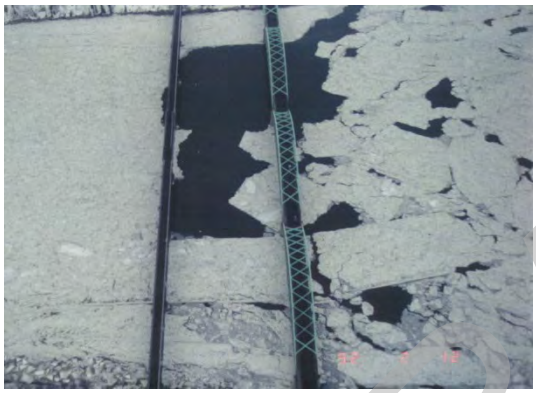

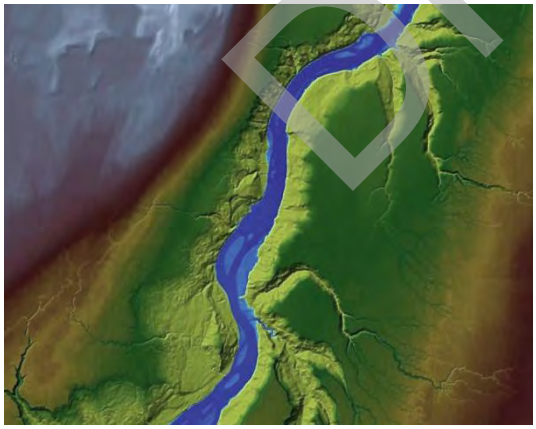

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION

FINAL REPORT

Prepared for:

Alberta Environment and Parks

24 October 2022

NHC Ref. No. 1001119

nhc
northwest hydraulic consultants
water resource specialists

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GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION

FINAL REPORT

Prepared for:

Alberta Environment and Parks
Edmonton, Alberta

Prepared by:

Northwest Hydraulic Consultants Ltd.
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24 October 2022

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APEGA Permit to Practice – P654

Prepared by:

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Principal

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DISCLAIMER

This report has been prepared by Northwest Hydraulic Consultants Ltd. in accordance with generally accepted engineering practices, for the benefit of Alberta Environment and Parks for specific application to the Peace River Hazard Study in Alberta. The information and data contained herein represent Northwest Hydraulic Consultants Ltd.'s best professional judgment based on the knowledge and information available to Northwest Hydraulic Consultants Ltd. at the time of preparation.

Except as required by law, this report and the information and data contained herein are to be treated as confidential and may be used and relied upon only by Alberta Environment and Parks, its officers and employees. Northwest Hydraulic Consultants Ltd. denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents.

CREDITS AND ACKNOWLEDGEMENTS

Northwest Hydraulic Consultants Ltd. would like to express appreciation to Alberta Environment and Parks for initiating this project, making available extensive background information including annual ice observation reporting. Key AEP representatives were Nadia Kovachis Watson, MSc, PEng (Project Manager) and Patricia Stevenson, BSc (Alternate Project Manager). Jane Eaket, MSc, PEng from AEP also provided her input and guidance in updating the governing design flood hazard maps.

The following NHC personnel provided the key contributions to the governing design flood hazard map production component of the Peace River Hazard Study. Dan Healy, PhD, PEng (Project Manager) ensured the overall direction of the project, design flood determination, and was the primary author of this report. Sarah North, GISP (GIS Specialist) assisted with mapping and database creation.

EXECUTIVE SUMMARY

Northwest Hydraulic Consultants Ltd. was retained in September 2015 by Alberta Environment and Parks to conduct a River Hazard Study for the Peace River through the Town of Peace River. The objectives of this River Hazard Study are to identify and assess river and flood-related hazards along 54 km of the Peace River, from about 6 km upstream of Shaftesbury Ferry to about 5 km downstream of the Highway 986 bridge, and along 1.2 km of the Heart River upstream of its confluence with the Peace River.

The Peace River Hazard Study has been structured into nine major project components. This report pertains to the work of the seventh component – Governing Design Flood Hazard Map Production. A summary of the work supporting the determination of the governing design flood and flood hazard mapping is provided.

The governing design flood profile is dominated by the ice jam design flood profile on both the Peace River and Heart River. The governing design flood hazard map depicts the floodway and flood fringe based on the information resulting from the floodway criteria mapping for the ice jam design flood. The governing design flood hazard map series is included as an appendix to this summary report. All of the supporting GIS data including: floodway, high hazard flood fringe, and flood fringe limits; governing design flood water surface TIN; and governing design flood depth grid, and elevation grid; are provided as a separate electronic deliverable.

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1 INTRODUCTION

1.1 Study Objectives

The overall objectives of the Peace River Hazard Study are to identify and assess river and flood hazards along the Peace and Heart rivers through the Town of Peace River (TPR). The study is being completed under the provincial Flood Hazard Identification Program (FHIP), the goals of which include enhancement of public safety and reduction of future flood damages through the identification of river and flood hazards. The intent is to reduce potential future flood damage and disaster assistance costs to the federal, provincial, and local governments, including First Nations. New floodplain maps will inform land use planning decisions, assist with developing flood mitigation options, and facilitate emergency response planning.

The Peace River Hazard Study has been structured into the following major project components.

1) Survey and Base Data Collection
2) Open Water Hydrology Assessment
3) Hydraulic Model Creation and Calibration
4) Open Water Flood Inundation Map Production
5) Open Water Flood Hazard Identification
6) Ice Jam Modelling Assessment & Flood Hazard Identification
7) Governing Design Flood Hazard Map Production
8) Flood Risk Assessment and Inventory
9) Channel Stability Investigation

This report summarizes the work of the seventh component – ***Governing Design Flood Hazard Map Production***. A summary of the work related to the determination of the governing design flood and flood hazard mapping production is provided. Flood hazard areas are utilized for both the open water and ice jam design floods, composed of floodway and flood fringe zones, using the FHIP Guidelines (Alberta Environment, 2011), incorporating technical changes implemented in 2021 regarding how floodways are mapped in Alberta. The governing flood mechanism along a study sub-reach is that which produces the highest design flood levels.

The main aspects of the approach relate to both floodway determination criteria and mapping standards. The floodway in previously unmapped areas is delineated primarily as the area of highest hazard, defined where flood depths are 1 m or deeper or where local flow velocities are 1 m/s or higher. Previously mapped floodways do not typically become larger, and can become smaller if deemed appropriate. Areas of higher hazard that fall outside of the floodway zone (defined primarily by flood depth and local flow velocity) can be identified within the flood fringe zone, and referred to as “high

hazard flood fringe" areas. Using this approach, dedicated flood control structures are assumed to be effective and protected areas are not mapped as flooded unless these structures are overtopped. In addition, governing design flood hazard maps prepared using this approach will include incremental areas at risk of flooding for the 200-year and 500-year open water floods, or the 200-year ice jam flood, as appropriate for the relevant study reach.

The governing design flood profile is dominated by the 100-year Ice Jam flood profile on both the Heart River and Peace River. Governing design flood hazard mapping depicts the floodway and flood fringe zones based on the information resulting from the floodway criteria mapping for the 100-year ice jam flood. The governing design flood hazard mapping component supports the associated supplementary flood risk assessment and inventory component of the overall project.

1.2 Study Area and Reach

The Peace River flows into northwestern Alberta from British Columbia, passing through TPR, which is located about 380 km northwest of Edmonton. The extent of the contributing basin for the study reach is shown in **Figure 1**. Peace River flows are regulated by BC Hydro for hydropower production at Bennett Dam and Peace Canyon (PCN) Dam. The primary storage unit that enables regulation is Williston Lake, the reservoir created by Bennett Dam, which has sufficient capacity to provide multi-year storage of inflows.

The study reach consists of a 54 km segment of the Peace River beginning at the west boundary of 1-82-24-W5M about 6 km upstream of the Shaftesbury Ferry crossing (Highway 740) to the north boundary of 24-85-21-W5M about 5 km downstream of the Highway 986 bridge. The location of the study reach is shown in **Figure 1.** TPR is the most developed and populated area along this reach of the Peace River. Also included in the study area is a 1.2 km reach of the Heart River upstream of its confluence with the Peace River and a limited reach of the Smoky River near its confluence with the Peace River. Study limits are shown in **Figure 2**.

2 GOVERNING DESIGN FLOOD DETERMINATION

2.1 Open Water and Ice Jam Design Flood Details

Details on the open water design and ice jam design floods are provided as part of other study components under separate covers within the ***Open Water Flood Hazard Identification*** and ***Ice Jam Modelling Assessment & Flood Hazard Identification*** reports. Details on the differences in the open water and ice jam design floods are described in the following section. The differences are based on a detailed comparison of design flood levels.

2.2 Comparison of Open Water and Ice Jam Design Flood Hazards

Tables 1 and **2** list the open water and ice jam design flood levels for the Peace River and Heart River, respectively. At each section, the higher value between open water and ice jam conditions is indicated in bold text. The ice jam design flood levels are higher than the open water levels at all sections with the exception of 2 cross sections (#8 and #10). At these sections the open water levels exceed the ice jam levels by 10 and 16 cm. **Figures 3** and **4** chart the open water and ice jam flood levels along the Peace River and Heart River, respectively. It is apparent that the ice jam flood level profile governs over the entire length of both study reaches.

Table 1 Comparison of Open Water and Ice Jam Design Flood Levels Peace River

Peace River Cross Section	Design Flood Level (m)		Peace River Cross Section	Design Flood Level (m)	
	Open Water	Ice Jam		Open Water	Ice Jam
XS #1	313.69	**314.04**	XS #28	319.79	na
XS #2	314.18	**314.31**	XS #29	319.82	**320.80**
XS #3	314.39	**314.69**	XS #30	320.20	**321.19**
XS #4	314.64	**314.95**	XS #31	320.38	**321.28**
XS #5	314.94	**315.19**	XS #32	320.66	**321.50**
XS #6	315.16	**315.29**	XS #33	321.38	**321.81**
XS #7	315.42	na	XS #34	321.77	**322.23**
XS #8	**315.51**	315.41	XS #35	321.81	**322.50**
XS #9	315.67	**315.72**	XS #36	322.10	**322.80**
XS #10	**316.26**	316.10	XS #37	322.20	**323.05**
XS #11	316.37	**316.50**	XS #38	322.69	**323.64**
XS #12	316.66	**316.90**	XS #39	322.84	**324.00**
XS #13	317.14	**317.29**	XS #40	323.00	**324.42**
XS #14	317.35	**317.67**	XS #41	323.38	**324.99**
XS #15	317.85	**318.10**	XS #42	323.78	**325.62**
XS #16	318.18	**318.41**	XS #43	324.12	**326.15**
XS #17	318.47	**318.70**	XS #44	324.44	**326.51**
XS #18	318.84	**319.10**	XS #45	324.99	**326.92**
XS #19	318.95	**319.62**	XS #46	325.31	**327.21**
XS #20	319.41	**320.11**	XS #47	325.49	**327.45**
XS #21	319.51	**320.28**	XS #48	325.79	**327.82**
XS #22	319.54	**320.43**	XS #49	326.04	**328.32**
XS #23	319.46	**320.59**	XS #50	326.29	**328.64**
XS #24	319.43	na	XS #51	326.87	**329.09**
XS #25	319.51	na	XS #52	327.18	**329.40**
XS #26	319.51	**320.69**	XS #53	327.69	**329.77**
XS #27	319.52	na	XS #54	328.30	**330.20**

Table 2 Comparison of Open Water and Ice Jam Design Flood Levels Heart River

Heart River Cross Section	Design Flood Level (m)		Heart River Cross Section	Design Flood Level (m)	
	Open Water	Ice Jam		Open Water	Ice Jam
XS #55	320.29	**321.25**	XS #69	320.53	**321.33**
XS #56	320.29	**321.25**	XS #70	320.59	**321.35**
XS #57	320.29	**321.25**	XS #71	320.60	**321.36**
XS #58	320.29	**321.25**	XS #72	320.62	**321.38**
XS #59	320.32	**321.25**	XS #73	320.65	**321.42**
XS #60	320.39	**321.25**	XS #74	320.68	**321.48**
XS #61	320.39	**321.25**	XS #75	320.70	**321.50**
XS #62	320.40	**321.26**	XS #76	320.73	**321.55**
XS #63	320.41	**321.26**	XS #77	320.77	**321.61**
XS #64	320.39	**321.26**	XS #78	320.82	**321.70**
XS #65	320.39	**321.26**	XS #79	320.92	**321.83**
XS #66	320.50	**321.32**	XS #80	320.95	**322.03**
XS #67	320.51	**321.32**	XS #81	321.14	**322.31**
XS #68	320.53	**321.32**			

2.3 Governing Design Flood Limiting Criteria

Riverine flooding on the Peace River and Heart River may result from open water or ice jam floods. The governing design flood is determined by a worst-case flood hazard criteria which is governed by the highest design flood levels resulting from either open water or ice jam flood levels. A section by section comparison of the open water and ice jam design flood levels found that the ice jam design flood scenario resulted in the highest flood levels everywhere but two locations (refer to XS #8 and XS #10, **Table 1)**. The difference in flood levels at these two locations, where open water levels were higher, was small (about 15 cm). The ice jam design flood was adopted as the governing design flood for both the Peace River and the Heart River.

