Peace Project Water Use Plan

Peace River Riparian Habitat Assessment

Implementation Year 2

Reference: GMSWORKS-7

Peace River Riparian Habitat Assessment Final Report

Study Period: 2010 - 2011

Cooper Beauchesne and Associates Ltd.
Northern Interior Office
Suite 1, 1257 4th Avenue
Prince George, BC

February 2013

GMSWORKS-7: Peace River Riparian Habitat Assessment Final Report

Final report submitted to:

BC Hydro
Environmental Risk Management
Burnaby, BC

Attn: Mike McArthur

Submitted by:

Cooper Beauchesne and Associates Ltd.
Head Office
Box 646, 1799 Swayne Road
Errington, BC V0R 1V0
Tel: 250 954-1822
Contact: John Cooper
jcooper@cooperbeauchesne.com

February 2013

Suggested Citation:

MacInnis, A.M., K. Bachmann, and R. Gill. 2013. GMSWORKS-7: Peace River Riparian Habitat Assessment Final Report. Unpublished report by Cooper Beauchesne and Associates Ltd., Errington, BC, for BC Hydro Generation, Water Licence Requirements, Hudson's Hope, BC. vi + 27 pp. + Appendices.

Keywords: Peace River, riparian habitat, Peace Spill Protocol, Peace Flood Pulse Plan

Cover photo: Plot 13 (Habitat Class 2), Peace River. Photo © K. Bachmann, Cooper Beauchesne and Associates Ltd.

EXECUTIVE SUMMARY

Changes in the hydrograph of the Peace River downstream of the Peace Canyon Dam are considered to have altered the dynamics and succession in riparian vegetation communities. It is assumed that the Peace River riparian communities have not yet reached a state of equilibrium under the regulated flow regime following construction of the W.A.C. Bennett and Peace Canyon dams.

The focus of this project, GMSWORKS 7 – Peace River Riparian Habitat Assessment, is to assess the current state of riparian habitats along the Peace River from the Peace Canyon Dam downstream to the confluence of the Pine River. The riparian zone was defined as the area between flows of 10,000 cfs (283 m^3/s) and 120,000 cfs (3398 m^3/s).This report presents the final results from the Peace River Riparian Habitat Assessment project. The focus of this report is on the results from ground sampling, and the final riparian habitat classification.

A total of 32 habitat classes and 1232 polygons were created through office based orthophoto interpretation to classify the more than 6255 ha of riparian habitats in the study area. Ground sampling was completed in September 2010 and August 2011 to verify the habitat classifications and polygon delineation created from photo interpretation. Ground sampling focused on vegetated riparian habitat classes that were considered the most likely to flood and be affected by flooding. The results from ground sampling generally corresponded with the classifications from photo interpretation with a few discrepancies. Following incorporation of the ground truthing data, the number of riparian habitat classes was reduced to 24. Revisions to the study area boundary that used the correct inundation line reduced the study area to 2442 ha while the number of polygons increased to 1485 due to fragmentation of larger polygons.

The final riparian habitat classifications were separated into five main groups based on major characteristics. The groups are non-vegetated (8 classes), wetland and aquatic (2 classes), shrub/graminoid/forb (3 classes), balsam poplar dominated (5 classes), and white spruce, paper birch, or trembling aspen dominated (6 classes). The majority of habitat classes were considered to have some degree of dependence on flooding. The wetland and aquatic and balsam poplar dominated habitat classes as well as one of the shrub/graminoid/forb classes were recommended as priority groups for future monitoring following a flood. Refining the mapping with current flood flow mapping and incremental flow mapping would improve the dataset for monitoring of post flood changes in vegetation.

ACKNOWLEDGEMENTS

A number of people have contributed to completion of the GMSWORKS 7 project. BC Hydro WLR sponsored the project. Guidance and support was provided by Kim Hawkins from project inception, with additional assistance from Jay Joyner, Karen Skibo, Anre MacIntosh, and Mike McArthur. Darrell Ratzlaff and Jim Voss assisted with the flight plans.

CBA staff Allan Carson and Ryan Gill completed the photo interpretation and the field surveys were completed by Karl Bachmann, Vicki Prigmore and Allan Carson. Ryan Gill provided GIS mapping and analysis. Andrew MacInnis (CBA Senior Fisheries Biologist) was Project Manager with assistance from John Cooper, the Project Advisor.

Helicopter services were provided by Vancouver Island Helicopters in Fort St. John.

The report was written by Andrew MacInnis, Karl Bachmann, and Ryan Gill. John Cooper provided a review of the report.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

The Peace Water Use Plan Committee identified changes in riparian succession downstream of the Peace Canyon Dam as one of the impacts of flow regulation on the Peace River (Anon. 2003). Flow regulation has altered the river hydrograph from annual flooding during the late spring and early summer (150,000 – 300,000 cfs or 4,248 – 8,495 m^3/s) to regulated flows (10,000 – 70,000 cfs or 283 – 1,982 m^3/s) with the greatest discharges occurring in the winter and the lowest in the summer (Anon. 2003). This change in the hydrograph is considered to have altered the dynamics and succession in riparian vegetation communities. Under the regulated flows, the vegetation communities and species that were adapted to and maintained by seasonal flooding are being replaced by upland communities and species. It is assumed that the Peace River riparian communities have not yet reached a state of equilibrium under the regulated flow regime (Anon. 2003).

The Peace River riparian zone, with particular emphasis on river bars and islands, was recognized as an important issue by the Peace Water Use Plan Committee. The focus of GMSWORKS 7 – Peace River Riparian Habitat Assessment is assessing the current state of riparian habitats along the Peace River from the Peace Canyon Dam downstream to the confluence of the Pine River. The project is a monitoring program under two related management plans in the Peace Project Water Use Plan: the Peace Spill Protocol and the Peace Flood Pulse Plan (BC Hydro 2007). The results of the project will create a baseline inventory of riparian habitats that can be used to assess distributions of riparian vegetation. This inventory will primarily be used to assess changes in riparian habitats, following spills, under GMSMON 6 - Peace River Riparian Flooding.

Year 1 of GMSWORKS 7 was completed in 2010 with initial habitat typing and classifications through air photo interpretation, as well as preliminary ground-truthing (MacInnis et al. 2011). This report details additional ground-truthing data collected in Year 2 (2011) and presents the final results of the Peace River Riparian Habitat Assessment project.

2 MANAGEMENT QUESTION AND OBJECTIVES

The management question and objectives for GMSWORKS-7 were stated in the Terms of Reference for the project (BC Hydro 2008). These are restated below with a brief summary of the approach to answering the management question and addressing the objectives in this study.

The single management question to be addressed by this project is:

1) What are the present distribution, species composition and spatial area of riparian vegetation along the Peace River?

Arising from this management question are the two objectives of this study:

1) Determine spatial distribution of vegetation communities (ecosystems) in the riparian zone of the Peace River
2) Determine species composition of the vegetation communities in the riparian zone of the Peace River.

The distribution, composition, and extent of riparian vegetation communities were assessed in Year 1 using office based air photo interpretation followed by ground sampling to confirm the riparian habitat classification. Additional ground sampling was completed in Year 2 and combined with ground-sampling data from Year 1 to refine and finalize the mapping. As this project consists of surveys to complete a baseline inventory of riparian habitats in the Peace River, there are no hypotheses to be tested.

3 STUDY AREA AND METHODS

3.1 Study Area

The study area was the Peace River corridor between the Peace Canyon Dam to just upstream of the confluence of the Pine River (the extent of available orthophoto coverage) (Figure 1). The focus of the project was on the riparian zone which is defined as the area between flows of 10,000 cfs (283 m^3/s) and 120,000 cfs (3398 m^3/s). Downstream of the Pine River, the impacts of flow regulation are reduced by tributary inflows (Anon. 2003). This area is located in the Boreal White and Black Spruce biogeoclimatic zone (BWBS) which is an extension of the Great Plains in the northeastern corner of the province (Meidinger and Pojar 1991).

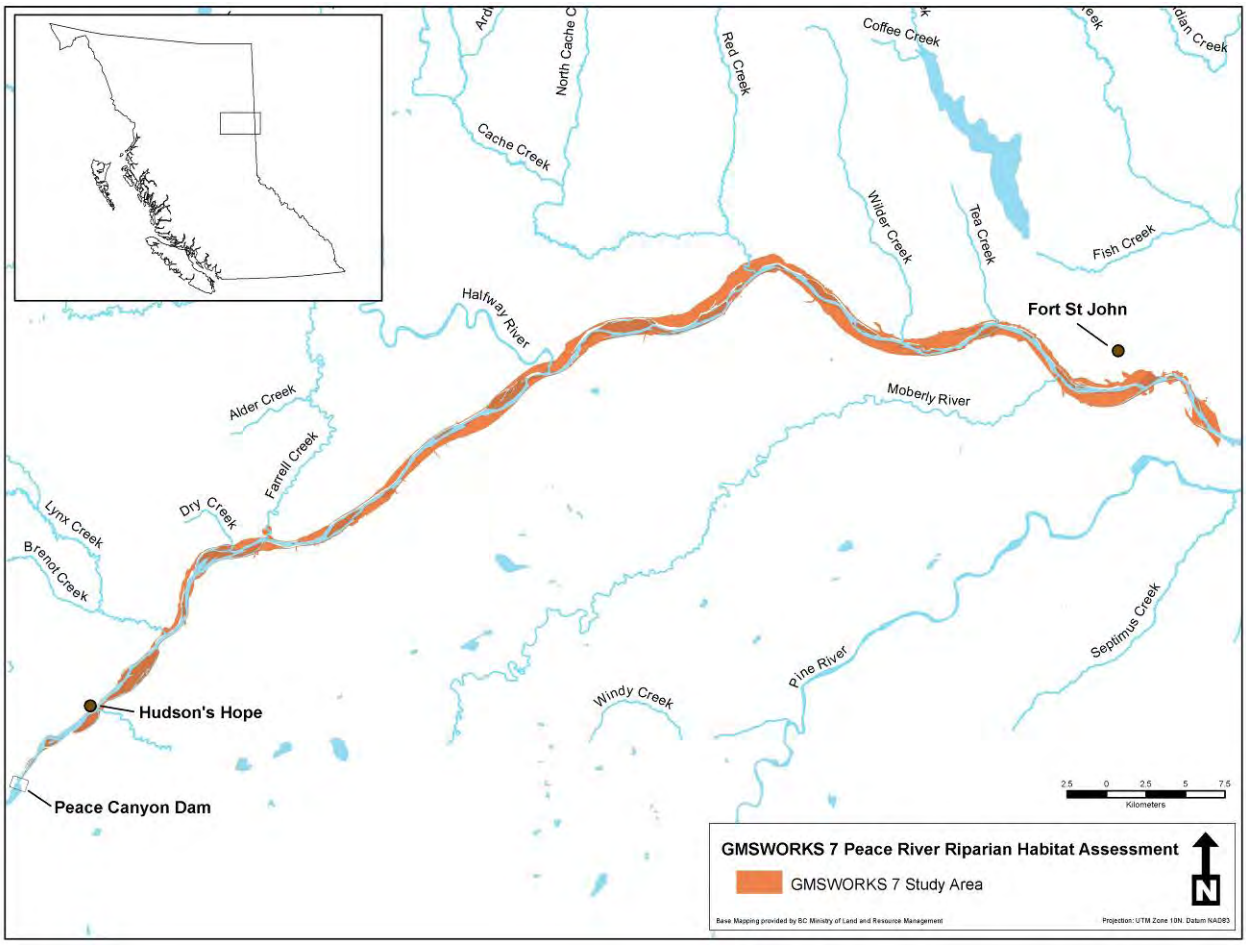


Figure 1. Peace River riparian habitat assessment study area.

3.2 Photo Interpretation

Relevant background documentation was reviewed prior to commencing the interpretation work to ensure familiarity with procedures and approaches for ecosystem classification and to review the ecosystem characteristics of the Peace River Corridor. Key sources of information included the Vegetation Resource Inventory Photo Interpretation Procedures (Resources Information Standards Committee 2010) – particularly the land cover classification scheme, Ecosystems of British Columbia (Meidinger and Pojar 1991) for the distribution and location of the Boreal White and Black Spruce zone, and Keystone Wildlife Research Ltd. (2007) for additional background

on the study area and the methods used in completing the 1:20,000 Terrestrial Ecosystem Mapping (TEM) that covers the study area.

All photo interpretation was completed in 2-D softcopy using ArcGIS (version 9.3, ESRI 2008). The file used for delineating riparian habitats consisted of the following base data layers:

- Digital ortho-rectified 1:5000 air photos taken September 13, 2009 at 10,700 cfs (303 m^3/s) (provided by BC Hydro) (refer to Figure 2 for the 2009 hydrograph),
- High water inundation line (120,000 cfs from 1996) (provided by BC Hydro),
- Recent TEM for the study area (Keystone Wildlife Research Ltd. 2007), and
- Vegetation Resources Inventory (VRI) data for the study area (BC Ministry of Forests 2006).

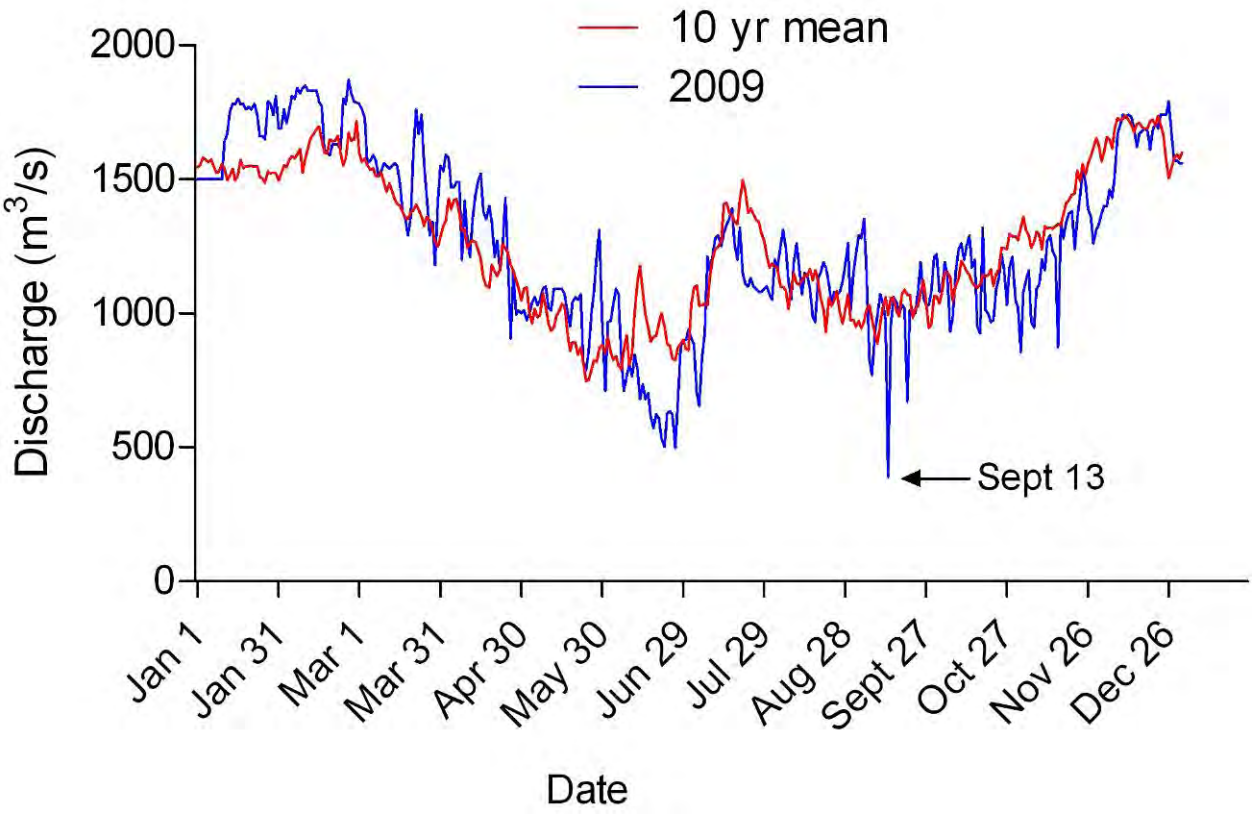


Figure 2. The Peace River 2009 hydrograph including the 10 year (2000-2009) average discharge. The air photos used in this project were taken on September 13, 2009. (Data from the Water Survey of Canada Station 07FA004 Peace River above Pine River)

The 1:20,000 TEM coverage was used in conjunction with the orthophotos as the framework upon which the new polygons were built. In some cases the TEM polygons were further subdivided to generate the riparian habitat polygons for this project. However, the riparian habitat classification was carried out at a larger scale (1:3000) so most polygons were delineated independently of the line work in the TEM data. In addition, due to the larger map scale (1:3000), smaller habitat features not identified in the TEM coverage were delineated in this project. All riparian habitat polygons generated were assigned a riparian vegetation code and a percent cover code.

Areas with visually uniform or homogeneous ground cover were characterized based on particular features that allowed for differentiation between neighbouring features. Typically, landscape features were adjacent to each other and transitioned from one habitat type to another. For example, a distinct mature forest stand transitioned to a distinct young forest/pole sapling stand, to a non-treed shrubby riparian area, to gravel shoreline, to water. Polygons were initially drawn using a scale of 1:5000, as it created a large visible area that made delineation fast and efficient. However, at this scale detailed delineation of polygon boundaries was limited and small pockets of habitat were missed. A map scale of 1:1000 was identified as the best resolution for identifying riparian habitats while retaining a reasonable scale for efficiency during interpretation. The scale varied roughly between 1:2000 and 1:200 throughout the interpretation process depending on the size of the habitat patch. The final scale of the riparian habitat maps was 1:3000.

A draft riparian habitat classification scheme was developed to capture all the riparian habitats in the study area visible at the final scale of 1:3000. The habitat classes were based on the VRI codes and then adapted to the finer detail at which polygons were mapped (Resources Inventory Committee 2002). The riparian habitat classes were first determined from an overview of the study area that identified the larger vegetation features. As the study area was viewed at finer scales during photo interpretation more vegetation features were identified. As new vegetation features were encountered, additional habitat classes were created to accommodate them. Coverage classes adopted from the VRI Land Cover Classification Scheme were assigned to each habitat class to quantify the density of vegetation comprising each polygon (Table 1). Coverage class was divided into five categories ranging from no vegetation to 100% coverage (Table 1).

Table 1. Percent cover codes used in photo interpretation and the corresponding VRI density codes.

Percent Cover Code	Cover Range	VRI Density Code for Vegetated Polygons
a	Non-vegetated	n/a
b	1-25%	SP (Sparse; between 10-25% for treed polygons and 20-25% for shrub or herb polygons)
c	25-50%	OP (Open; between 26-60%)
d	50-75%	DE (Dense; between 61-100%)
e	75-100%	DE (Dense; between 61-100%)

In a few areas the resolution of the orthophotos was insufficient for polygon typing. This was due to shadowing or overexposure and resulted in an inability to identify features in localized areas. Using TEM data along with the VRI data was valuable in the identification of tree species in cases where accurate polygon typing was difficult visually. In some cases Google Earth was used as a reference if imagery was of sufficient resolution to assist in identifying vegetation. Google Earth was also valuable in enabling a three dimensional view of the Peace River channel, banks, floodplain and islands to ascertain the relative grade of an area of interest.

Where the inundation line did not correspond perfectly with certain features (e.g., islands) and appeared to be slightly offset, the polygon boundary was adjusted to match the feature as seen on the air photo rather than the inundation line.

3.3 Ground Sampling

Ground-truthing of the results from photo interpretation was conducted to confirm the accuracy of habitat classifications. Habitat classes associated with areas likely to experience higher frequencies of and more significant impacts from flooding (e.g., flood channels, gravel bars) were considered the higher priority for ground-truthing; consequently some habitat classes identified in the air photo interpretation were not sampled (e.g., non-vegetated sandstone). Due to limited ground access to riparian areas along the Peace River and the need to access river bars and islands, ground sampling locations were accessed by helicopter from Fort St. John.

Standard TEM field sampling data collection methods were used for ground-truthing work (Province of British Columbia 1998, Resources Inventory Committee 1998). The field sampling design generally followed recommendations in Resource Inventory Committee (1998) but was modified to accommodate the project requirement for completion of a minimum of two plots in each of the priority habitat types identified during photo interpretation. Therefore, instead of conducting plots at random locations as suggested by the TEM standards (Resources Inventory Committee 1998), riparian habitat polygons were stratified by habitat classification and polygons from each classification were randomly selected for ground sampling plots. Two types of field sampling plots were sampled: full plots and ground inspection plots.

Full plots consisted of collecting site description, soil, vegetation, and tree characteristics data (Province of British Columbia 1998). The Resources Inventory Committee (1998) keys were used to describe soil characteristics and plant identifications were confirmed using Johnson et al. (1995). Data forms from the Field Manual for Describing Terrestrial Ecosystems (Province of British Columbia 1998) were used (Appendix 1). Plot centres were located in the middle of habitat polygons to avoid sampling habitat gradients on polygon peripheries. A differentially corrected GPS unit (SX Blue II) was used to take plot centre coordinates to within +/- 30 cm. A Suunto wristop computer was used to take elevations to +/- 5 m, and was calibrated at the Fort St. John airport at the beginning of each day. Plots consisted of a 20 m x 20 m square laid out around plot centre along cardinal directions. Soil pits were dug at roughly plot centre. Mensuration was completed by selecting the four largest trees in the plot for measurement. Tree heights were taken using a clinometer to measure angles and a hipchain to measure distances.

Ground inspection plots were completed on a ground inspection form (Appendix 2). These plots were generally conducted where the field crew was traversing a non-priority habitat class. Less detailed information was collected on ground inspection plots; however, sampling procedures were the same as for full plots (Province of British Columbia 1998).

An MS Access database was constructed to store all ground-truthing data collected in the scope of the project. Coordinates for each ground-truthing plot centre were exported as a .shp file in NAD 83. Pictures taken at each plot were labelled with the plot number; where a picture did not face north, it was indicated in the label.

3.4 Refining habitat classification with ground sampling data

Ground sampling was the primary method of addressing limitations of the office based orthophoto interpretation exercise. Data on vegetation composition and site characteristics from ground sampling was exported from the MS Access database into MS Excel for analysis. These data (tree species composition and percent cover, shrub percent cover, herb percent cover, percent cover of mineral soil, rocks, decayed wood, organic matter, bedrock and water) were averaged for all plots completed in each habitat class. Tree percent cover data by layer was

pooled (i.e., A1, A2, and A3 layers were pooled into an ‘A’ layer and B1 and B2 were pooled into a ‘B’ layer) as the orthophoto resolution was insufficient to distinguish between adjacent layer classes. For the same reasons, shrub and herb % cover was pooled across all shrub and herb species into total shrub % cover and total herb % cover, respectively. While data on soil, tree characteristics, and vegetation composition was also collected (section 3.3); these data did not provide any additional information for describing the different habitat classes.

Averaged vegetation composition data from ground sampling was used to compare differences between habitat classes and refine descriptions of each class. Too few plots were completed in each habitat class generated from the photo interpretation (maximum: 4 plots) to statistically test differences between similar classes. However, the discrepancies between habitat classes generated by orthophoto interpretation and ground-sampling tended to be discrete rather than continuous allowing for a qualitative assessment of habitat class similarities or differences. For example, some habitat classes were identified in the orthophoto interpretation as having a significant or dominant component of trembling aspen which ground sampling proved to be absent.

Once ground sampling data was analyzed, vegetation composition and structure data were qualitatively compared between habitat classes. The main criteria used were vegetation composition and percent cover (Figure 3). Information on successional status was used to separate classes of similar vegetation composition but distinctly different ages. Habitat classes that did not prove to be distinct were amalgamated into a single class. Data for all the amalgamated classes were then pooled and used to compile vegetation composition summaries for each of the final habitat classes.

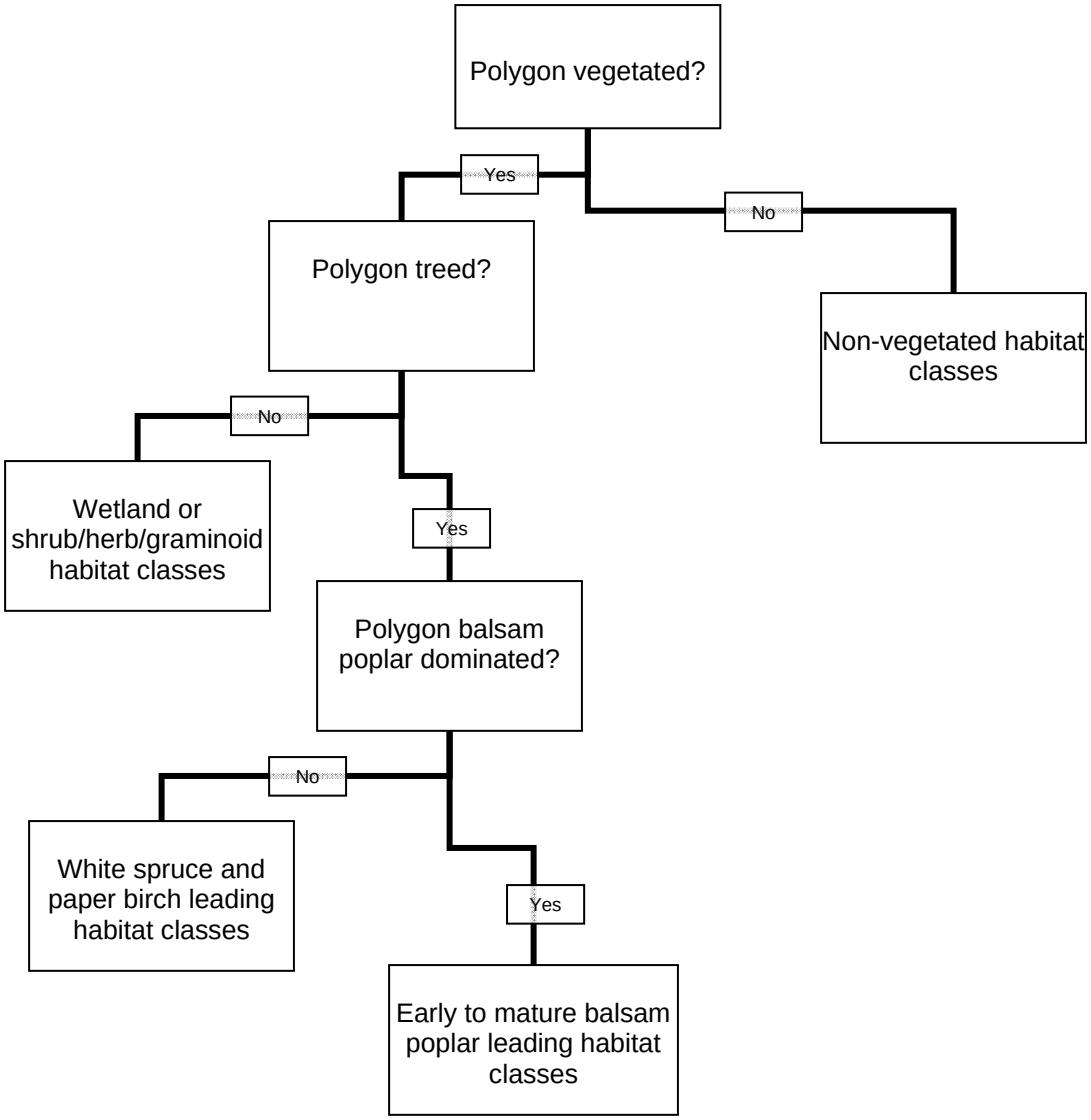


Figure 3. Criteria used for differentiating habitat classes based on ground sampling data, Peace River valley, BC.

During the review of the habitat classification data following incorporation of modifications from the ground-truthing results, any remaining overlapping polygon edges and stray geometric shapes were re-aligned or removed as a final QA/QC procedure.

4 RESULTS

4.1 Photo Interpretation

In Year 1, a total of 32 numbered habitat classes were created to classify riparian habitats in the study area (MacInnis et al. 2011). Riparian habitat classes identified through the photo interpretation component of the project included non-vegetated, herbaceous and shrub, forested, wetlands, and anthropogenic disturbance. A total of 1232 polygons were created to classify more than 6255 ha of riparian habitats in the study area.

Based on the results of the ground-truthing (described in Section 4.2), the 32 habitat classes originally identified were collapsed into 24 final habitat classes and assigned names and two letter codes instead of numbers (Table 2) (refer to section 4.3, Table 7 for details on the changes to habitat codes). The habitat names and codes are specific to the riparian habitats identified in the study area for this project. Adjacent polygons that were re-classified as the same habitat class were merged. During incorporation of the ground-truthing results it was noted that the inundation line originally provided was incorrect and resulted in the inclusion of large areas of upland habitat not influenced by river level changes. The incorporation of the correct inundation line (120,000 cfs) reduced the total area of riparian habitats classified to almost 2442 ha. However, the number of polygons increased to 1485 as a result of the fragmentation of larger polygons.

The majority of the habitat classes defined were strongly riparian influenced (i.e., river bottom areas dominated by balsam poplar in frequent to occasional flood regimes). The habitat classes upland shrub (US), birch – spruce slope (ES), and birch - aspen slope (EA) had vegetation characteristics (e.g., absence of balsam poplar, presence of trembling aspen) that were consistent with upland habitat types (Table 2).

The number of polygons for a given habitat class ranged from 4 (shale slope - SH) to 222 (gravel bars - GB) (Table 3). The most abundant habitats based on the number of polygons were GB (222 polygons), mid Ac (MA) (187 polygons), mature spruce (MS) (170 polygons), riparian shrub (RS) (165 polygons), and herbaceous (HE) (138 polygons), together comprising 70.47% of the study area (Table 3). All remaining habitat classes had less than 100 polygons (Table 3). The most abundant habitat classes based on total area were habitats GB (742.25 ha), MA (330.28 ha), RS (246.96) and HE (231.27 ha), totalling more than 63%) of the entire study area (Table 3).

Table 2. Final habitat codes, names, classes, and descriptions of riparian habitats identified during photo interpretation in the Peace River valley, BC.

Habitat Code	Habitat Name	Habitat Class	Habitat Description
Non-vegetated			
SA	Sandstone	Non-vegetated – gentle slope – sandstone	Non-vegetated sandstone flats occurring at the lower end of the Peace River canyon.
GB	Gravel bars	Non-vegetated – gentle slope – sand/gravel	Mostly non-vegetated sand/gravel bars along the river edge and surrounding islands.
GS	Gravel slope	Non-vegetated – moderate to steep slope – sand/gravel	Non-vegetated sand/gravel slopes along the river edge.
IN	Industrial	Industrial/ residential/ recreational/ agricultural land	Any land utilized for industrial, residential, recreational or agricultural activity.
BS	Boulder slope	Non-vegetated – gravel/ cobble/ boulder	Channel edges, often steep and cliff-like, consisting of various-sized rock substrate (i.e., gravels, cobbles and boulders); non-vegetated or sparsely vegetated/treed.
SH	Shale slope	Non-vegetated – shale – steep slope	Exposed shale bedrock or monoliths below the inundation line.
SS	Sandstone slope	Non vegetated-steep slope – sandstone.	Steep eroding bluffs, cliffs, or slopes; sand-dune like in appearance. Non- to sparsely vegetated.
OW	Open Water	Water*	Standing or pooled water occurring between the elevations of the inundation/high water mark and the low water mark.
Wetland and aquatic			
AV	Aquatic vegetation	Aquatic to semi-aquatic vegetation – depressions and side channels	Periodically inundated depressions and side channels along the river bank and between islands and the river bank; may be partially submerged in shallow water. Containing aquatic and semi-aquatic vegetation (e.g., sedges and rushes). Pioneer seral.
WE	Wetland	Wetland complex	Isolated depression or wet area that has developed wetland characteristics (e.g., standing water, wetland vegetation). Dis-climax.
Shrub/ graminoid/ forb			
HE	Herbaceous	Herb – gentle slopes – sand/ gravel.	Herbaceous-dominant vegetation cover on sand/gravel beds along the riverside and islands. Pioneer seral.
RS	Riparian shrub	Riparian shrub – graminoid/ forb	Shrubby vegetation composed of willow, alder, and poplar with some degree of grasses and forbs coverage. Pioneer seral.

US	Upland shrub	Upland low shrub – graminoid.	Plant community occurring on low relief/ floodplain/upland areas above riparian zone, as a matrix throughout disturbed areas such as agricultural fields, roads, right-of-ways, etc. (Can be interspersed with pockets of At and sometimes Ac.) Pioneer seral.
Balsam poplar dominated			
LA	Late Ac	Mature Ac stand	Mature balsam poplar-dominant stand with other intermittent tree species (e.g., white spruce). Mature to over-mature seral.
MA	Mid Ac	Mid Ac Sw-stand	Mid-seral balsam poplar -dominant stand with other intermittent species (e.g., white spruce). Ranges from pioneer seral to mid seral.
AG	Ac – Sw - gravel	Early Ac Sw – shrub – sand/ gravel	Young-seral balsam poplar and white spruce stand growing in on sand/gravel substrate. Pioneer seral to young seral.
AH	Ac – Sw - herb	Early Ac Sw – shrub and/or pole sapling	Balsam poplar-dominated with some white spruce, early successional stage. Ranges from pioneer to mid seral.
AS	Ac sapling	Mid Ac pole sapling and/or shrub	Balsam poplar stand. Pioneer to young seral.
White spruce, paper birch or trembling aspen dominated			
MM	Mature mixed	Mature Sw Ep Ac stand	Mixed stand of mature white spruce, paper birch, and balsam poplar; often on islands. Ranges from mid-seral to maturing climax stands.
MS	Mature spruce	Mature Sw Ac Ep stand	Mature white spruce-dominant with poplar and paper birch subdominant; stands along riparian zone and islands. Ranges from young climatic climax to maturing climatic climax.
SG	Sw – Ac - gravel	Early Sw Ac shrub – sand/ gravel	Mixed tree cover of white spruce and balsam poplar with well-developed shrub understory on sand/gravel substrate. Pioneer to young seral.
SP	Pioneer Sw	Early Sw Ac shrub – grass/ herb	White spruce dominated shrub cover mixed with balsam poplar; moderate to high grass/herb cover. Pioneer seral.
ES	Birch – Spruce slope	Steep slope – Ep Sw stand	Steep sloped riverbank or streambank with moderate to high cover of mature paper birch and white spruce, some balsam poplar may also be present; narrow sand/gravel bar at the base of the hillside may be present. Ranges from maturing seral to maturing climax.
EA	Birch – aspen slope	Steep slope – Ep At	Steep sloped riverbank or streambank with low to moderate cover of paper birch and trembling aspen, some white spruce may also be present; understory of grasses/forbs/shrubs; narrow sand/gravel bar at the base of the hillside may be present. Pioneer to mid seral.

*Note: this class does not include the area of the Peace River itself, only water that occurred within terrestrial polygons such as small ponds.

Table 3. Number of polygons and areas of final riparian habitat classes identified during photo interpretation for the Peace River valley, BC.

Habitat Class	Number of Polygons	Area (ha)				
		Minimum	Maximum	Mean	Total	Percent of Total Area
Non-vegetated						
SA	13	0.03	1.62	0.48	6.27	0.26
GB	222	0.01	42.45	3.34	742.25	30.40
GS	11	0.01	1.30	0.42	4.65	0.19
IN	9	0.02	0.33	0.13	1.17	0.05
BS	46	0.01	3.80	0.39	18.26	0.75
SH	4	0.01	0.25	0.11	0.44	0.02
SS	53	0.01	2.82	0.34	18.11	0.74
OW	24	0.01	7.94	1.06	25.51	1.04
				Totals	**816.65**	**33.44**
Wetland and Aquatic						
AV	39	0.03	45.48	2.48	96.68	3.96
WE	19	0.20	43.85	6.11	116.15	4.76
				Totals	**212.83**	**8.72**
Shrub/ graminoid/ forb						
HE	138	0.01	14.30	1.68	231.27	9.47
RS	165	0.01	18.90	1.50	246.96	10.11
US	5	0.05	2.92	0.81	4.05	0.17
				Totals	**482.29**	**19.75**
Balsam poplar dominated						
LA	87	0.01	40.13	1.15	99.90	4.09
MA	187	0.01	23.26	1.77	330.28	13.53
AG	52	0.01	24.42	2.11	109.88	4.50
AH	14	0.01	4.39	1.27	17.75	0.73
AS	35	0.02	6.32	1.22	42.79	1.75
				Totals	**600.60**	**24.60**
White spruce, paper birch or trembling aspen dominated						
MM	63	0.01	40.43	1.17	73.58	3.01
MS	170	0.01	32.12	1.00	170.00	6.96
SG	24	0.02	4.95	1.68	40.34	1.65
SP	13	0.03	4.52	0.90	11.70	0.48
ES	66	0.01	4.64	0.34	22.13	0.91
EA	26	0.01	4.36	0.45	11.79	0.48
				Totals	**329.54**	**13.50**
GRAND TOTAL	**1485**				**2441.91**	**100.00**

Examples of the final classification of riparian habitats from the upper, middle, and lower portions of the study are provided in Figures 4, 5, and 6, respectively. Riparian habitat maps for the entire study area are included in Appendix 3.

