ 99%
2. Digital map production

8.4.1 Polygon Attribute Entry

Quality control of digitally entered attributes will be completed by the contractor. Digital attributes must have less than 1% error per map sheet. An error in coding of attributes is considered to be one or more codes in single record coded incorrectly.

All quality control reports of coding attributes for map sheets are to be supplied to Forest Management Branch by the contractor.

8.4.2 Digital Map Production

Digitizing of polygon boundaries and base information must conform to Forest Management Branch Standards as outlined in this document.

Polygons selected for audit of interpretation will also be audited for quality control of digitizing. Ninety percent of all forest cover type lines digitized shall be accurate to with 50 metres (1 mm at map scale) of their true position. All topographic features, forest polygons management unit boundaries must be digitized to an accuracy of 1 mm or less that which is on the source document. All topographic features and management units must be labelled correctly. All forest polygons must have unique numbers. Flight lines and photo numbers must be digitized in correct location. All polygon joins must be clipped and neat (no overhangs).

All polygons shall be explicitly closed on themselves, the map neatline, double line rivers, lakes greater than 1 cm in size, roads greater than 30 metres wide, national parks, provincial boundaries or international boundaries. Interpretation will be limited to outside national parks and inside the Yukon Territory.

Maps must be vector clean with documentation of quality control to Forest Management Branch specifications (edge checked, polygons numbered sequentially one number per polygon). Map must also contain attached database in Forest Management Branch specified format completed to Forest Management Branch specifications. All files associated with the map must be checked to ensure that there are no corrupt elements.

Final digital product must be in Arc/INFO format.

All final digital maps with attached forest cover databases will include a quality control audit form signed by the contractor manager (see Page 42, Digital Map Production Audit - Submission #3).

Digital Map Production Audit – Subsmission #3

Contractor: Digitizer: Date of Work:

Number of polygons on mapsheet: Number of polygons checked on this mapsheet (sample intensity. 15%): Mapsheet:			Total Discrepancies Weighted (d)
PHOTO DETAIL TRANSFER TO BASE	Weight	Polygon Number - Discrepancy Noted/Counted	
Polygon boundaries	1.5		
Polygon numbering	1.5		
Field plot centre	1.0		
Photo Centre	1.0		

BASE MAP LABELLING	Value	Audit Score
Photo roll, line, print number	10	
Omitted/additional poly #'s	10	
Forest Polygon labels (placement)	10	
Forest Polygon labels (content)	10	
Tie-in to adjacent bases	10	
Geographic grid, coordinate location	10	
Legend	10	
Company's name	10	
Map sheet boundaries	10	
Neat linework (no overhands/double linework)	10	
Polygons closed and map vector clean	10	
All information present and labelled on appropriate level	10	
120 required for approval **Total Value**		

Accuracy = [1 - _____d_____] 100 = % d
total # of checked polygons

Acceptance =. 90%

COMMENTS:

I hereby certify that this quality control audit has been completed and this work meets or exceeds the contract specifications.
Authorized company Signing Official: _____ Date:_____

ANY EDITS PERFORMED DURING THE COMPLETION OF WORK MUST BE TRANSFERRED TO ALL MATERIALS (ie. photo, base maps, databases etc.)

Appendix A - Base Map Specifications

The standard base maps for the Yukon Vegetation Inventory are the National Topographic Series 1:50,000 scale digital data. The datum for these maps is NAD 83.

The following specifications describe the structure and format of Arc/INFO coverages required from the translation of National Topographic Series 1:50,000 scale digital data. These data are provided by Geomatics Canada, Centre for Topographic Information in CCOGIF format.