2.4 Governing Design Flood Profile

The governing design flood profile was determined by the worst-case flood hazard criteria on a reach basis and the ice jam design flood governed everywhere. **Figures 5** and **6** provide charts of the final governing design flood profiles on the Peace River and Heart River, respectively. A summary of the governing design flood profile levels for are provided in **Tables 3** and **4**. The governing design flood level profile is the same profile as the ice jam design flood level profile. Elevation values at cross sections that were omitted from the ice-enhanced model were linearly interpolated between nearby cross sections with calculated elevation values (interpolated values are indicated in **Table 3**).

Table 3 Final Governing Design Flood Levels – Peace River

Peace River Cross Section	Governing Design Flood Level (m)	Peace River Cross Section	Governing Design Flood Level (m)
XS #1	314.04	XS #28	*320.71**
XS #2	314.31	XS #29	320.80
XS #3	314.69	XS #30	321.19
XS #4	314.95	XS #31	321.28
XS #5	315.19	XS #32	321.50
XS #6	315.29	XS #33	321.81
XS #7	*315.29**	XS #34	322.23
XS #8	315.41	XS #35	322.50
XS #9	315.72	XS #36	322.80
XS #10	316.10	XS #37	323.05
XS #11	316.50	XS #38	323.64
XS #12	316.90	XS #39	324.00
XS #13	317.29	XS #40	324.42
XS #14	317.67	XS #41	324.99
XS #15	318.10	XS #42	325.62
XS #16	318.41	XS #43	326.15
XS #17	318.70	XS #44	326.51
XS #18	319.10	XS #45	326.92
XS #19	319.62	XS #46	327.21
XS #20	320.11	XS #47	327.45
XS #21	320.28	XS #48	327.82
XS #22	320.43	XS #49	328.32
XS #23	320.59	XS #50	328.64
XS #24	*320.67**	XS #51	329.09
XS #25	*320.68**	XS #52	329.40
XS #26	320.69	XS #53	329.77
XS #27	*320.70**	XS #54	330.20

* denotes values interpolated from values calculated at nearby cross sections

Table 4 Final Governing Design Flood Levels – Heart River

Heart River Cross Section	Design Flood Level (m)		Heart River Cross Section	Design Flood Level (m)	
	Open Water	Ice Jam		Open Water	Ice Jam
XS #55	320.50	**321.25**	XS #69	320.67	**321.33**
XS #56	320.50	**321.25**	XS #70	320.71	**321.35**
XS #57	320.50	**321.25**	XS #71	320.72	**321.36**
XS #58	320.50	**321.25**	XS #72	320.73	**321.38**
XS #59	320.52	**321.25**	XS #73	320.75	**321.42**
XS #60	320.57	**321.25**	XS #74	320.77	**321.48**
XS #61	320.57	**321.25**	XS #75	320.79	**321.50**
XS #62	320.58	**321.26**	XS #76	320.80	**321.55**
XS #63	320.59	**321.26**	XS #77	320.84	**321.61**
XS #64	320.57	**321.26**	XS #78	320.87	**321.70**
XS #65	320.57	**321.26**	XS #79	320.94	**321.83**
XS #66	320.65	**321.32**	XS #80	320.97	**322.03**
XS #67	320.66	**321.32**	XS #81	321.11	**322.31**
XS #68	320.67	**321.32**			

3 GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION

The ice jam design flood governed for the entire study reach and thus the governing design flood hazard map was developed through minor adjustments to the ice jam flood criteria map information described under a separate cover in the ***Ice Jam Modelling Assessment & Flood Hazard Identification*** report. The adjustments made to the ice jam flood criteria mapping information to develop the floodway and flood fringe for the governing design flood hazard map were as follows.

The limits of the floodway were delineated by the floodway boundary developed for the ice jam floodway criteria map. Areas of high ground or areas of depth less than 1 m inside the floodway boundaries were included as part of the floodway. The resulting floodway was represented as a single contiguous polygon.

The ice jam design flood extent developed for the ice jam floodway criteria map was adjusted to create the flood fringe. The limits of the flood fringe followed the extent of direct inundation of the ice jam design flood – isolated areas beyond these extents were not included in the flood fringe. Areas of high ground within the extent of direct inundation (and outside of the floodway) were preserved and were not indicated as flood fringe in the flood hazard map. The flood fringe is further divided into two zones: *Flood Fringe – High Hazard* and *Flood Fringe*, as described in the subsequent sections.

3.1 Areas in the Floodway

Notable overbank areas in the floodway include:

- Twelve Foot Davis Park.

The floodway boundaries were carried into the mouths of small tributaries, following the governing criteria established for adjacent cross sections on the Peace River.

More information and statistics regarding existing infrastructure and property within the floodway can be found in the ***Flood Risk Assessment and Inventory*** report, provided under separate cover.

3.2 Areas in the High Hazard Flood Fringe

The high hazard flood fringe includes areas outside of the floodway that are directly inundated by the 100-year ice jam design flood and deeper than 1 m. The notable overbank areas in the high hazard flood fringe include:

- the Lower West Peace townsite;
- low-lying portions of downtown Peace River between the Heart River and the Canadian National Railway (CNR) bridge over the Peace River; and
- low-lying portions of the Peace River townsite adjacent to the east dike downstream of the Highway 2 bridges.

More information regarding infrastructure and property within the high hazard flood fringe can be found in the ***Flood Risk Assessment and Inventory*** report, provided under separate cover.

3.3 Areas in the Flood Fringe

The flood fringe includes the remaining area directly inundated by the 100-year ice jam design flood, but outside of both the floodway and the high hazard flood fringe. Significant areas in the flood fringe include low-lying:

- portions of downtown Peace River upstream of the CNR bridge; and
- residential and commercial developments downstream of the Highway 2 bridge on the east side of the Peace River.

More information regarding infrastructure and property within the flood fringe can be found in the ***Flood Risk Assessment and Inventory*** report, provided under separate cover.

4 GOVERNING DESIGN FLOOD DEPTH GRIDS

Flood depth grids were prepared for the governing design flood and provided with the GIS deliverables for this study component, along with the WSE TINs, WSE grids, and inundation extent polygons. A description of the flood depth grids is provided below.

4.1 Flood Depth Grid Specifications

For each of the flood scenarios, each bare earth DTM grid tile was subtracted from the corresponding adjusted WSE grid tile (prior to clipping) to generate a set of flood depth grid tiles representing water depth in metres as 32-bit floating point values. All flood depth grids maintained the same alignment, horizontal resolution, and tiling boundaries as the LiDAR-derived bare earth DTM supplied by AEP. Grid cells with depth values less than 0 m, which represent dry areas, were assigned a value of *NoData*.

4.2 General Comments

The flood depth grids are provided for information only. Grid values are based on linear interpolation of water surface elevations between cross sections in the hydraulic model, and as such, discrete cell values should be considered approximate. Water's edge boundaries implied by the raster depth grids may deviate slightly from the inundation extent boundaries presented on the inundation maps. This is because the depth grids are computed by subtracting the bare earth DTM grids from the adjusted water surface grids, whereas the mapped inundation extent boundaries, which were derived from the depth grids, have been further filtered and smoothed. The filtering and smoothing methods were the same as described under a separate cover in the ***Ice Jam Modelling Assessment & Flood Hazard Identification*** report.

Also, since the LiDAR-derived DTM indicates the approximate water surface elevation at the time of the LiDAR survey for submerged portions of river beds and other ground covered by water, depth values in those areas should not be considered accurate.

5 POTENTIAL CLIMATE CHANGE IMPACTS

To address the potential impacts of climate change on flood levels, more severe open water and ice jam flood scenarios were compared to the current design flood estimates in order to obtain a measure of "freeboard" that may be generally appropriate for long-term planning purposes. To obtain information appropriate for other applications, the simplified approach taken herein could be supplemented by a future more rigorous regional climate analysis and site-specific impact assessment.

5.1 Comparative Scenarios

For the open water hazard, the current 100-year flood water levels were compared to those associated with discharges that are 10 and 20 percent greater than the current 100-year flood estimates. This approach is consistent with guidelines prepared by EGBC (2018). EGBC recommends that for basins where no historical trend is detectable in local or regional streamflow magnitude frequency relations, a 10 percent upward adjustment in design discharge be applied to account for likely future changes in water input from precipitation. On the other hand, if a statistically significant trend is detected, a 20 percent adjustment may be appropriate, particularly for smaller basins.

For the ice jam hazard, the previously computed 200-year flood levels were compared to the current 100-year ice jam flood level estimates.

5.2 Results

Open Water Hazard

For the Peace River, the average increases in flood levels are 0.69 m for a 10 percent increase in flow and 1.26 m for a 20 percent increase in flow. For the Heart River, the average increases are 0.76 m and 1.42 m, respectively.

Ice Jam Hazard

The analysis for the ice-affected flood scenario consisted of comparing 100-year and 200-year ice-affected flood water levels. The average increase in flood levels along Peace and Heart Rivers is 0.67 m and 0.78 m, respectively.

It is acknowledged that the above analyses are not based on a regional climate change impacts assessment, but are based on a simplified assumption that climate change will result in increased peak flood flows. The presented values can be viewed as a general range of potential climate change "freeboard" that could be considered in addition to computed design flood water levels.

5.3 Supplementary Information

Climate change has the potential to affect many factors related to flood severity and ice jam propensity. A comprehensive analysis would consider meteorological and hydrological factors at the basin scale to assess changes in flood peak discharges and their associated return periods. For ice jam induced flooding, the effects of climate change are even more complex.

6 CONCLUSIONS

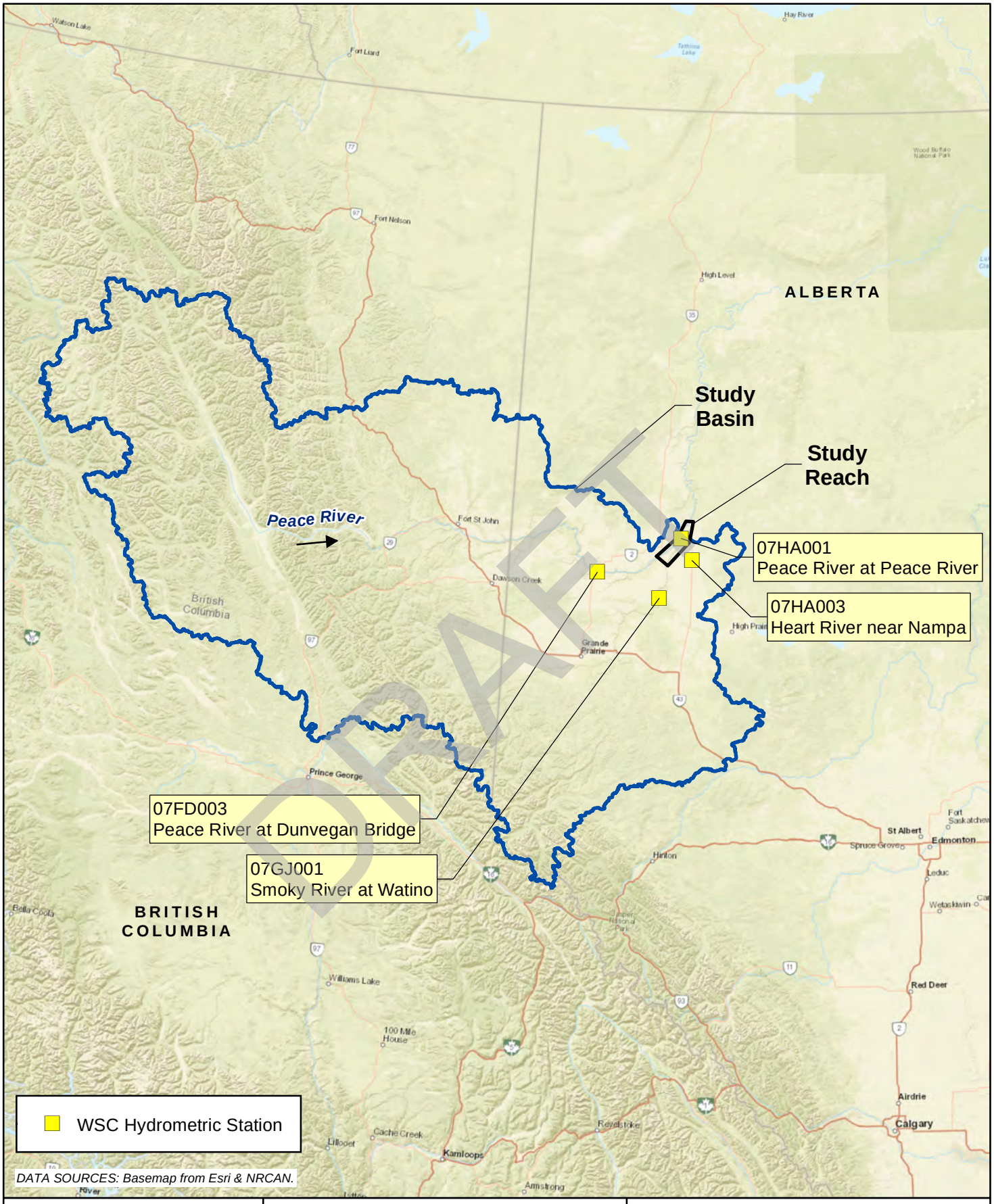
The objectives of this study were to assess river and flood-related hazards along a 54 km reach of the Peace River and a 1.1 km reach of the Heart River that includes the Town of Peace River. The Peace River Hazard Study was divided into nine major project components. This report summarizes the work of the seventh component – ***Governing Design Flood Hazard Map Production***.