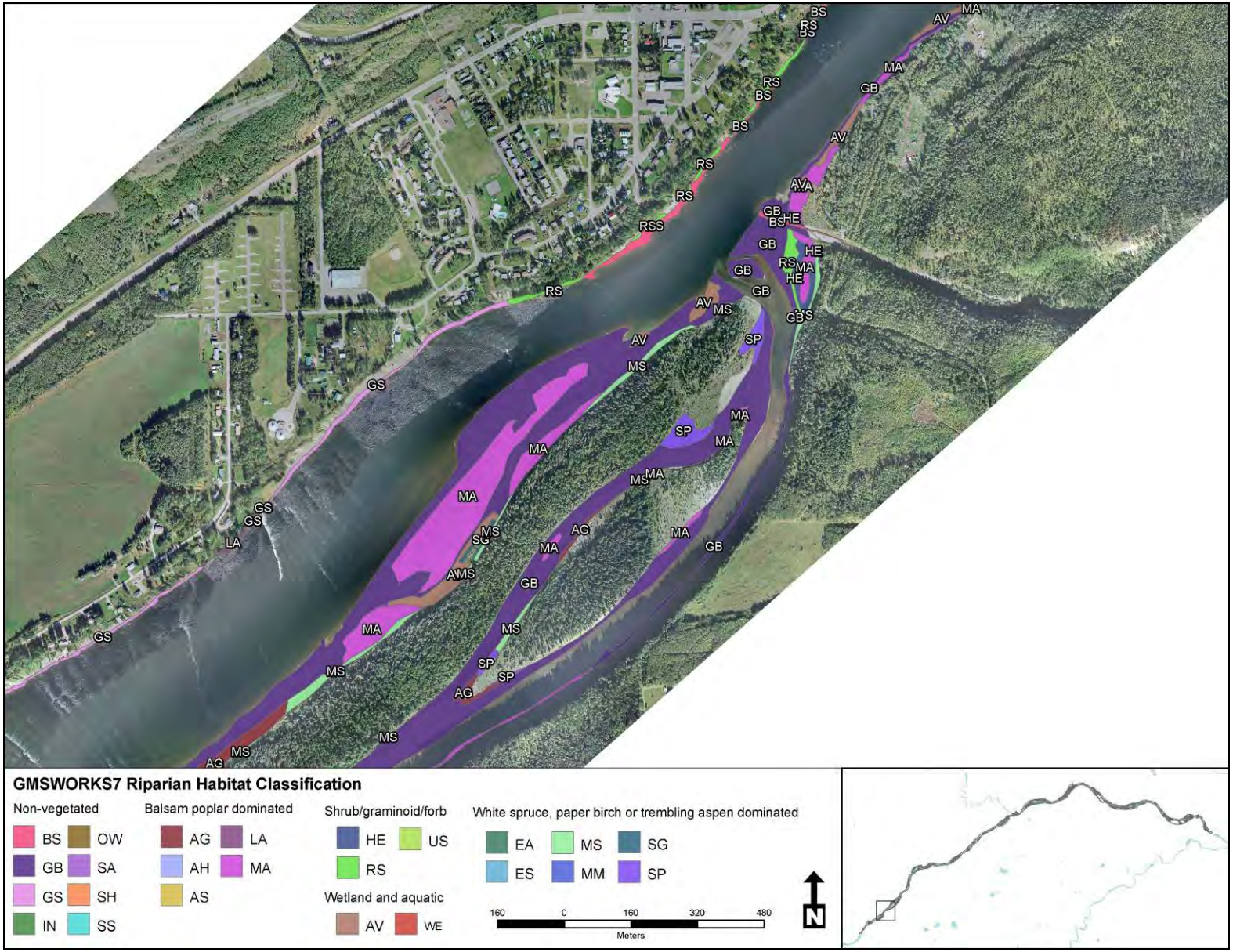


Figure 4. Riparian habitat classification example from the upper portion of the study area in the Peace River valley, BC.

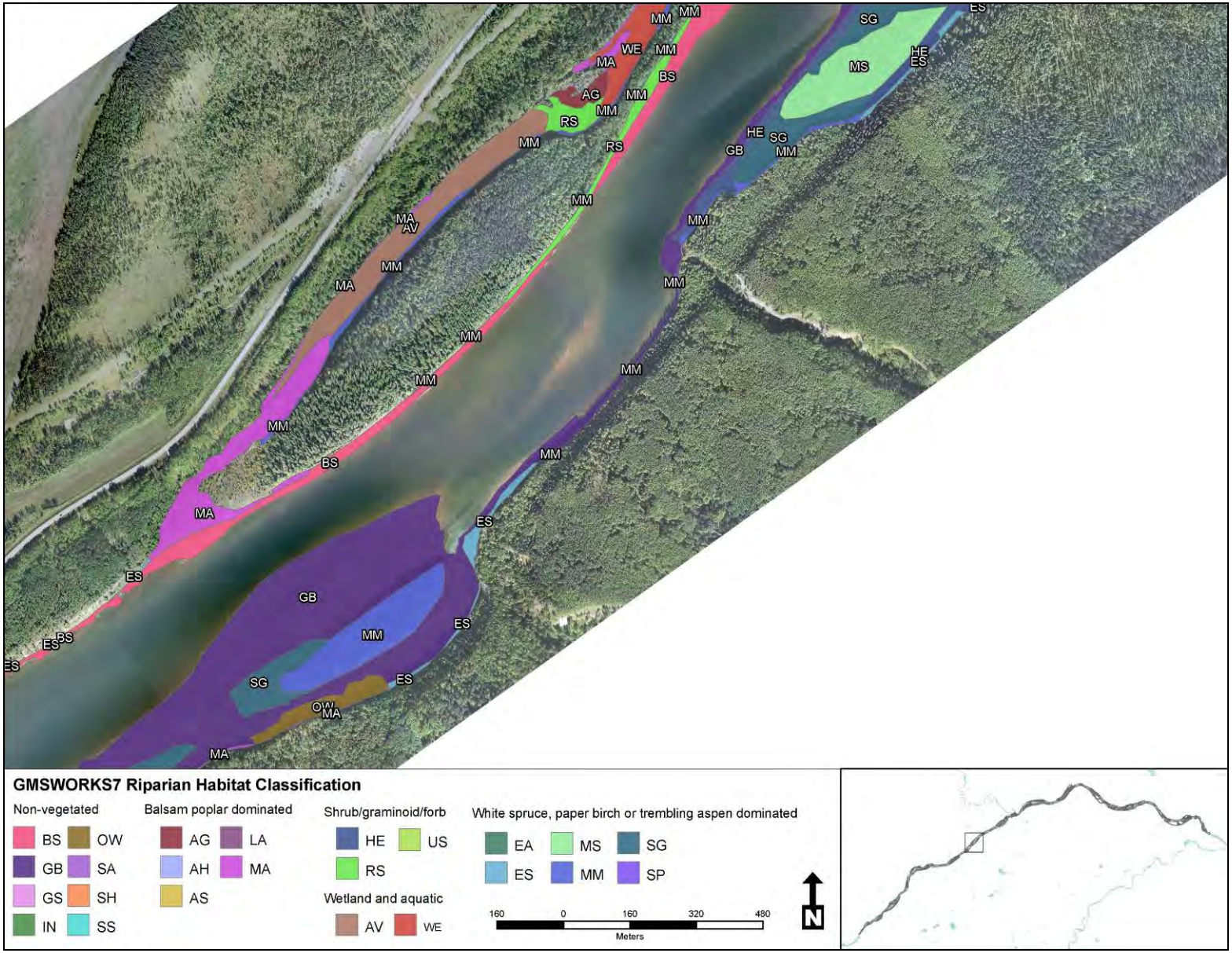


Figure 5. Riparian habitat classification example from the middle portion of the study area in the Peace River valley, BC.

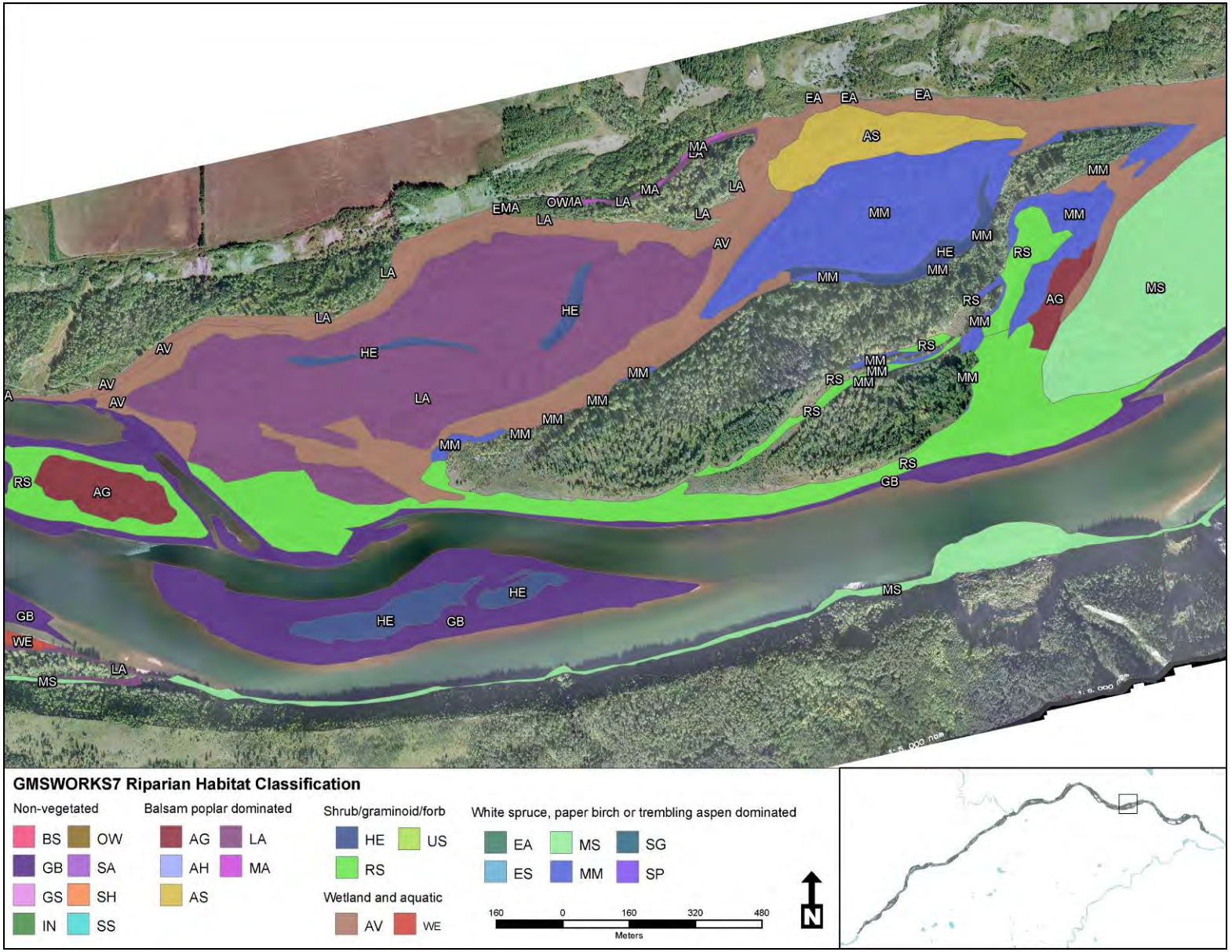


Figure 6. Riparian habitat classification example from the lower portion of the study area in the Peace River valley, BC.

4.2 Ground Sampling

Ground sampling of priority habitat classes (vegetated and potentially affected by flooding) was conducted from September 9 -15, 2010 and August 3 – 12, 2011. A total of 55 full plots distributed along the length of the study area were completed (Table 4, Appendix 4). Additionally, 3 ground-inspection plots were completed in Year 1 of the ground sampling. Non-vegetated (SA, GS, BS, SH, SS, and OW), industrial (IN), and upland (US) habitat classes were not included as priority habitats as they were either non-vegetated or unlikely to be impacted by flooding.

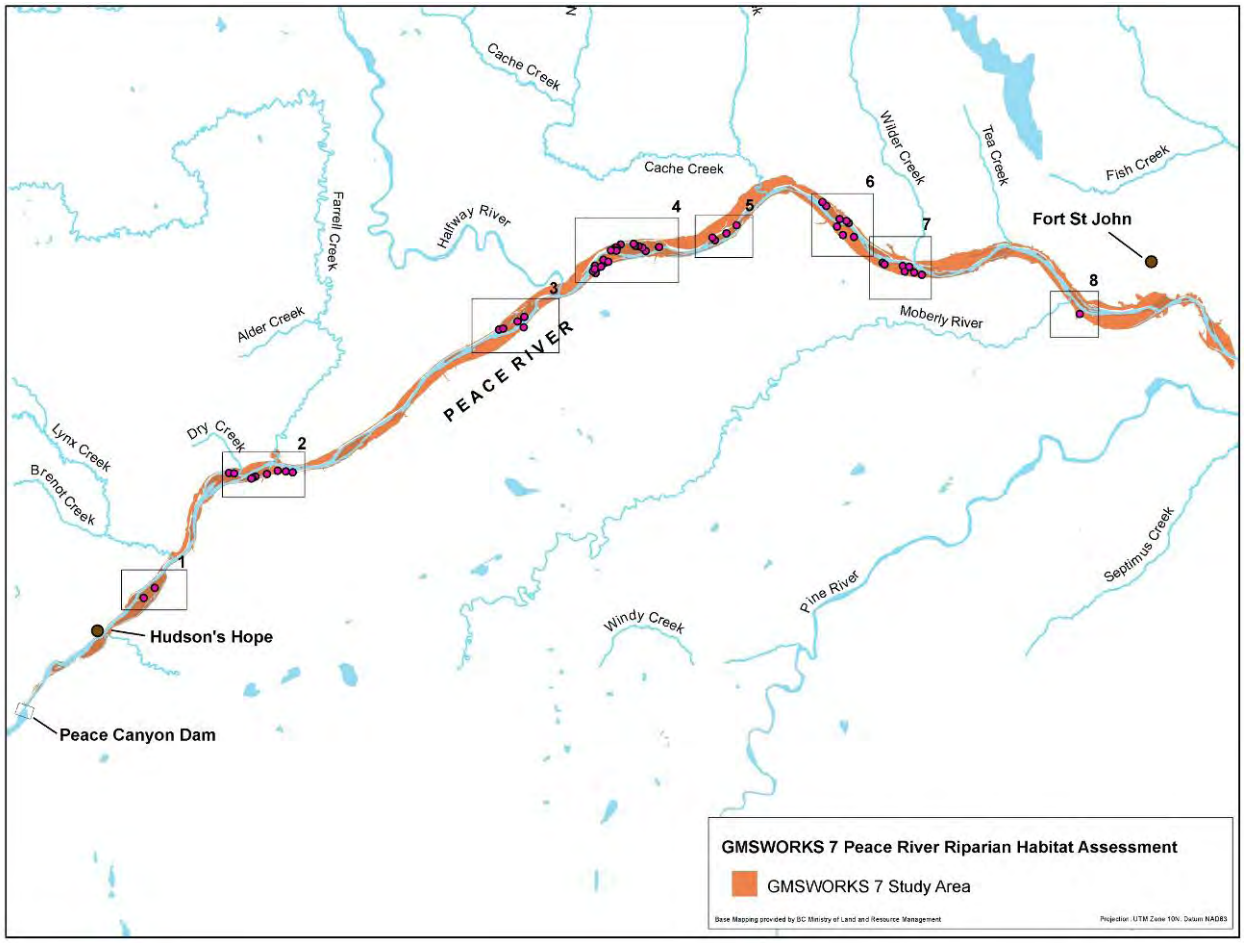


Figure 7. Distribution of ground sampling plots in study area, Peace River valley, BC. Numbered tiles refer to figures in Appendix 5.

Table 4. Ground-sampling plots completed for in riparian habitat classes in the Peace River valley, BC.

Habitat Class	Habitat Name	Plot Type	Number of Plots
HE	Herbaceous	Full	4
RS	Riparian shrub	Full	3
GB	Gravel bars	Full	3
LA	Late Ac	Full	3
MA	Mid Ac	Ground	1
		Full	8
AG	Ac – Sw – gravel	Ground	1
		Full	5
MM	Mature mixed	Full	3
AV	Aquatic vegetation	Full	3
MS	Mature spruce	Full	3
SG	Sw – Ac – gravel	Full	5
SP	Pioneer Sw	Full	1
ES	Birch – spruce slope	Full	3
AH	Ac – Sw – herb	Full	3
WE	Wetland	Ground	1
		Full	4
EA	Birch – aspen slope	Full	1
AS	Ac sapling	Full	3

4.3 Refining habitat classifications with ground sampling data

Tree cover in the A or B layer occurred in 12 of the 16 habitat classes sampled during ground truthing (Table 5). Three tree species composed the A and B layers in all ground sampling plots: balsam poplar (Ac), paper birch (Ep), and white spruce (Sw) (Table 5). Balsam poplar was the most widespread tree species occurring in all 12 habitat classes with tree cover (Table 5). White spruce was the next most abundant species occurring in seven of the 12 habitat classes (Table 5). Paper birch was only found in four of the 12 treed habitat classes, but where present it typically had a relatively high percent cover (Table 5). Trembling aspen did occur to a limited extent in some areas but it was not captured by any of the ground sampling plots.

Shrub percent cover varied by habitat class, but was highest in the non-treed habitat classes (Table 6). A total of 37 shrub species were recorded across all ground sampling plots. Shrub species richness within a habitat class varied from a minimum of two to a maximum of 21. The dominant shrub species in the 16 habitat classes sampled were balsam poplar (in ten classes), mountain alder (in 11 classes), prickly rose (in ten classes), red-osier dogwood (in ten classes), white spruce (in nine classes) and willow spp. (in ten classes), averaging 13.3, 9.2, 7.1, 6.2, 3.2 and 7.2 % cover, respectively. Red raspberry (eight habitat classes, 5.0% average cover), saskatoon (six habitat classes, 1.3% average cover), and western snowberry (six habitat classes, 1.6% average cover) were also relatively wide-spread. All other shrub species occurred in five or fewer classes.

Table 5. Average tree percent cover by species and layer for ground sampling plots in the Peace River valley, BC.

	A1			A2			A3			B1			B2		
Habitat class (# of plots)	**Ac**	**Ep**	**Sw**	**Ac**	**Ep**	**Sw**	**Ac**	**Ep**	**Sw**	**Ac**	**Ep**	**Sw**	**Ac**	**Ep**	**Sw**
AV (3)	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-
HE (4)	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-
RS (3)	-	-	-	-	-	-	-	-	-	27.5	-	-	5.0	-	1.0
AH (3)	10.0	-	-	-	-	15.0	8.0	-	-	-	-	20.0	-	-	3.0
AG (5)	50.0	-	-	25.0	-	-	-	-	-	15.0	-	12.5	5.0	-	12.5
MA (8)	15.0	-	-	31.0	-	-	6.0	-	-	60.0	-	5.0	3.0	-	1.0
AS (3)	-	-	-	8.0	-	-	17.0	-	4.0	-	-	-	-	-	-
LA (3)	22.5	-	-	40.0	-	2.0	-	-	6.0	-	-	20.0	-	-	-
SG (4)	-	-	10.0	-	-	-	-	-	-	2.5	1.0	25	20.0	1.0	1.5
MS (3)	10.5	-	36.7	-	10.0	10.0	-	-	-	-	3.5	23.3	-	-	2.5
MM (4)	15.0	40.0	10.0	23.0	15.0	32.5	-	-	-	-	-	5.0	-	-	5.0
ES (3)	-	15.0	-	-	25.0	8.0	1.0	20.0	2.0	-	5.0	-	-	-	5.0
Average	**19.0**	**27.5**	**26.0**	**25.9**	**16.7**	**16.7**	**9.8**	**20.0**	**4.0**	**31.9**	**3.3**	**16.7**	**5.6**	**1.0**	**4.4**

A total of 85 herb species were recorded across all the ground sampling plots. Total percent cover ranged from 0.7% to 13.1% (Table 6). No single herb species or group of species predominated within or across habitat classes. For substrate, the percentage of organic matter was the highest cover class in the plot, except habitat EA (Table 6).

The changes to the original numbered habitat classes (MacInnis et al. 2011) after incorporation of the ground sampling data are summarized in Table 7. The major changes include:

- *Habitat classes 11, 16, and 18 were collapsed into class MA.*
  - Both class 16 and 18 were originally classified with a trembling aspen component which proved absent during ground sampling. Once the aspen component was removed, there was no major difference between the classes.

- *Habitat classes 13 and 20 were collapsed into class AG.*
  - Class 13 was originally classified as Ac shrub – sand/gravel and class 20 as Sw shrub – sand/gravel. However, both classes contained Ac and Sw components, and were merged into one class.

- *Habitat classes 3, 4, and 5 were re-classified into more specific habitat classes.*
  - Classes 3, 4, and 5 were broad classes created during the initial stages of the habitat classification process, and had less than 10 polygons in each. Once the classification process had progressed further and more specific habitat classes had been created, these polygons were re-assigned.

- *Habitat class 29 was re-classified into class HE or RS.*

- The original habitat class used concentrated accumulations of coarse woody debris as a habitat feature. As these features can be ephemeral (i.e., are deposited during a flood and can be removed by the same process in subsequent years), this feature was dropped as diagnostic of this class. The 14 polygons originally in class 29 were then re-assigned to class HE or RS.

The descriptions of all habitat classes were also updated to reflect the tree species composition and successional stage data collected during ground sampling (Table 7).

Table 6. Vegetation percent cover and site characteristic averages for final habitat classes in the Peace River valley.

Habitat Code	Habitat Class	Number of ground sampling plots	A layers tree species average % cover[1, 2]			B layers tree species average % cover[1, 3]			Average total shrub % cover[4]	Average total herb % cover	% Organic matter	% Rocks	% Decayed wood	% Mineral soil	% Bedrock	% Water
			Ac	Ep	Sw	Ac	Ep	Sw								
HE	Herb – gentle slopes – sand/ gravel	4	0.0	0.0	0.0	1.0	0.0	0.0	4.3	12.8	92.5	1.3	5.0	1.3	0.0	0.0
RS	Riparian shrub – graminoid/ forb	3	0.0	0.0	0.0	16.3	0.0	0.5	22.4	11.8	82.3	1.0	1.7	15.0	0.0	0.0
SA	Non-vegetated – gentle slope – sandstone	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GB	Non-vegetated – gentle slope – sand/ gravel	3	0.0	0.0	0.0	0.0	0.0	0.0	4.0	22.6	25.0	35.0	0.0	40.0	0.0	0.0
GS	Non-vegetated – moderate to steep slope – sand/ gravel	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IN	Industrial/ residential/ recreational/ agricultural land	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LA	Mature Ac stand	3	20.8	0.0	2.7	0.0	0.0	10.0	9.5	4.2	88.3	0.0	11.7	0.0	0.0	0.0
MA	Mid Ac Sw-stand	8	17.3	0.0	0.0	31.5	0.0	3.0	6.4	2.0	75.5	9.6	6.8	8.1	0.0	0.0
AG	Early Ac Sw – shrub – sand/ gravel	5	25.0	0.0	0.0	10.0	0.0	12.5	6.1	4.1	53.0	22.0	1.2	23.8	0.0	0.0
MM	Mature Sw Ep Ac stand	4	19.0	27.5	21.3	0.0	0.0	5.0	4.5	3.0	75.0	0.0	20.0	5.0	0.0	0.0
AV	Aquatic to semi-aquatic vegetation – depressions and side channels	3	0.0	0.0	0.0	0.5	0.0	0.0	18.8	13.1	100.0	0.0	0.0	0.0	0.0	0.0

Habitat Code	Habitat Class	Number of ground sampling plots	A layers tree species average % cover[1, 2]			B layers tree species average % cover[1, 3]			Average total shrub % cover[4]	Average total herb % cover	% Organic matter	% Rocks	% Decayed wood	% Mineral soil	% Bedrock	% Water
			Ac	Ep	Sw	Ac	Ep	Sw								
BS	Non-vegetated – gravel/ cobble/ boulder	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MS	Mature Sw Ac Ep stand	3	3.5	3.3	15.6	0.0	1.8	12.9	4.1	7.2	86.7	0.0	13.3	0.0	0.0	0.0
SG	Early Sw Ac shrub – sand/ gravel	4	0.0	0.0	3.3	11.3	1.0	13.3	5.5	2.7	85.5	1.5	3.8	9.3	0.0	0.0
SP	Early Sx Ac shrub – grass/ herb	1	0.0	0.0	0.0	0.0	0.0	0.0	2.8	6.4	100.0	0.0	0.0	0.0	0.0	0.0
SH	Non-vegetated – shale – steep slope	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Steep slope – Ep Sw stand	3	0.3	20.0	3.3	0.0	2.5	2.5	4.2	3.2	85.0	0.0	8.3	6.7	0.0	0.0
AH	Early Ac Sw – shrub and/or pole sapling	3	6.0	0.0	5.0	0.0	0.0	11.5	4.1	4.3	76.7	10.0	10.0	3.3	0.0	0.0
SS	Non vegetated-steep slope – sandstone.	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WE	Wetland complex	4	0.0	0.0	0.0	0.0	0.0	0.0	1.8	10.9	82.5	3.8	0.0	3.8	0.0	10.0
US	Upland low shrub – graminoid.	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EA	Steep slope – Ep At	1	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.7	35.0	5.0	0.0	60.0	0.0	0.0
AS	Mid Ac pole sapling and/or shrub	3	8.3	0.0	1.3	0.0	0.0	0.0	5.1	1.5	80.0	1.7	1.7	16.7	0.0	0.0
OW	Water	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1] Species codes: Ac – balsam poplar, Ep – paper birch, Sw – white spruce, At – trembling aspen
[2] Includes A1 (veteran and main canopy), A2 (sub-dominant), and A3 () layers
[3] Includes B1 (0.3 – 2.0 m) and B2 (2 – 10 m) layers
[4] Includes B1 and B2 layers

Table 7. Changes made to initial habitat classifications using ground sampling data.

Old Habitat Code	Old Habitat Class	Action	New Habitat Code	New Habitat Class
1	Herb-gentle slopes-sand/ gravel	-	HE	Herb – gentle slopes – sand/ gravel.
2	Riparian shrub-graminoid/ forb	-	RS	Riparian shrub – graminoid/ forb
3	Deciduous-stand	Re-assigned to more specific classes	-	-
4	Coniferous-stand	Re-assigned to more specific classes	-	-
5	Mixed wood	Re-assigned to more specific classes	-	-
6	Non-vegetated – gentle slope – sandstone	-	SA	Non-vegetated – gentle slope – sandstone
7	Non-vegetated – gentle slope – sand/ gravel	-	GB	Non-vegetated – gentle slope – sand/ gravel
8	Non-vegetated – moderate to steep slope – sand/ gravel	-	GS	Non-vegetated – moderate to steep slope – sand/ gravel
9	Industrial/ residential/ recreational/ agricultural land	-	IN	Industrial/ residential/ recreational/ agricultural land
10	Ac-stand	Added ‘mature’ modifier	LA	Mature Ac stand
11	At-stand	Changed dominant species to Ac and added ‘mid’ modifier	MA	Mid Ac-stand
13	Ac-shrub-sand/ gravel	Added ‘early’ modifier	AG	Early Ac Sw – shrub – sand/ gravel
14	Sx At-stand	Changed secondary species to Ep and Ac and added modifier ‘mature’	MM	Mature Sw Ep Ac stand
15	Aquatic to semi-aquatic vegetation – depressions and side channels	-	AV	Aquatic to semi-aquatic vegetation – depressions and side channels
16	Ac At-stand	Removed At component and move into old habitat class 11	MA	Mid Ac-stand
17	Non-vegetated-gravel/ cobble/ boulder	-	BS	Non-vegetated – gravel/ cobble/ boulder
18	Ac At-shrub – sand/ gravel	Removed At component and move into old habitat class 11	MA	Mid Ac-stand
19	Sw Ac-stand	Added Ep component to habitat type	MS	Mature Sw Ac Ep stand
20	Sx-shrub-sand/ gravel	Move into old habitat class 13 and added modifier ‘early’	AG	Early Ac Sw – shrub – sand/ gravel

Old Habitat Code	Old Habitat Class	Action	New Habitat Code	New Habitat Class
21	Sx At Ac-shrub-sand/ gravel	-	SG	Early Sw Ac shrub – sand/ gravel
22	Sx At Ac-shrub-grass/ sedge	Removed At component, replaced sedge component with herb	SP	Early Sw Ac shrub – grass/ herb
23	Non-vegetated-shale-steep slope	-	SH	Non-vegetated – shale – steep slope
24	Steep slope - Sw Ac At-stand	Removed At component, added Ep as dominant tree species	ES	Steep slope – Ep Sw stand
25	Ac-At shrub and/or pole sapling	Removed At component and added Sw component, added modifier 'early'	AH	Early Ac Sw – shrub and/or pole sapling
26	Non vegetated-Steep slope-sandstone.	-	SS	Non vegetated-steep slope – sandstone.
27	Wetland Complex	-	WE	Wetland complex
28	Upland low shrub-graminoid.	-	US	Upland low shrub – graminoid.
29	Sparsely vegetated gravel bars with CWD.	Moved into old habitat class 1 or 2	HE	Herb – gentle slopes – sand/ gravel
			RS	Riparian shrub – graminoid/ forb
30	Steep slope- At/ Ac	Removed Ac component, added Ep as dominant tree species	EA	Steep slope – Ep At
31	At- Ac shrub and/or pole sapling	Removed At component, added modifier 'mid'	AS	Mid Ac pole sapling and/or shrub
999	Water	-	OW	Water
000	Unknown	-	-	-

5 DISCUSSION

Construction of the W.A.C. Bennett and Peace Canyon dams altered the hydrograph of the Peace River from a typical hydrograph of peak flows during run-off (late spring/ early summer) and low flows during winter to a regulated system with flows that fluctuate within a narrower range on a daily basis depending on electricity demand. The highest flows now occur during the winter and the lowest flows in the summer (Figure 2). This altered hydrograph has resulted in changes to the riparian vegetation from communities and species that were adapted to and dependent on annual flooding to upland communities and species that are not dependent on or are intolerant of annual flooding.

The primary goal of this project is to create a current baseline inventory of riparian habitats in the Peace River. This baseline is intended to be used to identify future changes in riparian vegetation communities from spill or flood pulse events. These are associated with the Peace Spill Protocol and Peace Flood Pulse Plan.

Of the 24 final habitat classes identified in this project, five main groups were identified: non-vegetated, wetland and aquatic, shrub/graminoid/forb, balsam poplar dominated, and white spruce, paper birch or trembling aspen dominated. Descriptions of each community including the shrub and herb species are provided in Appendix 6. The majority of the non-vegetated habitat classes containing exposed sandstone were located at the top end of the study area near the Peace Canyon dam. For the remaining classes, patterns in spatial distribution were based on elevation above the river level rather than from upstream to downstream in the study area. The polygons closest to the water were usually identified as mineral (gravel, boulder/cobble, etc.), followed by an herbaceous polygon, then a shrub-dominant polygon, transitioning to forest edge (see examples in Figure 3, 4, and 5). This pattern was noted during orthophoto interpretation and confirmed during ground sampling, especially on the mid-stream islands. The only notable difference was locations where a steep-slope habitat (habitats ES and EA) directly connected the river or riparian zone to upland areas.

The open water habitat class (OW) that defines areas of standing water is partially a result of the low water level the air photos were obtained at (Figure 2). This habitat class does not include the Peace River itself. While these areas are not considered terrestrial riparian habitat, this polygon type should be retained in the data set to assist in interpreting the effects of a future flood. For example an increase in the area of these polygons could indicate where larger changes in riparian vegetation could be expected due to alterations in hydrology or indicate potential benefits to fish habitat. The remaining 17 habitat classes tend to be smaller polygons distributed throughout the study area. Only three habitat classes have areas greater than 10% of the study area (classes GB, MA, and RS), one of which is non-vegetated (GB).

Of the habitat classes delineated, the balsam poplar dominated group, wetland and aquatic group, and habitat RS (riparian shrub/ graminoid/ forb) are considered the most likely to be affected by flood events or altered flood regimes. Together these classes cover >43% of the study area, and so are a significant component of the riparian vegetation. Balsam poplar reaches its maximum development on floodplains in northeastern BC and is the dominant colonizer of disturbed sites in these areas (Burns and Honkala 1990), so flood events serve to maintain these habitats. However, large flood or spill events can alter existing vegetation and habitat values in the short term (Braatne et al. 2008). Conversely, a decrease in flood frequency and intensity may drive a shift from Ac and riparian shrub classes to classes dominated by species that are less flood tolerant such as white spruce.

Some Ac leading habitat classes appear to have been established during previous flood events based on the presence of fluvial soil deposits such as sand and silt. This was especially evident on the highest mid-stream islands where the highest elevation areas were often occupied by a mature balsam poplar or balsam poplar/ white spruce mix. These top sites would only be inundated during large flood events. Occasional accumulations of large coarse woody debris piles in advanced states of decomposition (estimated >50 years old) deposited relatively far from the current river edge provided evidence of past large flood events. Current dam-moderated flood regimes may be shifting these areas to white spruce dominated habitat classes. Younger Ac dominated classes in the study area demonstrated signs of more recent and frequent flooding. However, the presence of less flood-tolerant species such as white spruce in the understory (A3, B1 and B2 layers) also suggests that changes in flood regime are also shifting some habitat classes (e.g., classes AH, AG, MA) away from balsam poplar dominated stands.

Ground sampling showed that in general, the results of the orthophoto interpretation were accurate. The major inaccuracy detected by the ground sampling proved to be the mapping of trembling aspen in several of the habitat classes. Ground sampling data and general observation of the study area showed that little trembling aspen occurred within the study area, and generally occurs in small stands or as single stems. This interpretation issue occurred in the early- and mid-successional habitat classes that contained young balsam poplar and not young trembling aspen. These two species are difficult to differentiate during photo interpretation. This also holds true for differentiating paper birch from either of the previous two species.

Eight of the total 24 habitat classes were not ground sampled, and a further two classes (classes SP and EA) had only one plot completed in each type. Seven of the eight classes not sampled were non-vegetated (classes SA, GS, IN, BS, SH, SS, OW) or were considered to be unlikely to be impacted by flooding due to their topographic location (class US). Class SP consists of only 13 polygons and 0.48% of the study area, and so was only sampled once due to logistical and efficiency constraints. Class EA was considered to be less influenced by flood events due to its steep slope, and so was also a lower priority for sampling.

Recommendations for Year 2 of this study made by MacInnis et al. (2011) were addressed by the ground sampling and subsequent habitat class refinements. These included:

- Eliminating height classes from the habitat class descriptions and using broad successional status descriptions to separate classes of similar vegetation compositions by different ages.

- Confirming absence of dead pine, the presence of white spruce, rather than hybrid spruce, and the predominance of willow and alder as the main shrub species.

- Distributing ground sampling plots throughout the study area to capture variation within individual habitat classes.

- Revising the habitat class descriptions and mapping to reflect the results of ground sampling.

5.1 Recommendations

The riparian habitat mapping detailed in this report can act in its current form as a baseline for assessing future changes in riparian habitat extent and composition. However, the completion of

some additional work will increase the utility of this dataset for monitoring future riparian habitat changes. The following additional work is recommended:

1. The riparian habitat mapping should be refined with current flow mapping for 120,000 cfs. The inundation line used in this report is from 1996 and should be updated with more recent information to account for any river channel changes that have occurred.

2. Obtain flow data to assess the potential impacts of spill events – large water releases are spill events are defined as >70,000 cfs. Overlaying the extent of inundation at different levels of flow progressing up from 70,000 cfs in 10,000 cfs increments may identify thresholds of riparian habitat change or areas of particular concern.

3. Future monitoring of changes in extent and composition of riparian vegetation under GMSMON-6 Peace River Riparian Flooding (and other monitoring programs, where relevant) should focus on habitat groups and classes that may be significantly impacted by changes in flood regime – this includes:
    a. Balsam poplar leading areas – this includes habitat classes AH, AG, MA, AS, and LA
    b. Riparian shrub / graminoid / forb – class RS
    c. Low lying and frequently inundated areas – this includes habitat classes WE and AV (wetland and aquatic group)

6 LITERATURE CITED

Anon. 2003. Committee report: Peace River water use plan. Peace River Water Use Plan Consultative Committee.

BC Hydro. 2007. Peace project water use plan. Revised for acceptance for the comptroller of water rights. BC Hydro.

BC Hydro. 2008. Peace Project Water Use Plan, Physical Works Terms of Reference: Peace River Riparian Habitat Assessment, GMSWORKS-7.

BC Ministry of Forests. 2006. VRI - Forest Vegetation Composite Polygons and Rank 1 Layer. BC Ministry of Forests, Forest Analysis and Inventory Branch. Retrieved from https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=47574&recordSet=ISO19115.

Braatne, J. H., S. B. Rood, L. A. Goater, and C. L. Blair. 2008. Analyzing the Impacts of Dams on Riparian Ecosystems: A Review of Research Strategies and Their Relevance to the Snake River Through Hells Canyon. Environmental Management 41:267–281.

Burns, R. M., and B. H. Honkala. 1990. Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook, US Department of Agriculture, Forest Service, Washington, DC.

Keystone Wildlife Research Ltd. 2007. Terrestrial ecosystem mapping of the Peace River study area report. Baseline inventory surveys 2007. BC Hydro.

MacInnis, A. M., K. Bachmann, and R. Gill. 2011. GMSWORKS-7: Peace River riparian habitat assessment Year 1 data report. Unpublished report by Cooper Beauchesne and Associates Ltd for BC Hydro Water License Requirements, Hudson's Hope, BC.

Meidinger, D., and J. Pojar. 1991. Ecosystems of British Columbia. BC Ministry of Forests, Victoria, B.C.

Province of British Columbia. 1998. Field manual for describing Terrestrial Ecosystems. Ministry of Environment, Lands and Parks and Ministry of Forests, Victoria, BC.

Resources Information Standards Committee. 2010. Vegetation resources inventory. Photo interpretation procedures. Ministry of Forests and Range, Victoria, B.C.

Resources Inventory Committee. 1998. Standard for terrestrial ecosystem mapping in British Columbia. Ministry of Forests, Victoria, B.C.

Resources Inventory Committee. 2002. Vegetation resources inventory. The B.C. land cover classification scheme. Ministry of Sustainable Resource Management, Victoria, B.C.

Appendix 1. Field forms used for full plot surveys.

BRITISH COLUMBIA
MINISTRY OF FORESTS
BC ENVIRONMENT

ECOSYSTEM FIELD FORM

DATE Y M D | PLOT NO.

PROJECT ID. | FIELD NO. | SURVEYOR(S)

SITE DESCRIPTION

LOCATION

GENERAL LOCATION

FOREST REGION | MAPSHEET | UTM ZONE | LAT./ NORTH. | LONG./ EAST.