CCOGIF to Arc/INFO Translation Specifications:

A. Coverage Names and Descriptions

Description	Arc/INFO Coverages Required	Coverage Type
1. Water bodies	FWAT_A	area
2. Water courses	FWAT	line
3. Wetland	FWET	area
4. Snow and Ice	FICE	area
5. Transportation and other access	FTRN	line
6. Elevation contours	FCON	line, point
7. Water secondary features	FHYD	line, point
8. Water secondary features	FHYD_A	area
9. Cultural features	FCUL	line, point
10. Cultural features	FCUL_A	area
11. Vegetation - forest	FVEG	area
12. Misc. Physiographic features	FPHY	line, point
13. Misc. Physiographic features	FPHY_A	area
14. Place names (Toponomy)	FTOP	point

B. List of NTDB Entities Required to Generate Arc/INFO Coverages

The following table shows the required Arc/INFO coverages with the NTDB entity names that will be combined to construct them. Note that some of the entity names are found both in the area and line/point coverages, as this is the original data structure.

GIS COVER DESCRIPTION	ARC/INFO COVER NAME	OBJECT	NTDB ENTITY NAME	
1. Water bodies	FWAT_A	area	WATERBODY	
2. Watercourse	FWAT	line	WATERCOURSE	
3. Wetland	FWET		WETLAND PALSA BOG STRING BOG	
4. Snow and Ice	FICE	area	PERMANENT SNOW AND ICE	
5. Transportation and other access	FTRN	line	CUT LINE PIPELINE: NATURAL GAS, ABOVEGROUND RAILWAY ROADS: ALL TYPES TRANSMISSION LINE TRAIL TRAIL: PORTAGE	
6. Elevation contours	FCON	line point	BREAKLINE CENTROID CONTOUR ELEVATION POINT: PRECISE ALTITUDE ELEVATION POINT: SPOT HEIGHT	
7. Water, secondary features	FHYD	line point	DISAPPEARING STREAM FALLS FORD RAPIDS SPRING	
8. Water, secondary features	FHYD_A	area	DRY RIVER BED FLOODED AREA FORESHORE FLATS NAVIGABLE CANAL RAPIDS RESERVOIR TUNDRA POND WATERBODY: INTERMITTENT/SLOUGH WATERBODY: IN STRING BOG	
9. Cultural features	FCUL	line point	AERIAL CABLEWAY BARRIER/GATE BEACON BOAT RAMP BREAKWALL/BREAK WATER BRIDGE	NAVIGATION BEACON NAVIGATION LIGHT OIL/GAS FACILITIES PARABOLIC ANTENNA PICNIC SITE RESERVOIR

GIS COVER DESCRIPTION	ARC/INFO COVER NAME	OBJECT	NTDB ENTITY NAME	
			BUILDING BURNER CAMP CAMPGROUND CEMETERY CHIMNEY CONDUIT CONVEYOR CRANE CROSS DAM DRIVE-IN THEATRE DYKE/LEVEE EXPOSED SHIPWRECK FERRY ROUTE FENCE FISH LADDER FOOTBRIDGE GOLF DRIVING RANGE GREENHOUSE HELIPORT HISTORIC SITE/POINT OF INTEREST IRRIGATION CANAL/DITCH LOCK GATE LOOKOUT MARINA/YACHT CLUB MINE: ABANDONED MINE: OPERATIONAL,OPEN-PIT NAVIGABLE CANAL	RUINS RUNWAY: AIRFIELD SEAPLANE BASE SEAWALL SHRINE SILO SKI AREA SKI JUMP SLUICE GATE SNOWSHED SPORTS/RACE TRACK SWIMMING POOL (OUTDOOR) TANK TOWER: CLEARANCE TOWER: COMMUNICATION TOWER: CONTROL TOWER: FIRE TOWER: LOOKOUT TRANSFORMER STATION (ELECTRIC) TRANSMISSION LINE TUNNEL TURNTABLE (RAILWAY) VALVE WASTE: SETTLING POND WASTE: SEWAGE DISPOSAL WELL WHARF WIND-OPERATED DEVICE
10. Cultural features	FCUL_A	area	AMUSEMENT PARK AUTO WRECKER BUILT-UP AREA BOTANICAL GARDEN BREAKWALL/BREAKWATER BUILDING CAMPGROUND CAUSEWAY CEMETERY CUT DAM DRIVE-IN THEATRE DRYDOCK	