The governing design flood hazard map depicts the floodway, high hazard flood fringe, flood fringe, and associated flood hazard boundary. The ice jam design flood was the governing condition for both the Peace River and Heart River. Thus, the flood hazard map information was based on the information developed for the ice jam floodway criteria map.

7 REFERENCES

Engineers and Geoscientists British Columbia (2018). Legislated Flood Assessments in a Changing Climate in BC. Version 2.1.

Figures



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Coordinate System: NAD 1983 CSRS 10TM AEP FOREST
Units: METRES

Job: 1001119

Date: 31-MAR-2021

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION

LOCATION MAP

FIGURE 1

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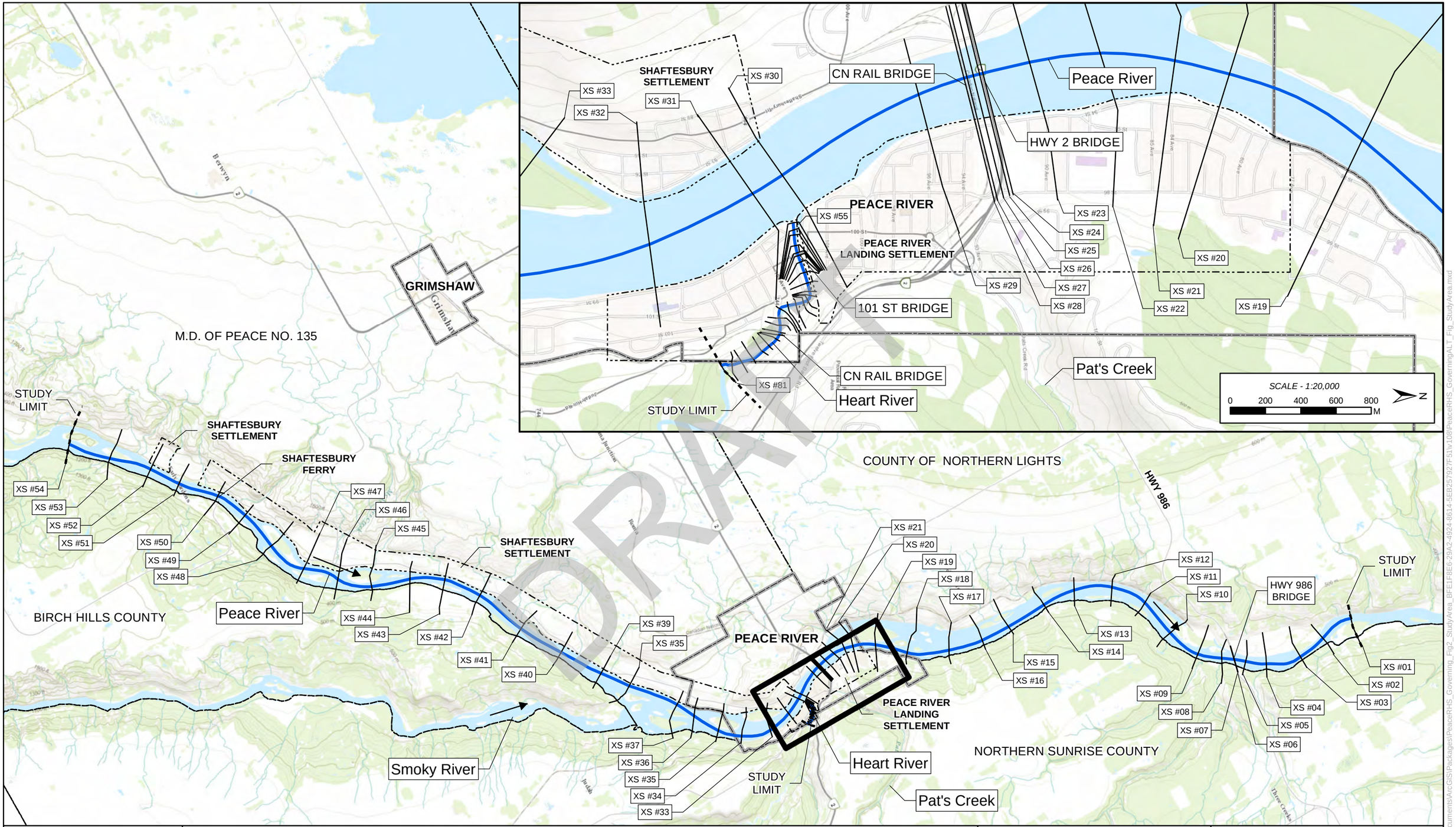
MSN, C:\Users\MBachynsky\Documents\ArcGIS\Packages\PeaceRHS_Governing_Fig1_LocnMap_A875E78D-6C6A-4A26-9DB7-7FD51FC55851\v108\PeaceRHS_GoverningALT_Fig_LocnMap.mxd



DRAFT

Alberta Government

nhc northwest hydraulic consultants

Model Stream Network
Model Cross Section
Settlement
Town
County or Municipal District

DATA SOURCES: Basemap from Esri & NRCAN.

SCALE - 1:130,000
0 1 2 3 4 5 KM
N

Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

Job: 1001119 | *Date: 31-MAR-2021*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN
FLOOD HAZARD MAP PRODUCTION

STUDY AREA

FIGURE 2

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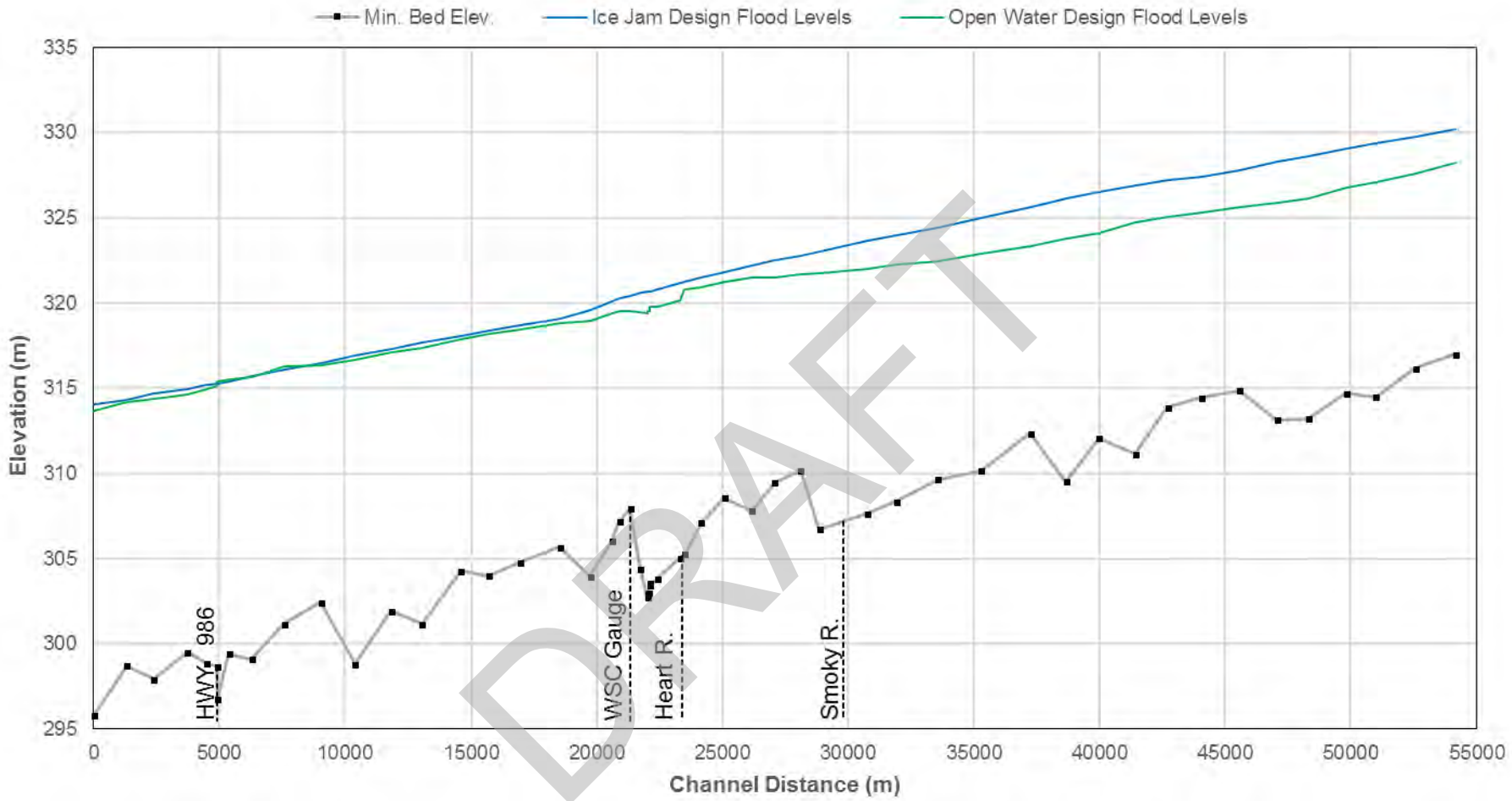

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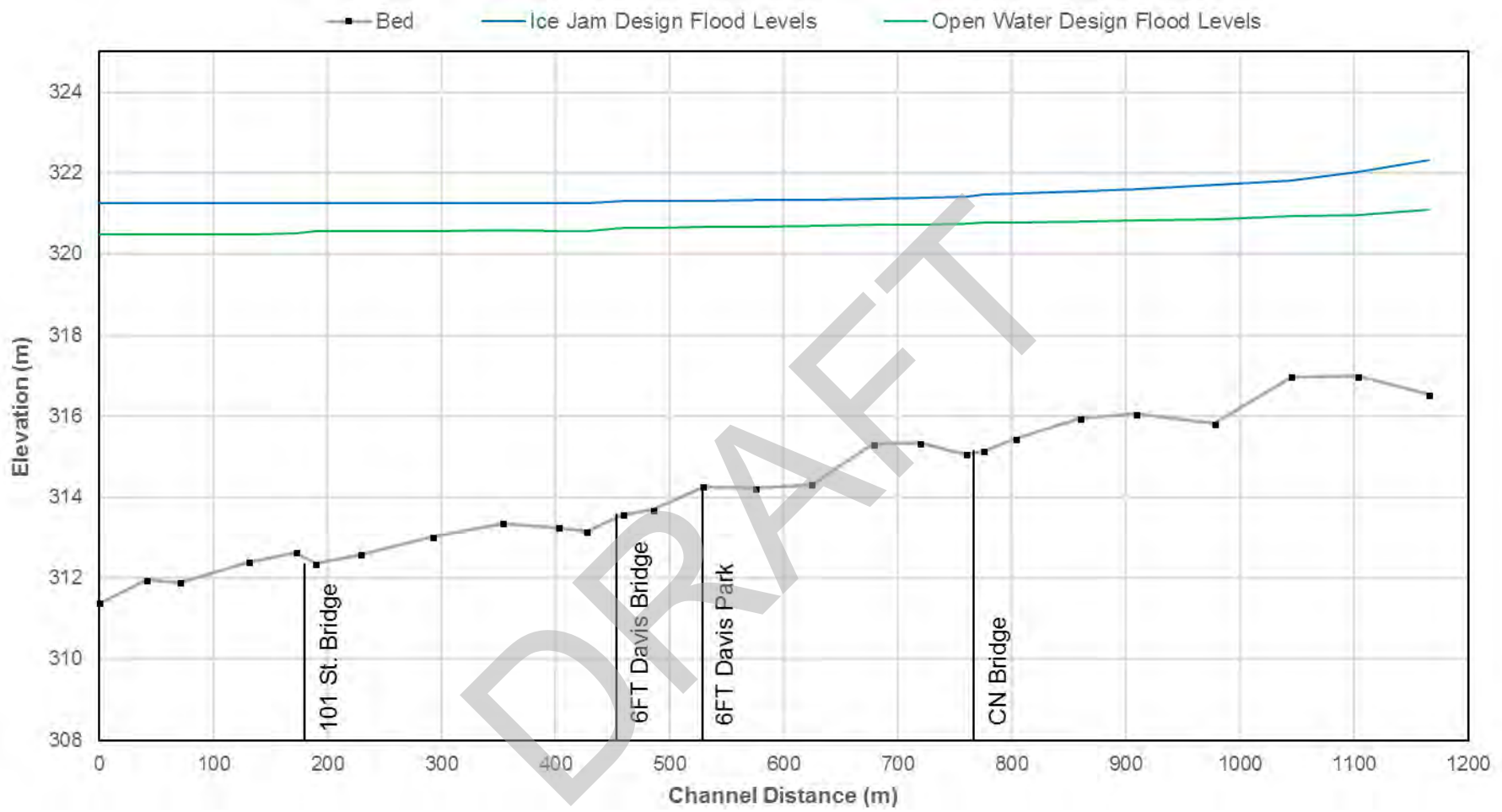
ALBERTA ENVIRONMENT AND PARKS		
PEACE RIVER HAZARD STUDY GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION **REACH-BASED GOVERNING DESIGN FLOOD OVERVIEW – PEACE RIVER**		
1001119	11 OCT 2022	**FIGURE 3**