AIRPHOTO NO. | X CO-ORD. | Y CO-ORD. | MAP UNIT

SITE INFORMATION

PLOT REPRESENTING

BGC UNIT | SITE SERIES | TRANS./ DISTRIB. | ECOSECTION

MOISTURE REGIME | NUTRIENT REGIME | SUCCESS. STATUS | STRUCT. STAGE | REALM/ CLASS

ELEV. m. | SLOPE % | ASPECT ° | MESO SLOPE POS. | SURFACE TOPOG.

SITE DIAGRAM

SITE DISTURB. | PHOTO ROLL

EXPOS. TYPE | FRAME NOS.

NOTES

SUBSTRATE (%)

ORG. MATTER | ROCKS

DEC. WOOD | MINERAL SOIL

BEDROCK | WATER

FS882 (1) HRE 98/5

SOIL DESCRIPTION

GEOLOGY BEDROCK | C. F. LITH. | SURVEYOR(S) | PLOT NO.

TERRAIN TEXTURE 1 2 | SURFICIAL 1 MATERIAL 2 | SURFACE 1 EXPR. 2 | GEOMORPH. 1 PROCESS 2 | PROFILE DIAGRAM

SOIL CLASS. | HUMUS FORM | HYDROGEO.

ROOTING DEPTH cm | ROOT RESTRICT. LAYER TYPE DEPTH cm | WATER SOURCE | DRAINAGE

R. Z. PART. SIZE | SEEPAGE cm | FLOOD RG.

ORGANIC HORIZONS/LAYERS

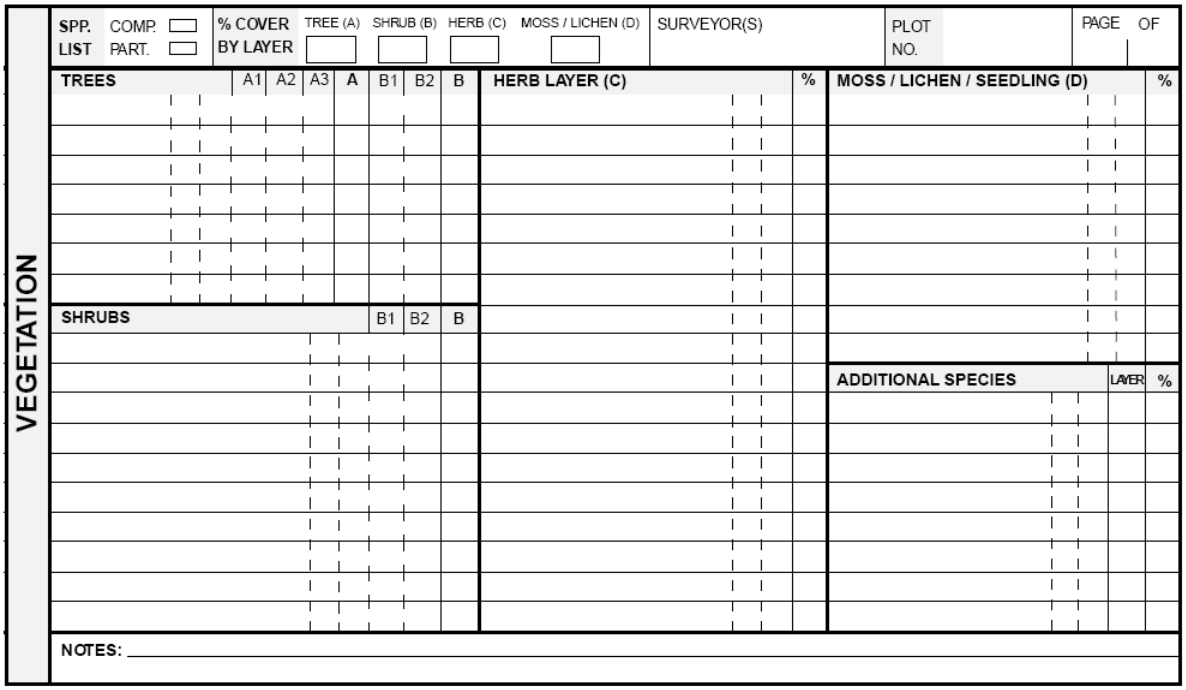
HOR/ LAYER	DEPTH	FABRIC STRUCTURE	FABRIC vPOST	MYCEL. AB.	FECAL AB.	ROOTS AB.	ROOTS SIZE	pH	COMMENTS (consistency, character, fauna, etc):

MINERAL HORIZONS/LAYERS

HOR/ LAYER	DEPTH	COLOUR	ASP.	TEXT.	% COARSE FRAGMENTS G	C	S	TOTAL	SHAPE	ROOTS AB.	ROOTS SIZE	STRUCTURE CLASS	STRUCTURE KIND	pH	COMMENTS (mottles, clay films, effervesc., etc):

NOTES:

FS882 (2) HRE 98/5



VEGETATION

SPP. COMP. ☐ LIST PART. ☐ | % COVER BY LAYER | TREE (A) | SHRUB (B) | HERB (C) | MOSS / LICHEN (D) | SURVEYOR(S) | PLOT NO. | PAGE OF

TREES	A1	A2	A3	A	B1	B2	B

SHRUBS	B1	B2	B

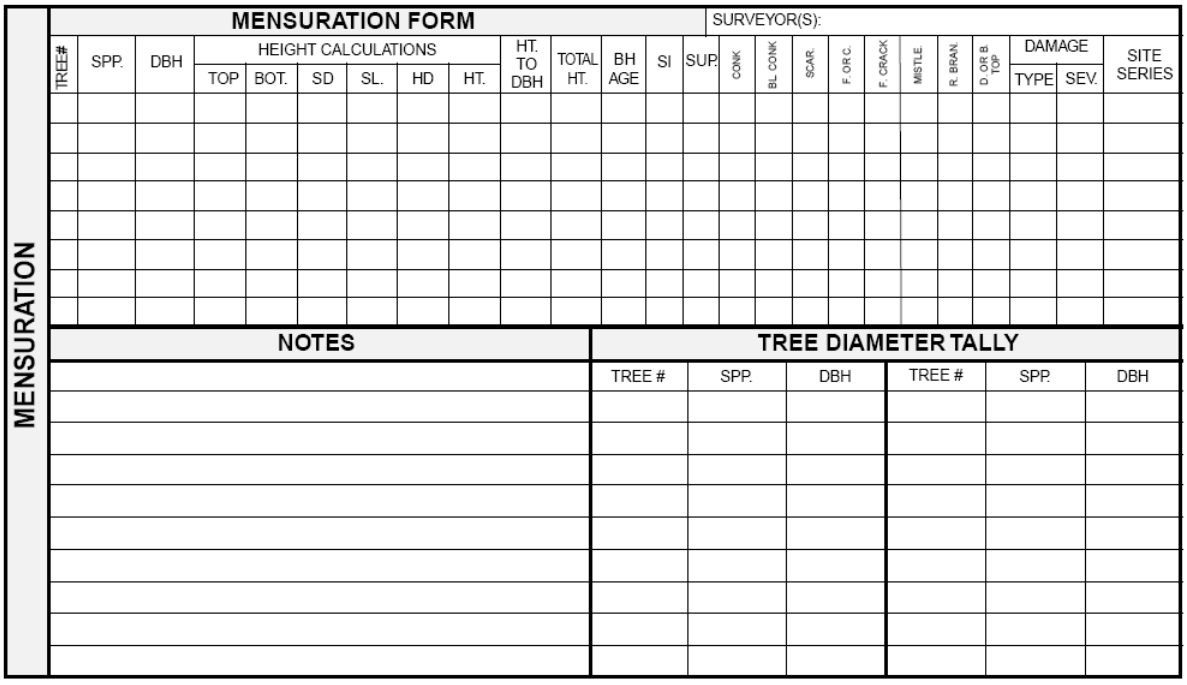
HERB LAYER (C)	%

MOSS / LICHEN / SEEDLING (D)	%

ADDITIONAL SPECIES	LAYER	%

NOTES:

FS882 (3) HRE 98/5



MENSURATION

MENSURATION FORM | SURVEYOR(S):

TREE#	SPP.	DBH	HEIGHT CALCULATIONS: TOP	BOT.	SD	SL.	HD	HT.	HT. TO DBH	TOTAL HT.	BH AGE	SI	SUP.	CONK	BL CONK	SCAR.	F. OR C.	F. CRACK	MISTLE	R. BRAN.	D. OR B. TOP	DAMAGE: TYPE	SEV.	SITE SERIES

NOTES	TREE DIAMETER TALLY					
	TREE #	SPP.	DBH	TREE #	SPP.	DBH

FS 882 (4) HRE 98/5

Appendix 2. Field form used for ground inspection plot surveys.

BRITISH COLUMBIA — GROUND INSPECTION FORM

G ☐ vs V ☐	PHOTO	X:	Y:	DATE
PROJECT ID.		SURV.		
MAP SHEET		PLOT #		POLY. #
UTM ZONE	LAT. / NORTH	LONG. / EAST		
ASPECT °		ELEVATION m		
SLOPE %	SMR	SNR		

MESO SLOPE POSITION	☐ Crest	☐ Mid slope	☐ Depression	
	☐ Upper slope	☐ Lower slope	☐ Level	
		☐ Toe		
DRAINAGE - MINERAL SOILS	☐ Very rapidly	☐ Well	☐ Poorly	
	☐ Rapidly	☐ Mod. well	☐ Very poorly	
		☐ Imperfectly		
MOISTURE SUBCLASSES - ORGANIC SOILS	☐ Aqueous	☐ Aquic	☐ Perhumid	
	☐ Peraquic	☐ Subaquic	☐ Humid	
MINERAL SOIL TEXTURE	☐ Sandy (LS,S)	☐ Silty (SiL,Si)		
	☐ Loamy (SL,L,SCL,FSL)	☐ Clayey (SiCL,CL,SC,SiC,C)		

ORGANIC SOIL TEXTURE ☐ Fibric ☐ Mesic ☐ Humic	SURF. ORGANIC HORIZON THICKNESS ☐ 0–40 cm ☐ > 40 cm
HUMUS FORM ☐ Mor ☐ Moder ☐ Mull	ROOT RESTRICTING LAYER Depth _____ cm Type _____
COARSE FRAGMENT CONTENT ☐ < 20% ☐ 20–35% ☐ 35–70% ☐ > 70%	

TERRAIN — COMPONENT: TC1 ☐ TC2 ☐ TC3 ☐

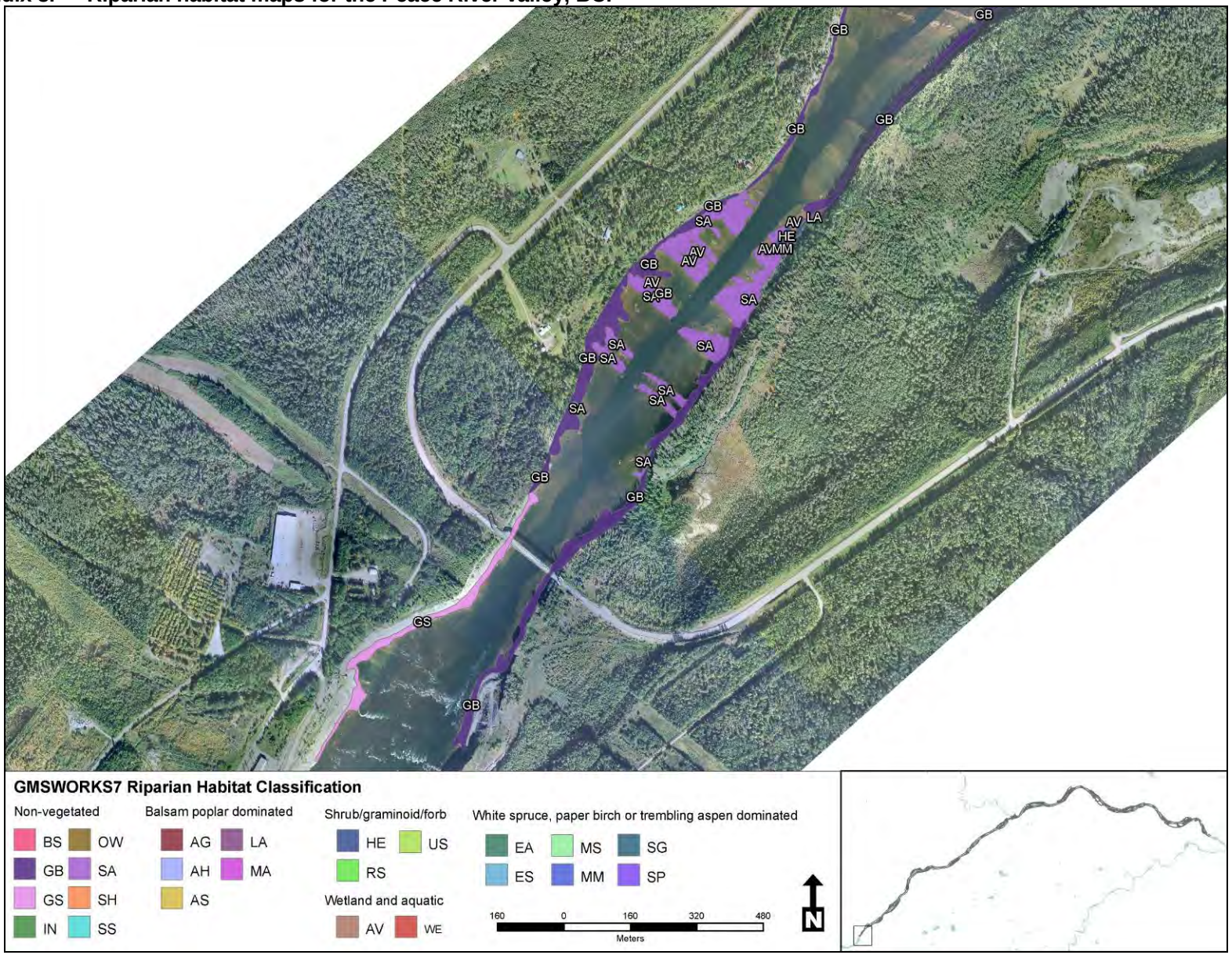
TERRAIN TEXTURE	SURFICIAL MATERIAL	SURFACE EXPRESSION	GEOMORPH PROCESS
1	1	1	1
2	2	2	2

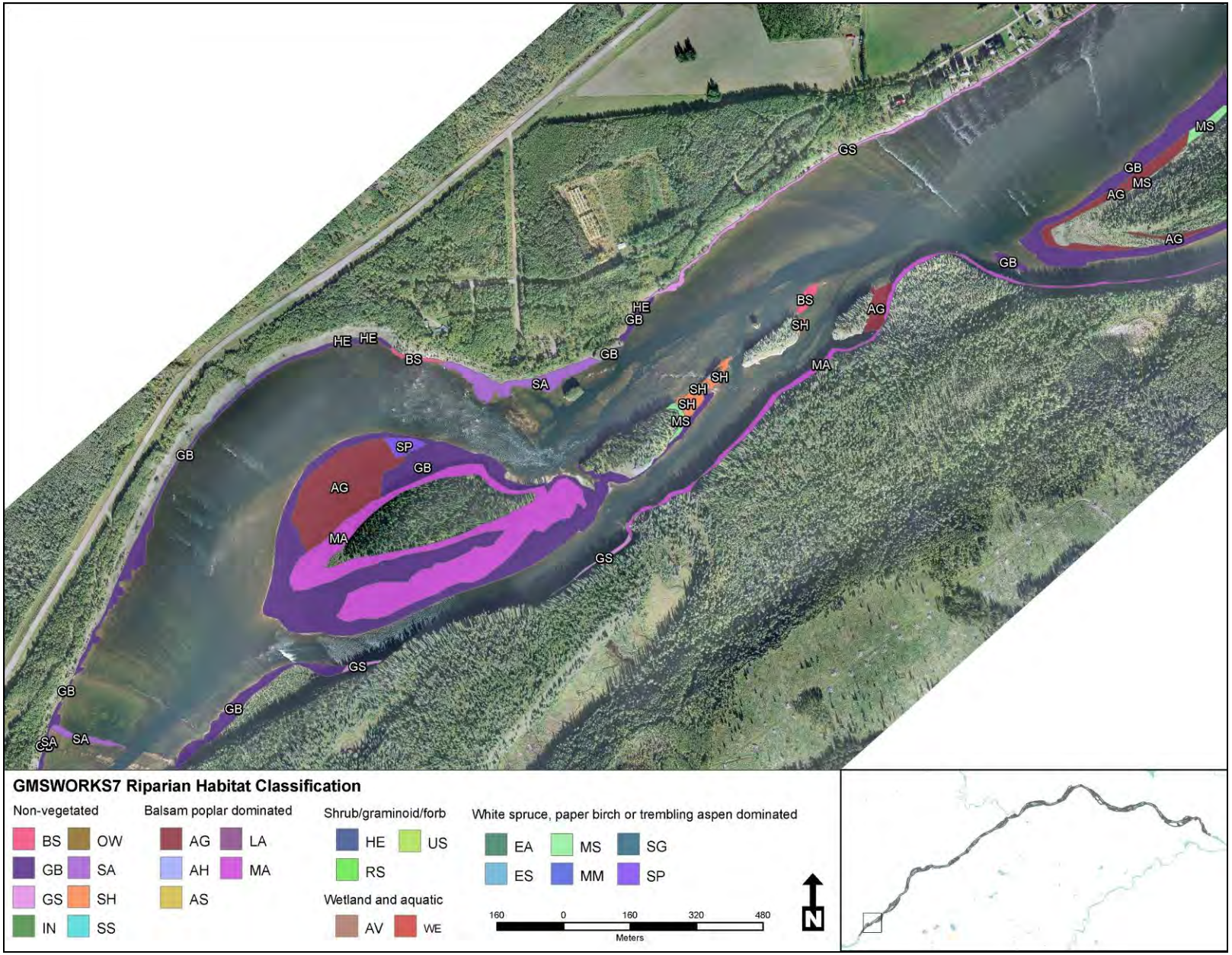
ECOSYSTEM — COMPONENT: EC1 ☐ EC2 ☐ EC3 ☐

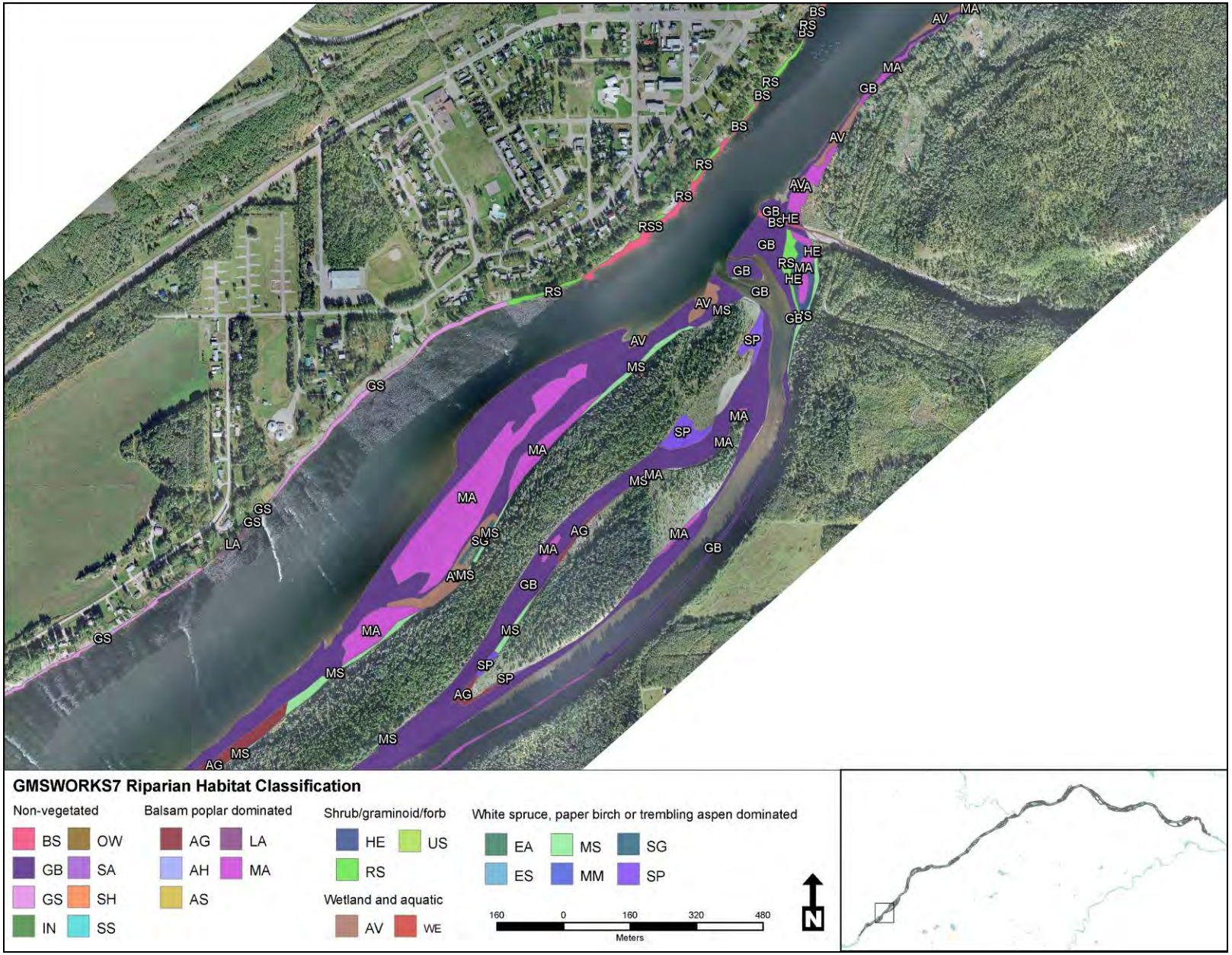
BGC UNIT	ECOSECTION
SITE SERIES	SITE MODIFIERS
STRUCTURAL STAGE	CROWN CLOSURE %

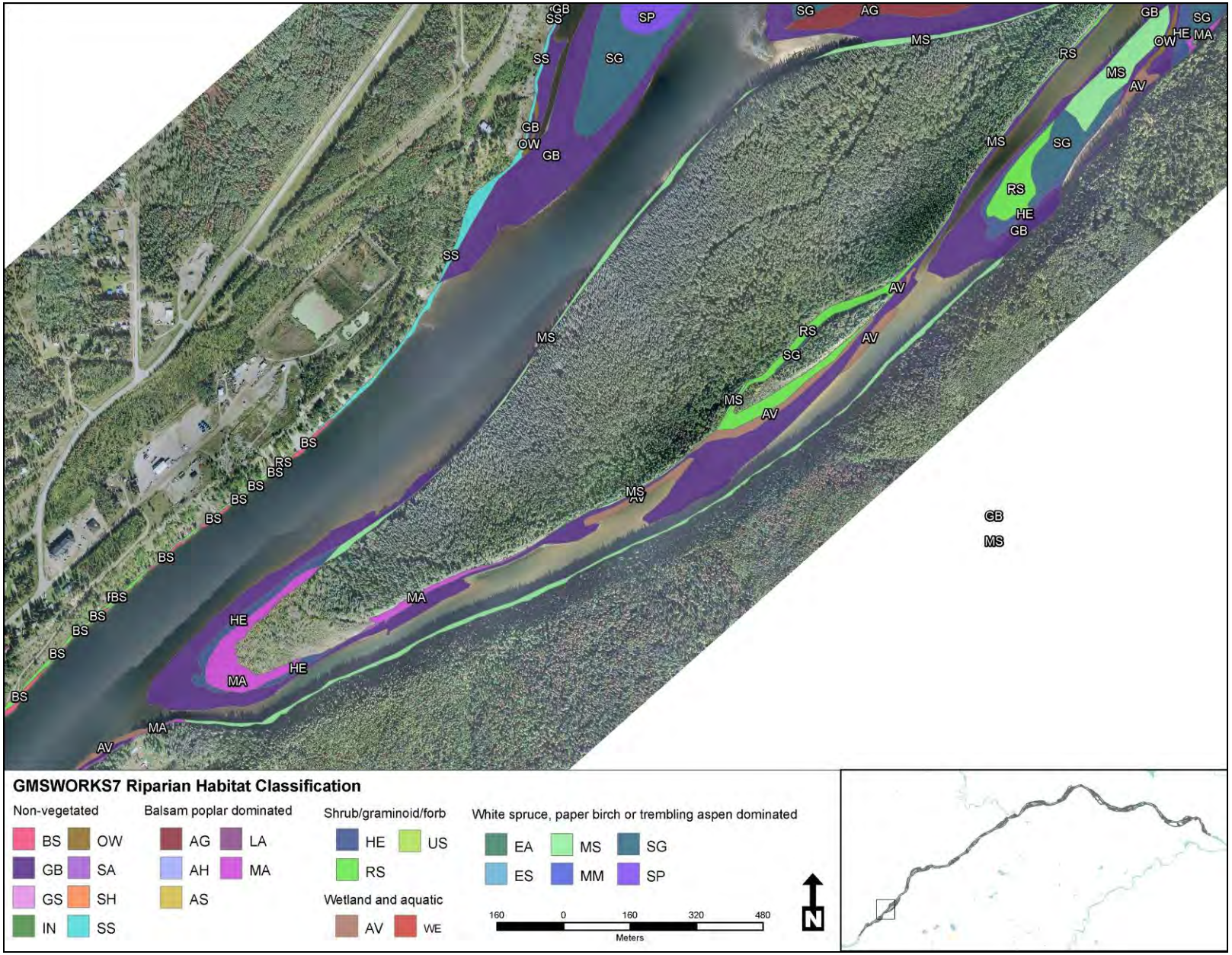
ECOSYSTEM POLYGON SUMMARY					TERRAIN POLYGON SUMMARY		
	%	SS	SM	ST		%	Classification
EC1					TC1		
EC2					TC2		
EC3					TC3		

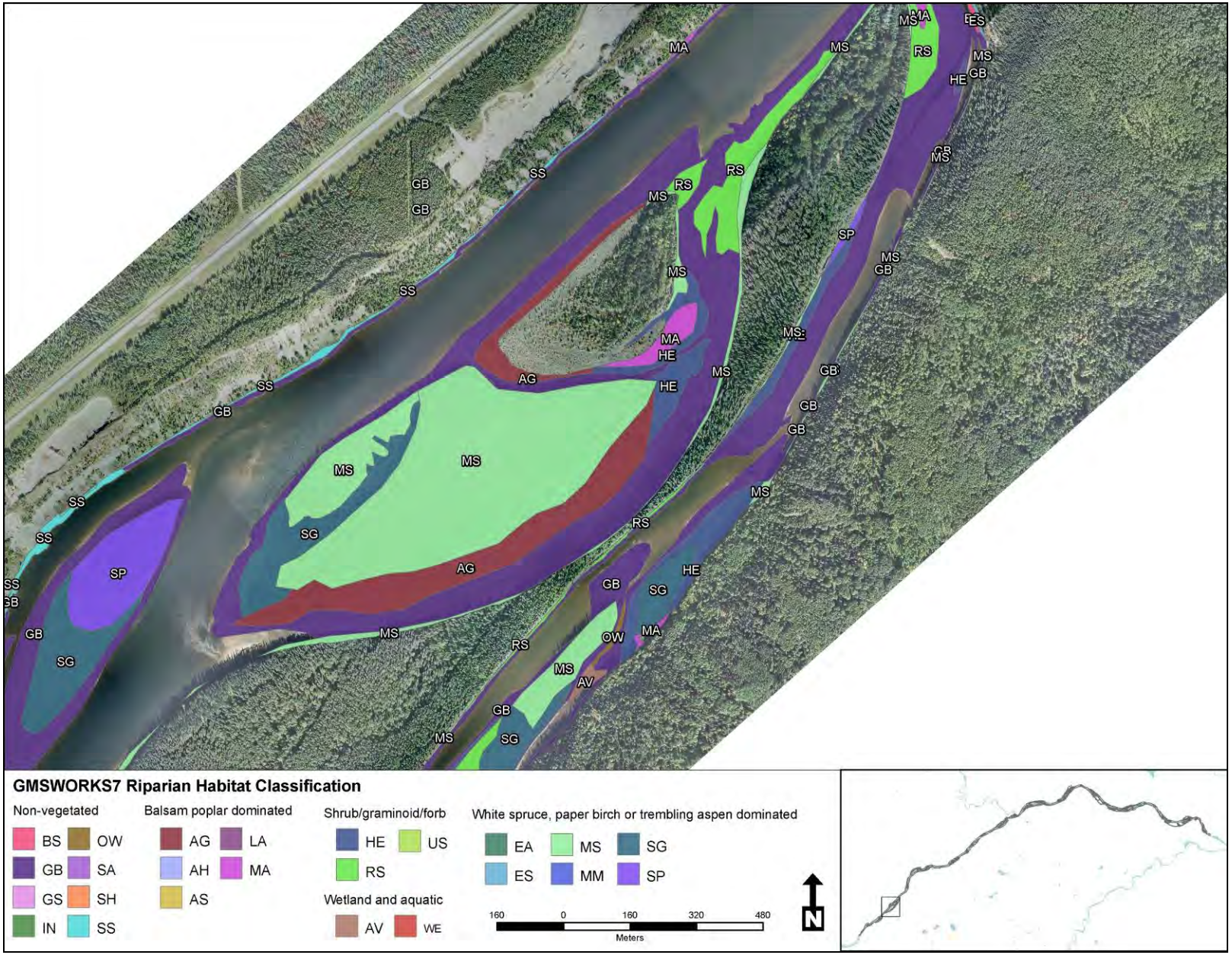
Appendix 3. Riparian habitat maps for the Peace River valley, BC.