GIS COVER DESCRIPTION	ARC/INFO COVER NAME	OBJECT	NTDB ENTITY NAME
			DUMP: ABANDONED DUMP: OTHER EXHIBITION GROUND/FAIRGROUND FISH POUND FORT GOLF COURSE GOLF DRIVING RANGE GREENHOUSE IRRIGATION CANAL/DITCH LOCK GATE LOOKOUT LUMBER YARD MINE: ABANDONED MINE: OPERATIONAL,OPEN-PIT MOBILE HOME PARK OIL/GAS FACILITIES PARK/SPORTS FIELD PEAT CUTTING PICNIC SITE PIT QUARRY RUINS RUNWAY: AIRFIELD SLIP SLUICE GATE SPORTS/RACE TRACK STADIUM STOCKPILE STOCKYARD SWIMMING POOL (OUTDOOR) TANK TRANSFORMER STATION (ELECTRIC) TREE NURSERY WASTE: SETTLING POND WASTE: SEWAGE DISPOSAL WHARF ZOO
11. Vegetation – forest	FVEG	area	VEGETATION: WOODED AREA
12. Misc. physiographic features	FPHY	line point	CAVE ENTRANCE ESKER OBSTACLE IN WATER PINGO ROCK IN WATER
13. Misc. physiographic features	FPHY_A	area	EMBANKMENT KELP MORAINE ROCKY LEDGE/REEF SAND TUNDRA POLYGON

GIS COVER DESCRIPTION	ARC/INFO COVER NAME	OBJECT	NTDB ENTITY NAME
14. Place names (Toponomy)	FTOP	point	TOPONYM: HYDROGRAPHY TOPONYM: PLACE TOPONYM: RELIEF TOPONYM: SHORELINE TOPONYM: TRANSPORT

C. Master List of All 1:50,000 Scale NTDB Entities and Their Attributes

The CCOGIF attributes that are required for the generated ARC/IFO coverages are:

a) NTDB ENTITY CODE
b) NTDB EXPLICIT CODE
c) FIXED ATTRIBUTE 1
d) FIXED ATTRIBUTE 2
e) FIXED ATTRIBUTE 3
f) FIXED ATTRIBUTE 4
g) FIXED ATTRIBUTE 5
h) FIXED ATTRIBUTE 6

The following list details the NTDB entities as provided by Geomatics Canada.

ENTITY NAMES	OBJECT	NTDB ENTITY CODE	FIXED ATTRIBUTES	NTDB EXPLICIT CODE
AERIAL CABLEWAY: OTHER	L	10	1	11
AERIAL CABLEWAY: SKI LIFT	L	10	2	12
AMUSEMENT PARK	A	23		23
AUTO WRECKER	A	34		34
BARRIER/GATE: OTHER	P	45	1	46
BARRIER/GATE: TOLLGATE	P	45	2	47
BOAT RAMP	P	58		58
BOTANICAL GARDEN	A	69		69
BREAKLINE	L	1547		1547
BREAKWALL/BREAKWATER	LA	80		80
BRIDGE: COVERED	L	91	1	92
BRIDGE: MOVEABLE SURFACE	L	91	2	93
BRIDGE: OTHER	L	91	3	94
BUILDING: ARENA	PA	105	1	106
BUILDING: ARMOURY	PA	105	2	107
BUILDING: AUTOMOBILE PLANT	PA	105	3	108
BUILDING: BARN/MACHINERY SHED	PA	105	4	109
BUILDING: CABIN	PA	105	5	110
BUILDING: CEMENT PLANT	PA	105	6	111
BUILDING: CHEMICAL PLANT	PA	105	7	112
BUILDING: CHURCH	PA	105	8	113
BUILDING: CITY HALL	PA	105	9	114
BUILDING: COAST GUARD STATION	PA	105	10	115
BUILDING: COLLEGE	PA	105	11	116
BUILDING: COMMUNITY CENTRE	PA	105	12	117
BUILDING: CONVENT	PA	105	13	118
BUILDING: CORRECTIONAL INSTITUTE	PA	105	14	119
BUILDING: COURTHOUSE	PA	105	15	120
BUILDING: CUSTOMS POST	PA	105	16	121
BUILDING: DOME	PA	105	17	122
BUILDING: ELECTRIC POWER STATION	PA	105	18	123
BUILDING: FACTORY	PA	105	19	124
BUILDING: FILTRATION PLANT	PA	105	20	125
BUILDING: FIRE STATION	PA	105	21	126
BUILDING: FIRE/POLICE STATION	PA	105	22	127
BUILDING: FISH HATCHERY	PA	105	23	128
BUILDING: FISH PROCESSING PLANT	PA	105	24	129
BUILDING: GRAIN ELEVATOR	PA	105	25	130
BUILDING: HALL	PA	105	26	131
BUILDING: HIGHWAY SERVICE CENTRE	PA	105	27	132
BUILDING: HOSPITAL	PA	105	28	133
BUILDING: HOSTEL	PA	105	29	134
BUILDING: HOTEL	PA	105	30	135
BUILDING: KILN (TOBACCO)	PA	105	31	136
BUILDING: LUMBER MILL	PA	105	32	137
BUILDING: MEDICAL CENTRE	PA	105	34	139
BUILDING: MONASTERY	PA	105	35	140
BUILDING: MOTEL	PA	105	36	141
BUILDING: MUNICIPAL HALL	PA	105	37	142
BUILDING: MUSEUM	PA	105	38	143
BUILDING: NON-CHRISTIAN PLACE OF WORSHIP	PA	105	39	144
BUILDING: OBSERVATORY	PA	105	40	145
BUILDING: OIL/GAS FACILITIES BUILDING	PA	105	41	146
BUILDING: OTHER	PA	105	42	147
BUILDING: OUTBUILDING	PA	105	43	148
BUILDING: PARLIAMENT BUILDING	PA	105	44	149
BUILDING: PENITENTIARY	PA	105	45	150
BUILDING: PETROLEUM REFINERY	PA	105	46	151
BUILDING: PLANT	PA	105	47	152
BUILDING: POLICE STATION	PA	105	48	153
BUILDING: PULP/PAPER MILL	PA	105	49	154