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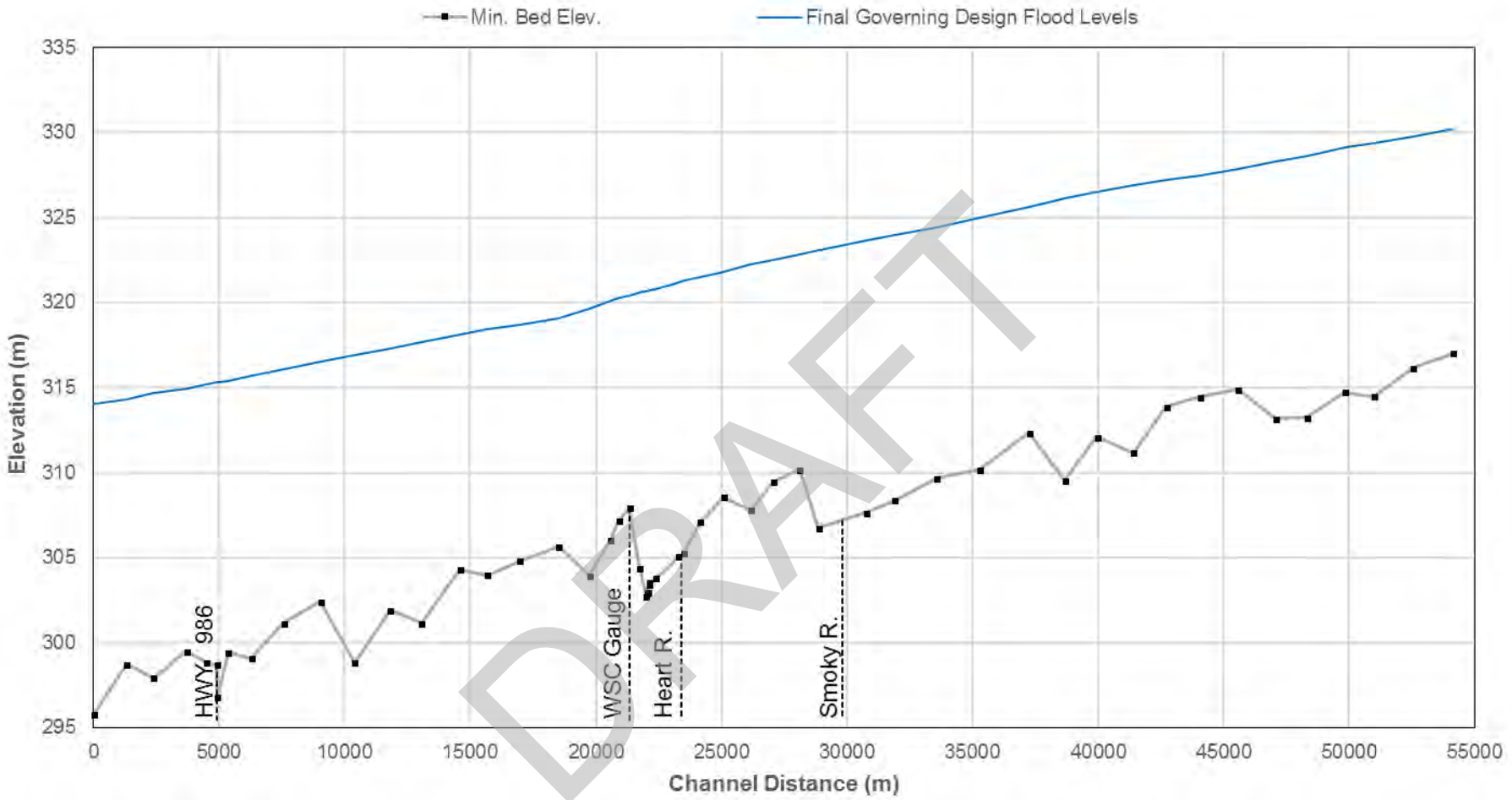
ALBERTA ENVIRONMENT AND PARKS		
PEACE RIVER HAZARD STUDY GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION **REACH-BASED GOVERNING DESIGN FLOOD OVERVIEW – HEART RIVER**		
1001119	11 OCT 2022	**FIGURE 4**



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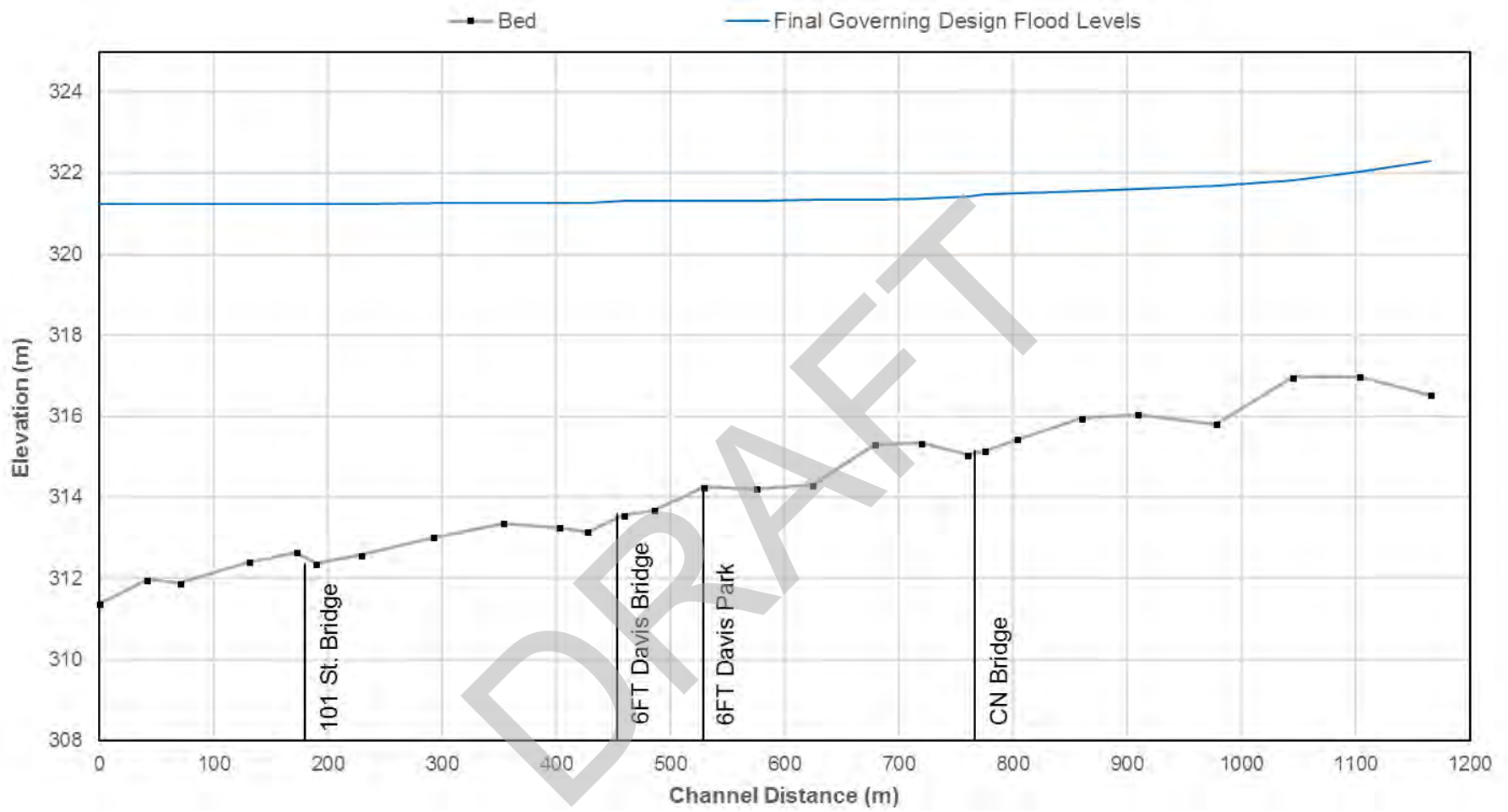
PEACE RIVER HAZARD STUDY GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION

FINAL GOVERNING DESIGN FLOOD PROFILE – PEACE RIVER

1001119	11 OCT 2022	**FIGURE 5**



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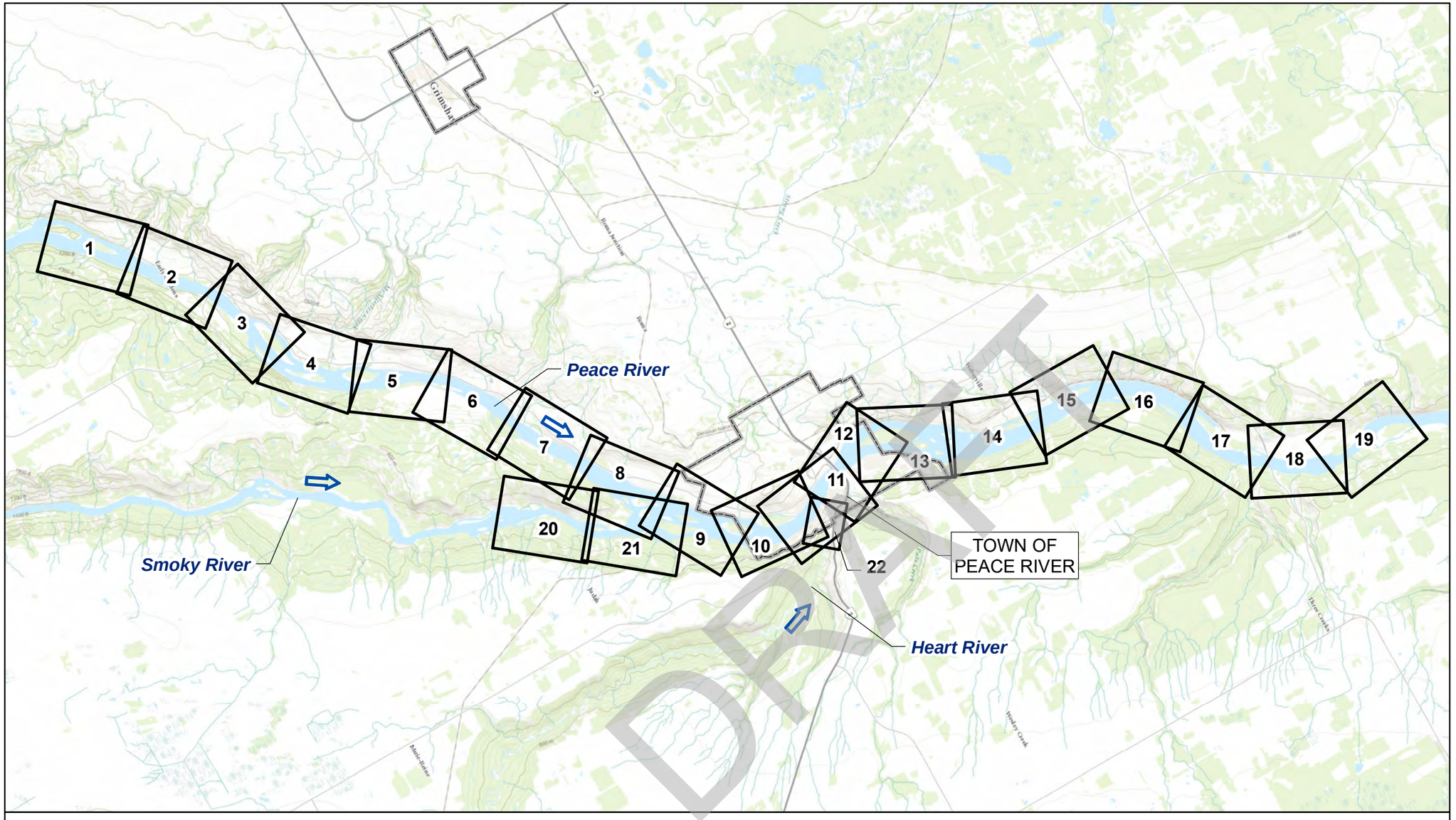
PEACE RIVER HAZARD STUDY GOVERNING DESIGN FLOOD HAZARD MAP PRODUCTION **FINAL GOVERNING DESIGN FLOOD PROFILE – HEART RIVER**		
1001119	11 OCT 2022	**FIGURE 6**