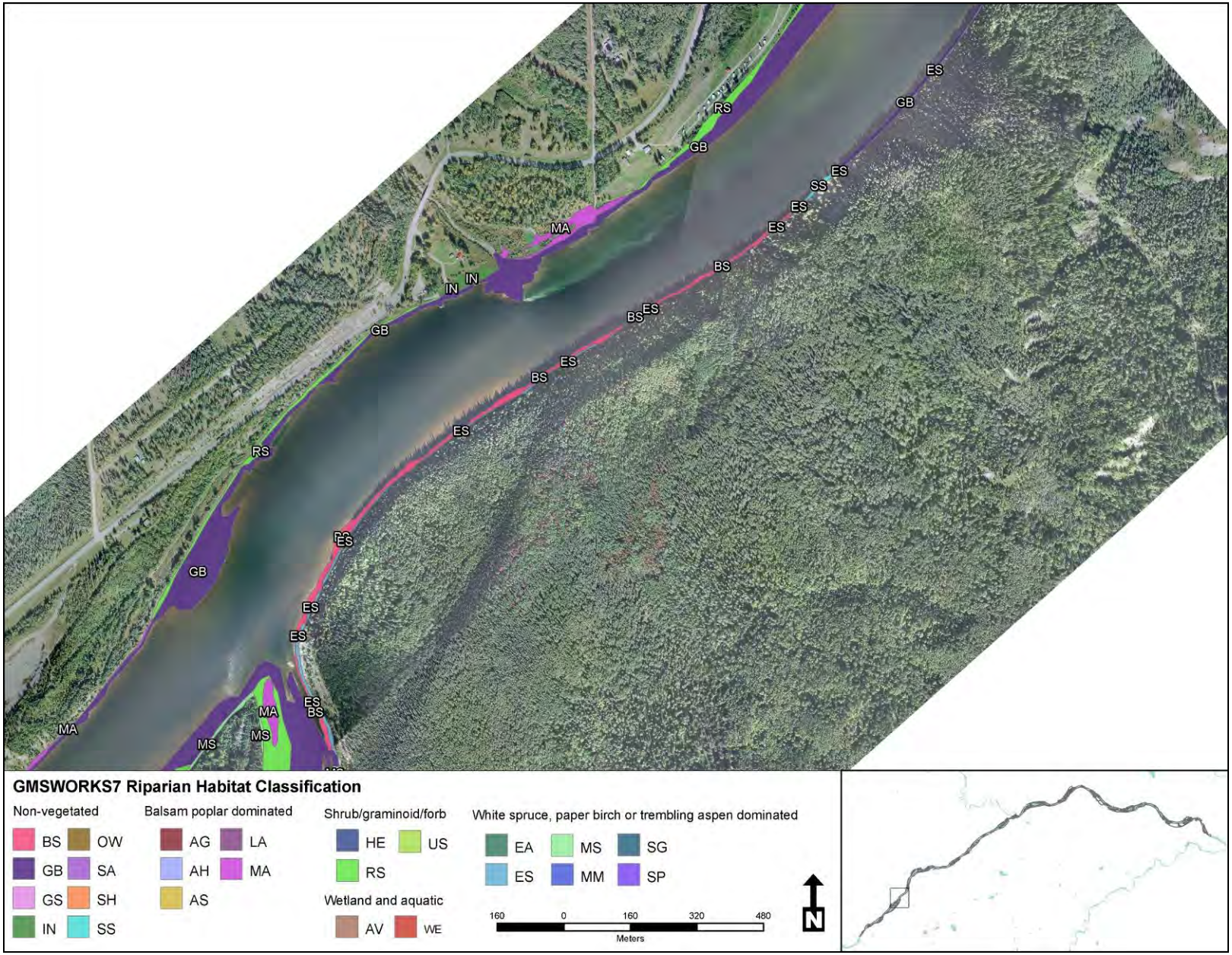


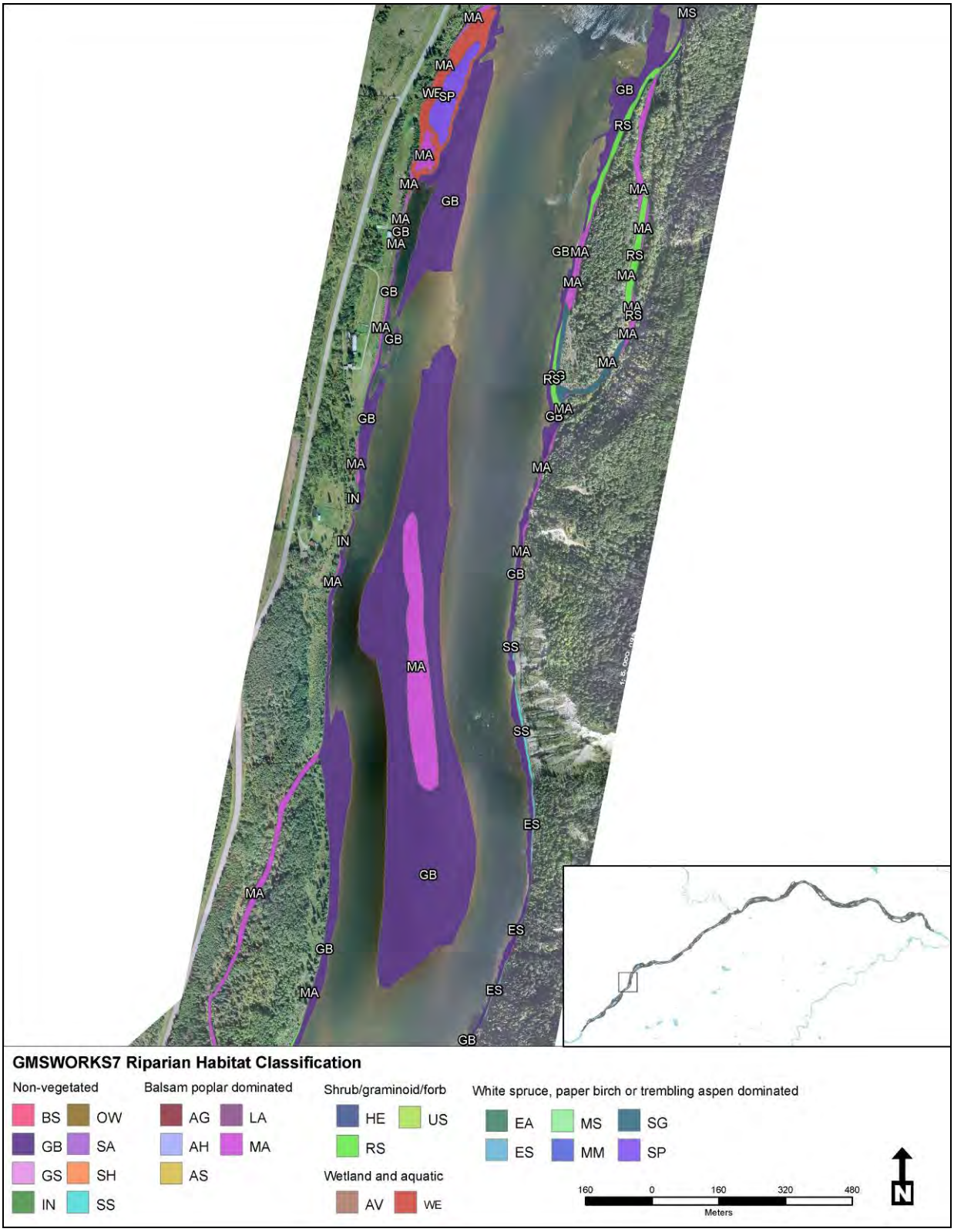

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

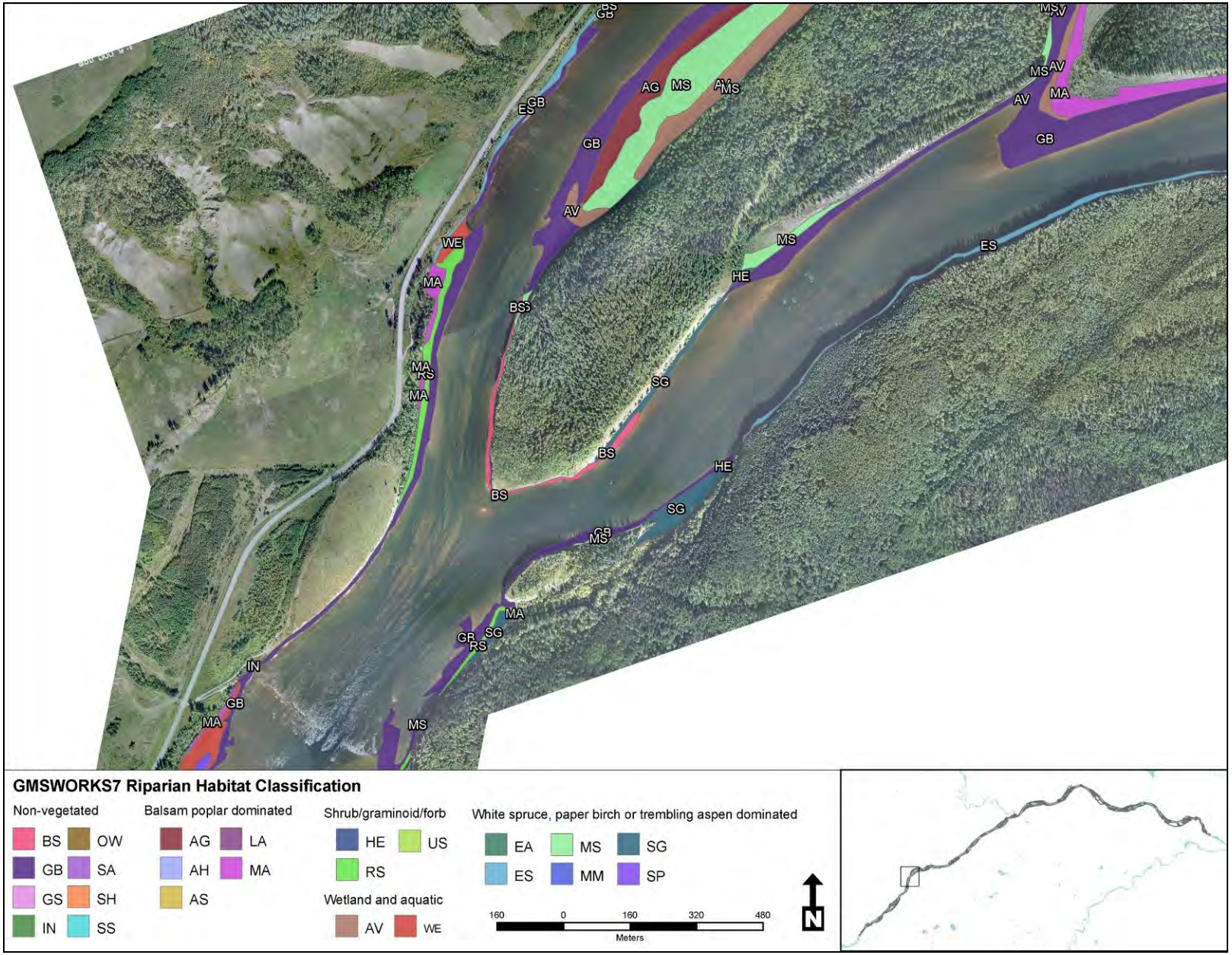

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

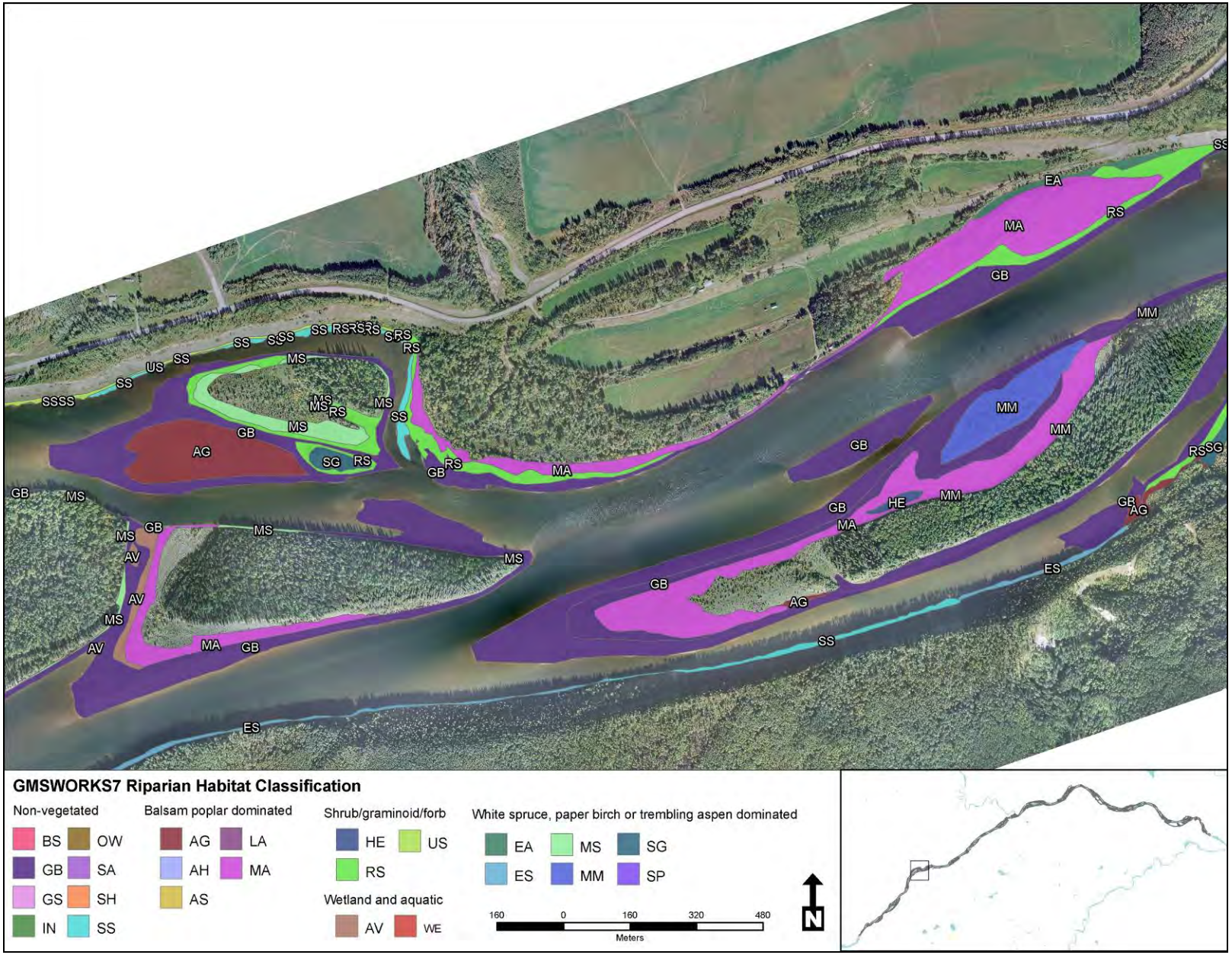

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

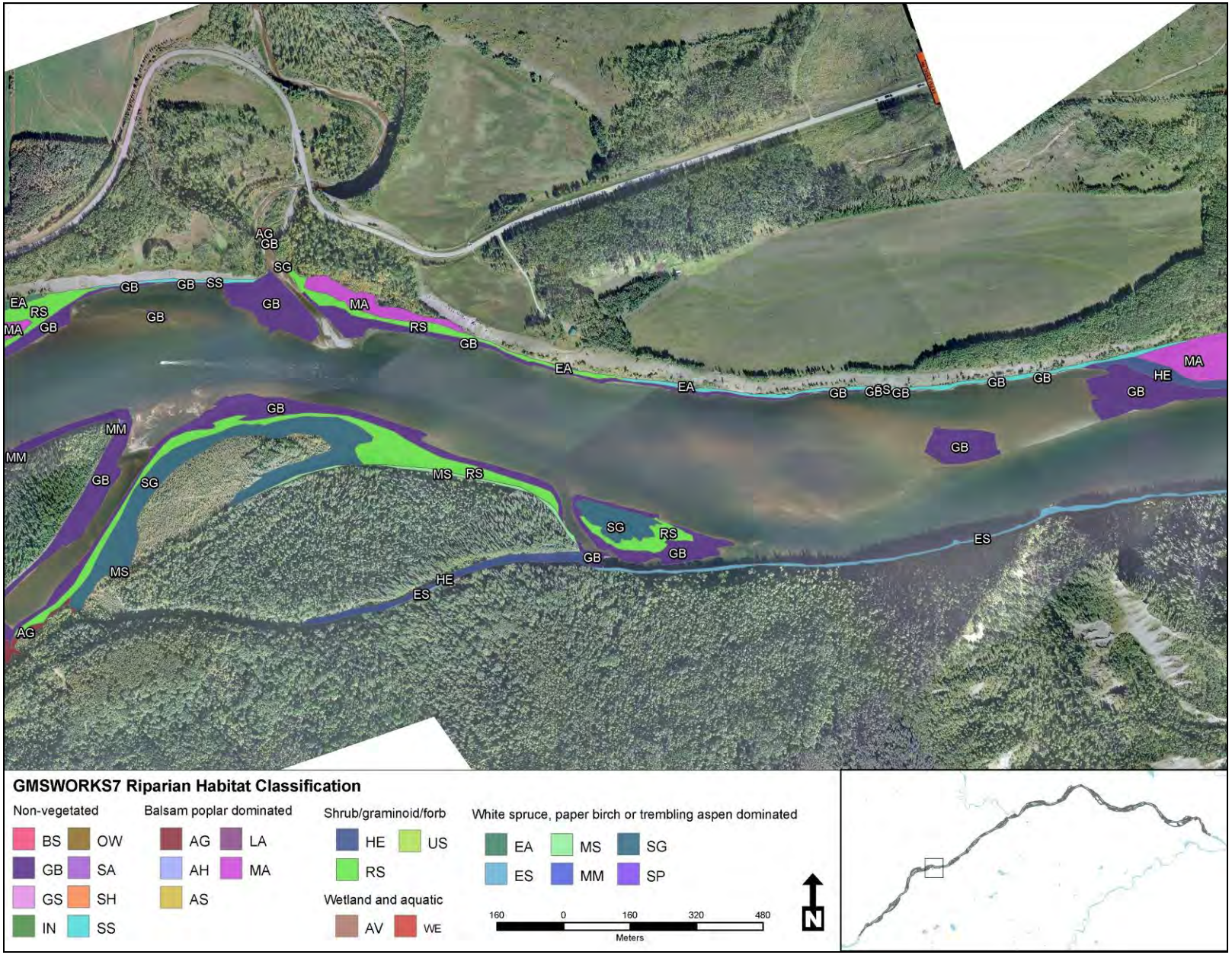

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

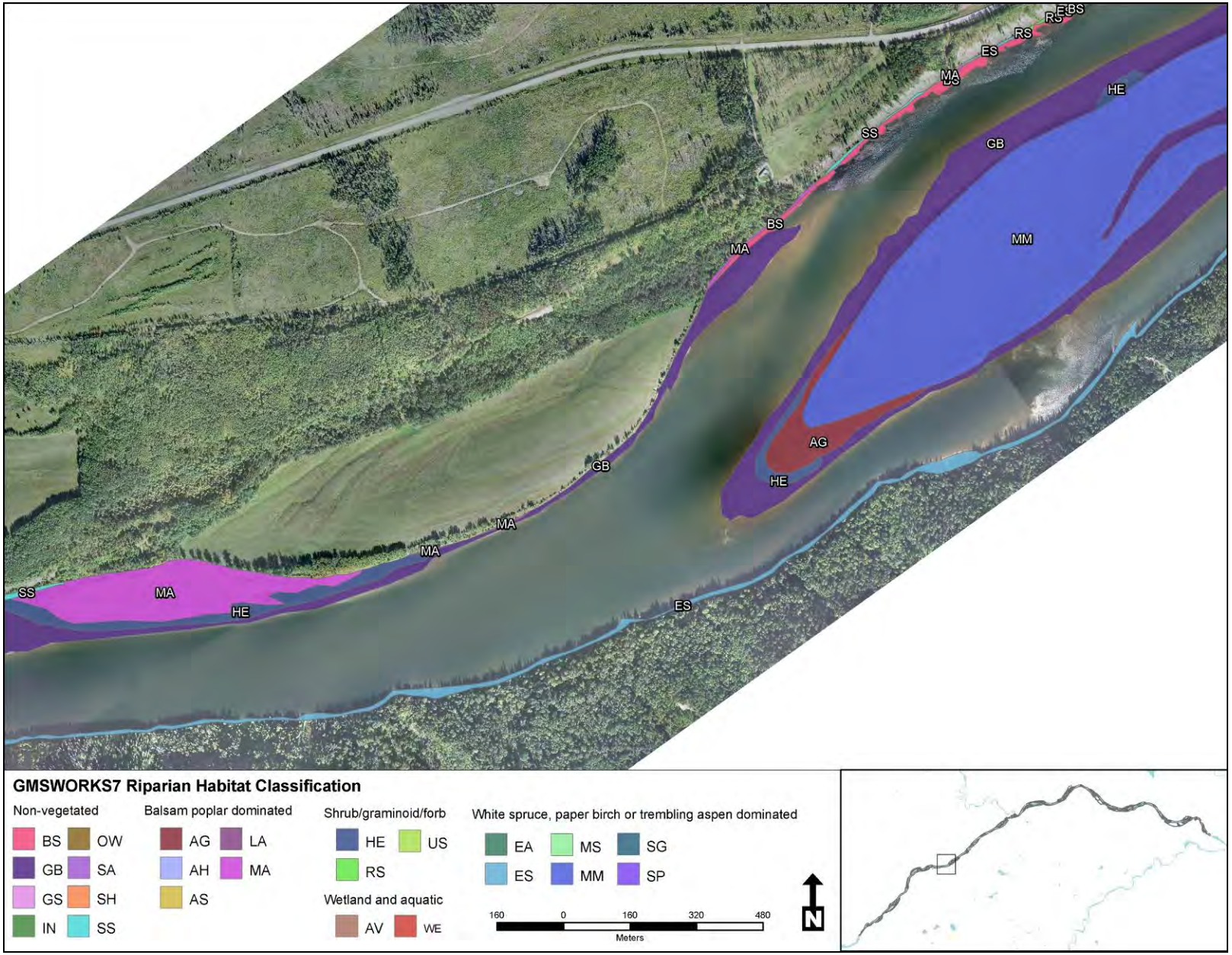

ES
GB
RS
GB
ES
SS
ES
ES
MA
BS
IN
IN
BS
ES
GB
ES
BS
ES
RS
ES
GB
ES
ES
ES
BS
MA
MA
MS
MS
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

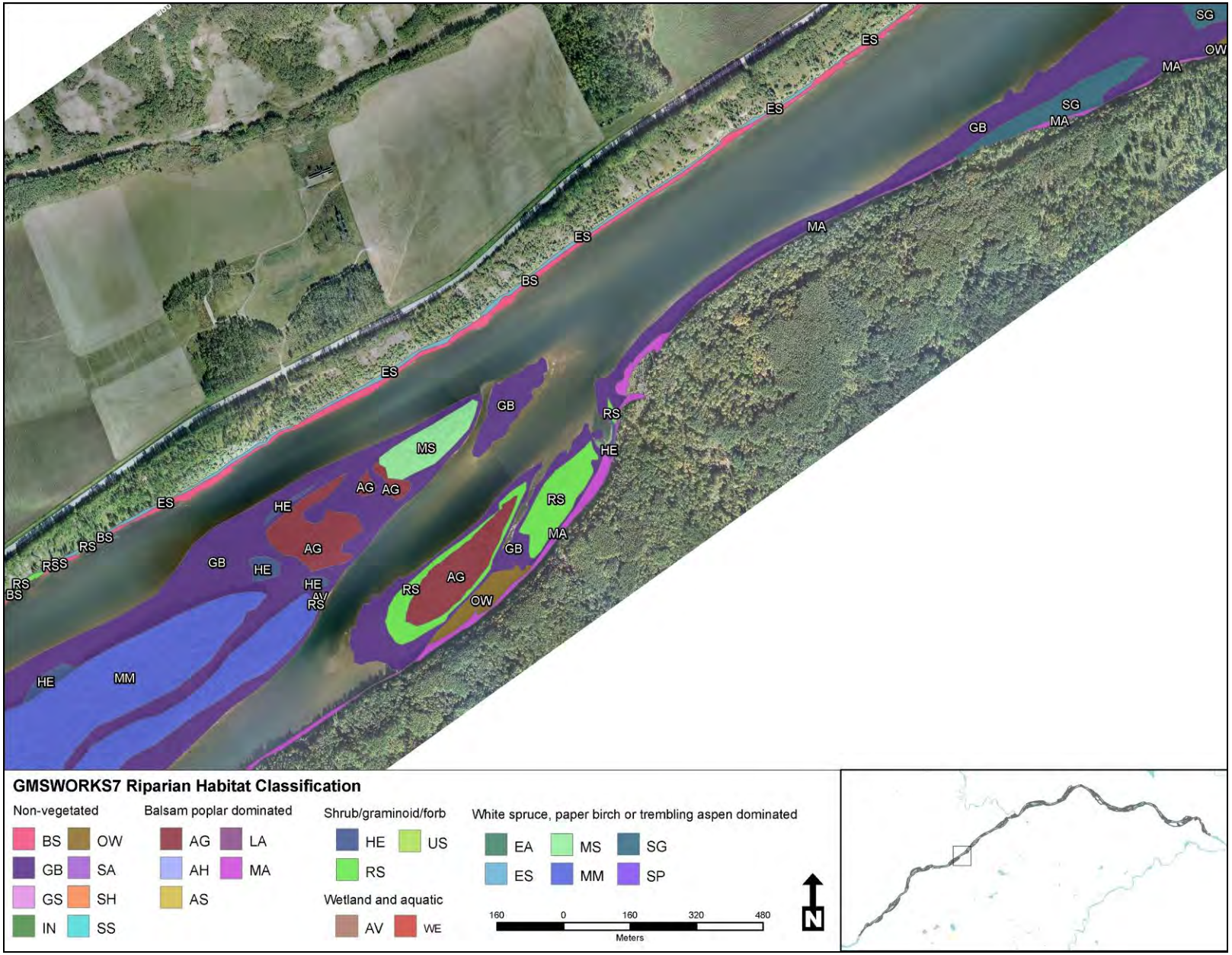

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

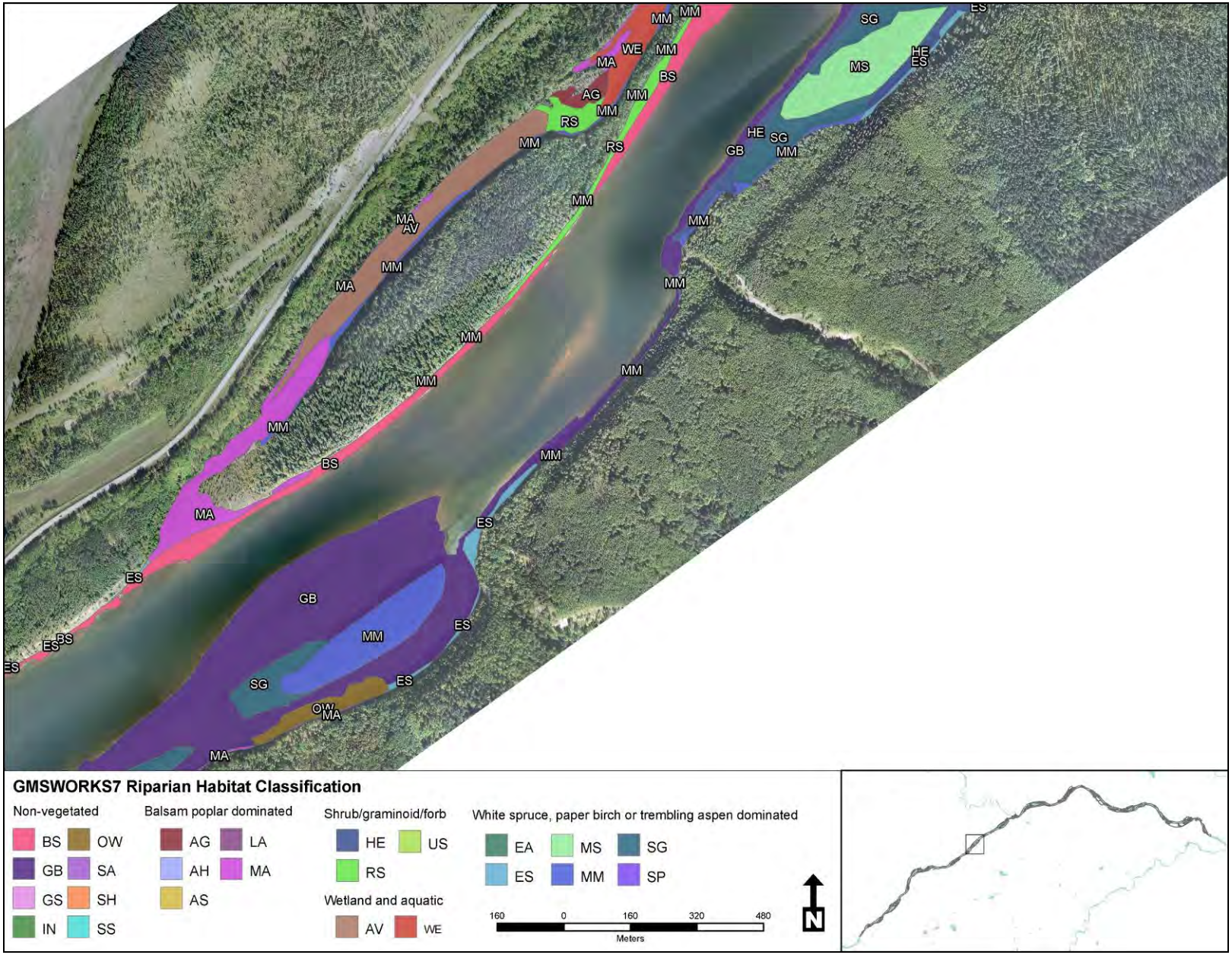

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

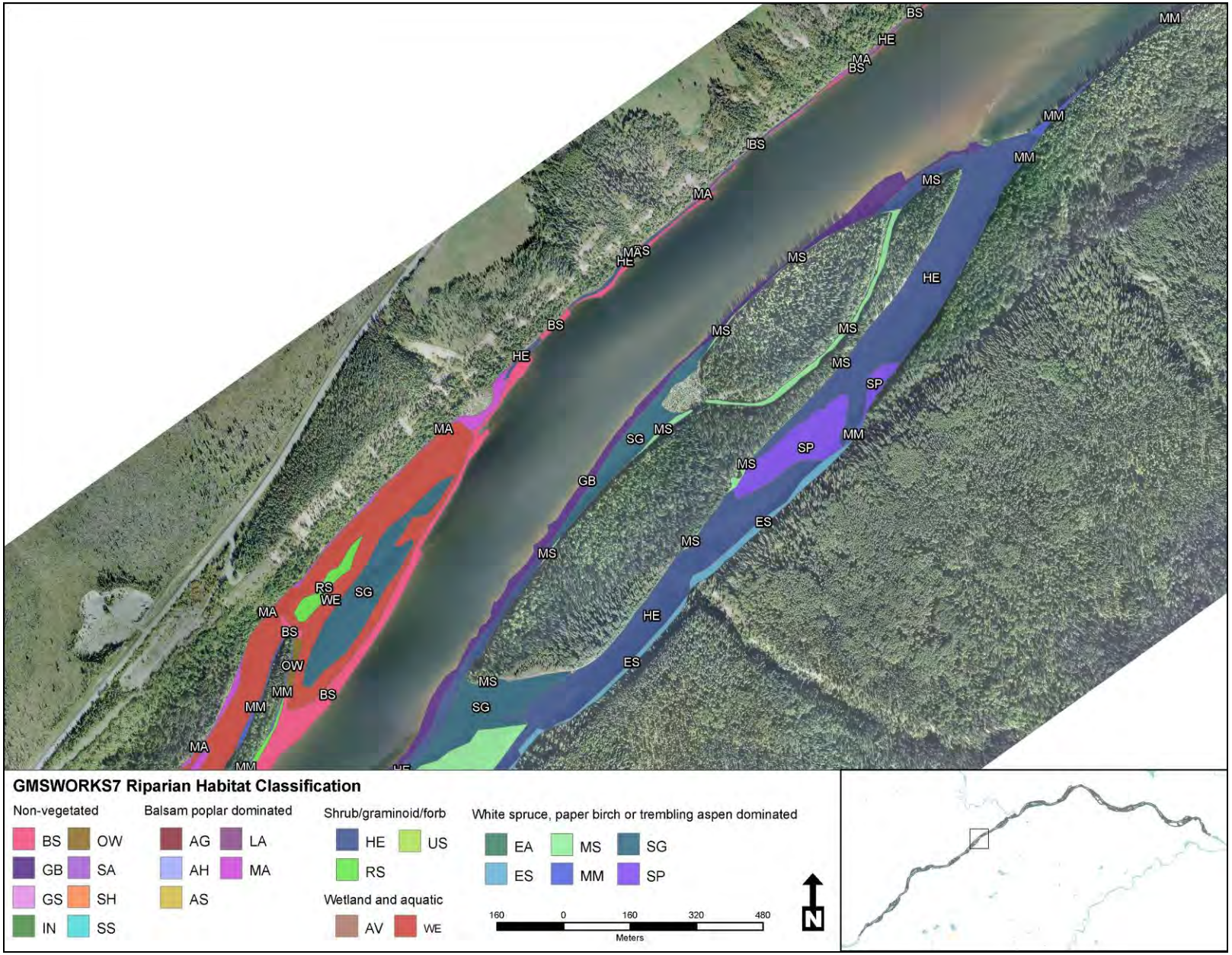

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

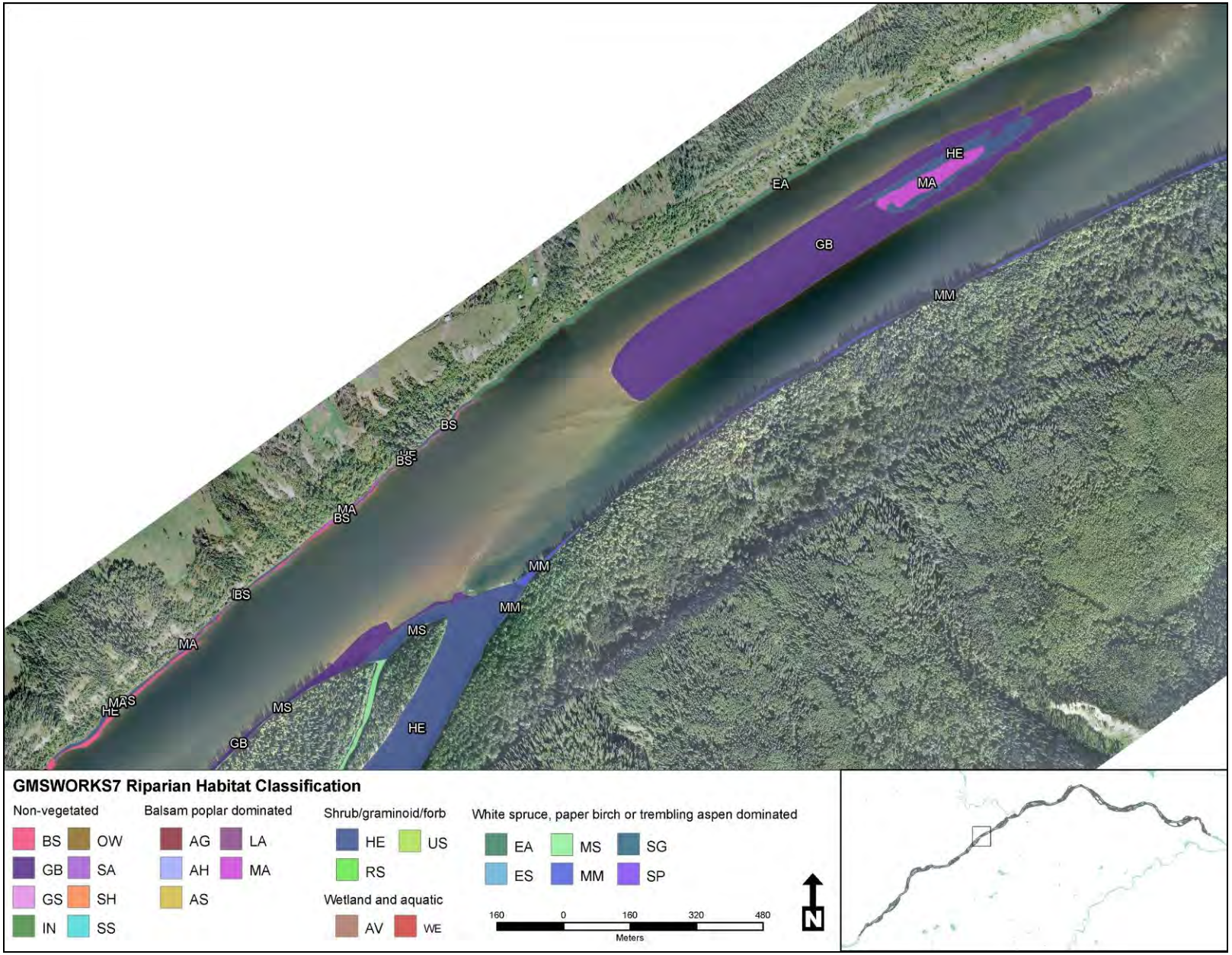

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

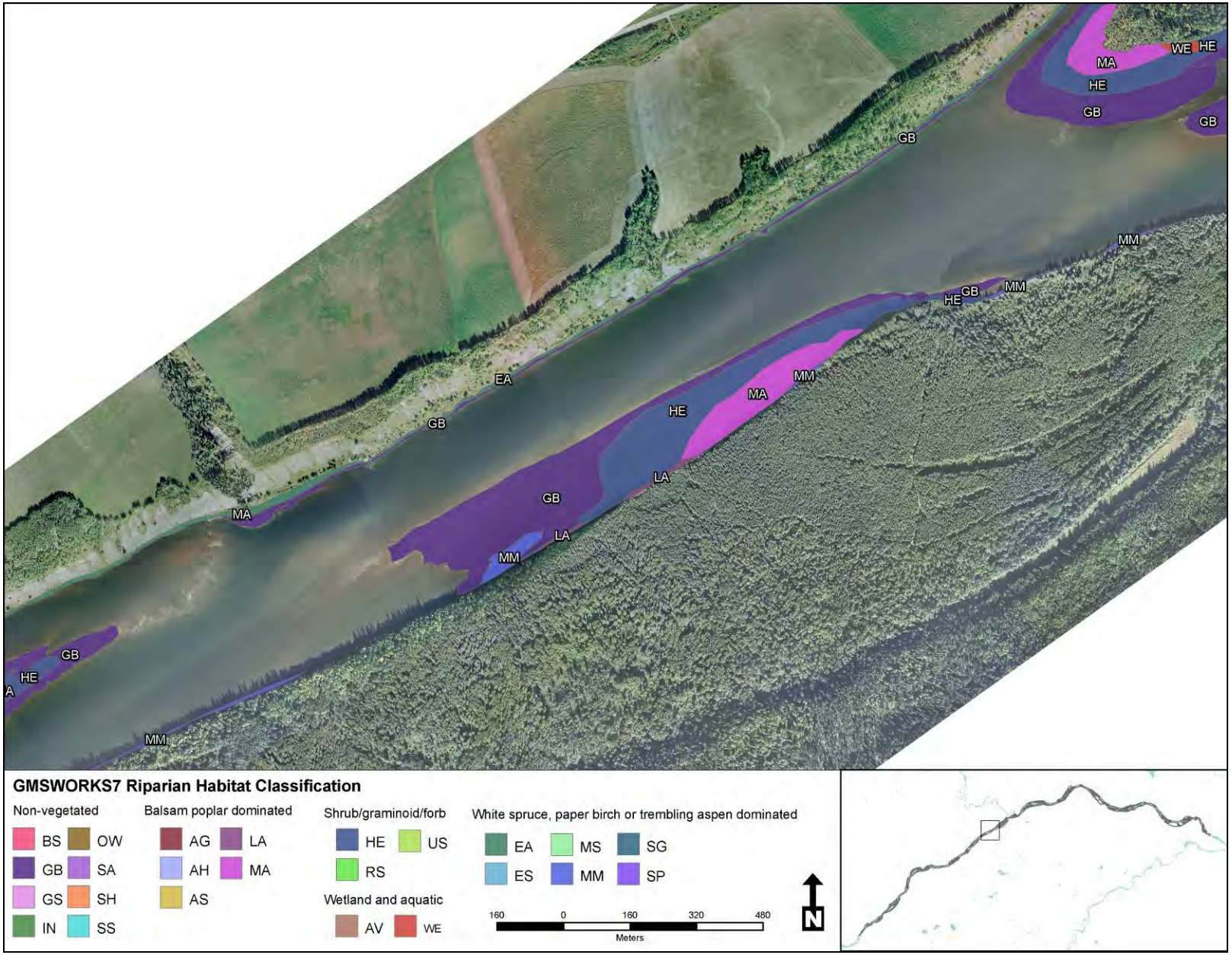

BS
RS
ES
MA
HE
SS
GB
MM
AG
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

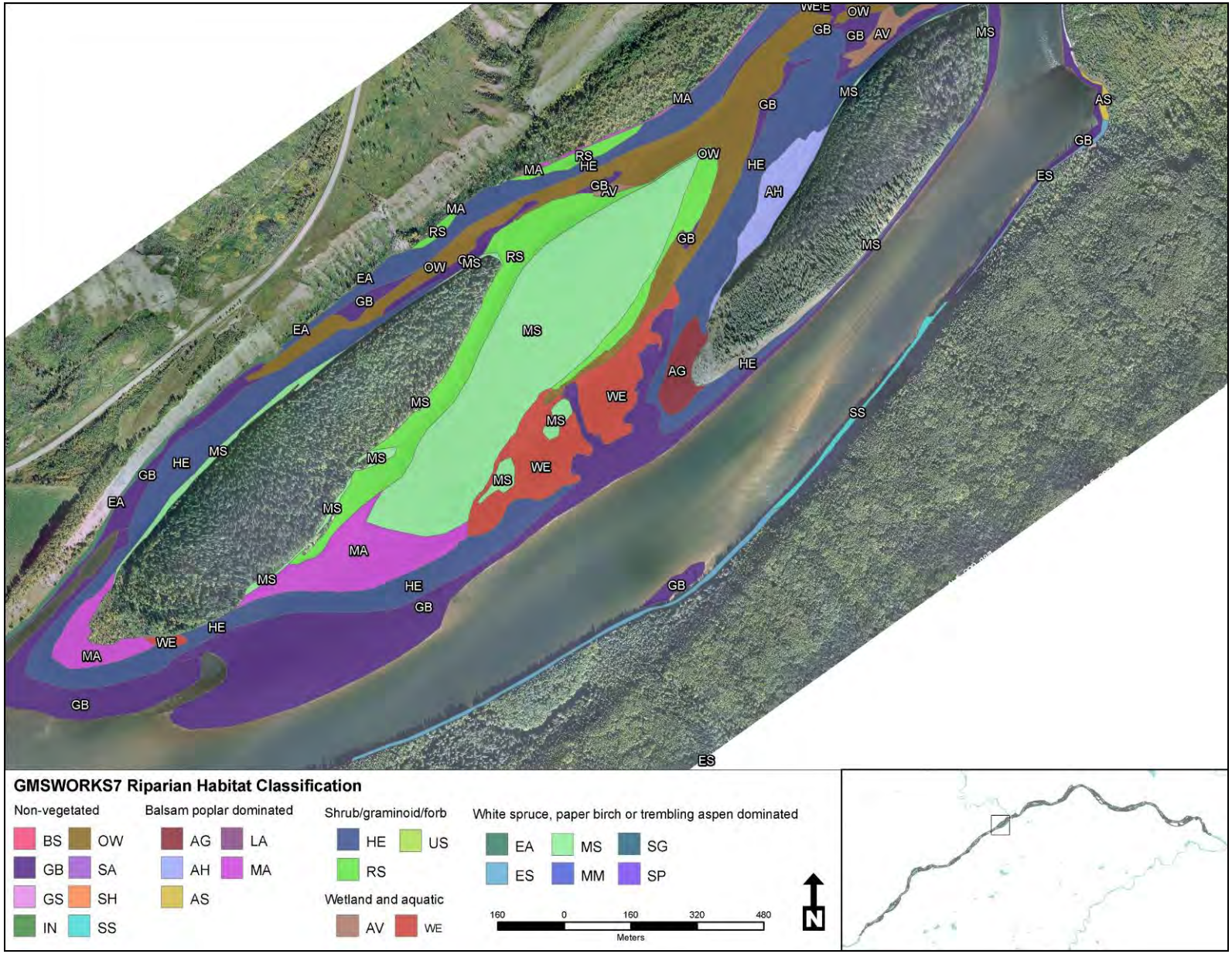

SG
ES
OW
MA
ES
SG
GB
MA
MA
ES
BS
ES
GB
RS
MS
HE
AG
AG
ES
HE
RS
MA
BS
RS
AG
GB
GB
HE
RS
HE
AG
RS
AV
OW
RS
HE
MM
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