BUILDING: RAILWAY STATION	PA	105	50	155
BUILDING: REFORMATORY	PA	105	51	156
BUILDING: SANATORIUM	PA	105	52	157
BUILDING: SATELLITE-TRACKING STATION	PA	105	53	158
BUILDING: SAWMILL	PA	105	54	159
BUILDING: SCHOOL	PA	105	55	160
BUILDING: SEMINARY	PA	105	56	161
BUILDING: SENIOR CITIZENS HOME	PA	105	57	162
BUILDING: SEWAGE TREATMENT PLANT	PA	105	58	163
BUILDING: SHIPYARD	PA	105	59	164
BUILDING: SHOPPING CENTRE	PA	105	60	165
BUILDING: SPORTSPLEX	PA	105	61	166
BUILDING: STEEL MILL	PA	105	62	167
BUILDING: TRADING POST	PA	105	63	168
BUILDING: UNIVERSITY	PA	105	64	169
BUILDING: WARDEN/RANGER STATION	PA	105	65	170
BUILDING: WATER TREATMENT PLANT	PA	105	66	171
BUILDING: WEIGH SCALE (HIGHWAY)	PA	105	67	172
BUILT-UP AREA	A	184		184
BURNER	P	195		195
CAMP	P	206		206
CAMPGROUND	PA	217		217
CAUSEWAY	A	228		228
CAVE ENTRANCE	P	239		239
CEMETERY	PA	250		250
CENTROID	P	2045		2045
CHIMNEY: FLARE STACK	P	261	1	262
CHIMNEY: INDUSTRIAL	P	261	2	263
CONDUIT: ABOVEGROUND, PENSTOCK	L	274	1 2	275
CONDUIT: UNDERGROUND, PENSTOCK	L	274	2 2	276
CONDUIT: ABOVEGROUND, OTHER	L	274	1 1	277
CONDUIT: UNDERGROUND, OTHER	L	274	2 1	278
CONDUIT BRIDGE	L	289		289
CONTOUR: DEPRESSION, COLLECTED	L	1558	1 1	1559
CONTOUR: DEPRESSION, DERIVED	L	1558	1 2	1560
CONTOUR: OTHER, COLLECTED	L	1558	2 1	1561
CONTOUR: OTHER, DERIVED	L	1558	2 2	1562
CONVEYOR	L	300		300
CRANE: MOVEABLE	PL	311	1	312
CRANE: STATIONARY	PL	311	2	313
CROSS	P	324		324
CUT	A	335		335
CUT LINE: FIREBREAK	L	346	1	347
CUT LINE: OTHER	L	346	2	348
DAM	PLA	359		359
DISAPPEARING STREAM: OTHER	P	370	1	371
DISAPPEARING STREAM: SINKHOLE	P	370	2	372
DRIVE-IN THEATRE	PA	383		383
DRY RIVER BED	A	394		394
DRYDOCK	A	405		405
DUMP: ABANDONED	A	416	1	417
DUMP: OTHER	A	416	2	418
DYKE/LEVEE	L	429		429
ELEVATION POINT: HYBRID	P	1573	1	1574
ELEVATION POINT: PRECISE ALTITUDE	P	1573	2	1575
ELEVATION POINT: SPOT HEIGHT	P	1573	3	1576
EMBANKMENT	A	440		440
ESKER	L	451		451
EXHIBITION GROUND/FAIRGROUND: EXHIBITION GROUND	A	462	1	463
EXHIBITION GROUND/FAIRGROUND: FAIRGROUND	A	462	2	464
EXPOSED SHIPWRECK	P	475		475
FALLS	PL	486		486
FENCE	L	497		497
FERRY ROUTE	PL	508		508
FISH LADDER	P	519		519
FISH POUND	A	530		530
FLOODED AREA	A	541		541
FOOTBRIDGE	L	552		552