Appendix A
Governing Design Flood Hazard Map



Notes to Users:

1. Please refer to the accompanying **Peace River Hazard Study – Governing Design Flood Hazard Map Production Report** for important information concerning these maps.
2. Within the flood inundation areas shown on this map, there may be isolated pockets of high ground. To determine whether or not a particular site is subject to flooding, reference should be made to the computed flood levels in conjunction with site-specific surveys where detailed definition is required.
3. Non-riverine and local sources of water have not been considered, and structures such roads, railways or barriers such as levees can restrict water flow and affect local flood levels. Channel obstruction, local stormwater inflow, groundwater seepage or other land drainage can cause flood levels to exceed those indicated on the map. Lands adjacent to a flooded area may be subject to flooding from tributary streams not indicated on the maps.
4. Backwater flood inundation along the Smoky River near the mouth was considered using simulated water levels from the Peace River near the mouth of the Smoky River.
5. The flood inundation area is shown above the line work for bridges and flood control structures that are below flood levels.

Definitions:

Flood Hazard Map - A flood hazard map is a specific type of flood map that identifies the area flooded for the 1:100 design flood, and divides that flood hazard area into floodway and flood fringe zones. Flood hazard maps can also show additional flood hazard information, including the incremental areas at risk for more severe floods like the 1:200 and 1:500 floods. Flood hazard maps are typically used for long-term flood hazard area management and land-use planning.

Design Flood - The design flood standard in Alberta is the 1:100 flood, which is a flood that has a 1% chance of being equaled or exceeded in any given year. The design flood is typically based on the 1:100 open water flood, but it can also reflect 1:100 ice jam flood levels or be based on a historical flood event. Different sized floods have different chances of occurring – for example, a 1:200 flood has a 0.5% chance of occurring in any given year and a 1:500 flood has a 0.2% chance of occurring in any given year – but only the 1:100 design flood is used to define the floodway and flood fringe zones on flood hazard maps.

Floodway - When a floodway is first defined on a flood hazard map, it typically represents the area of highest flood hazard where flows are deepest, fastest, and most destructive during the 1:100 design flood. When a flood hazard map is updated, the floodway will not get larger in most circumstances to maintain long-term regulatory certainty, even if the flood hazard area gets larger or design flood levels get higher.

Flood Fringe - The flood fringe is the area outside of the floodway that is flooded or could be flooded during the 1:100 design flood. The flood fringe typically represents areas with shallower, slower, and less destructive flooding, but it may also include "high hazard flood fringe" areas. Areas at risk of flooding behind flood berms may also be mapped as "protected flood fringe" areas.

High Hazard Flood Fringe - The high hazard flood fringe identifies areas within the flood fringe with deeper or faster moving water than the rest of the flood fringe. High hazard flood fringe areas are likely to be most significant for flood maps that are being updated, but they may also be included in new flood maps.

Protected Flood Fringe - The protected flood fringe identifies areas that could be flooded if dedicated flood berms fail or do not work as designed during the 1:100 design flood, even if they are not overtopped. Protected flood fringe areas are part of the flood fringe and do not differentiate between areas with deeper or faster moving water and shallower or slower moving water.

Data Sources and References:

1. Orthophoto imagery acquired by ORTHOSHOP Geomatics Ltd. (3 May 2016) for Alberta Environment and Parks.
2. Base data from Town of Peace River, Alberta Environment and Parks, AltaLIS, and NRCan.
3. Additional base mapping from Esri.

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SCALE - 1:150,000

0 2,900 5,800 M

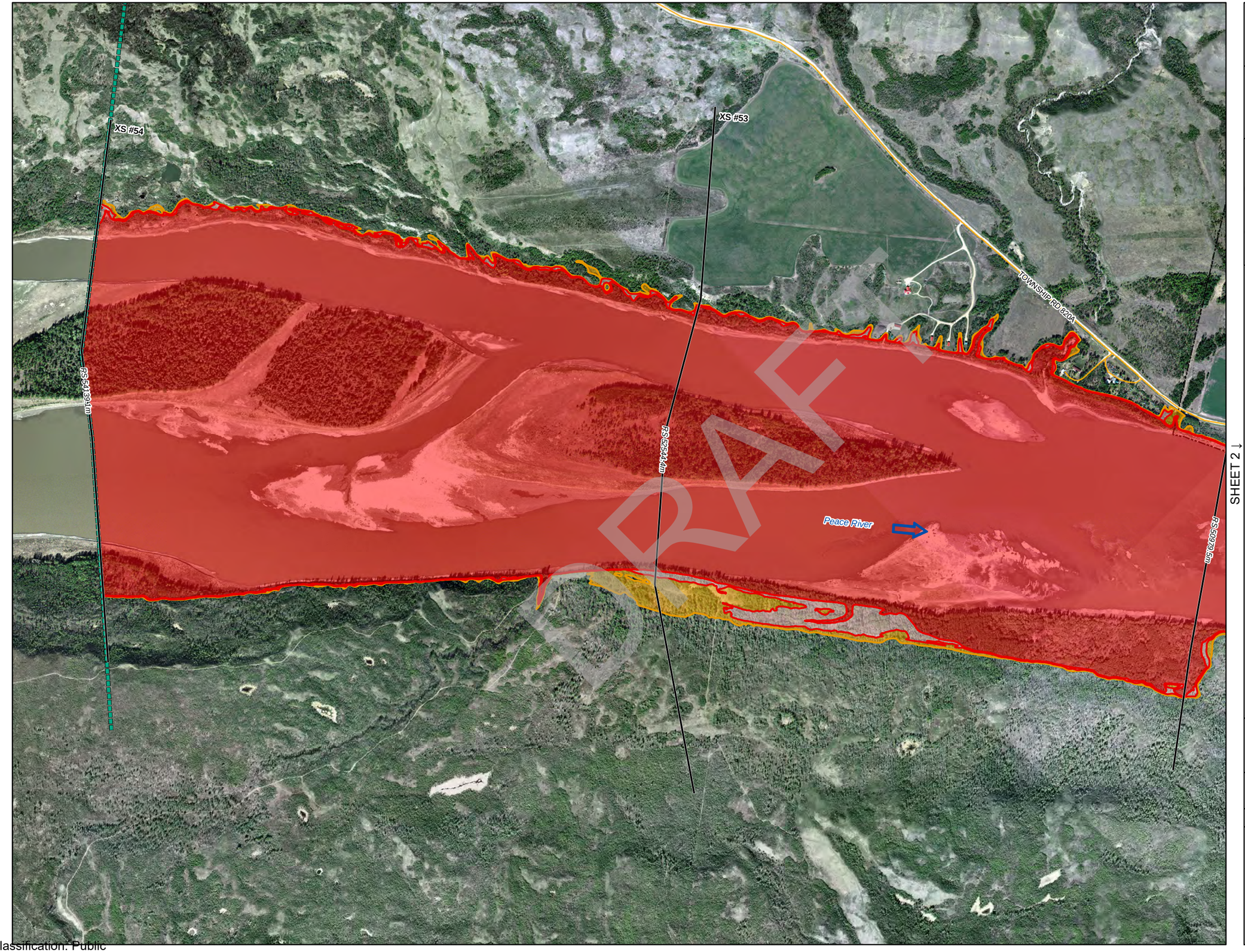
Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

Job: 1001119 | Date: 07-OCT-2022

PEACE RIVER HAZARD STUDY
GOVERNING DESIGN FLOOD HAZARD INDEX MAP

INDEX MAP

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazardIndex_2022Update.mxd



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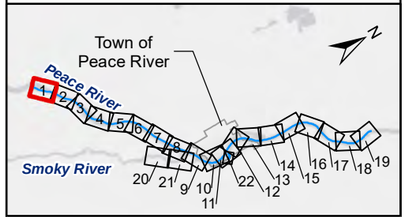

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- FLOOD FRINGE
- HIGH HAZARD FLOOD FRINGE
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- MAJOR ROAD
- LOCAL ROAD
- FERRY ROUTE
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- SETTLEMENT BOUNDARY

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SCALE - 1:10,000

0 200 400 M

Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

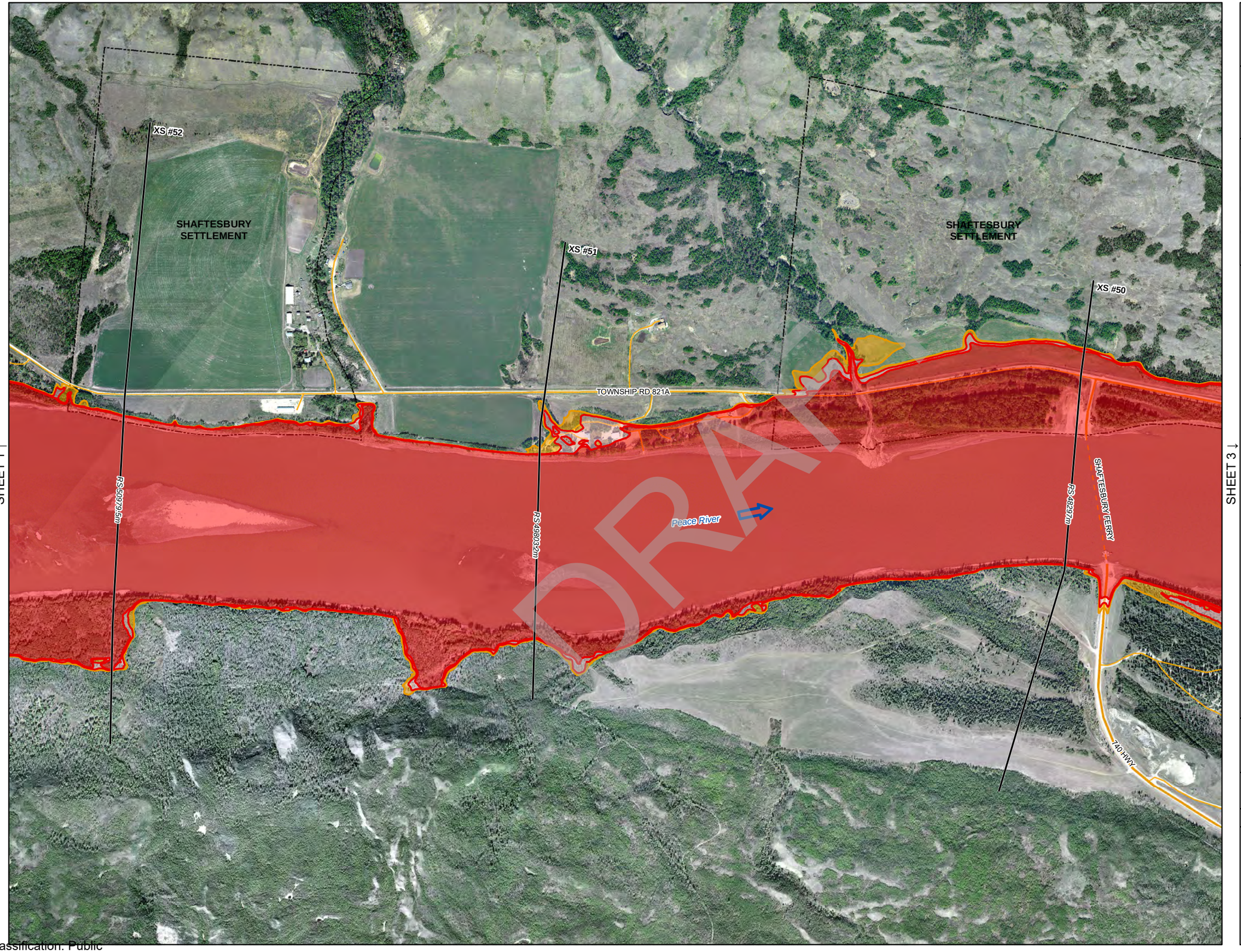
Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 1 OF 22