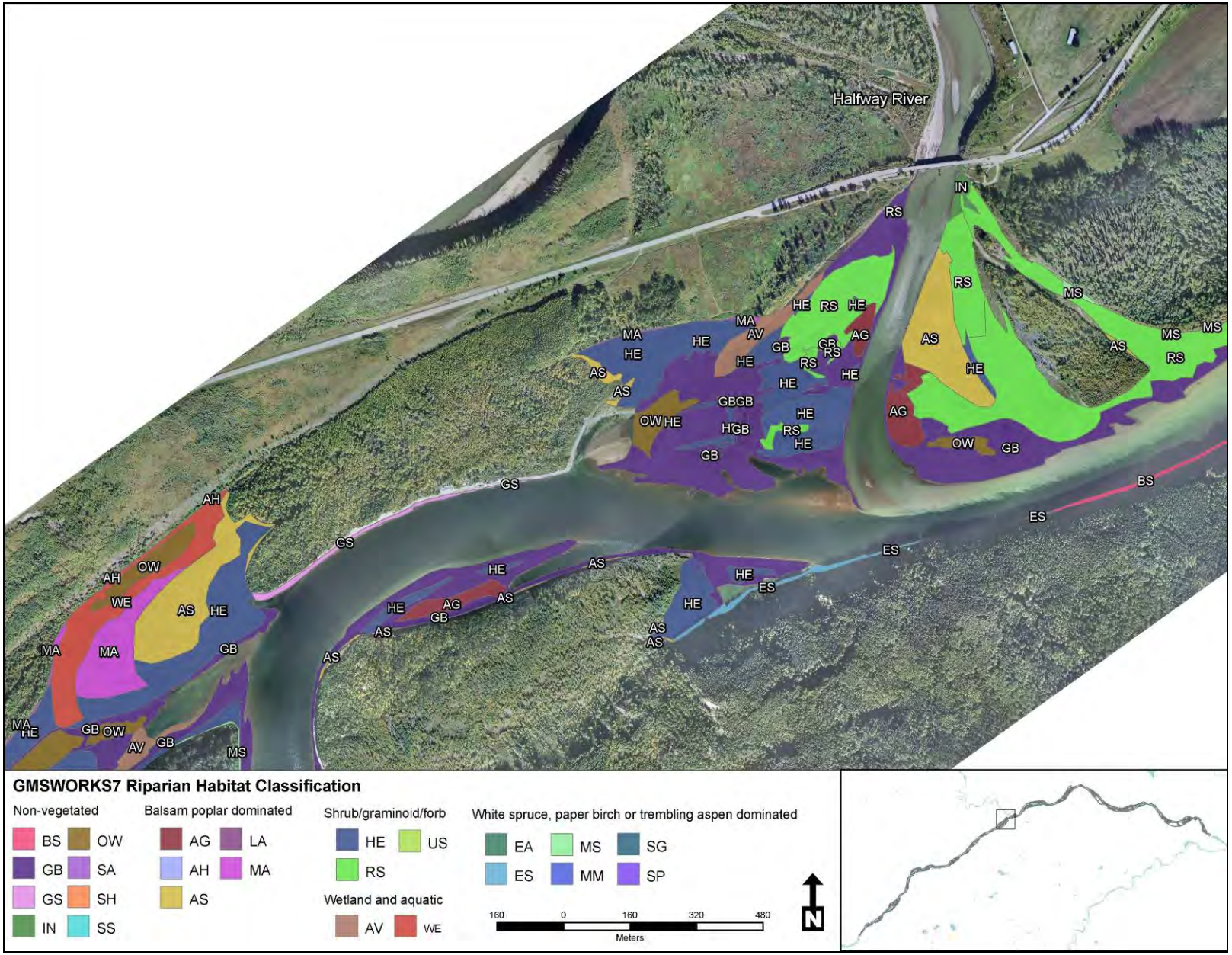

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

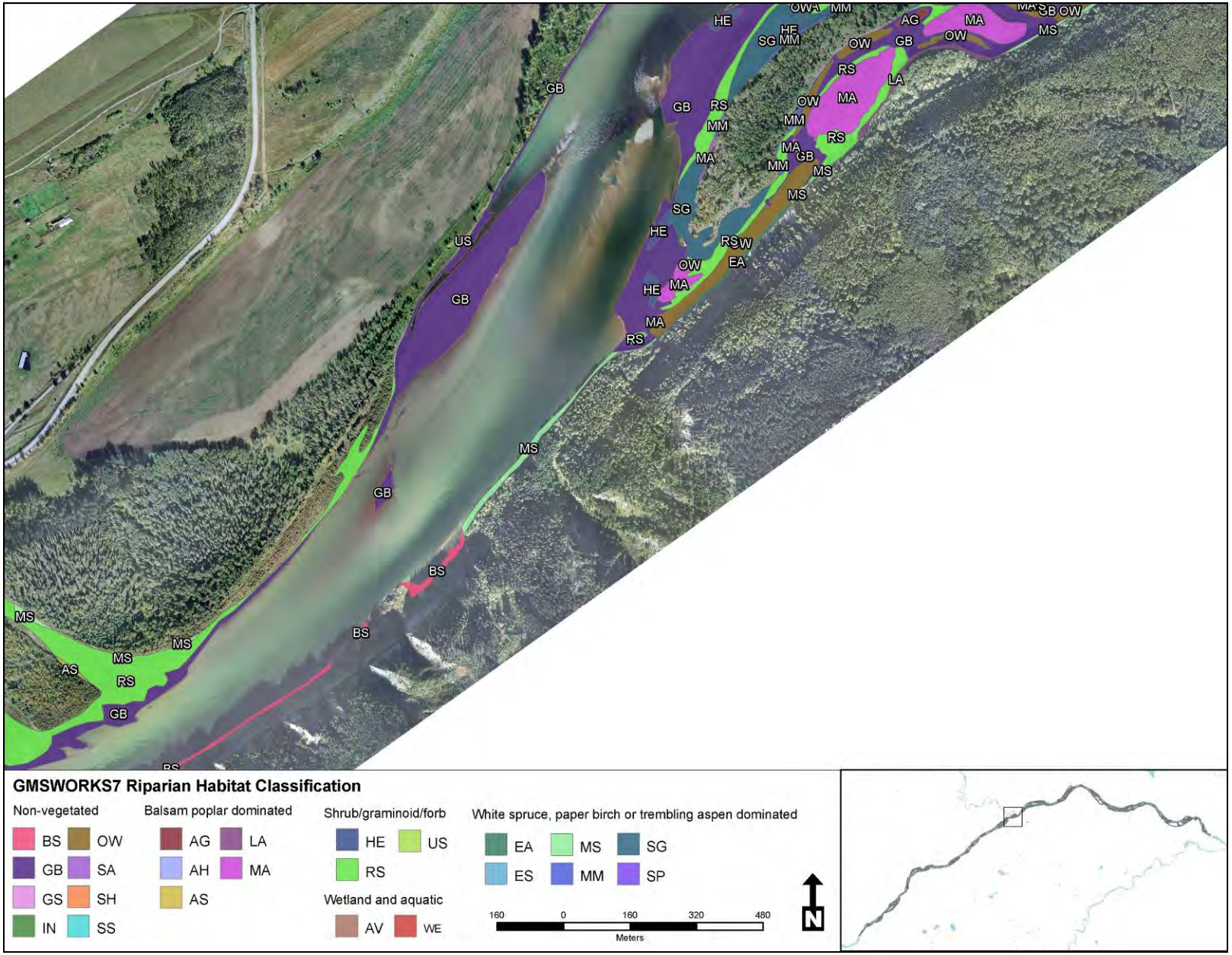

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

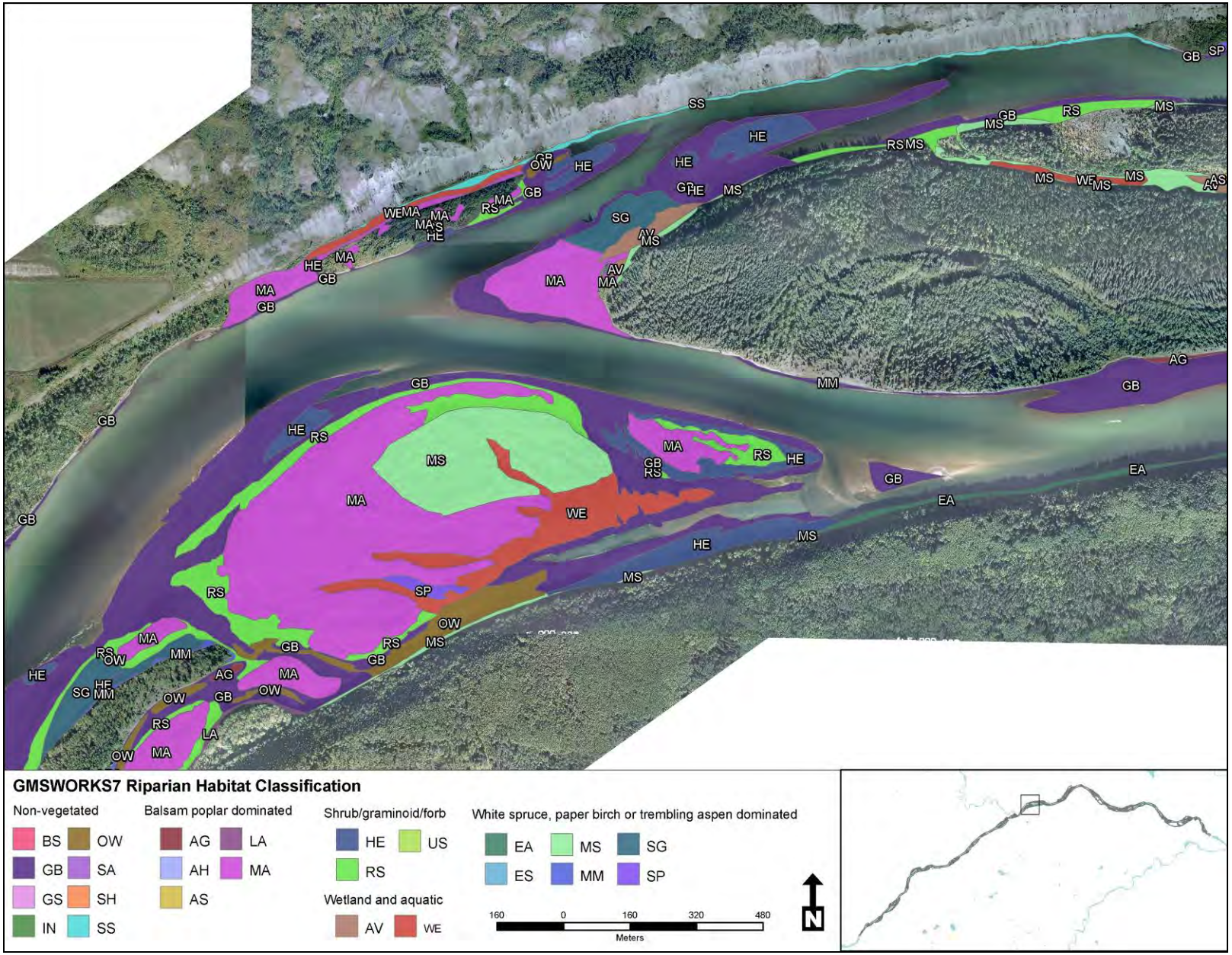

HE
MA
EA
GB
MM
BS
BS
MA
BS
MM
BS
MM
MS
MA
MAS
HE
MS
HE
GB
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

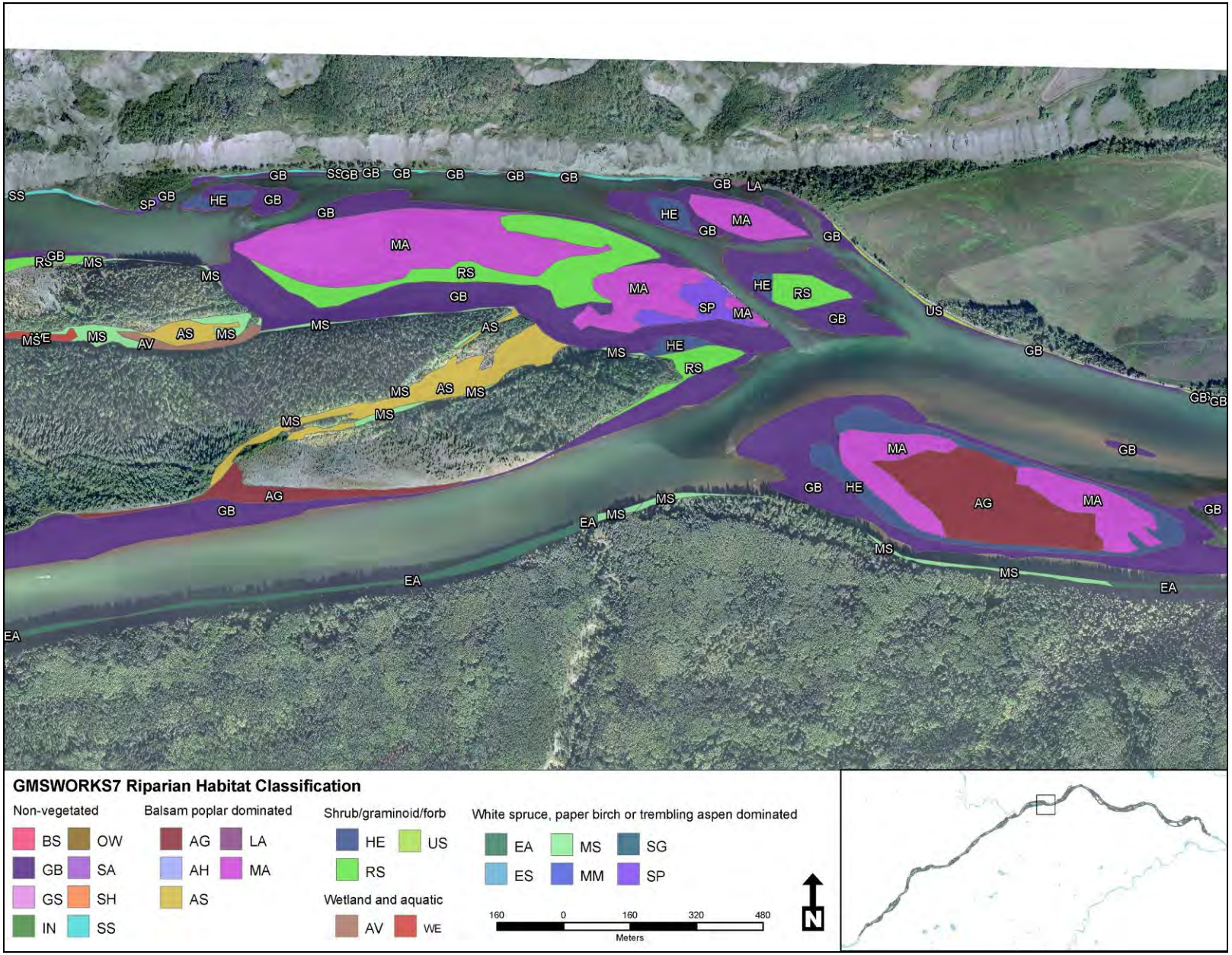

WE
HE
MA
HE
GB
GB
GB
MM
GB
HE
MM
EA
MA
MM
HE
GB
LA
GB
MA
LA
MM
GB
HE
A
MM
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