FORD	PL	563		563
FORESHORE FLATS	A	574		574
FORT	A	585		585
GOLF COURSE	A	596		596
GOLF DRIVING RANGE	PA	607		607
GREENHOUSE	PA	618		618
HELIPORT	P	629		629
HISTORIC SITE/POINT OF INTEREST	P	640		640
IRRIGATION CANAL/DITCH	LA	651		651
KELP	A	662		662
LOCK GATE	PL	673		673
LOOKOUT	PA	684		684
LUMBER YARD	A	695		695
MARINA/YACHT CLUB: MARINA	P	701	1	702
MARINA/YACHT CLUB: YACHT CLUB	P	701	2	703
MINE: ABANDONED,N/A	PA	706	1 1	707
MINE: OPERATIONAL,OPEN-PIT	PA	706	2 2	708
MINE: OPERATIONAL,OTHER	PA	706	2 3	709
MOBILE HOME PARK	A	720		720
MORAINE	A	731		731
NAVIGABLE CANAL: ABANDONED	LA	742	1	743
NAVIGABLE CANAL: OPERATIONAL	LA	742	2	744
NAVIGATION BEACON	P	755		755
NAVIGATION LIGHT	P	766		766
NEATLINE	L	1536		1536
OBSTACLE IN WATER	P	777		777
OIL/GAS FACILITIES	PA	788		788
PALSA BOG	A	799		799
PARABOLIC ANTENNA: RADAR	P	810	1	811
PARABOLIC ANTENNA: RADIO TELESCOPE	P	810	2	812
PARK/SPORTS FIELD	A	823		823
PEAT CUTTING	A	834		834
PERMANENT SNOW AND ICE: DEBRIS-COVERED ICE	A	845	1	846
PERMANENT SNOW AND ICE: OTHER	A	845	2	847
PICNIC SITE	PA	858		858
PINGO	P	869		869
PIPELINE: NATURAL GAS ,ABOVEGROUND	L	880	1 1	881
PIPELINE: NATURAL GAS,UNDERGROUND	L	880	1 2	882
PIPELINE: OIL,ABOVEGROUND	L	880	2 1	883
PIPELINE: OIL,UNDERGROUND	L	880	2 2	884
PIPELINE: SEWAGE/WASTE,ABOVEGROUND	L	880	3 1	885
PIPELINE: UNKNOWN,ABOVEGROUND	L	880	4 1	886
PIPELINE: UNKNOWN,UNDERGROUND	L	880	4 2	887
PIPELINE: MULTIUSE, ABOVEGROUND	L	880	5 1	890
PIPELINE: MULTIUSE, UNDERGROUND	L	880	5 2	891
PIT	A	898		898
POND PARTITION: FISH POUND	L	909	1	910
POND PARTITION: RESERVOIR	L	909	2	911
POND PARTITION: WASTE	L	909	3	912
QUARRY	A	923		923
RAILWAY: N/A,N/A,ABANDONED,N/A	L	934	2 3 1 2	935
RAILWAY: NARROW GAUGE,N/A,OPERATIONAL,N/A	L	934	1 3 2 2	936
RAILWAY: NARROW GAUGE,N/A,OPERATIONAL,SIDE TRACK	L	934	1 3 2 3	937
RAILWAY: SPECIAL,DEPRESSED,OPERATIONAL,MULTIPLE	L	934	3 1 2 1	938
RAILWAY: SPECIAL,DEPRESSED,OPERATIONAL,SINGLE	L	934	3 1 2 4	939
RAILWAY: SPECIAL,ELEVATED,OPERATIONAL,MULTIPLE	L	934	3 2 2 1	940
RAILWAY: SPECIAL,ELEVATED,OPERATIONAL,SINGLE	L	934	3 2 2 4	941
RAILWAY: SPECIAL,N/A,UNDER CONSTRUCTION,MULTIPLE	L	934	3 3 3 1	942
RAILWAY: SPECIAL,N/A,UNDER CONSTRUCTION,SINGLE	L	934	3 3 3 4	943
RAILWAY: SPECIAL,OTHER,OPERATIONAL,MULTIPLE	L	934	3 4 2 1	944
RAILWAY: SPECIAL,OTHER,OPERATIONAL,SINGLE	L	934	3 4 2 4	945
RAILWAY: STANDARD GAUGE,DEPRESSED,OPERATIONAL,MULTIPLE	L	934	4 1 2 1	946
RAILWAY: STANDARD GAUGE,DEPRESSED,OPERATIONAL,SIDE TRACK	L	934	4 1 2 3	947
RAILWAY: STANDARD GAUGE,DEPRESSED,OPERATIONAL,SINGLE	L	934	4 1 2 4	948
RAILWAY: STANDARD GAUGE,ELEVATED,OPERATIONAL,MULTIPLE	L	934	4 2 2 1	949
RAILWAY: STANDARD GAUGE,ELEVATED,OPERATIONAL,SIDE TRACK	L	934	4 2 2 3	950
RAILWAY: STANDARD GAUGE,ELEVATED,OPERATIONAL,SINGLE	L	934	4 2 2 4	951
RAILWAY: STANDARD GAUGE,N/A,UNDER CONSTRUCTION,MULTIPLE	L	934	4 3 3 1	952