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd



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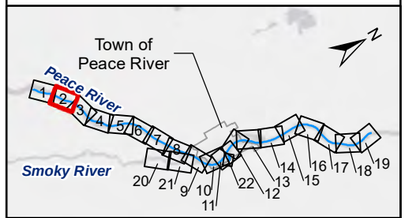

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Coordinate System: NAD 1983 CSRS 3TM 117
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PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 2 OF 22

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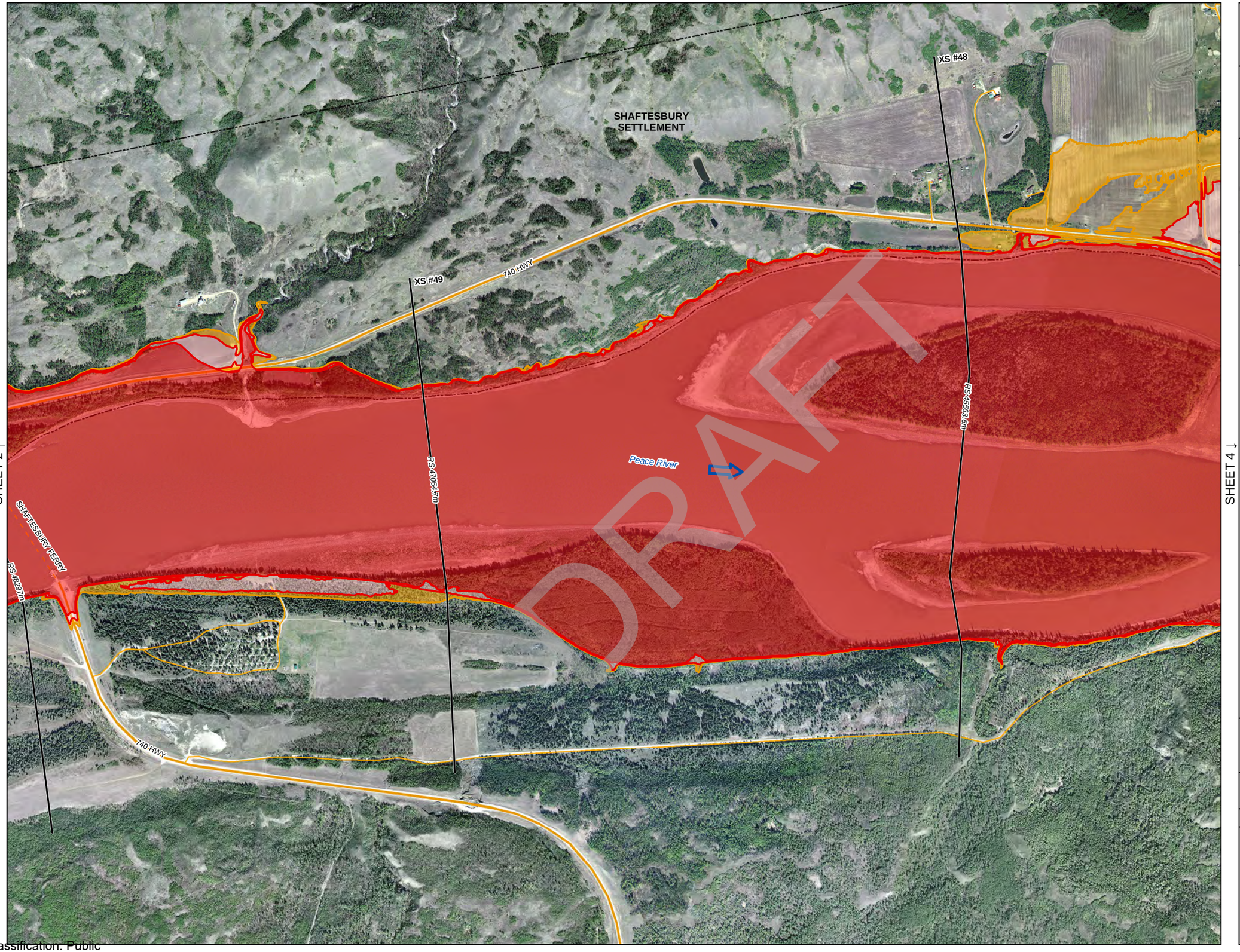

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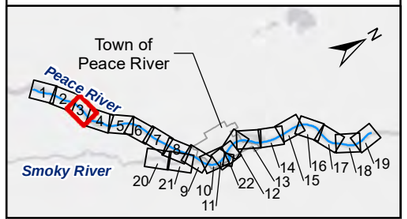

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PEACE RIVER HAZARD STUDY

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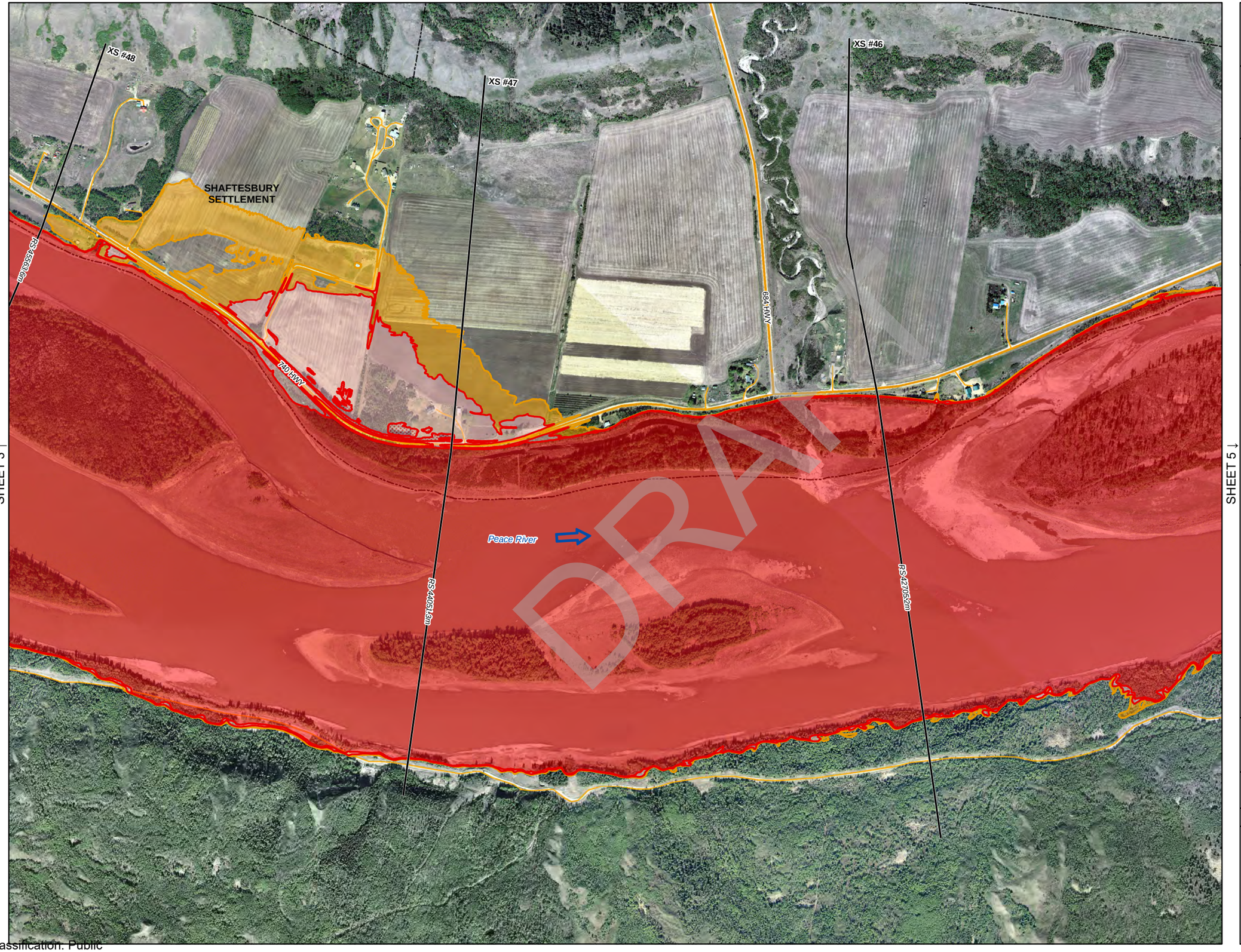

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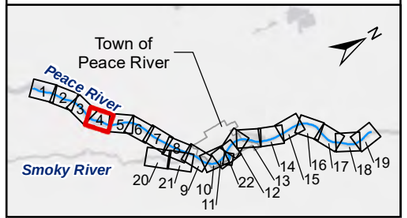

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PEACE RIVER HAZARD STUDY

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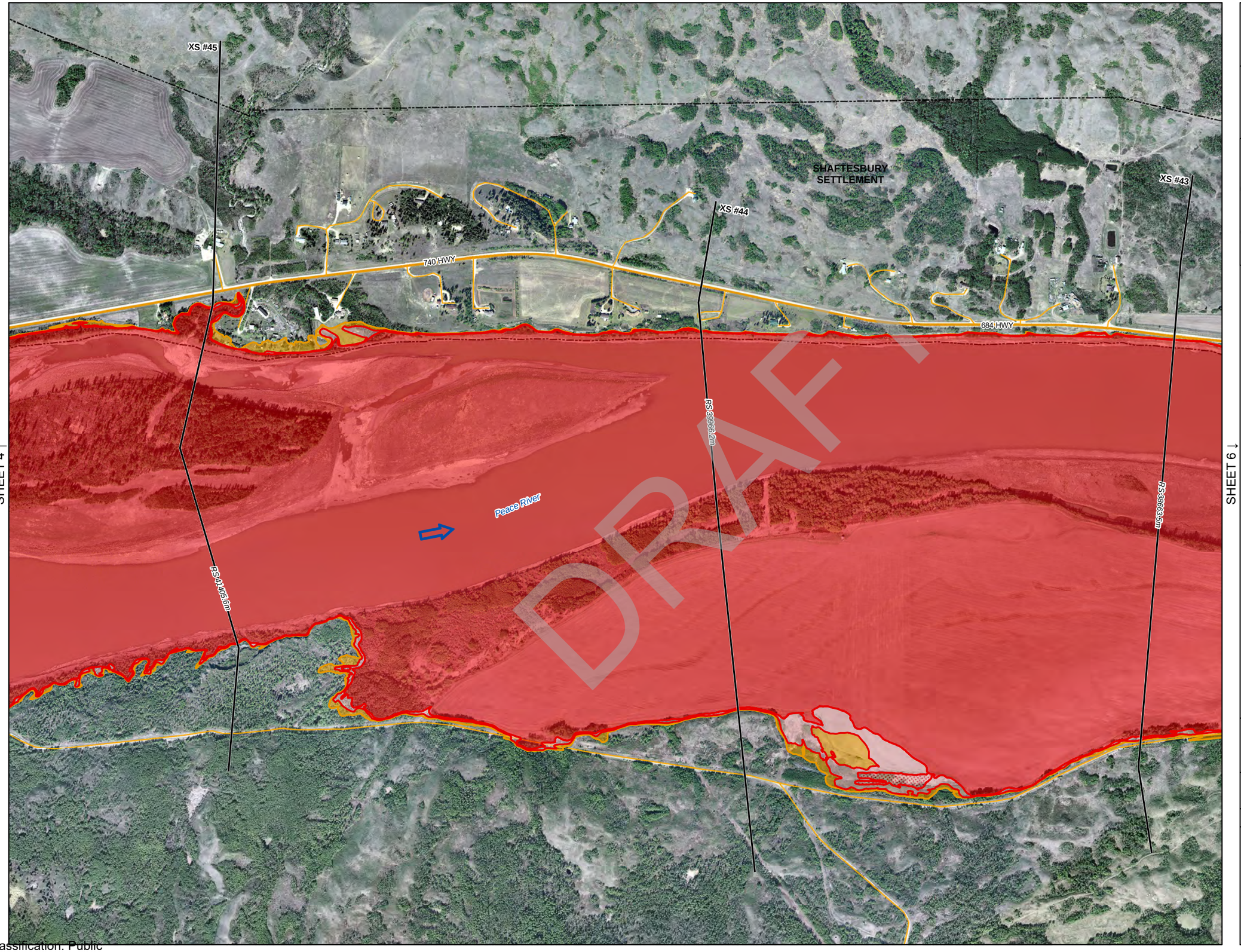

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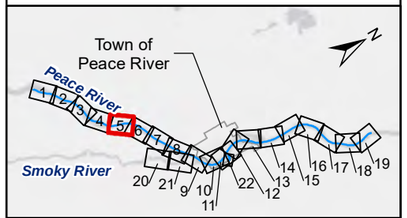