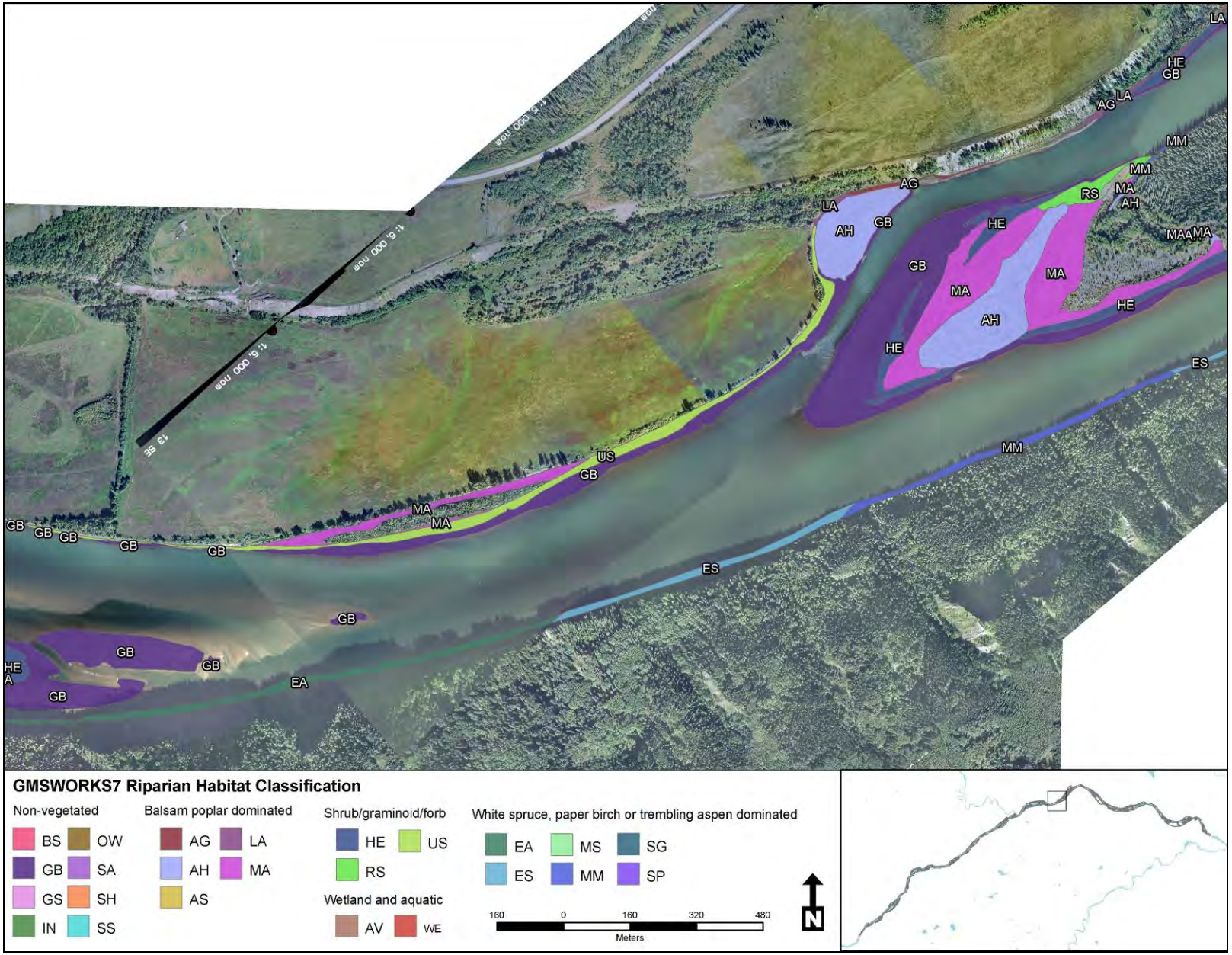

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

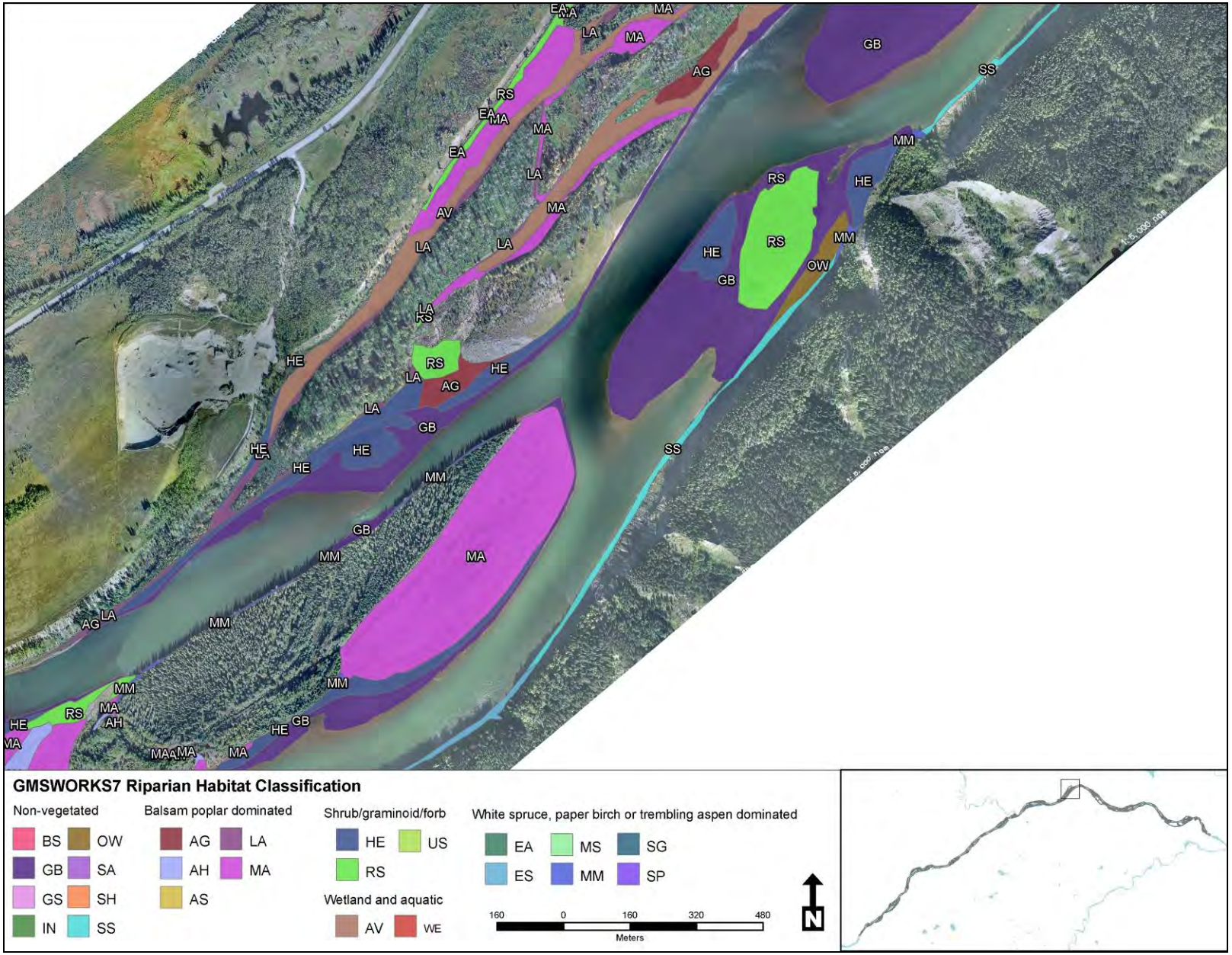

Halfway River
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

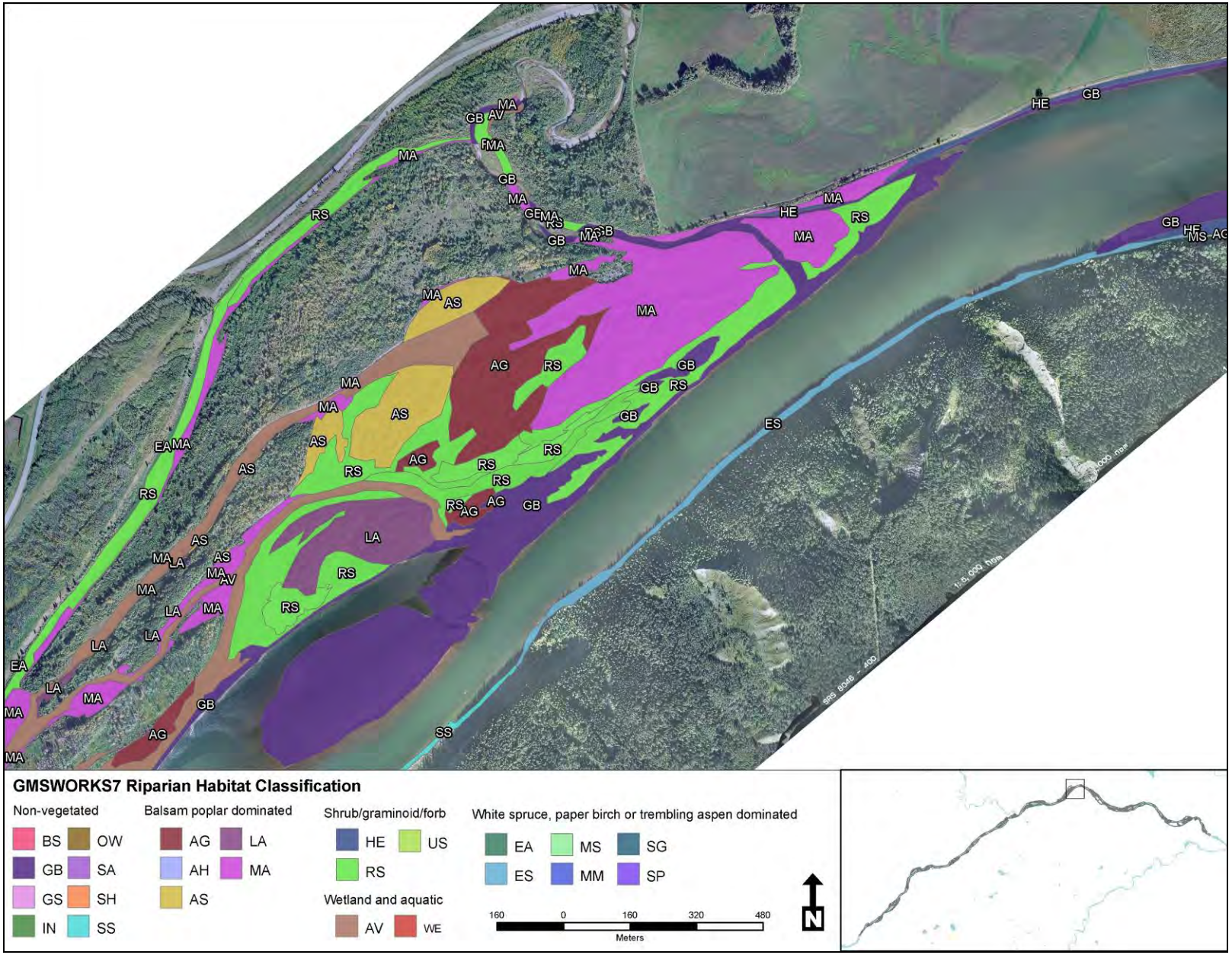

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

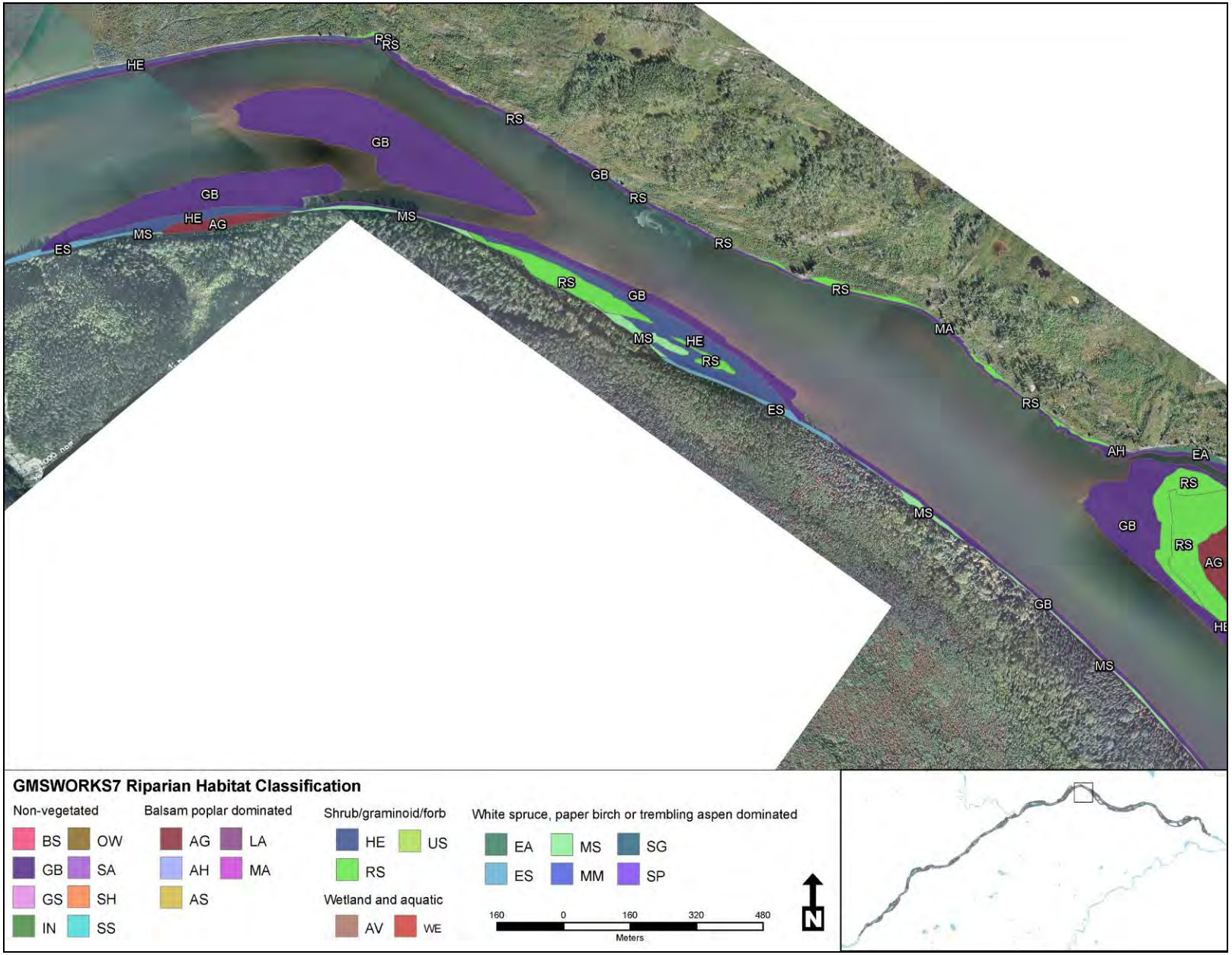

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

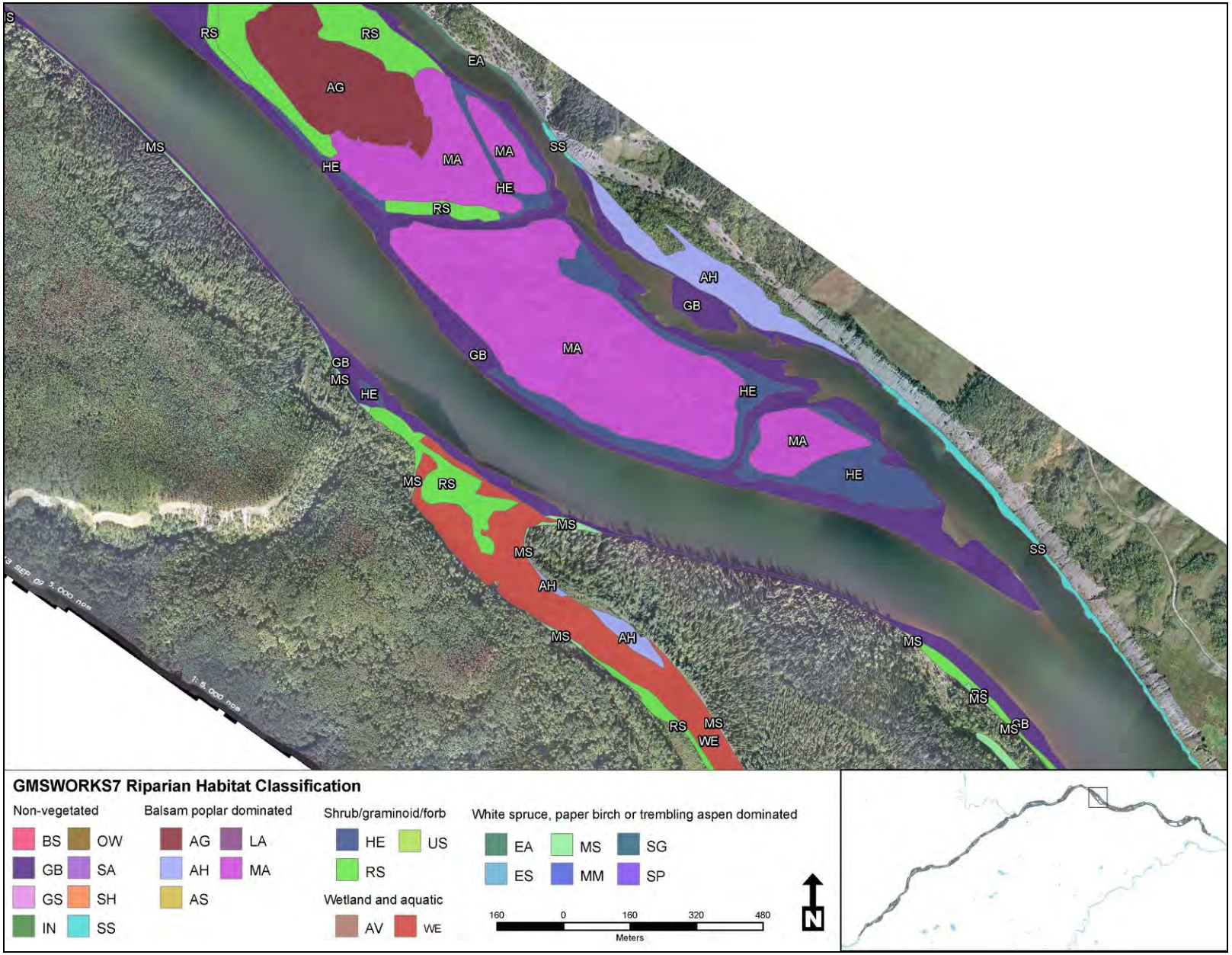

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

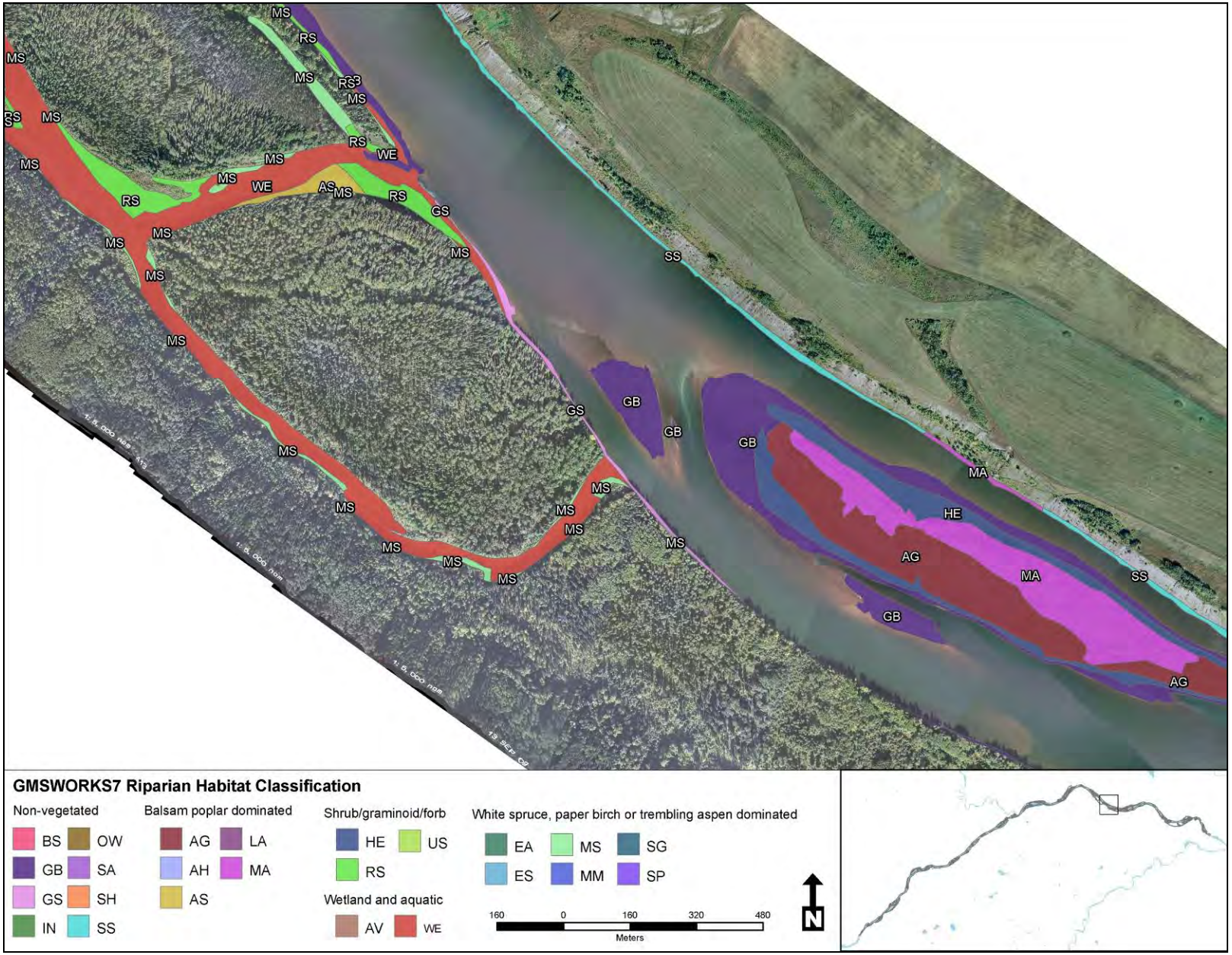

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

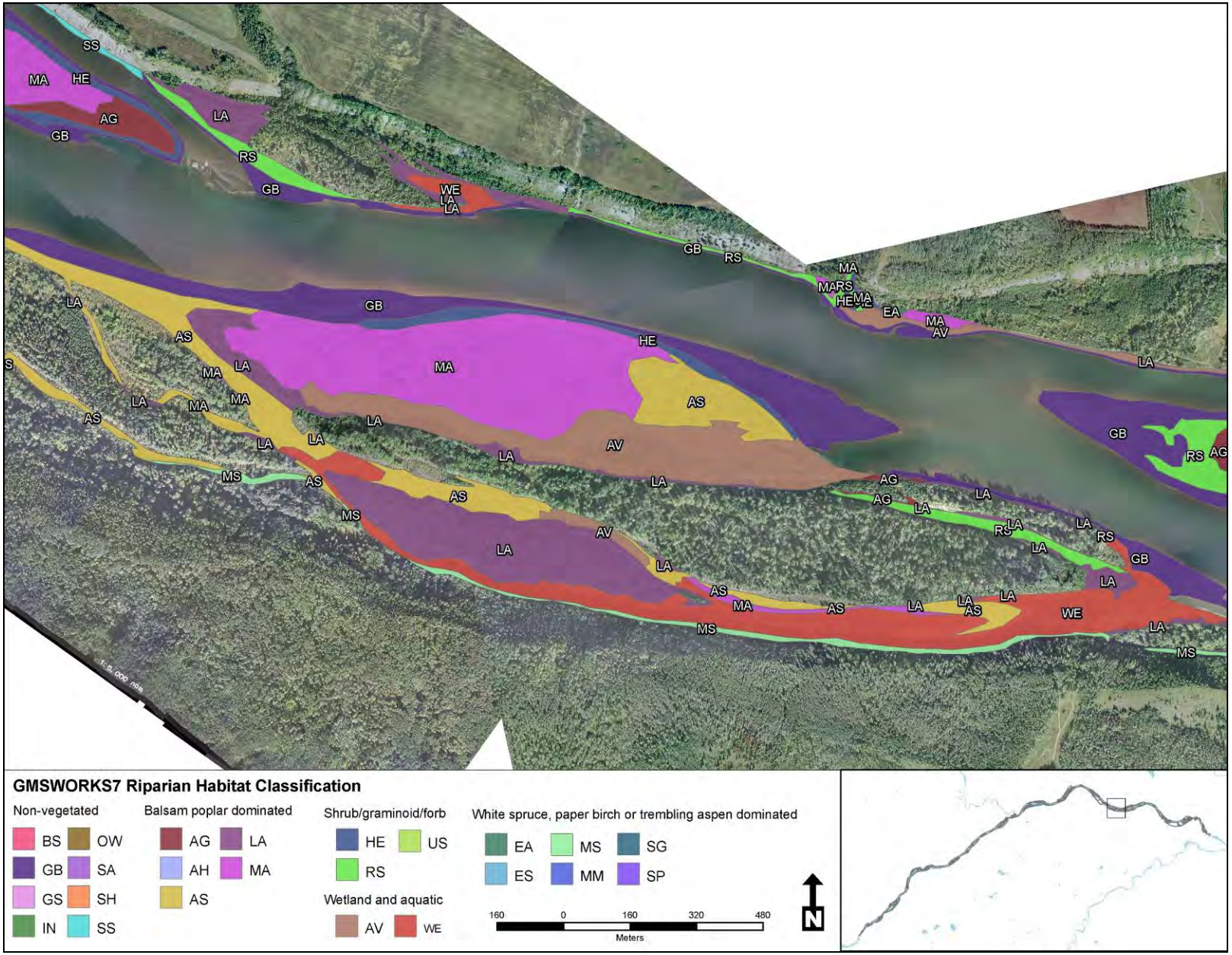

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

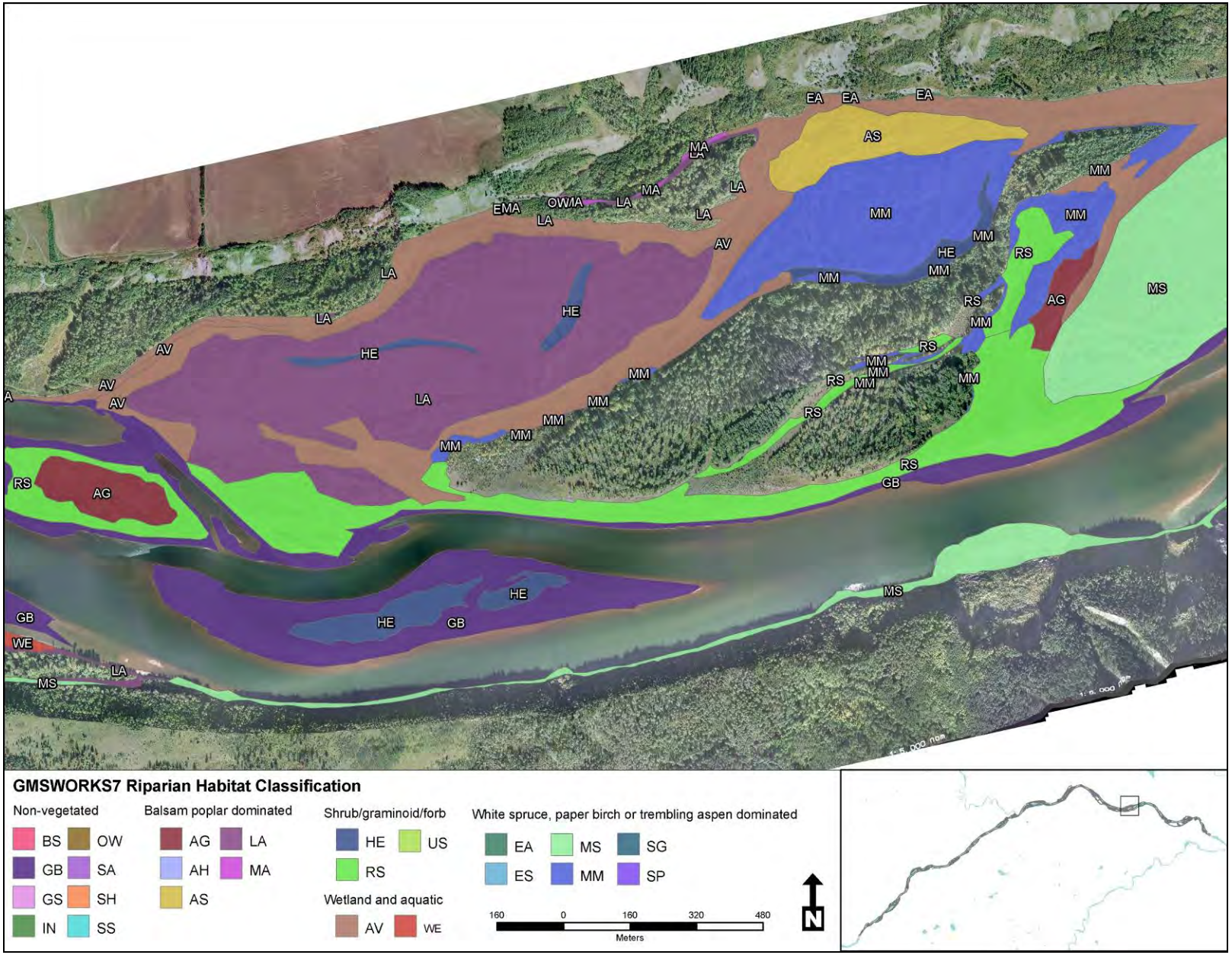

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

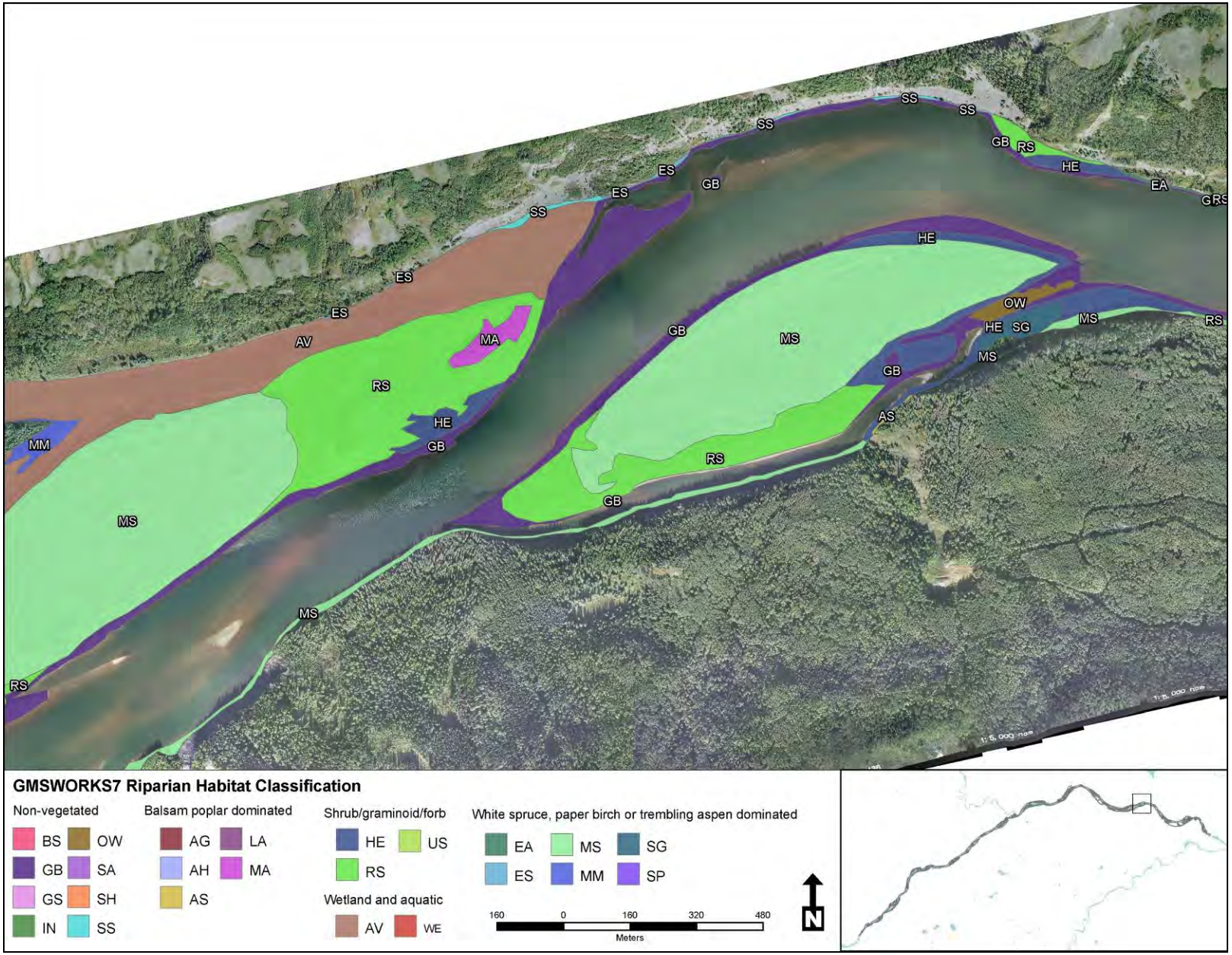

HE
RS
RS
RS
GB
GB
RS
GB
HE
AG
MS
MS
ES
RS
RS
GB
RS
MA
MS
HE
RS
ES
RS
AH
EA
RS
MS
GB
RS
AG
GB
MS
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

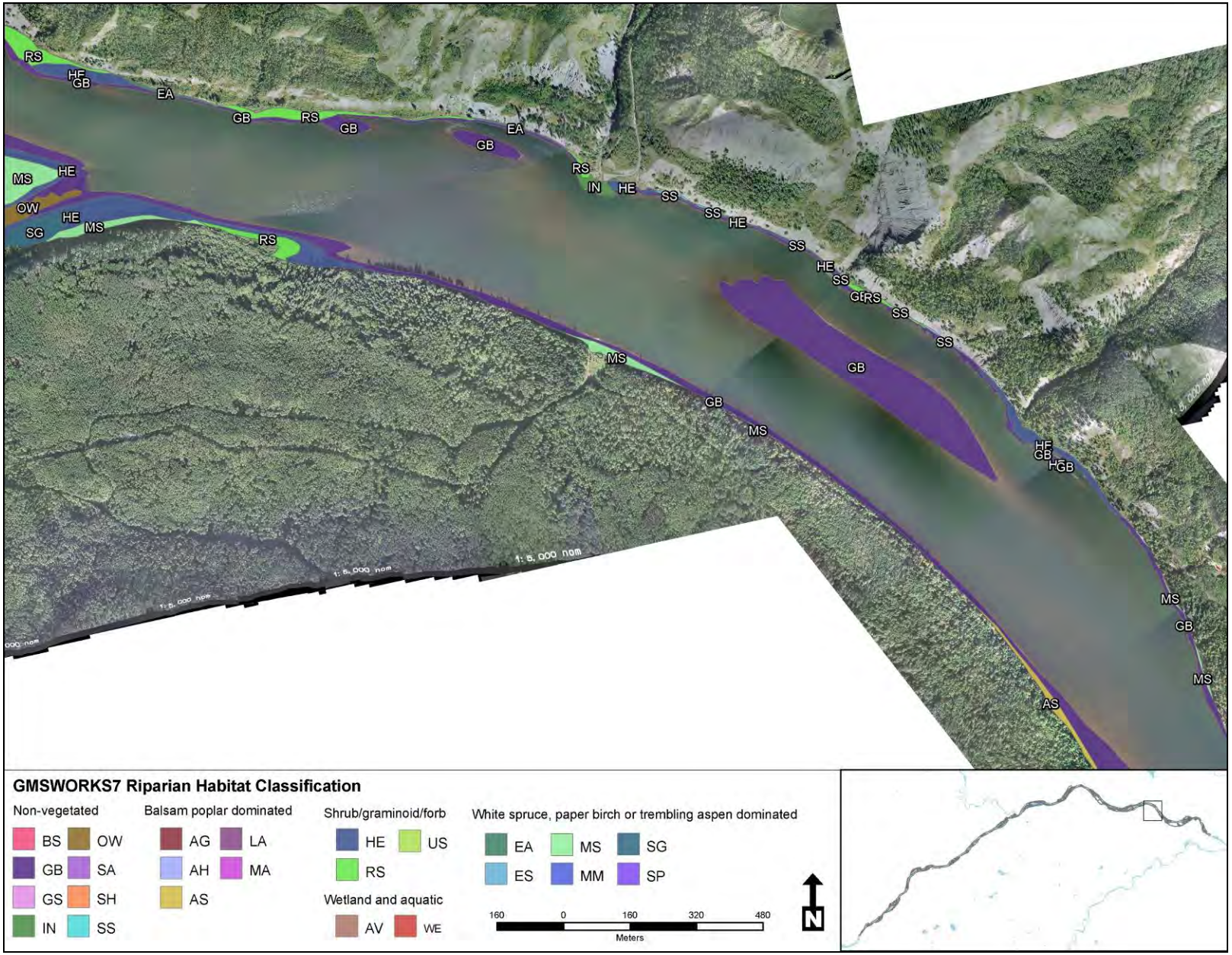

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160 0 160 320 480
Meters
N

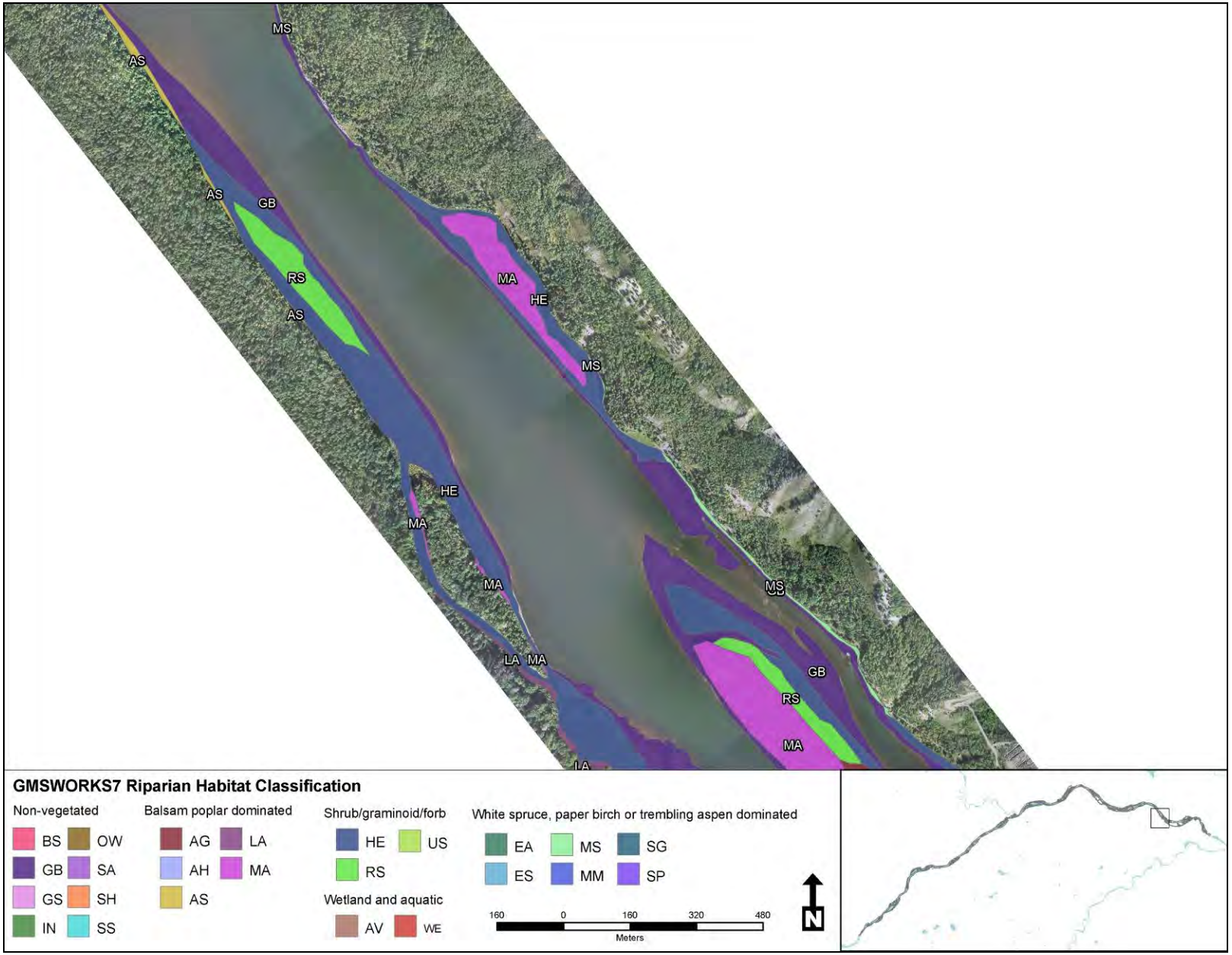

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

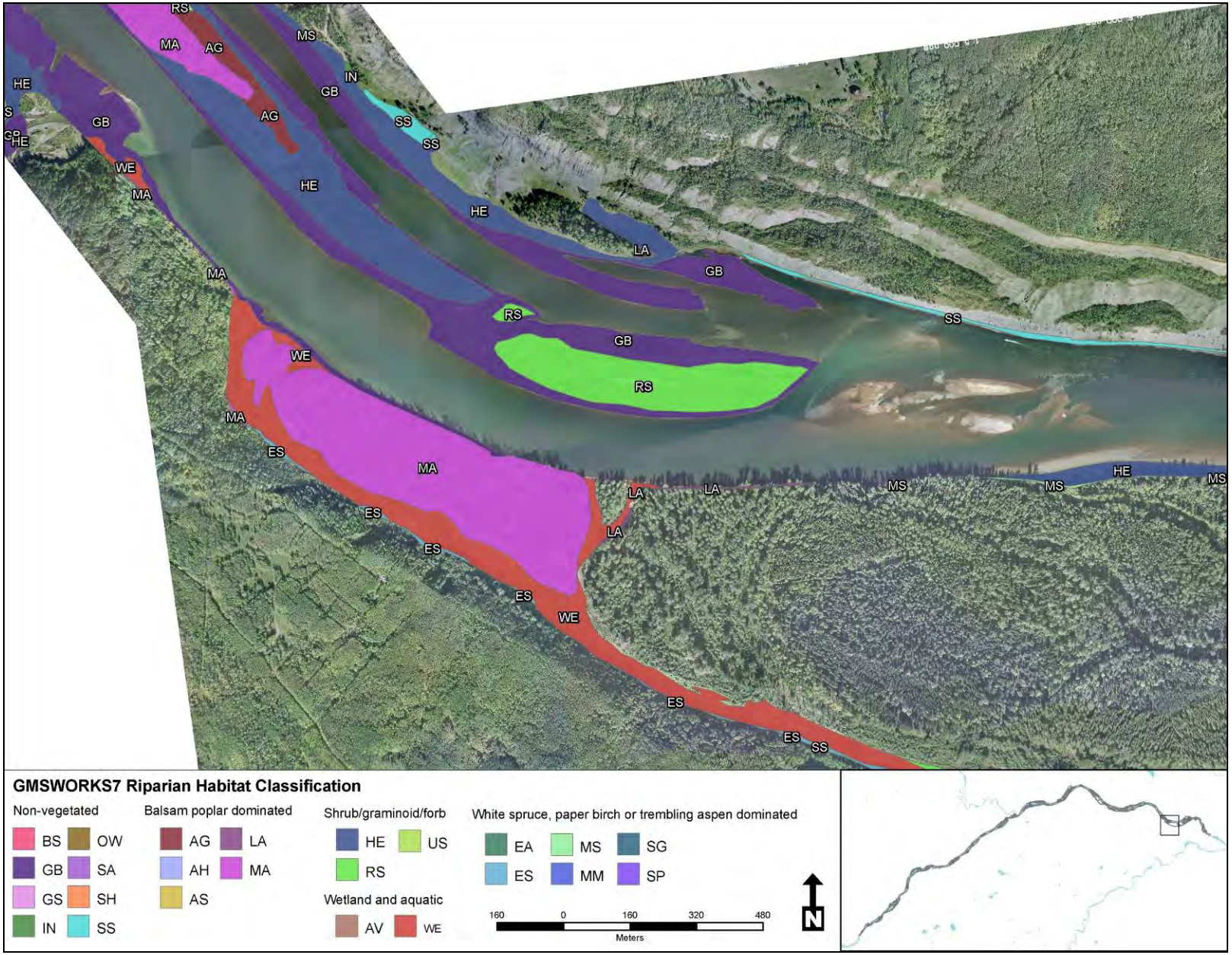

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

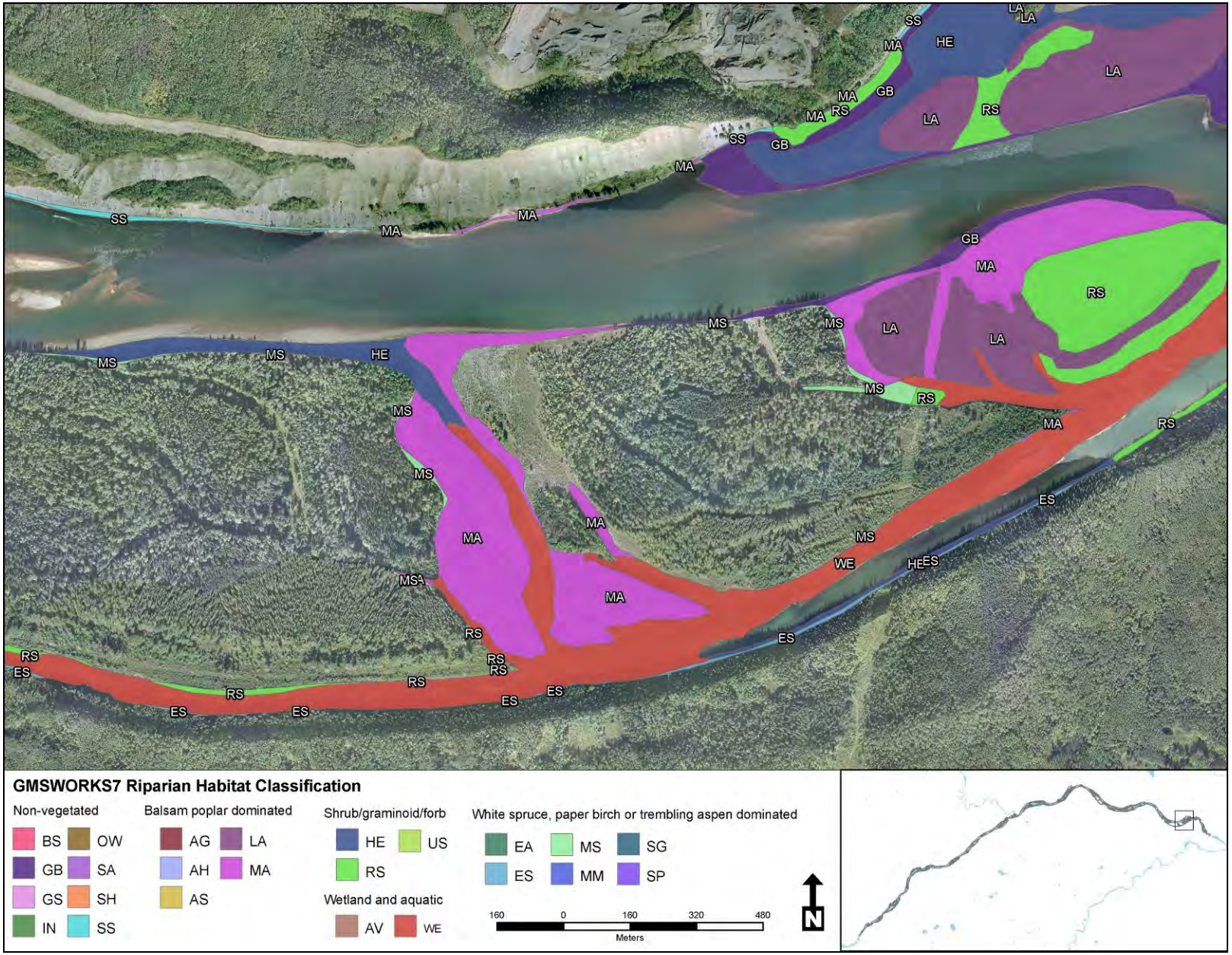

GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

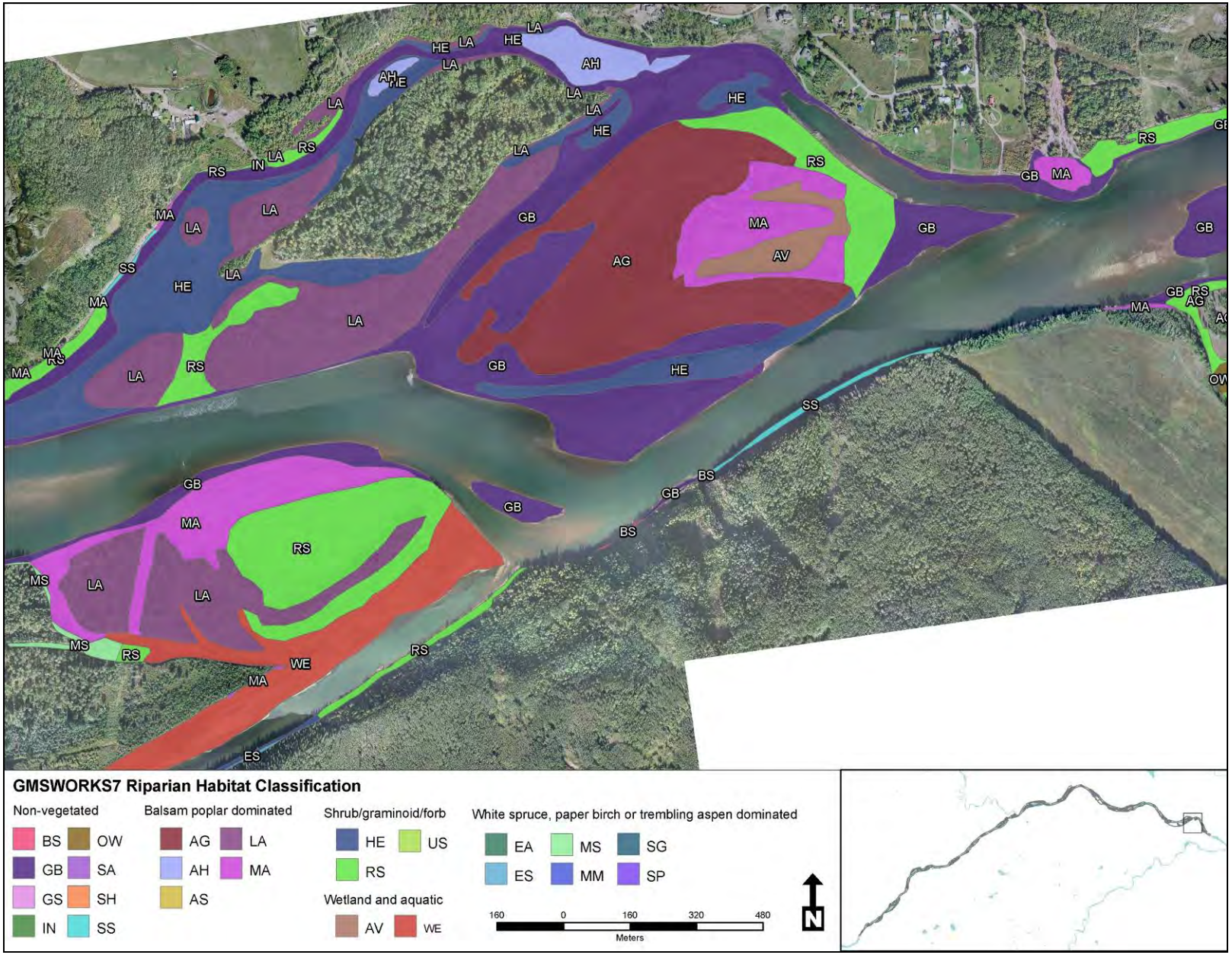

SS
SS
SS
GB
RS
HE
EA
GB
ES
ES
SS
ES
ES
AV
MA
RS
HE
GB
MM
MS
MS
RS
HE
OW
HE SG
MS
RS
MS
GB
GB
MS
AS
RS
GB
RS
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

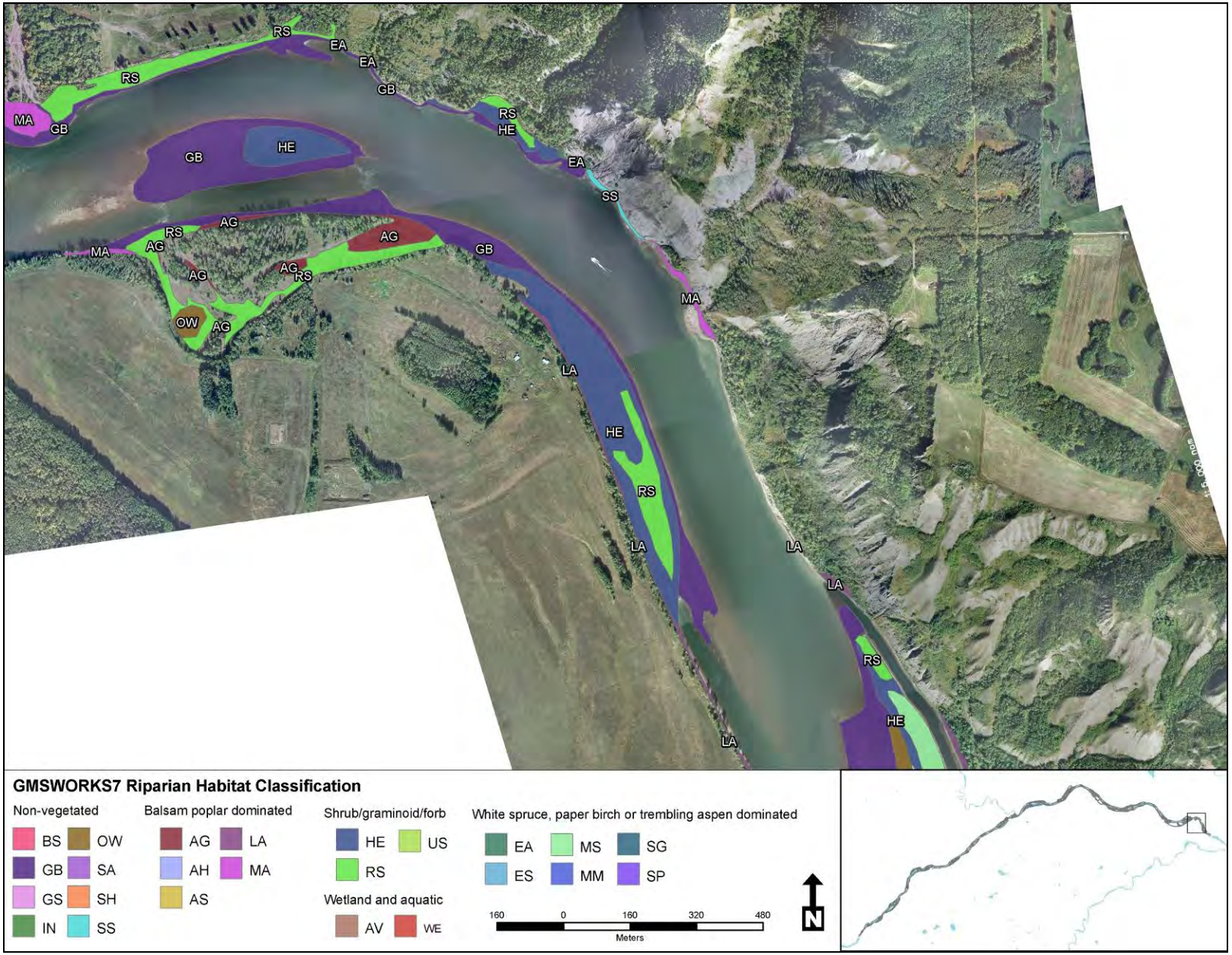

RS
HE
GB
EA
GB
RS
GB
EA
GB
RS
IN
HE
SS
SS
HE
SS
HE
SS
GB
RS
SS
SS
MS
GB
MS
GB
HE
GB
GB
MS
GB
MS
AS
MS
HE
OW
SG
MS
RS
1: 5,000 nom
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

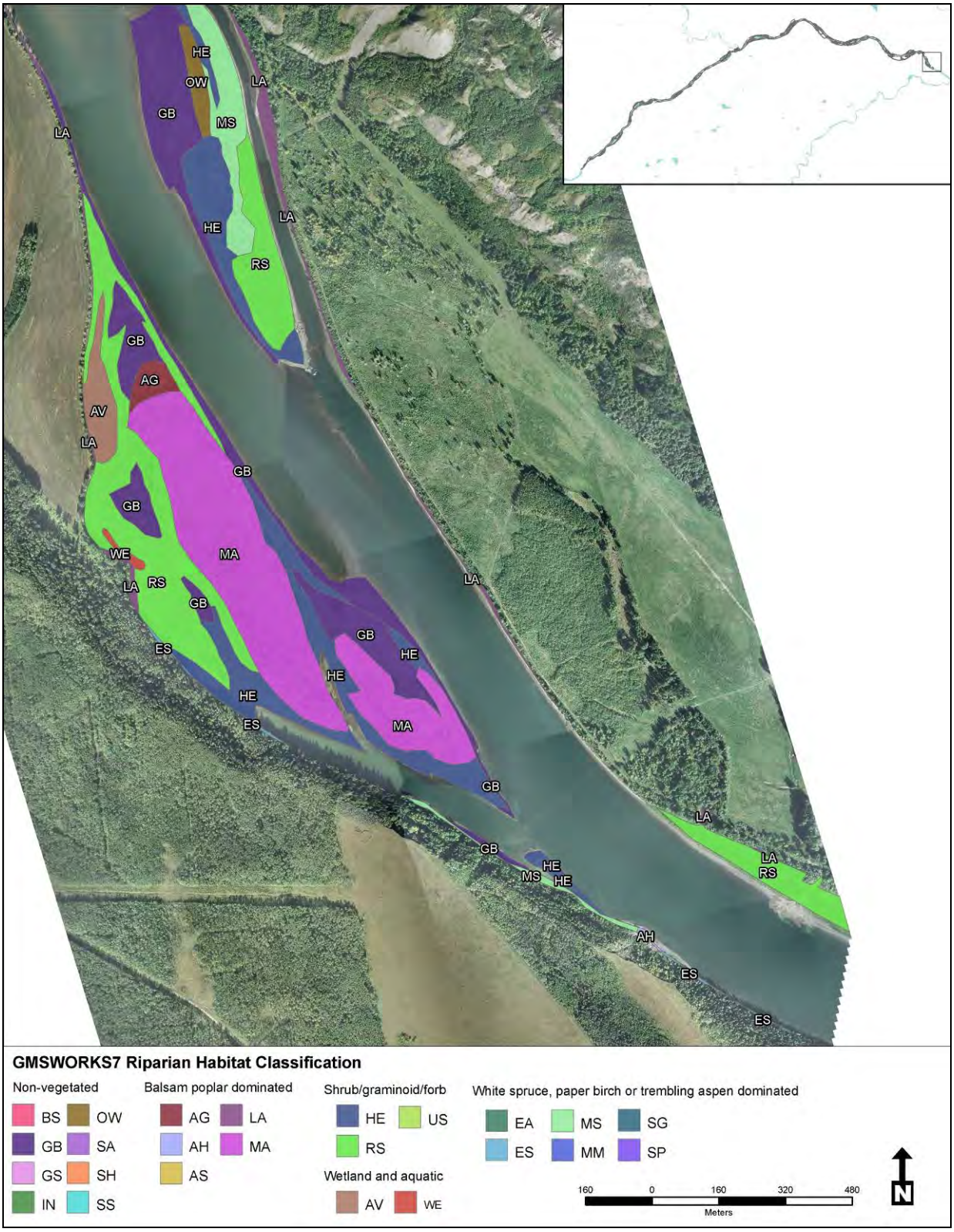

MS
AS
AS
GB
RS
AS
MA
HE
MS
HE
MA
MA
MS
LA
MA
GB
RS
MA
LA
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N


RS
MA
AG
MS
IN
HE
GB
SS
WE
ES
LA
GB
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N


GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N


GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N


RS
EA
EA
GB
RS
HE
MA
GB
HE
GB
EA
SS
AG
RS
AG
AG
MA
GB
AG
AG
RS
OW
AG
MA
LA
HE
RS
LA
LA
LA
RS
HE
LA
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