RAILWAY: STANDARD GAUGE,N/A,UNDER CONSTRUCTION,SINGLE	L	934			4	3	3	4	953
RAILWAY: STANDARD GAUGE,OTHER,OPERATIONAL,MULTIPLE	L	934			4	4	2	1	954
RAILWAY: STANDARD GAUGE,OTHER,OPERATIONAL,SIDE TRACK	L	934			4	4	2	3	955
RAILWAY: STANDARD GAUGE,OTHER,OPERATIONAL,SINGLE	L	934			4	4	2	4	956
RAPIDS	PLA	967							967
RESERVOIR: OPEN, DRINKING WATER RESERVOIR	PA	978					1	1	979
RESERVOIR: UNDERGROUND,DRINKING WATER RESERVOIR	PA	978					2	1	980
RESERVOIR: OPEN,DUGOUT	PA	978					1	2	981
RESERVOIR: OPEN,FILTRATION POND	PA	978					1	3	982
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,DEPR.,OPER.,HARD	L	993		1	3	1	1	1	994
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,ELEV.,OPER.,HARD	L	993	1	1	3	2	1	1	995
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,N/A,U/C,HARD	L	993	1	1	3	3	3	1	996
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,N/A,U/C,LOOSE	L	993	1	1	3	3	3	2	997
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,OTHER,OPER.HARD	L	993	1	1	3	4	1	1	998
ROAD: LESS THAN 2 LANES,ALL SEASON,UNDIV.,OTHER,OPER.,LOOSE	L	993	1	1	3	4	1	2	999
ROAD: MORE THAN 2 LANES,ALL SEASON,UNDIV.,DEPR.,OPER.,HARD	L	993	2	1	3	1	1	1	1000
ROAD: MORE THAN 2 LANES,ALL SEASON,UNDIV.,ELEV.,OPER.,HARD	L	993	2	1	3	2	1	1	1001
ROAD: MORE THAN 2 LANES,ALL SEASON,UNDIV.,N/A,U/C,HARD	L	993	2	1	3	3	3	1	1002
ROAD: MORE THAN 2 LANES,ALL SEASON,UNDIV.,OTHER,OPER.,HARD	L	993	2	1	3	4	1	1	1003
ROAD: N/A,CART TRACK,N/A,OTHER,OPER.,LOOSE	L	993	3	2	2	4	1	2	1004
ROAD: N/A,DRY WEATHER,UNDIV.,OTHER,OPER.,LOOSE	L	993	3	3	3	4	1	2	1005
ROAD: N/A,N/A,UNDIV.,OTHER,UNCLASSIFIED,N/A	L	993	3	4	3	4	2	3	1006
ROAD: N/A,RAPID TRANSIT,N/A,DEPR.,OPER.,HARD	L	993	3	5	2	1	1	1	1007
ROAD: N/A,RAPID TRANSIT,N/A,ELEV.,OPER.,HARD	L	993	3	5	2	2	1	1	1008
ROAD: N/A,RAPID TRANSIT,N/A,OTHER,OPER.,HARD	L	993	3	5	2	4	1	1	1009
ROAD: N/A,RAPID TRANSIT,N/A,N/A,U/C,HARD	L	993	3	5	2	3	3	1	1010
ROAD: N/A,STREET,N/A,N/A,OPER.,HARD	L	993	3	6	2	3	1	1	1011