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PEACE RIVER HAZARD STUDY

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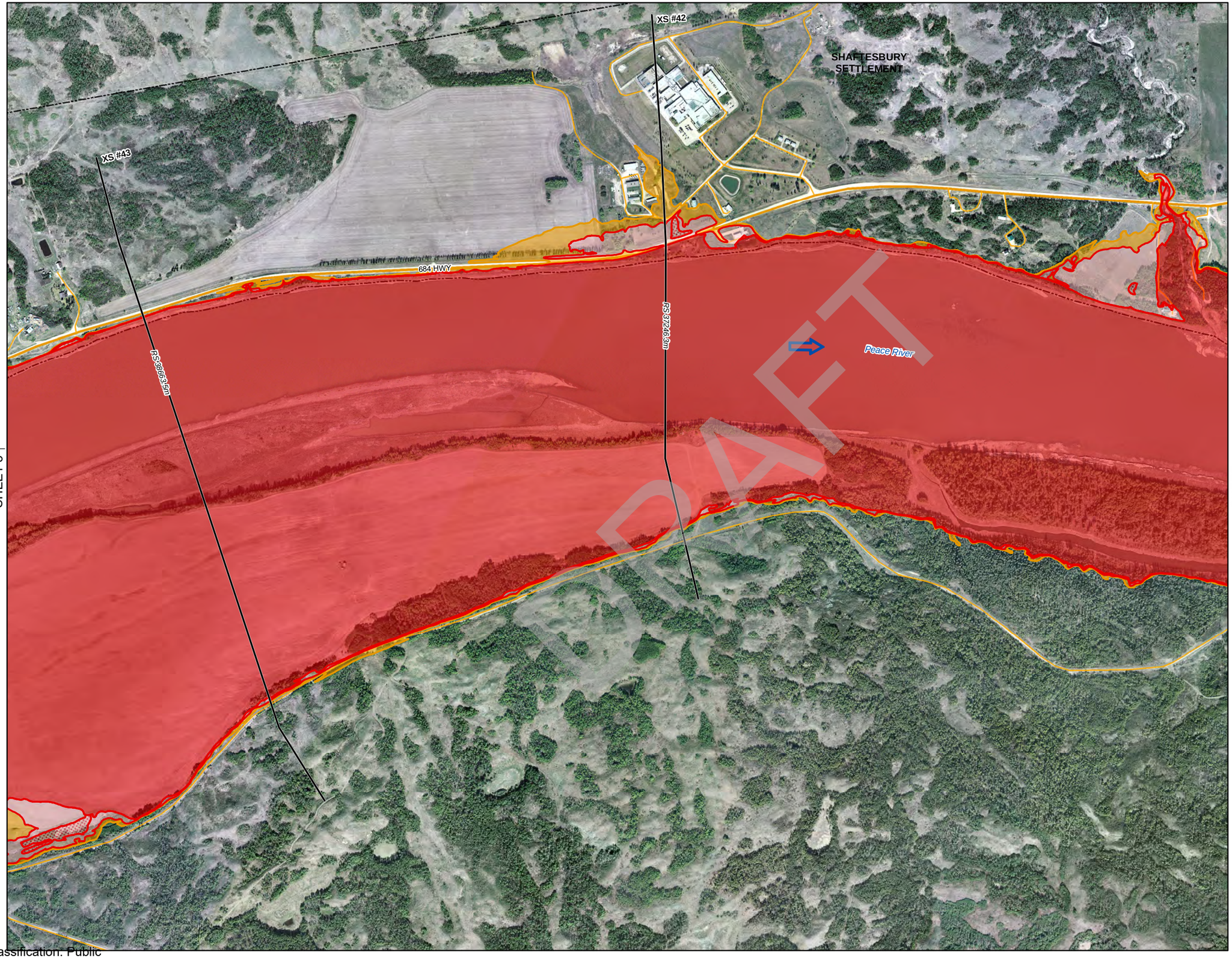

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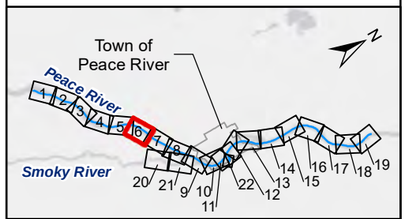

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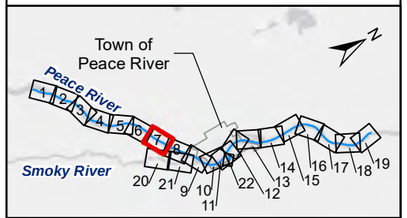

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PEACE RIVER HAZARD STUDY

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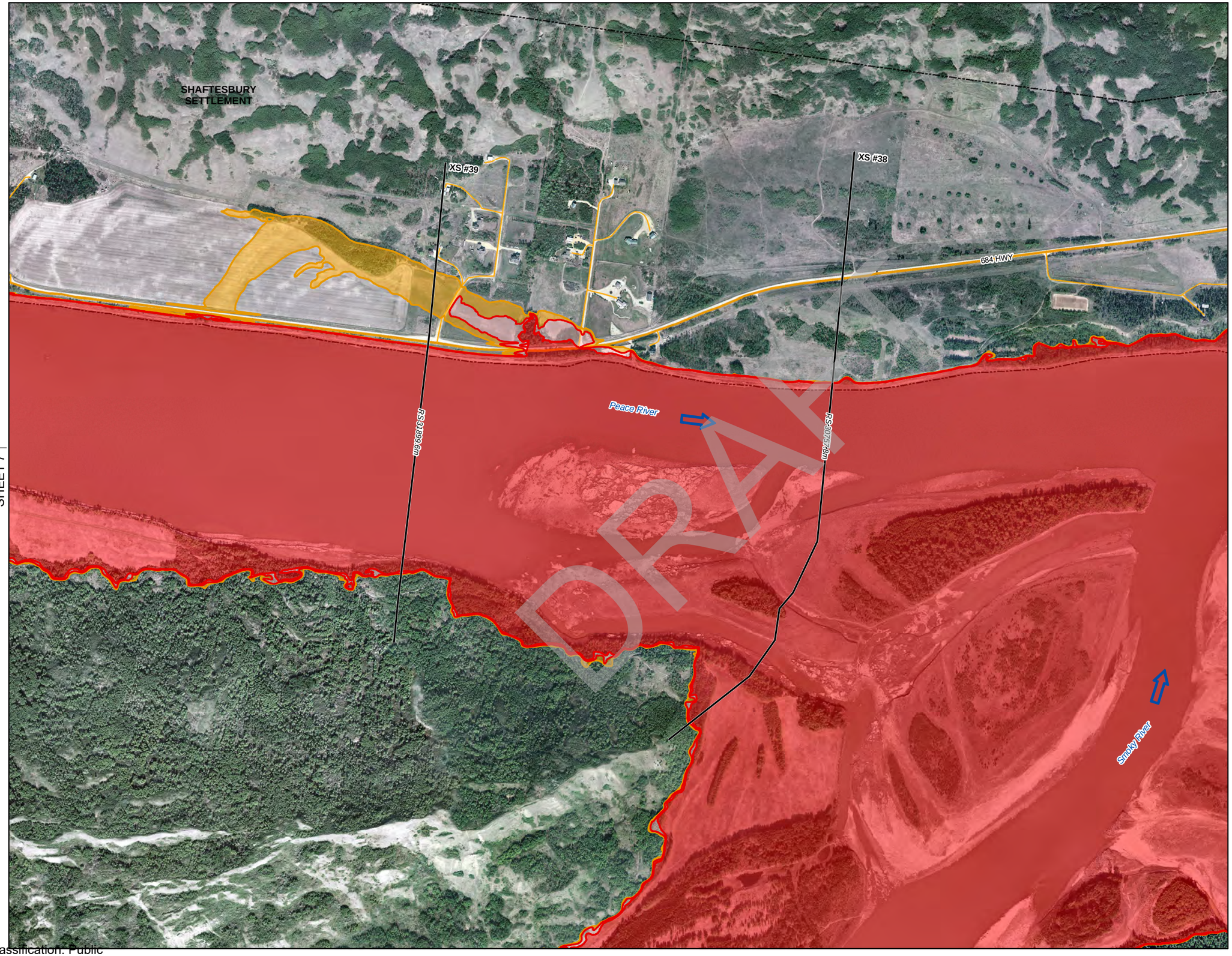

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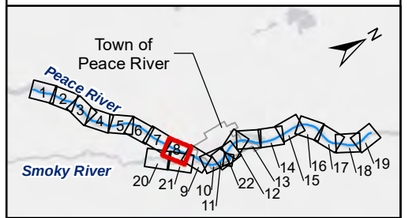

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PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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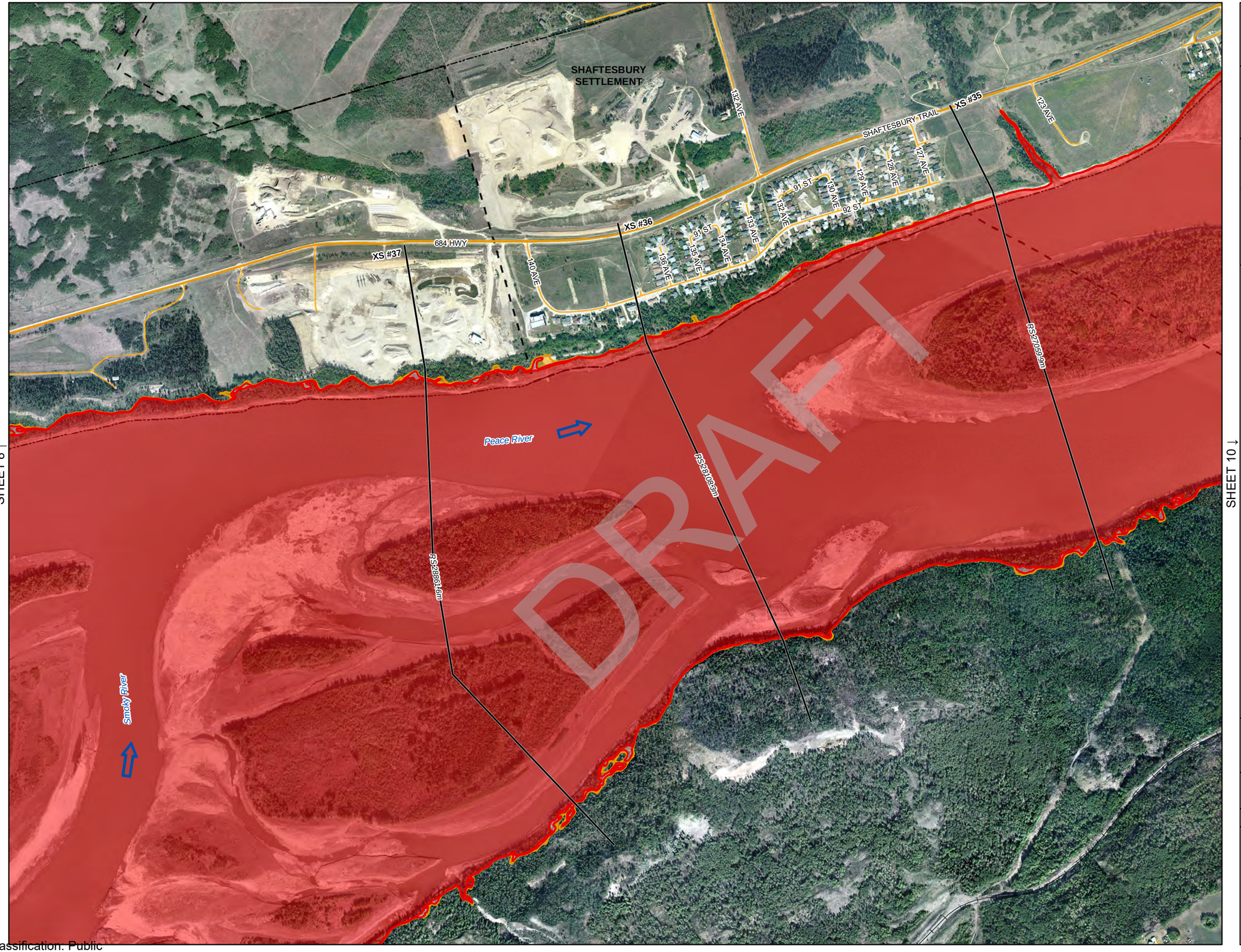

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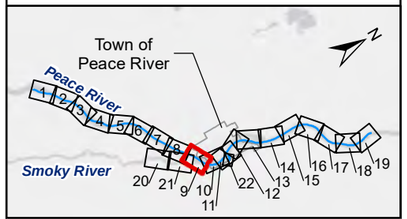