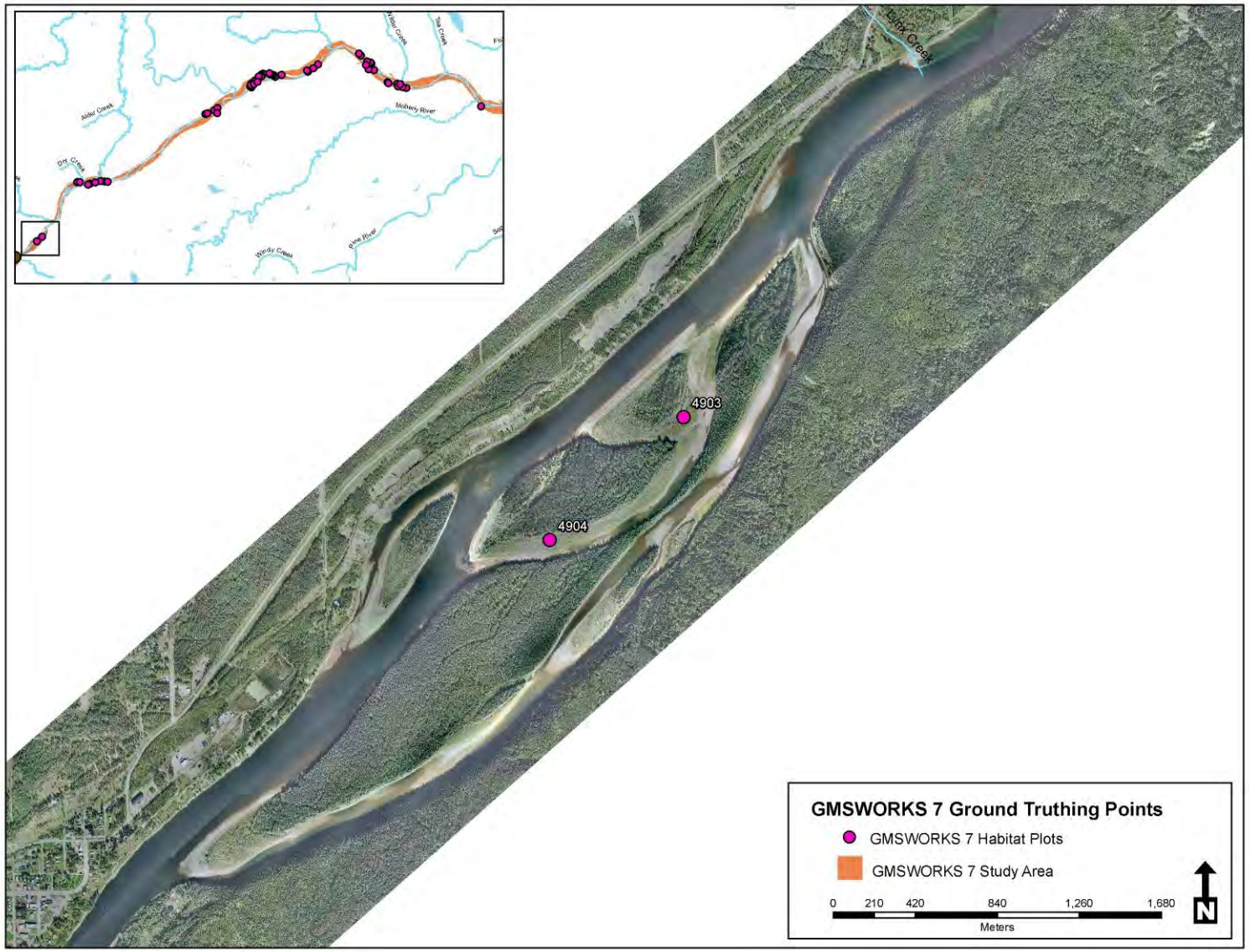

HE
OW
LA
GB
MS
LA
HE
LA
RS
GB
AG
AV
LA
GB
GB
WE
MA
LA
RS
LA
GB
GB
ES
HE
HE
HE
ES
MA
GB
LA
GB
HE
MS
HE
LA
RS
AH
ES
ES
GMSWORKS7 Riparian Habitat Classification
Non-vegetated
BS
OW
GB
SA
GS
SH
IN
SS
Balsam poplar dominated
AG
LA
AH
MA
AS
Shrub/graminoid/forb
HE
US
RS
Wetland and aquatic
AV
WE
White spruce, paper birch or trembling aspen dominated
EA
MS
SG
ES
MM
SP
160
0
160
320
480
Meters
N

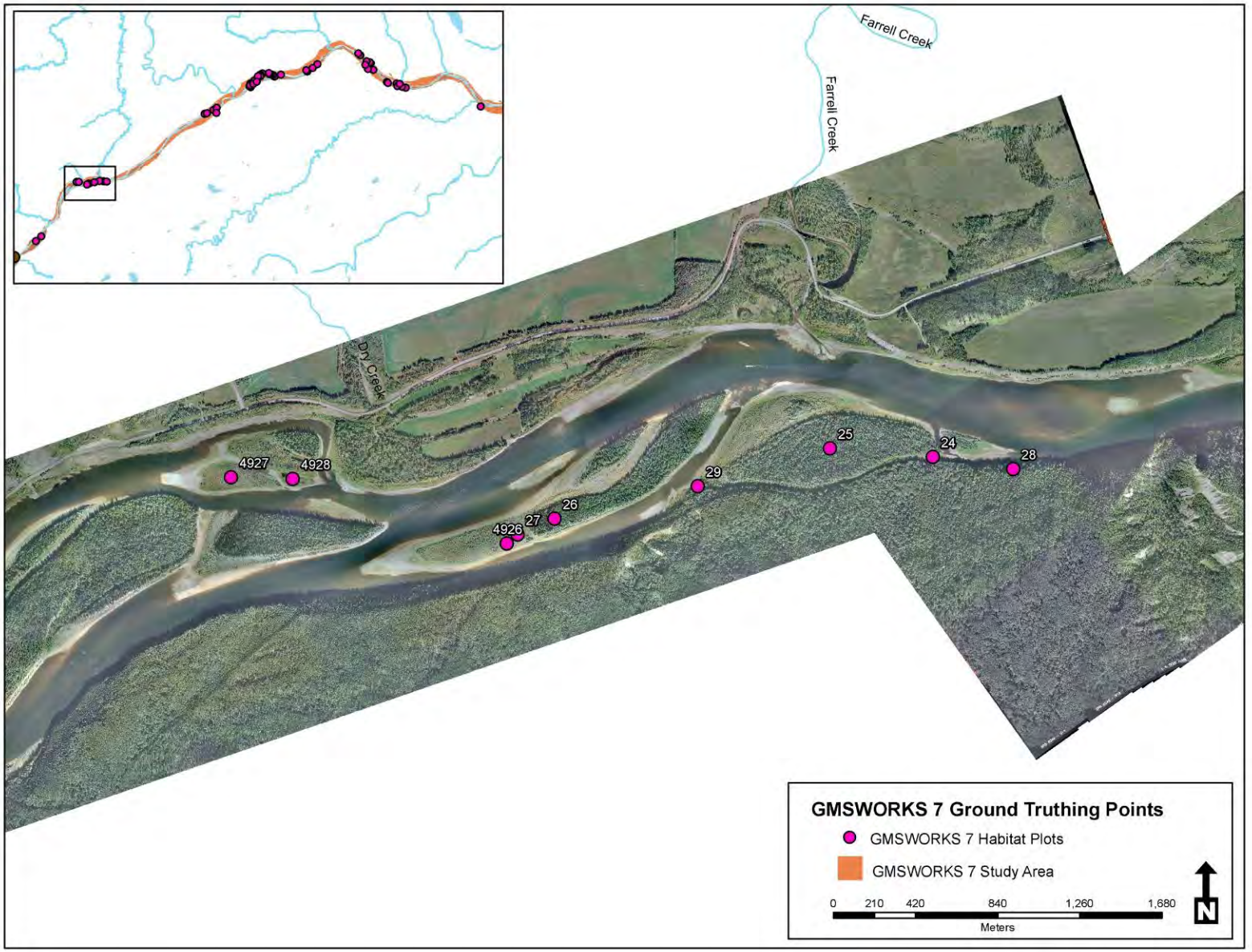
Appendix 4. Peace River riparian habitat classification ground sampling plots.

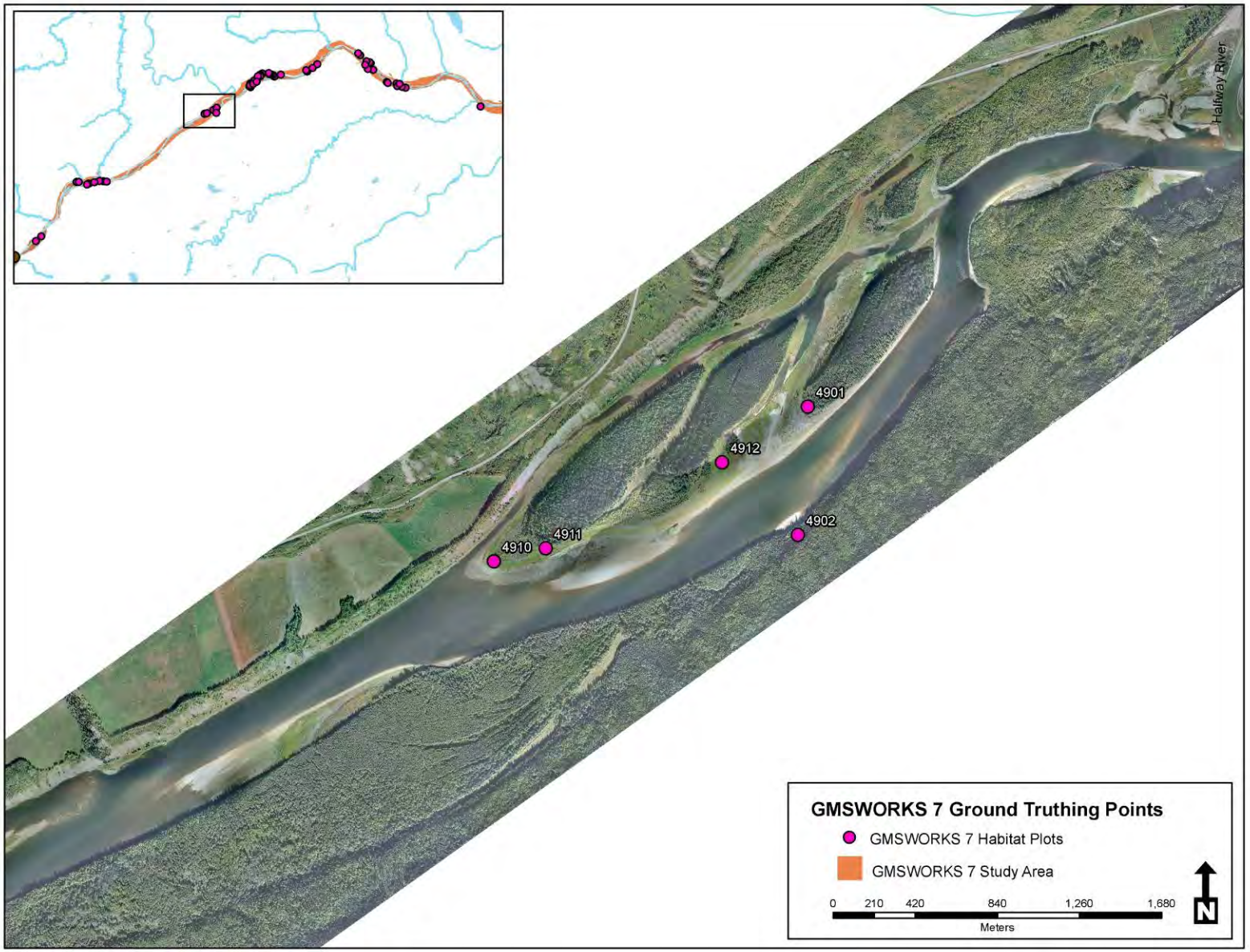
Date	Plot Number	Plot Type	Easting	Northing	Old Habitat Classification	New Habitat Classification
2010-09-10	5	Full	614582	6235185	1	HE
2010-09-14	24	Full	579322	6219461	1	HE
2011-08-05	4910	Full	592717	6228372	1	HE
2010-09-09	2	Full	618844	6231949	10	LA
2011-08-07	4921	Full	599154	6232313	10	LA
2011-08-09	4930	Full	616990	6232457	10	LA
2011-08-03	4903	Full	571058	6212154	11	MA
2011-08-04	4906	Full	599289	6232742	11	MA
2011-08-04	4907	Full	598953	6232254	11	MA
2010-09-10	7	Ground inspection	613320	6236128	13	AG
2010-09-12	14	Full	601963	6233310	13	AG
2010-09-15	29	Full	578121	6219312	13	AG
2011-08-03	4904	Full	570372	6211526	13	AG
2010-09-15	26	Full	577388	6219146	14	MM
2011-08-04	4908	Full	598769	6232257	14	MM
2011-08-07	4920	Full	598733	6232179	14	MM
2010-09-12	16	Full	601508	6233601	15	AV
2010-09-13	20	Full	600156	6233523	15	AV
2011-08-09	4931	Full	618242	6232022	15	AV
2010-09-10	6	Ground inspection	614158	6235321	16	MA
2011-08-04	4905	Full	599400	6232559	16	MA
2011-08-07	4919	Full	598639	6232045	16	MA
2010-09-09	3	Full	618126	6232370	18	MA
2010-09-11	9	Full	607664	6234920	18	MA
2010-09-13	22	Full	599945	6233371	18	MA
2010-09-12	15	Full	601747	6233516	19	MS
2010-09-13	23	Full	600122	6233326	19	MS
2010-09-14	25	Full	578796	6219505	19	MS
2010-09-10	8	Full	613060	6236383	2	RS
2010-09-12	13	Full	602786	6233556	2	RS
2010-09-13	18	Full	601189	6233751	2	RS
2011-08-08	4926	Full	577144	6219019	20	AG
2011-08-08	4927	Full	575734	6219358	20	AG
2010-09-13	21	Full	600059	6233538	21	SG
2010-09-15	27	Full	577199	6219066	21	SG
2011-08-04	4909	Full	598755	6232381	21	SG
2011-08-08	4928	Full	576049	6219350	21	SG
2011-08-07	4922	Full	599606	6232636	22	SP
2010-09-15	28	Full	579734	6219400	24	ES
2011-08-05	4902	Full	594272	6228507	24	ES
2011-08-09	4933	Full	629265	6229362	24	ES
2010-09-11	11	Full	606309	6233984	25	AH
2011-08-05	4901	Full	594322	6229161	25	AH
2011-08-08	4925	Full	613997	6234848	25	AH
2010-09-09	1	Full	619343	6231808	27	WE
2010-09-13	17	Ground inspection	601304	6233624	27	WE
2011-08-05	4911	Full	592982	6228439	27	WE
2011-08-05	4912	Full	593884	6228877	27	WE
2011-08-08	4924	Full	614350	6234302	27	WE
2010-09-13	19	Full	600383	6233724	29	HE
2011-08-07	4918	Full	598812	6231912	30	EA

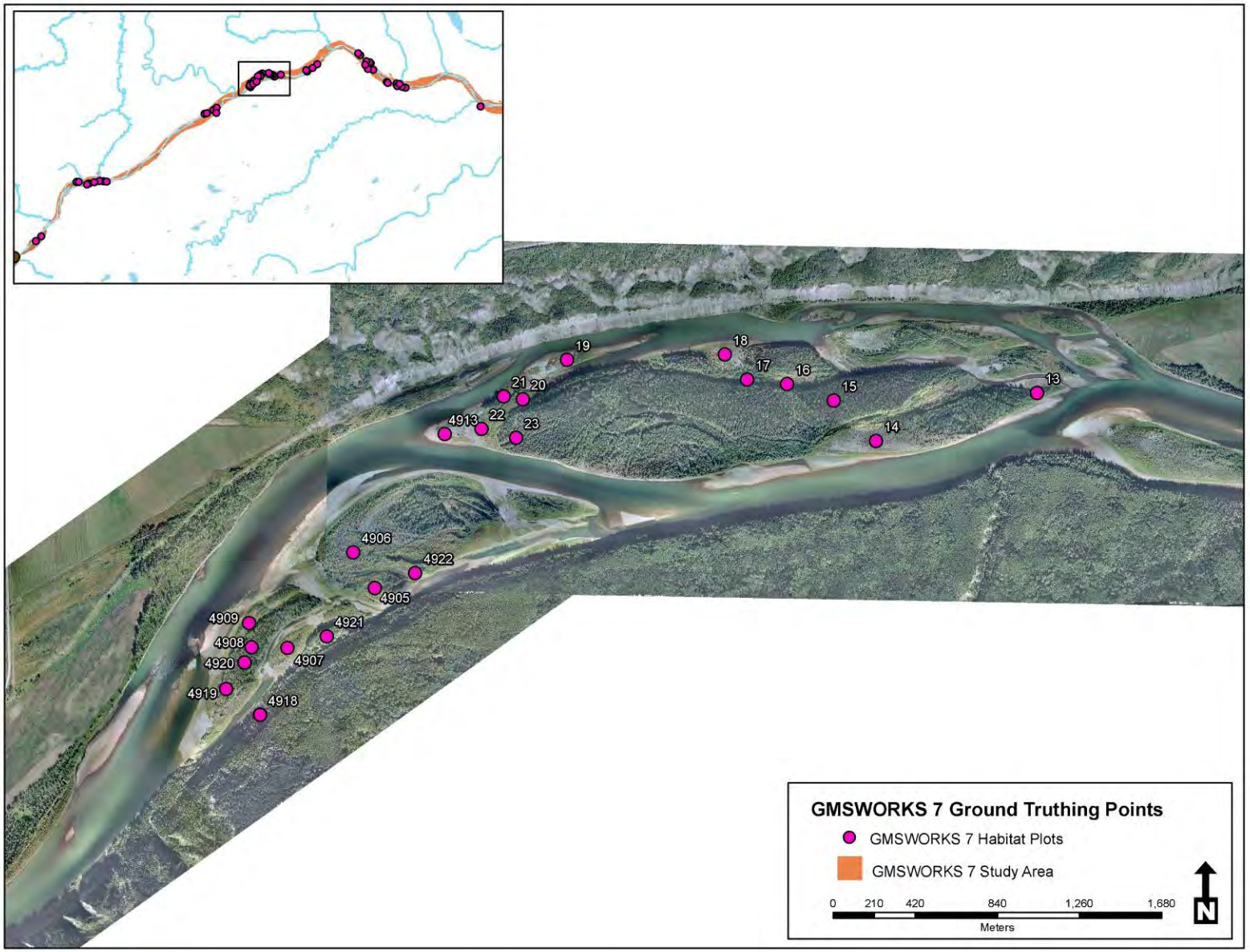
Date	Plot Number	Plot Type	Easting	Northing	Old Habitat Classification	New Habitat Classification
2011-08-08	4923	Full	615062	6234194	31	AS
2011-08-09	4929	Full	616849	6232570	31	AS
2011-08-09	4932	Full	618533	6232321	31	AS
2010-09-11	10	Full	607022	6234418	5	SG
2010-09-10	4	Full	614721	6235066	7	GB
2010-09-11	12	Full	606160	6234149	7	GB
2011-08-06	4913	Full	599756	6233345	7	GB

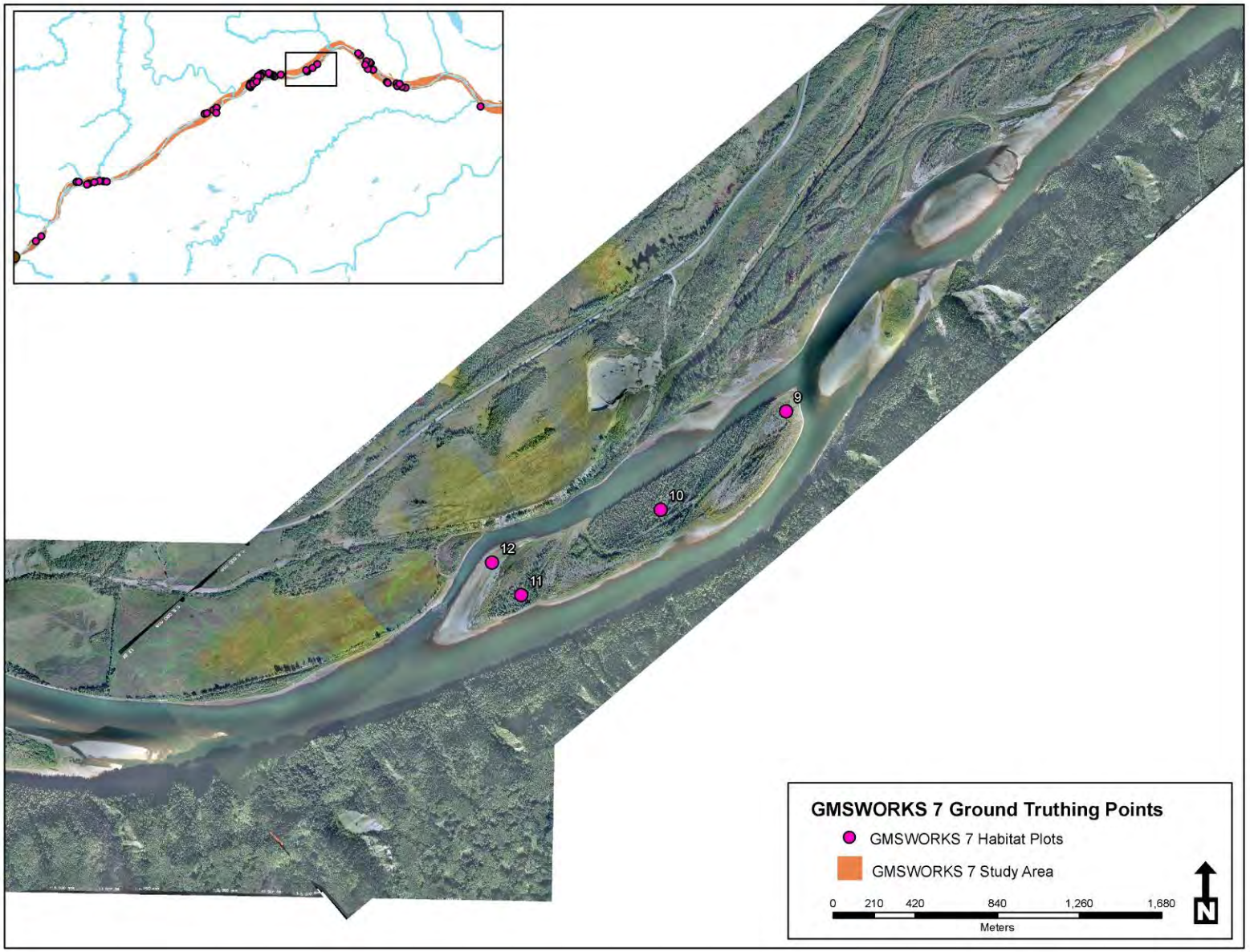
Appendix 5. Peace River riparian habitat classification ground sampling locations.

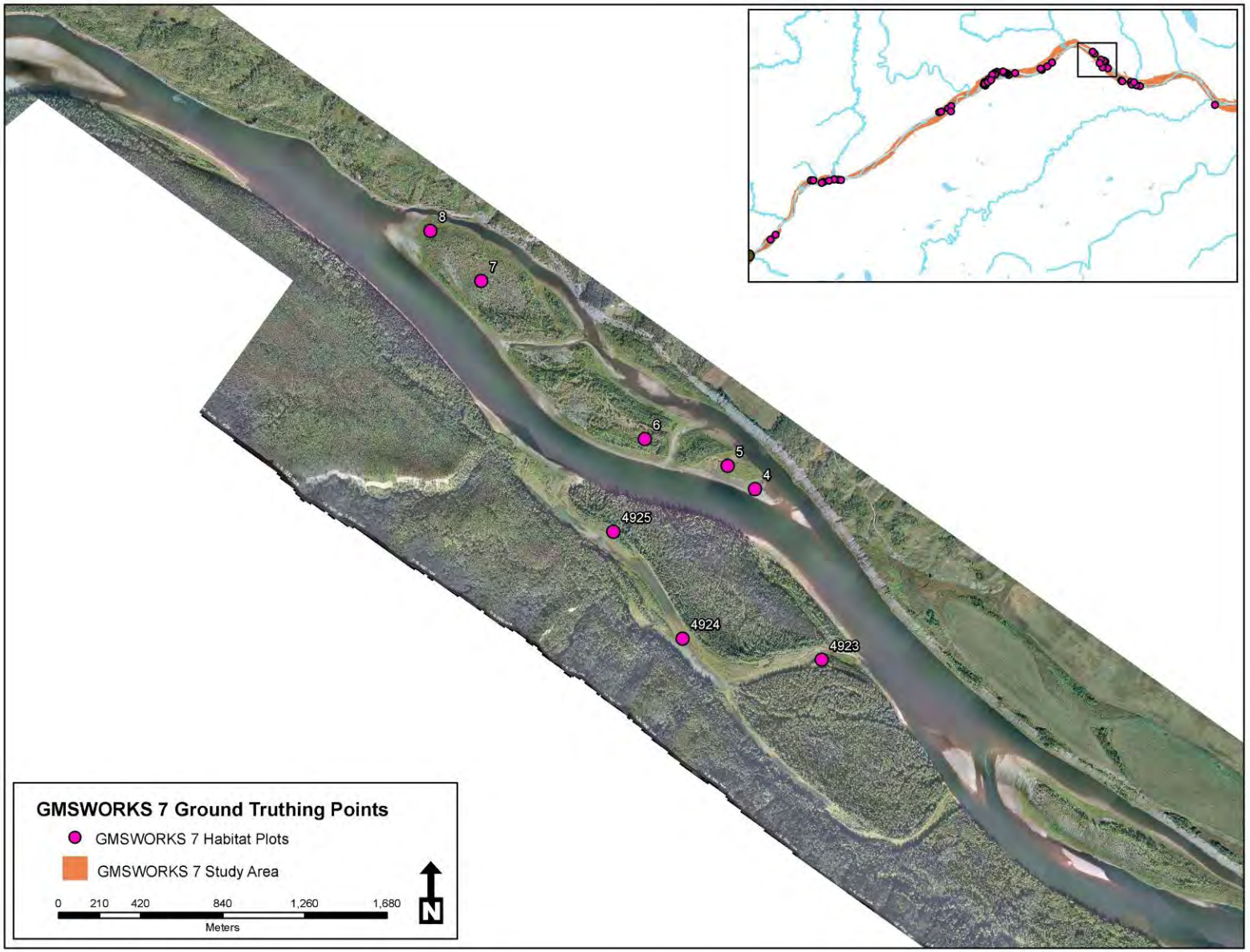


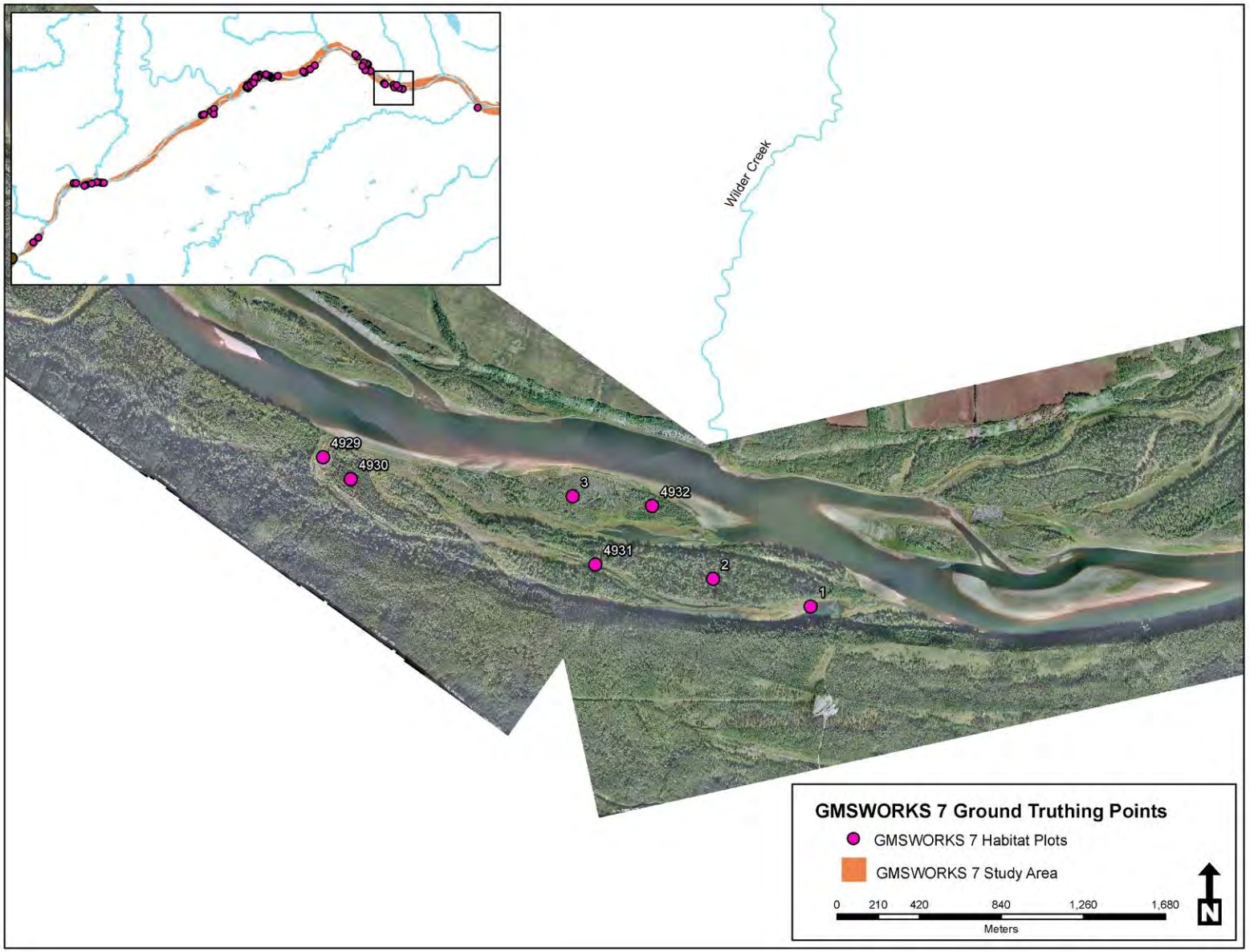

Farrell Creek
Farrell Creek
DY Creek
4927
4928
4926
27
26
29
25
24
28
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N

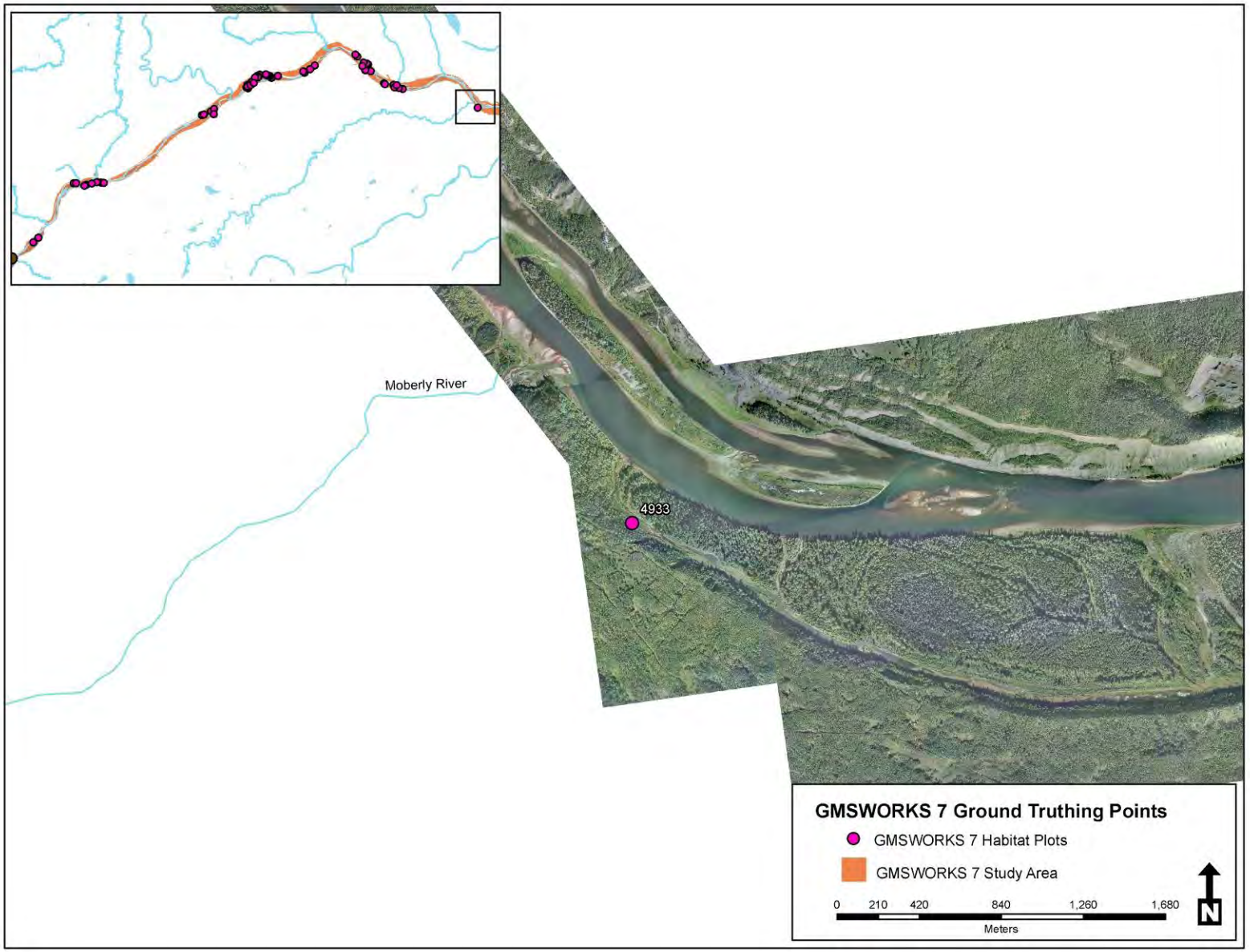

Halfway River
4901
4912
4902
4911
4910
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N


19
18
17
16
15
13
21
20
4913
22
23
14
4906
4922
4905
4909
4921
4908
4907
4920
4919
4918
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N


9
10
11
12
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N


8
7
6
5
4
4925
4924
4923
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N


Wilder Creek
4929
4930
3
4932
4931
2
1
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N

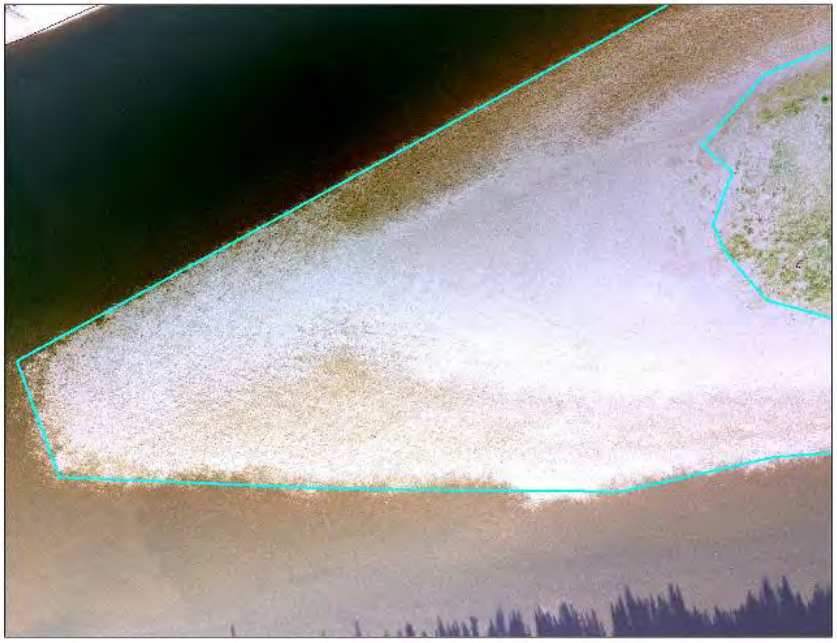

Moberly River
4933
GMSWORKS 7 Ground Truthing Points
GMSWORKS 7 Habitat Plots
GMSWORKS 7 Study Area
0 210 420 840 1,260 1,680
Meters
N

Appendix 6. Peace River riparian habitat classification legend.

Non-Vegetated

SA - Sandstone	
Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Non-vegetated – gentle slope - sandstone	
Habitat Description: Non-vegetated sandstone flats occurring at the lower end of the Peace River canyon.	
Vegetation: None.	

GB – Gravel Bars

Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Non-vegetated – gentle slope – sand/gravel

Habitat Description: Mostly non-vegetated sand/gravel bars along the river edge and surrounding islands.

Vegetation: In areas where sparse patches of vegetation have established, common shrub and herbs species present include seedlings of balsam poplar (3% cover), white sweet clover (2% cover), yellow sweet clover (2% cover), scouring rush, hair bentgrass and bluejoint.