ROAD: N/A,STREET,N/A,N/A,OPER.,LOOSE	L	993	3	6	2	3	1	2	1012
ROAD: N/A,WINTER,N/A,OTHER,OPER.,LOOSE	L	993	3	7	2	4	1	2	1027
ROAD: 2 LANES,ALL SEASON,UNDIV.,DEPR.,OPER.,HARD	L	993	4	1	3	1	1	1	1013
ROAD: 2 LANES,ALL SEASON,UNDIV.,ELEV.,OPER.,HARD	L	993	4	1	3	2	1	1	1014
ROAD: 2 LANES,ALL SEASON,UNDIV.,N/A,U/C,HARD	L	993	4	1	3	3	3	1	1015
ROAD: 2 LANES,ALL SEASON,UNDIV.,OTHER,OPER.,HARD	L	993	4	1	3	4	1	1	1016
ROAD: 2 LANES OR MORE,ALL SEASON,DIV.,DEPR.,OPER.,HARD	L	993	5	1	1	1	1	1	1017
ROAD: 2 LANES OR MORE,ALL SEASON,DIV.,ELEV.,OPER.,HARD	L	993	5	1	1	2	1	1	1018
ROAD: 2 LANES OR MORE,ALL SEASON,DIV.,N/A,U/C,HARD	L	993	5	1	1	3	3	1	1019
ROAD: 2 LANES OR MORE,ALL SEASON,DIV.,OTHER,OPER.,HARD	L	993	5	1	1	4	1	1	1020
ROAD: 2 LANES OR MORE,ALL SEASON,UNDIV.,N/A,U/C,LOOSE	L	993	5	1	3	3	3	2	1021
ROAD: 2 LANES OR MORE,ALL SEASON,UNDIV.,OTHER,OPER.,LOOSE	L	993	5	1	3	4	1	2	1022
ROCK IN WATER	P	1033							1033
ROCKY LEDGE/REEF	A	1044							1044
RUINS	PA	1055							1055
RUNWAY: AIRFIELD,CONDITION UNKNOWN,N/A	PA	1066				1	2	3	1067
RUNWAY: AIRFIELD,OPERATIONAL,HARD SURFACE	PA	1066				1	3	1	1068
RUNWAY: AIRFIELD,OPERATIONAL,LOOSE SURFACE	PA	1066				1	3	2	1069
RUNWAY: AIRPORT,OPERATIONAL,HARD SURFACE	PA	1066				2	3	1	1070
RUNWAY: N/A,ABANDONED,N/A	PA	1066				3	1	3	1071
SAND: OTHER	A	1082						2	1083
SAND: UNDERWATER	A	1082						1	1084
SEAPLANE BASE/ANCHORAGE: ANCHORAGE	P	1095						1	1096
SEAPLANE BASE/ANCHORAGE: BASE	P	1095						2	1097
SEAWALL	L	1108							1108
SHRINE	P	1119							1119
SILO	P	1130							1130
SKI AREA	P	1141							1141
SKI JUMP	P	1152							1152
SLIP	A	1163							1163
SLUICE GATE	PL	1174							1174
SNOWSHED	L	1185							1185
SPORTS/RACE TRACK: DRAG STRIP	LA	1196						1	1197
SPORTS/RACE TRACK: OTHER	LA	1196						2	1198
SPRING	P	1209							1209
STADIUM	A	1220							1220
STOCKPILE	A	1231							1231
STOCKYARD	A	1242							1242
STRING BOG	A	1253							1253
SWIMMING POOL (OUTDOOR)	PA	1264							1264
TANK: HORIZONTAL,N/A	PA	1275					1	1	1276

TANK: VERTICAL,OTHER	PA	1275	2 2	1277
TANK: VERTICAL,WATER	PA	1275	2 3	1278
TOPONYM: HYDROGRAPHY	P	1850	2	1852
TOPONYM: PLACE	P	1850	1	1851
TOPONYM: RELIEF	P	1850	4	1854
TOPONYM: SHORELINE	P	1850	3	1853
TOPONYM: TRANSPORT	P	1850	5	1855
TOWER: CLEARANCE	P	1289	1	1290
TOWER: COMMUNICATION	P	1289	2	1291
TOWER: CONTROL	P	1289	3	1292
TOWER: FIRE	P	1289	4	1293
TOWER: LOOKOUT	P	1289	5	1294
TRAIL: OTHER	L	1305	1	1306
TRAIL: PORTAGE	L	1305	2	1307
TRANSFORMER STATION (ELECTRIC)	PA	1318		1318
TRANSMISSION LINE: POWER,OTHER	L	1329	1 1	1330
TRANSMISSION LINE: POWER,SUBMARINE	L	1329	1 2	1331
TRANSMISSION LINE: TELEPHONE,OTHER	L	1329	2 1	1332
TREE NURSERY	A	1343		1343
TUNDRA POLYGON	A	1354		1354
TUNDRA POND	A	1365		1365
TUNNEL	L	1376		1376
TURNTABLE (RAILWAY)	P	1387		1387
VALVE	P	1398		1398
VEGETATION: ORCHARD	A	1409	1	1410
VEGETATION: VINEYARD/HOPFIELD	A	1409	2	1411
VEGETATION: WOODED AREA	A	1409	3	1412
WALL	L	1423		1423
WASTE: OTHER, LIQUID	PA	1434	1 1	1435
WASTE: SETTLING POND,LIQUID	PA	1434	2 1	1436
WASTE: SEWAGE DISPOSAL POND,LIQUID	PA	1434	3 1	1437
WASTE: OTHER,SOLID	PA	1434	1 2	1438
WATERBODY: INTERMITTENT/SLOUGH	A	1449	1	1450
WATERBODY: IN STRING BOG	A	1449	2	1451
WATERBODY: OTHER	A	1449	3	1452
WATERCOURSE	L	1463		1463
WELL: BRINE	P	1478	1	1479
WELL: PETROLEUM	P	1478	2	1480
WELL: WATER	P	1478	3	1481
WETLAND	A	1492		1492
WHARF	LA	1503		1503
WIND-OPERATED DEVICE	P	1514		1514
ZOO	A	1525		1525

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