Shrubs: Mean richness: 1

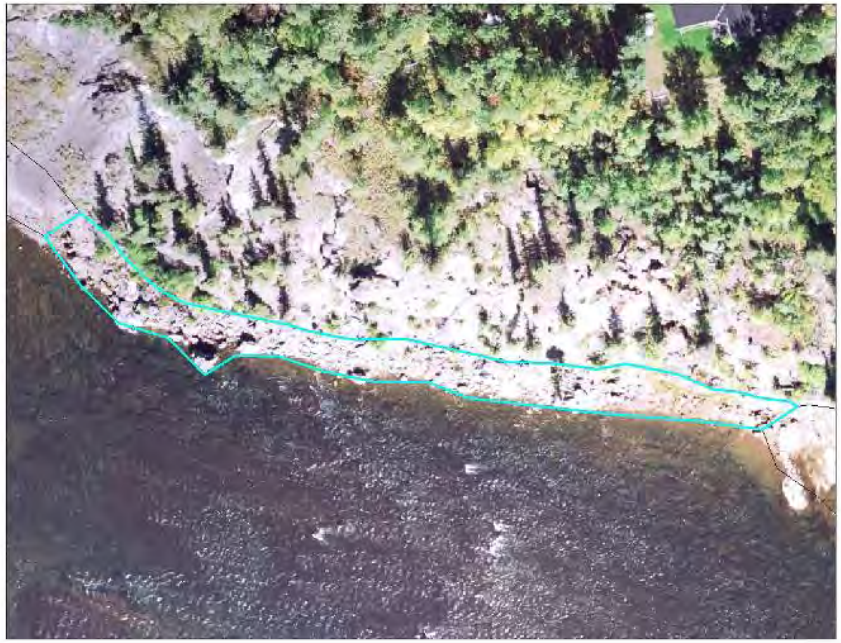
Species
Salix sp.
Balsam poplar

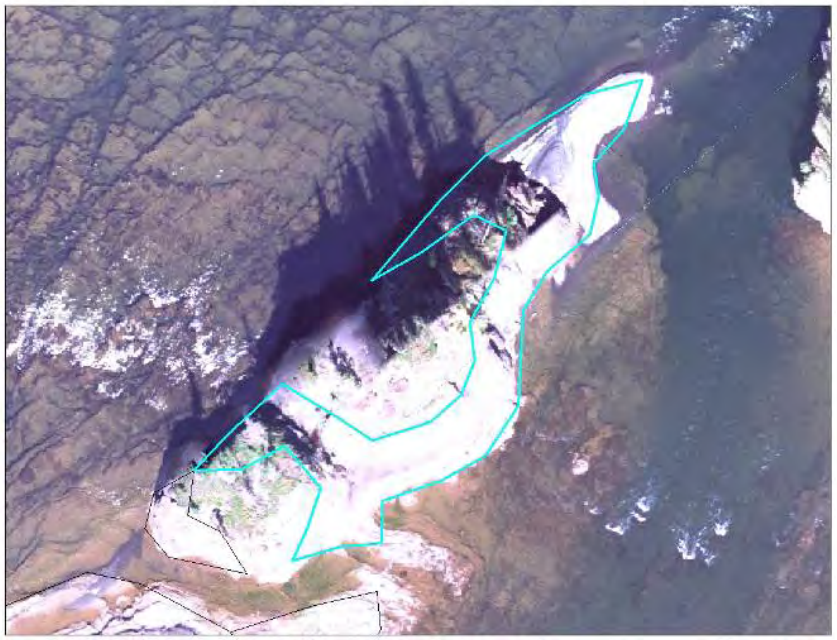
Herbs: Mean richness: 5

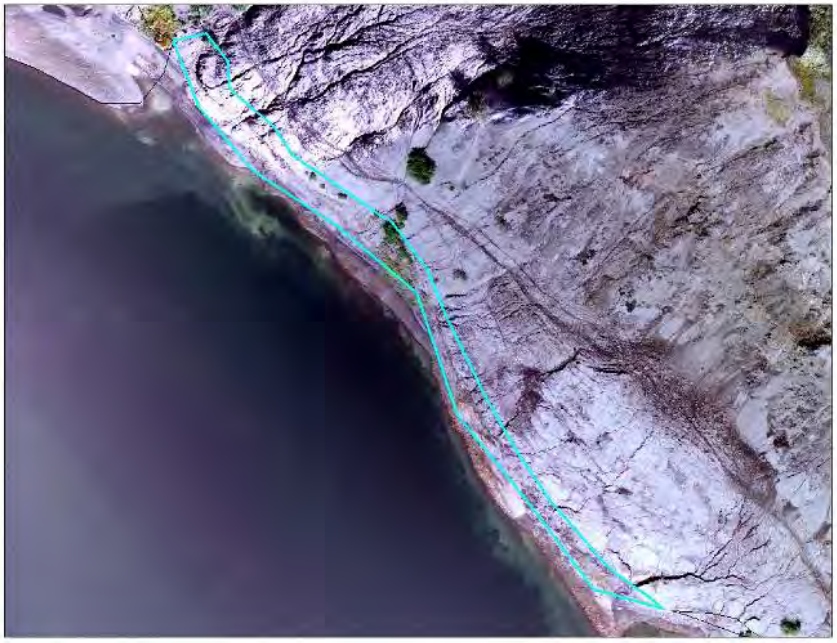
Species		
Grass spp.	Hair bentgrass	Canada goldenrod
Wild chives	Scouring rush bluejoint	Slender wheatgrass
Aster spp.	Western tansymustard	
	White sweet clover	

GS – Gravel Slope	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Non-vegetated – moderate to steep slope – sand/gravel	
Habitat Description: Non-vegetated sand/gravel slopes along the river edge.	
Vegetation: None.	

IN – Industrial	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Industrial/ residential/ recreational/ agricultural land	
Habitat Description: Any land utilized for industrial, residential, recreational or agricultural activity.	
Vegetation: Not sampled.	

BS – Boulder Slope	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Non-vegetated – gravel/ cobble/ boulder	
Habitat Description: Channel edges, often steep and cliff-like, consisting of various-sized rock substrate (i.e., gravels, cobbles and boulders); non-vegetated or sparsely vegetated/treed.	
Vegetation: Not sampled	

SH – Shale Slope	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Non-vegetated – shale – steep slope	
Habitat Description: Exposed shale bedrock or monoliths below the inundation line.	
Vegetation: None.	

SS – Sandstone Slope	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Non vegetated-steep slope – sandstone.	
Habitat Description: Steep eroding bluffs, cliffs, or slopes; sand-dune like in appearance. Non- to sparsely vegetated	
Vegetation: Not sampled.	

OW – Open Water	
Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	
Habitat Class: Water	
Habitat Description: Standing or pooled water occurring between the elevations of the inundation/high water mark and the low water mark.	
Vegetation: Not sampled.	

Wetland and Aquatic

AV – Aquatic Vegetation

Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Aquatic to semi-aquatic vegetation – depressions and side channels

Habitat Description: Periodically inundated depressions and side channels along the river bank and between islands and the river bank; may be partially submerged in shallow water. Containing aquatic and semi-aquatic vegetation (e.g., sedges and rushes). Pioneer seral.

Vegetation: In old, inactive channels, willow (including pacific willow; 36% cover) may dominate. Common herbs in open channels include grasses (25% cover), small-flowered bulrush (10% cover), alsike clover (8% cover) and field mint.

Shrubs: Mean richness: 2

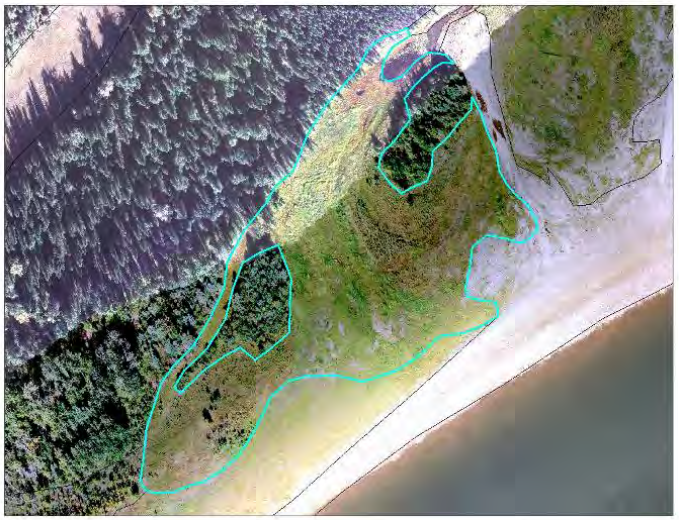
Species
Salix spp.
Pacific willow
Mountain alder

Herbs: Mean richness 4

Species

Carex sp.	Bluejoint	Mint
Grass sp.	Clover	*Potentilla* sp.
Red clover	Common dandelion	Tuberous rush
Small-flowered bulrush	*Aster* spp.	

WE – Wetland

Example Aerial Photograph (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Wetland complex

Habitat Description: Isolated depression or wet area that has developed wetland characteristics (e.g., standing water, wetland vegetation). Dis-climax.

Vegetation: Patches of willow (2% cover) and balsam poplar seedlings (1% cover) may be present. Common species within the diverse herbaceous cover include beaked sedge (13% cover), small-flowered bulrush (10% cover), bluejoint (10% cover), field mint, meadow horsetail, reed canarygrass water sedge, Crawford's sedge, wild chive, hair bentgrass and common rush.

Shrubs: Mean richness 1

Species
Salix spp.
Balsam poplar
Narrowleaf willow

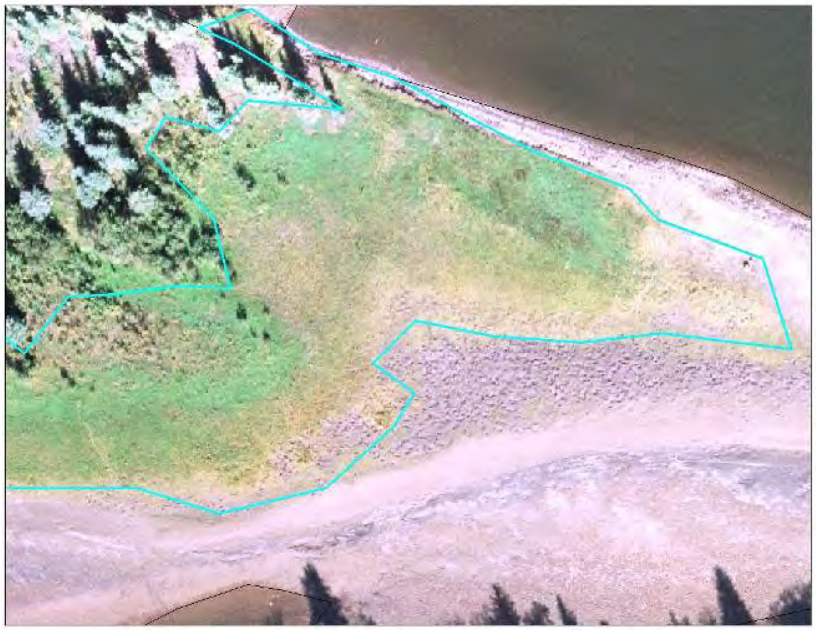
Herbs: Mean richness: 13

Species		
Tuberous rush	Alsike clover Water	Slender wheatgrass
Beaked sedge	sedge	Scouring rush
Bluejoint	Grass spp.	Marsh skullcap
Small-flowered	Canada goldenrod	Knotted rush
bulrush	Black medic	Foxtail barley
Hair bentgrass	Field mint	Crawford's sedge
Timothy	*Arnica* spp.	Common spikerush
Reed canarygrass	Bird's-foot trefoil	Spotted cowbane
Meadow horsetail	*Aster* spp.	Lesser spearwort
		Common rush

Shrub/ Graminoid/ Forb

<table>
<tr><td colspan="2">HE - Herbaceous</td></tr>
<tr><td>Example Aerial Photo (green outline around polygon):</td><td>Example Habit Photo:</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Habitat Class: Herb – gentle slopes – sand/ gravel</td></tr>
<tr><td colspan="2">Habitat Description: Herbaceous-dominant vegetation cover on sand/gravel beds along the riverside and islands. Pioneer seral.</td></tr>
<tr><td colspan="2">Vegetation: Some shrub cover may be present; species include, willow (including narrowleaf willow; 7% cover), seedlings of balsam poplar (1% cover) and prickly rose. Common species within the diverse herbaceous cover include grasses (including hair bentgrass, fescue and timothy; 53% cover), black medic (5% cover), alsike clover (1% cover), wild chive, yellow rattlesnake, arnica, foxtail barely, Canada goldenrod and wood strawberry.</td></tr>
<tr><td>Shrubs: Mean richness: 3
<u>Species</u>
Salix spp.
Mountain alder
Balsam poplar
Narrowleaf willow</td><td>Herbs: Mean richness: 8
<u>Species</u>
Carex sp.
Bird's-foot trefoil
Field mint
Hair bentgrass
Slender wheatgrass
Northern sweet vetch
Fabaceae spp.
Timothy
Prickly rose
Fescue
Wild chives
Red clover
Thistle
Aster spp
Western tansymustard
Yarrow
Canada goldenrod
White sweet clover
Arnica spp.
Foxtail barley
Wood strawberry</td></tr>
</table>

RS – Riparian Shrub

Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Riparian shrub – graminoid/ forb

Habitat Description: Shrubby vegetation composed of willow, alder, and poplar with some degree of grasses and forbs coverage. Pioneer seral.

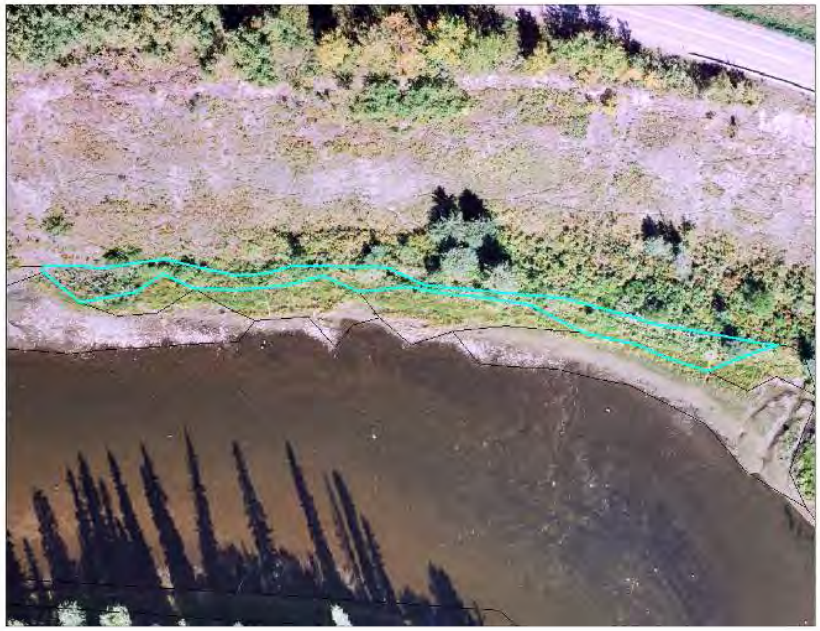
Vegetation: Herbaceous cover is dominated by grasses (may include hair bentgrass, bluejoint, tufted hairgrass and common timothy; 53% cover). Other common herbs include, white sweet clover (3% cover), alsike clover (3% cover), yarrow (1% cover) and common dandelion.

Shrubs: Mean richness: 3

Species
Mountain alder
Salix spp.
Red raspberry
Red osier dogwood

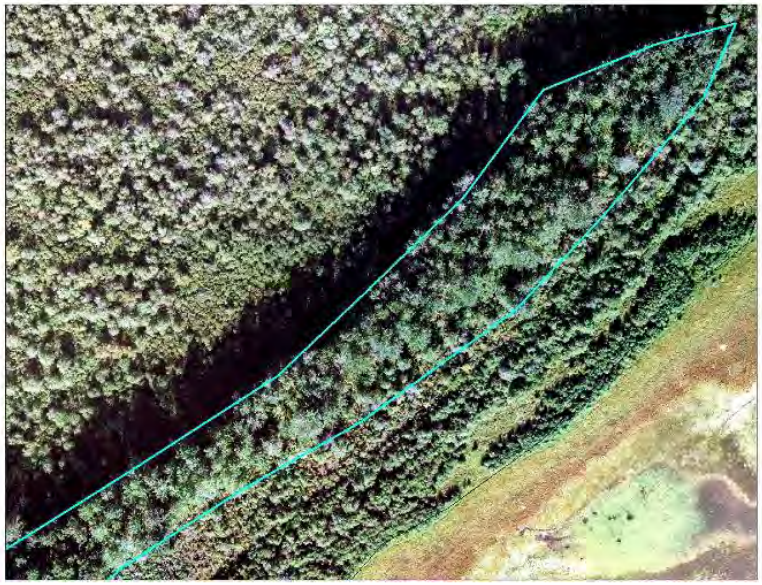
Herbs: Mean richness: 6

Species
Grass spp.
Stinging nettle
Dryas drummondii
Red clover
Sweet white clover
Common dandelion
Fireweed
Carrot sp.
Equisetum sp.
Perennial sow thistle
Sweet-scented bedstraw
Yarrow

US – Upland Shrub	
Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	Not sampled.
Habitat Class: Upland low shrub – graminoid.	
Habitat Description: Plant community occurring on low relief/ floodplain/upland areas above riparian zone, as a matrix throughout disturbed areas such as agricultural fields, roads, right-of-ways, etc. (Can be interspersed with pockets of At and sometimes Ac.). Pioneer seral.	
Vegetation: Not sampled.	

Balsam Poplar Dominated

LA – Late Ac

Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Mature Ac stand

Habitat Description: Mature balsam poplar-dominant stand with other intermittent tree species (e.g., white spruce). Mature to over-mature seral.

Vegetation: A diversity of both shrub and herbaceous species is present. Common shrubs include red-osier dogwood (18% cover), mountain alder (4% cover) red raspberry (3% cover), highbush cranberry, prickly rose and saskatoon. Common herbs include bluejoint (8% cover), wild lily-of-the-valley (1% cover), Canada goldenrod (1% cover), common pink wintergreen, American vetch, cream pea, scouring rush, star-flowered false Solomon's-seal, and northern bedstraw.

Shrubs: Mean richness: 8

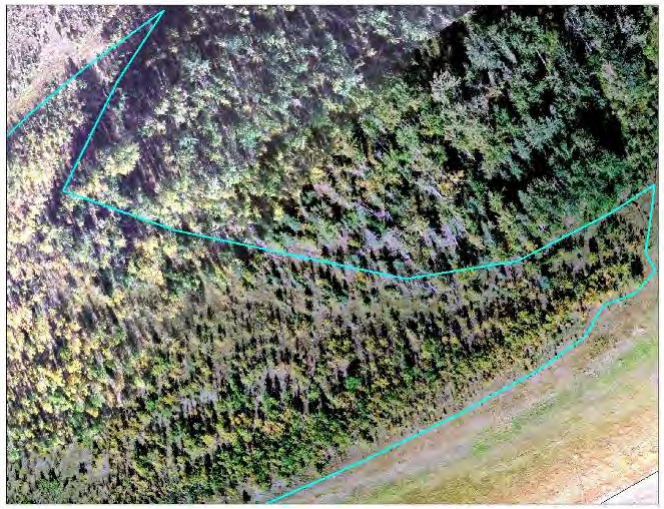
Species	
Red osier dogwood	Saskatoon
Mountain alder	Western snowberry
Prickly rose	Paper birch
White spruce	Snowberry
Red raspberry	Soopalallie
Highbush cranberry	*Salix* spp.

Herbs: Mean richness: 15

Species		
Wild sarsaparilla	*Pyrola* spp.	Northern bedstraw
Twinflower	Roughfruit fairybells	Sweet-scented bedstraw
Wild strawberry	Scouring rush	Canada goldenrod
American vetch	Star-flowered false	Common horsetail
Common pink	Solomon's seal	Mountain sweet-cicely
Wintergreen	Wild lily-of-the-valley	
Cream pea	Grass spp.	

MA - Mid Ac

Example Aerial Photo (green outline around polygon):



Example Habit Photo:

Habitat Class: Mid Ac Sw stand

Habitat Description: Mid-seral balsam poplar -dominant stand with other intermittent species (e.g., white spruce). Ranges from pioneer seral to mid seral.

Vegetation: A diversity of shrubs is present in these stands including seedlings of balsam poplar (45% cover) and white spruce (2% cover), red-osier dogwood (1% cover), narrowleaf willow, prickly rose, red raspberry, western snowberry and soopolallie. Common herbs present include white sweet clover (11% cover), yellow sweet clover (5% cover), aster (2.5% cover), alpine vetch, yarrow, black medic, Canada goldenrod and common dandelion.

Shrubs: Mean richness: 6

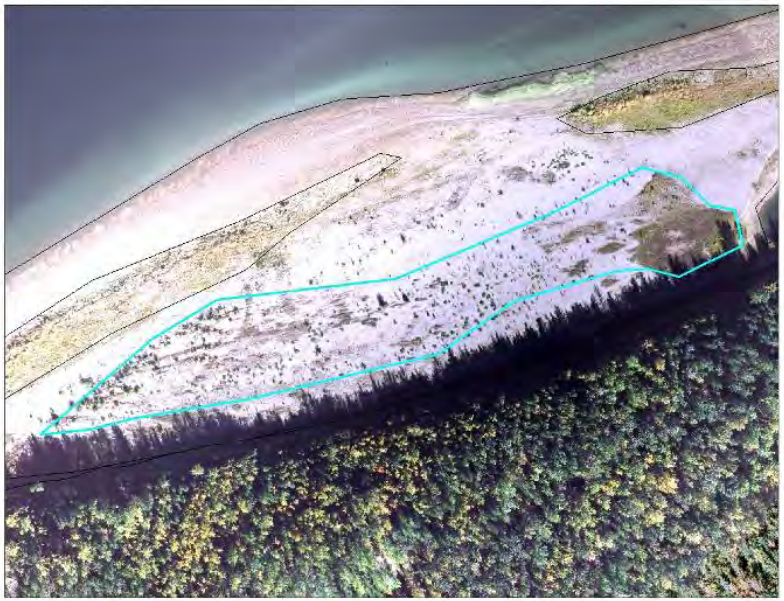
Species		
Balsam poplar	Mountain alder	Red osier dogwood
Silverberry	*Salix* spp.	Red raspberry
White spruce	Snowberry	Saskatoon
Narrowleaf willow	Western snowberry	Trembling aspen
Northern gooseberry	Prickly rose	Water birch
Soopolallie		

Herbs: Mean richness: 13

Species		
White sweet clover	Grass spp.	American vetch
Yellow sweet clover	Poaceae sp.	Boreal wormwood
Alpine milkvetch	Slender wheatgrass	Common pink wintergreen
Black medic	Alfalfa	*Erigeron* spp.
Canada goldenrod	Arctic sweet coltsfoot	Northern bedstraw
Showy locoweed	*Astragalus* spp.	Star-flowered false Solomon's seal
Sommon dandelion	*Castilleja* spp.	Sweet-scented bedstraw
Scouring rush	Twinflower	
Aster spp.	Yarrow	
	Alsike clover	

AG – Ac-Sw-gravel

Example Aerial Photo (green outline around polygon):



Example Habit Photo:

Habitat Class: Early Ac Sw – shrub – sand/ gravel

Habitat Description: Young-seral balsam poplar and white spruce stand growing in on sand/gravel substrate. Pioneer seral to young seral.

Vegetation: Shrub cover includes seedlings and saplings of balsam poplar (23% cover) and white spruce (6% cover), wood strawberry (1% cover) and prickly rose. Common herbs species present include Drummond`s mountain-avens (35% cover), white sweet clover (3% cover), northern bedstraw (1% cover), blue wildrye and wood strawberry.

Shrubs: Mean richness: 3

Species		
Balsam poplar	Red osier dogwood	Wood strawberry
Mountain alder	White spruce	Prickly rose

Herbs: Mean richness: 7

Species		
Drummond's mountain-avens	Northern bedstraw	Sweet-scented bedstraw
Blue wildrye	carrot sp.	Alpine milkvetch
White sweet clover	Cut-leaved anemone	*Aster* spp.
Alfalfa	Common dandelion	Canada goldenrod
Boreal wormwood	Kentucky bluegrass	Hair bentgrass
Equisetum sp.	Round-leaved violet	Kinnikinnick
	Wild strawberry	Slender wheatgrass

AH – Ac-Sw-herb

Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Early Ac Sw – shrub and/or pole sapling

Habitat Description: Balsam poplar-dominated with some white spruce, early successional stage. Ranges from pioneer to mid seral.

Vegetation: Balsam poplar dominates the shrub cover (29% cover). High diversity of herbs; common species include grasses (25%) white sweet clover (2% cover), yellow sweet clover (2% cover), Canada goldenrod, alsike clover, American vetch, common dandelion, yarrow, sweet-scented bedstraw and alfalfa.

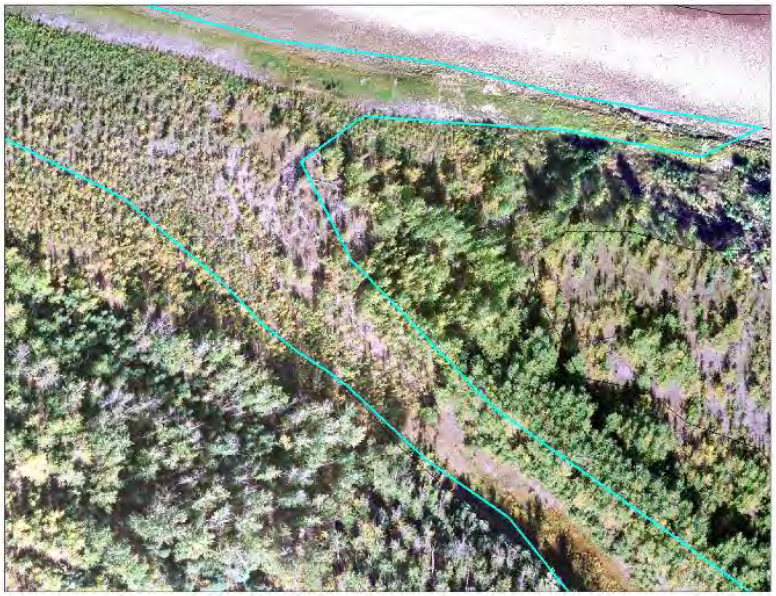
Shrubs: Mean richness: 5

Species		
Balsam poplar	Mountain alder	Red osier dogwood
Silverberry	Prickly rose	Red raspberry
White spruce	Western snowberry	Paper birch

Herbs: Mean richness: 12

Species		
Grass spp.	American vetch	Cream pea
Canada goldenrod	*Cirsium* spp.	Scouring rush
Alpine milkvetch	Common dandelion	Star-flowered false
Aster spp.	Alfalfa	Solomon's seal
White sweet clover	*Antennaria* spp.	Sweet-scented bedstraw
Yellow sweet clover	Boreal wormwood	Yarrow
Alsike clover	Common plantain	Yellow avens

AS – Ac sapling

Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Mid Ac pole sapling and/or shrub

Habitat Description: Balsam poplar stand. Pioneer to young seral.

Vegetation: Common shrubs include seedlings of white spruce (4% cover) and balsam poplar (3% cover), mountain alder (3% cover), prickly rose and red-osier dogwood. High diversity of herbaceous species; most common include alsike clover (4% cover), alfalfa (4% cover), Canada goldenrod (2% cover) and white and yellow sweet clover.

Shrubs: Mean richness: 6

Species		
Balsam poplar	Northern gooseberry	Saskatoon
White spruce	Prickly rose	Silverberry
Mountain alder	Red osier dogwood	Western snowberry
Narrowleaf willow		

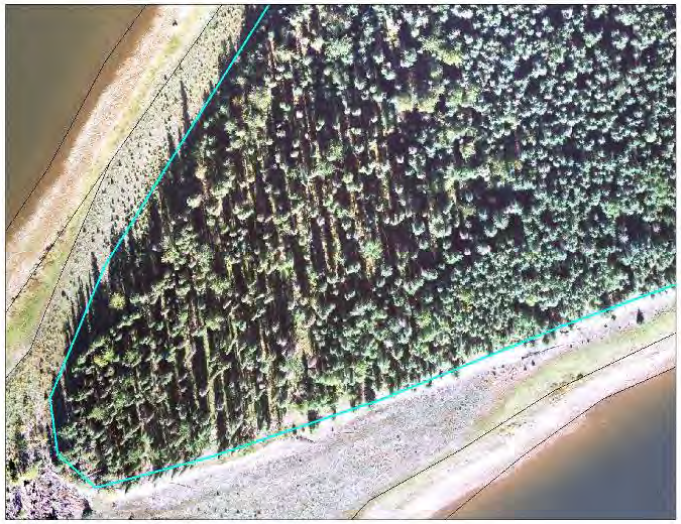
Herbs: mean richness: 17

Species		
Alsike clover	*Aster* spp.	*Pyrola* spp.
Alfalfa	Blue wildrye	Slender wheatgrass
Canada goldenrod	Fabaceae spp.	Star-flowered false
Common dandelion	White sweet clover	Solomon's seal
Alpine milkvetch	Wild lily-of-the-valley	Yarrow
Grass spp.	Scouring rush	
Showy locoweed	Yellow sweet clover	
American vetch	Canadian milkvetch	

White Spruce, Paper Birch, or Trembling Aspen Dominated

MM – Mature Mixed

Example Aerial Photo (green outline around polygon):



Example Habit Photo:

Habitat Class: Mature Sw Ep Ac stand

Habitat Description: Mixed stand of mature white spruce, paper birch, and balsam poplar; often on islands. Ranges from mid-seral to maturing climax stands.

Vegetation: Common shrubs may include seedlings of paper birch and white spruce, northern gooseberry, common snowberry, red raspberry, prickly rose, highbush cranberry red-osier dogwood and saskatoon. Common herbs may include wild sarsaparilla, sweet-scented bedstraw, twinflower, bunchberry, common horsetail and wood strawberry.

Shrubs: Mean richness: 6

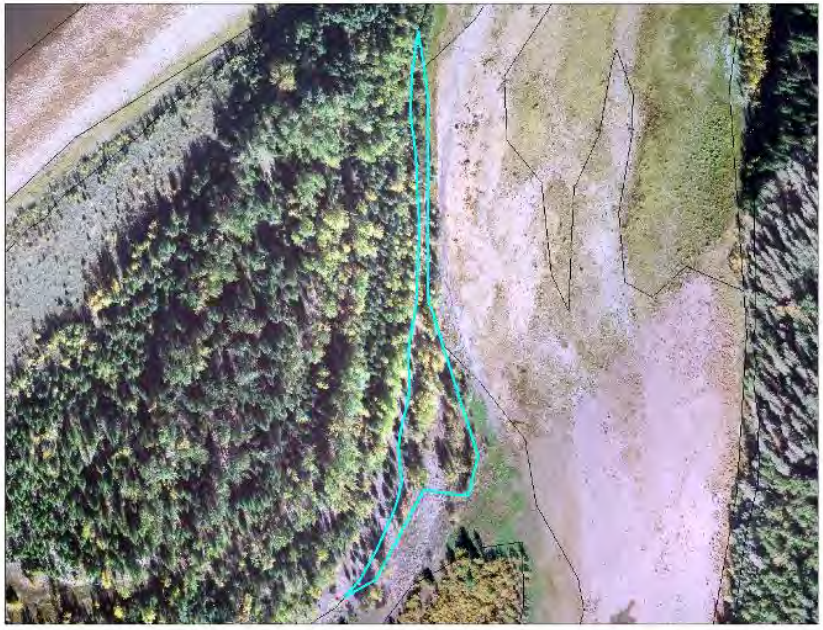
Species		
Balsam poplar	Prickly rose	Utah honeysuckle
Glaucous-leaved honeysuckle	Red osier dogwood	Western snowberry
Highbush cranberry	Red raspberry	White spruce
Mountain alder	Saskatoon	
	Soopalallie	

Herbs: Mean richness: 6

Species		
Wild sarsaparilla	Northern bedstraw	Common mitrewort
Bluejoint	*Pyrola* spp.	*Equisetum* sp.
Wild lily-of-the-valley	Slender wheatgrass	Scouring rush
Enchanter's nightshade	Star-flowered false Solomon's seal	American vetch
Wild strawberry	Sweet-scented bedstraw	Canada goldenrod
Common dandelion	*Aster* spp.	Grass spp.
Cornus canadensis	Blue wildrye	Mountain sweet-cicely
Fringed brome		Purple meadow-rue

MS – Mature Spruce

Example Aerial Photo (green outline around polygon):



Example Habit Photo:

Habitat Class: Mature Sw Ac Ep stand

Habitat Description: Mature white spruce-dominant with poplar and paper birch subdominant; stands along riparian zone and islands. Ranges from young climatic climax to maturing climatic climax.

Vegetation: Common shrubs may include seedlings of paper birch and white spruce, northern gooseberry, common snowberry, red raspberry, prickly rose, highbush cranberry red-osier dogwood and saskatoon. Common herbs may include wild sarsaparilla, sweet-scented bedstraw, twinflower, bunchberry, common horsetail and wood strawberry.

Shrubs: Mean richness: 4

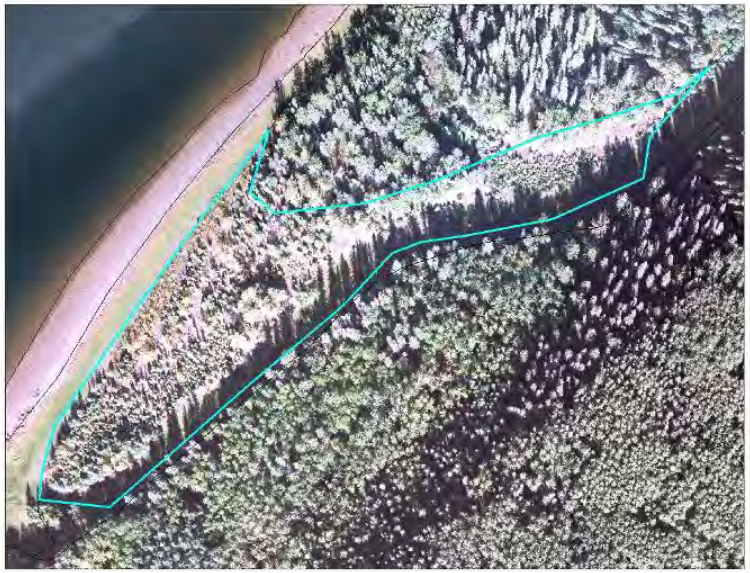
Species		
Prickly rose	Snowberry	Pincherry
Highbush cranberry	Black gooseberry	Red raspberry
Red osier dogwood		

Herbs: Mean richness: 6

Species		
Cornus canadensis	Grass spp.	Clasping twisted stalk
Wild sarsaparilla	Common mitrewort	Sweet scented bedstraw
Equisetum sp.	Twinflower	Round-leaved violet
Wild strawberry	*Aster* spp.	Wintergreen

SG – Sw-Ac-gravel

Example Aerial Photo (green outline around polygon):



Example Habit Photo:

Habitat Class: Early Sw Ac shrub – sand/ gravel

Habitat Description: Mixed tree cover of white spruce and balsam poplar with well-developed shrub understory on sand/gravel substrate. Pioneer to young seral

Vegetation: High diversity of shrubs and herbs present. Common shrubs include seedlings and saplings of balsam poplar (34% cover) and white spruce (2% cover), mountain alder (7% cover), silverberry, northern gooseberry and red-osier dogwood. Common herbs include white sweet clover (9% cover), yellow sweet clover (3%), Canada goldenrod (2% cover), alpine vetch, slender wheatgrass, northern bedstraw and timothy.

Shrubs: Mean richness: 4

Species		
Balsam poplar	Silverberry	Northern gooseberry
Mountain alder	White spruce	Soopalallie
Prickly rose	*Rubus* sp.	Wood strawberry
Red osier dogwood	*Salix* spp.	

Herbs: Mean richness: 12

Species		
White sweet clover	*Aster* spp.	Tufted hairgrass
Yellow sweet clover	*Castilleja* spp.	Western tansymustard
Canada goldenrod	Red clover	Yarrow
Wild sarsparilla	Common dandelion	Bird's-foot trefoil
Alpine milkvetch	*Equisetum* sp.	Black medic
Grass spp.	Fireweed	Kinnikinnick
Alfalfa	Hawkweed sp.	Northern bedstraw
Slender wheatgrass	Northern sweet vetch	*Pyrola* spp.
Alsike clover	Sweet scented bedstraw	

SP – Pioneer Sw

Example Aerial Photo (green outline around polygon):

Example Habit Photo:

Habitat Class: Early Sw Ac shrub – grass/ herb

Habitat Description: White spruce dominated shrub cover mixed with balsam poplar; moderate to high grass/herb cover. Pioneer seral.

Vegetation: Shrubs include willows (e.g., narrowleaf willow; 5% cover) and seedlings and sapling of balsam poplar (7% cover). Herbaceous cover is diverse and includes bluejoint (25% cover), yellow sweet clover (15% cover), white sweet clover (10% cover), western snowberry, hair bentgrass, black medic, alfalfa, timothy, bluejoint, yellow rattlesnake and a few other species of grasses.

Shrubs: Mean richness: 3

Species		
Narrowleaf willow	Balsam poplar	*Salix* spp.

Herbs: Mean richness: 15

Species		
Bluejoint	Alfalfa	Canada goldenrod
Grass spp.	Black medic	Common dandelion
Yellow sweet clover	Fescue	Timothy
Hair bentgrass	*Aster* spp.	*Hieracium* spp.
White sweet clover		

ES – Birch-Spruce Slope

Example Aerial Photo (green outline around polygon):

Example Habit Photo:

Habitat Class: Steep slope – Ep Sw stand

Habitat Description: Steep sloped riverbank or streambank with moderate to high cover of mature paper birch and white spruce, some balsam poplar may also be present; narrow sand/gravel bar at the base of the hillside may be present. Ranges from maturing seral to maturing climax

Vegetation: A diversity of shrubs and herbs are present within these stands. Common shrubs include willow (12 % cover), highbush cranberry (8% cover), mountain alder (6% cover), northern gooseberry, common snowberry, red raspberry, prickly rose, red-osier dogwood and saskatoon. Common herbs include wild sarsaparilla (20% cover), wood strawberry (5% cover), bunchberry (5% cover), sweet-scented bedstraw, twinflower and common horsetail.

Shrubs: Mean richness: 11

Species		
Mountain alder	Prickly rose	Paper birch
Salix spp.	Red osier dogwood	Western snowberry
Highbush cranberry	Common snowberry	White spruce
Red raspberry	Northern gooseberry	Black gooseberry
Birch-leaved spiraea	Saskatoon	Pyramid spiraea
	Skunk currant	

Herbs: Mean richness: 16

Species		
Wild sarsaparilla	Northern bedstraw	Baneberry
Bunchberry	Twinflower	Columbia bower
Equisetum sp.	Bluejoint	Common dandelion
Grass spp	Cream pea	Common mitrewort
Sweet-scented bedstraw	Enchanter's nightshade	One-sided wintergreen
American vetch	Lady fern	Roughfruit fairybells
Common horsetail	Palmate coltsfoot	Yarrow
Cornus canadensis	Wild strawberry	Canada goldenrod
	Aster spp.	Wild lily-of-the-valley

EA – Birch-Aspen Slope

Example Aerial Photo (green outline around polygon):	**Example Habit Photo:**
	

Habitat Class: Steep slope – Ep At

Habitat Description: Steep sloped riverbank or streambank with low to moderate cover of paper birch and trembling aspen, some white spruce may also be present; understory of grasses/forbs/shrubs; narrow sand/gravel bar at the base of the hillside may be present. Pioneer to mid seral.

Vegetation:

Shrubs: Mean richness: 8

Species		
Trembling aspen	Northern gooseberry	Prickly rose
Soopalallie	Paper birch	Red raspberry
White spruce	Saskatoon	

Herbs: Mean richness: 11

Species		
Fabaceae spp.	White sweet clover	Narrow-leaved hawkweed
Northern bedstraw	Alpine milkvetch	
Aster spp.	American vetch	Wild strawberry
Spikelike goldenrod	Canada goldenrod	Yarrow

Appendix 7. Peace River riparian habitat vegetation database.

See MS Access database ‘GMSWORKS_7_Data’ that accompanies this report.

Appendix 8. Peace River riparian habitat .shp file.

See .shp file ‘2010_riparian_interpretation_10N’ that accompanies this report.