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PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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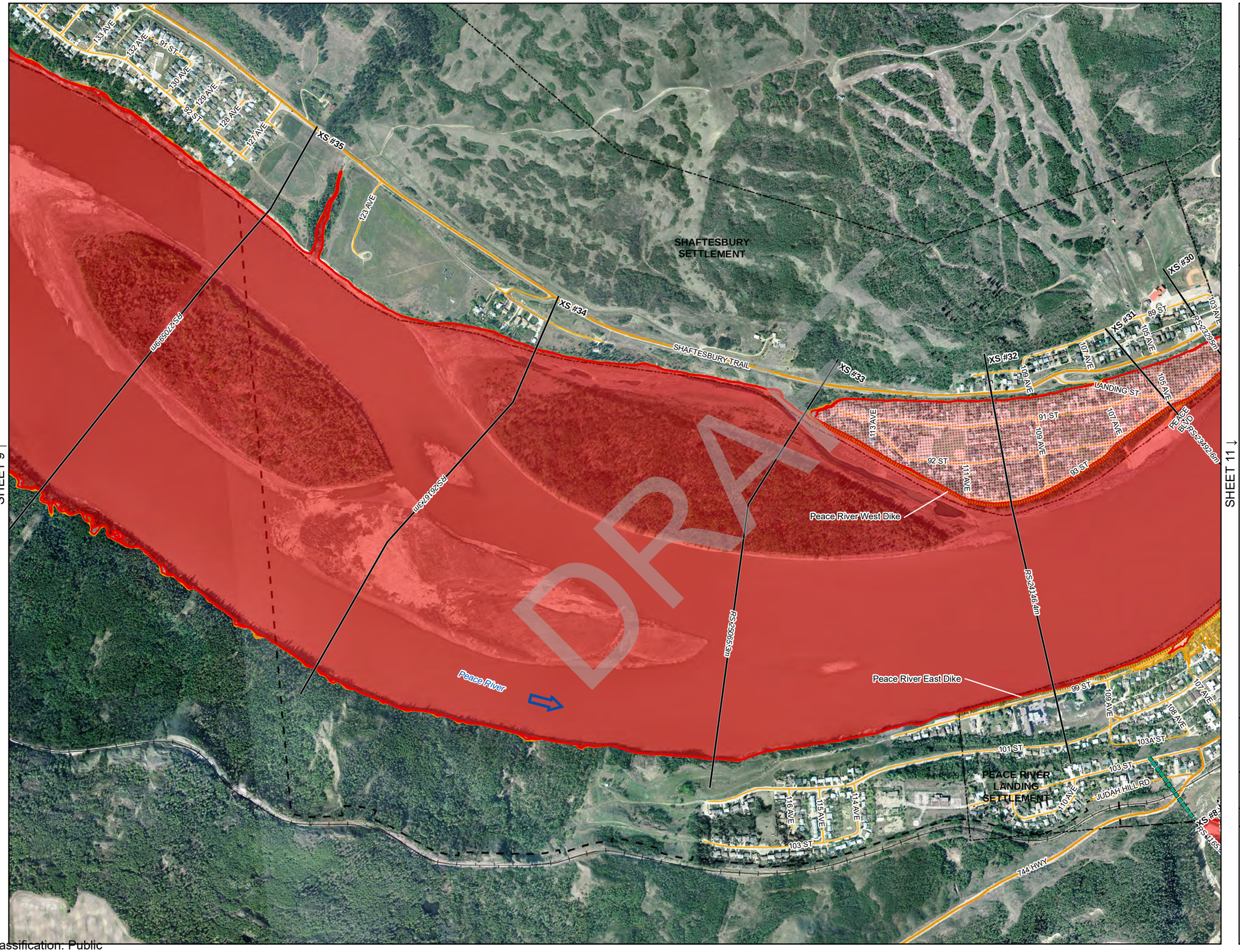

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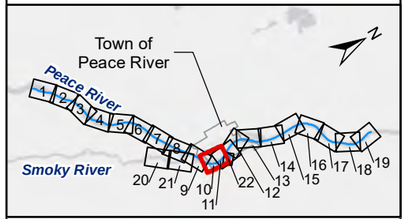

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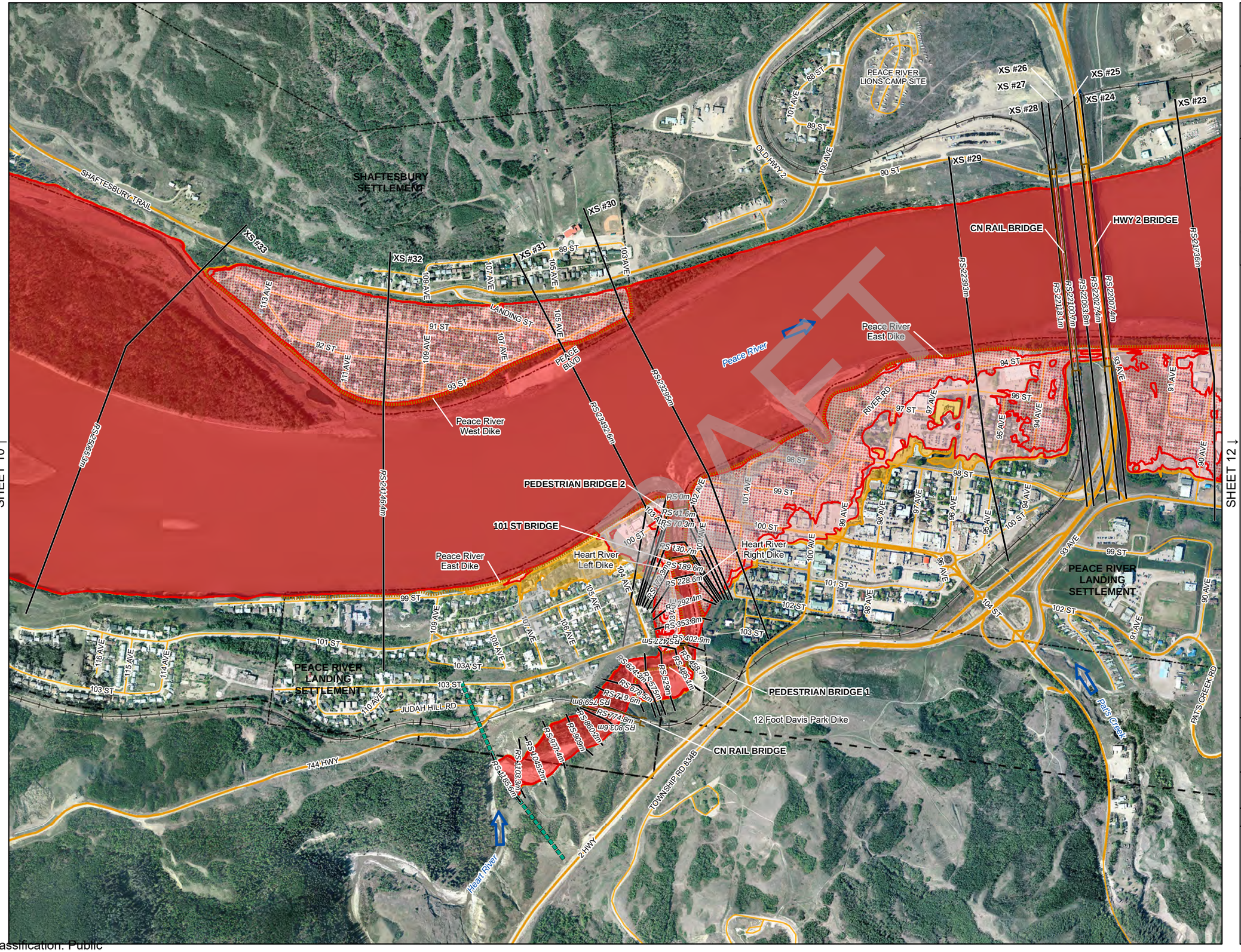
PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 10 OF 22



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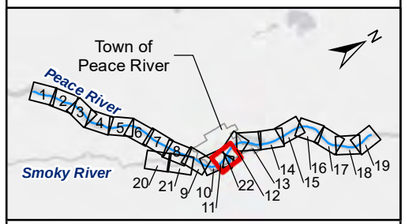

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PEACE RIVER HAZARD STUDY

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SHEET 11 OF 22

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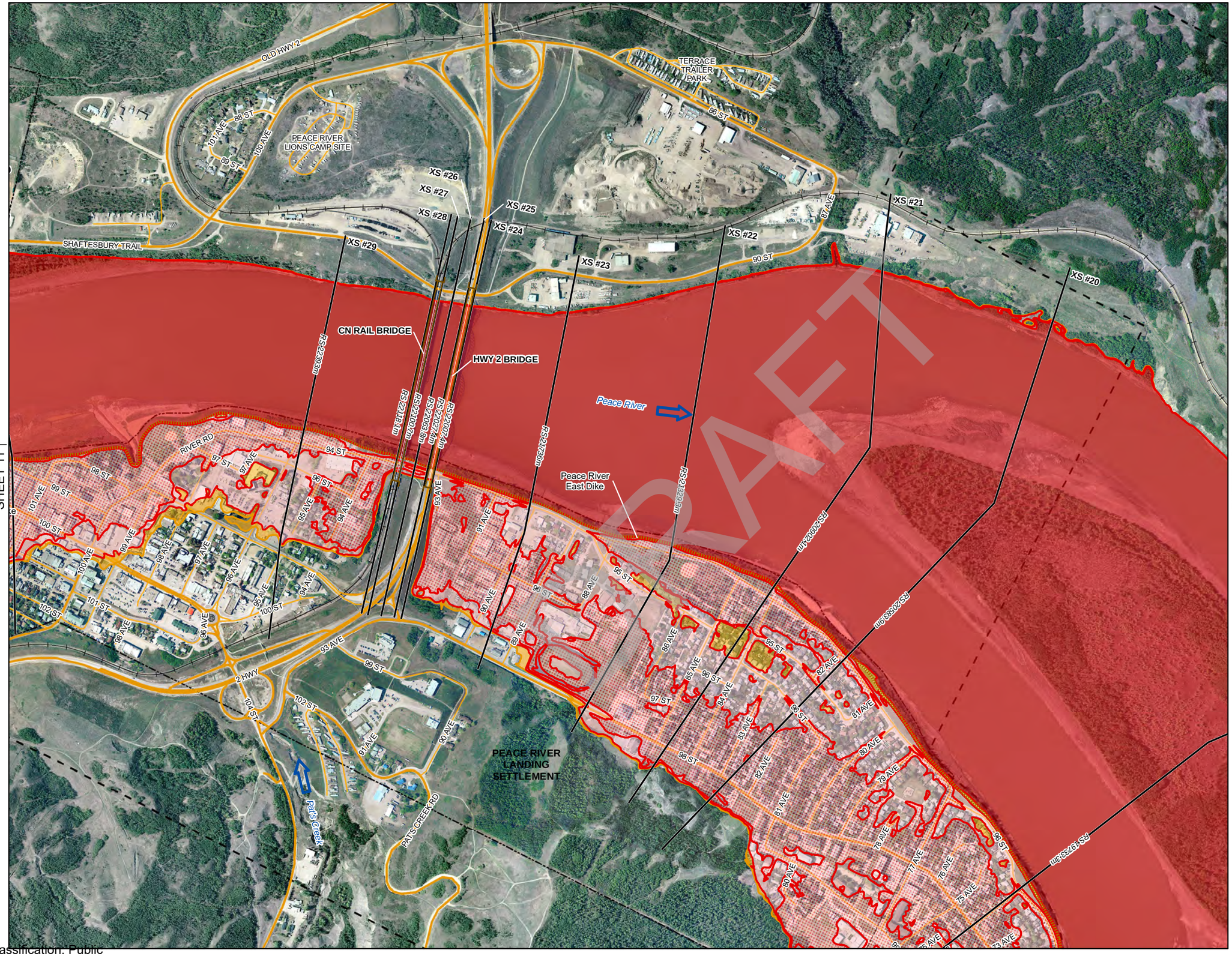

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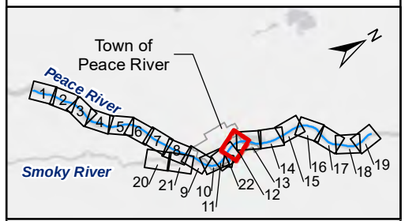

- FLOW DIRECTION
- BRIDGE
- CROSS SECTION
  (RS denotes river station - distance from most downstream cross section.)
- STUDY BOUNDARY
- FLOOD CONTROL STRUCTURE
- FLOODWAY
- FLOOD FRINGE
- HIGH HAZARD FLOOD FRINGE
- 200-YEAR ICE JAM EXTENT
- RAILWAY
- MAJOR ROAD
- LOCAL ROAD
- FERRY ROUTE
- PEACE RIVER TOWN BOUNDARY
- SETTLEMENT BOUNDARY

The design event is the 100-year ice jam flood.

SCALE - 1:10,000

0 200 400 M

N

Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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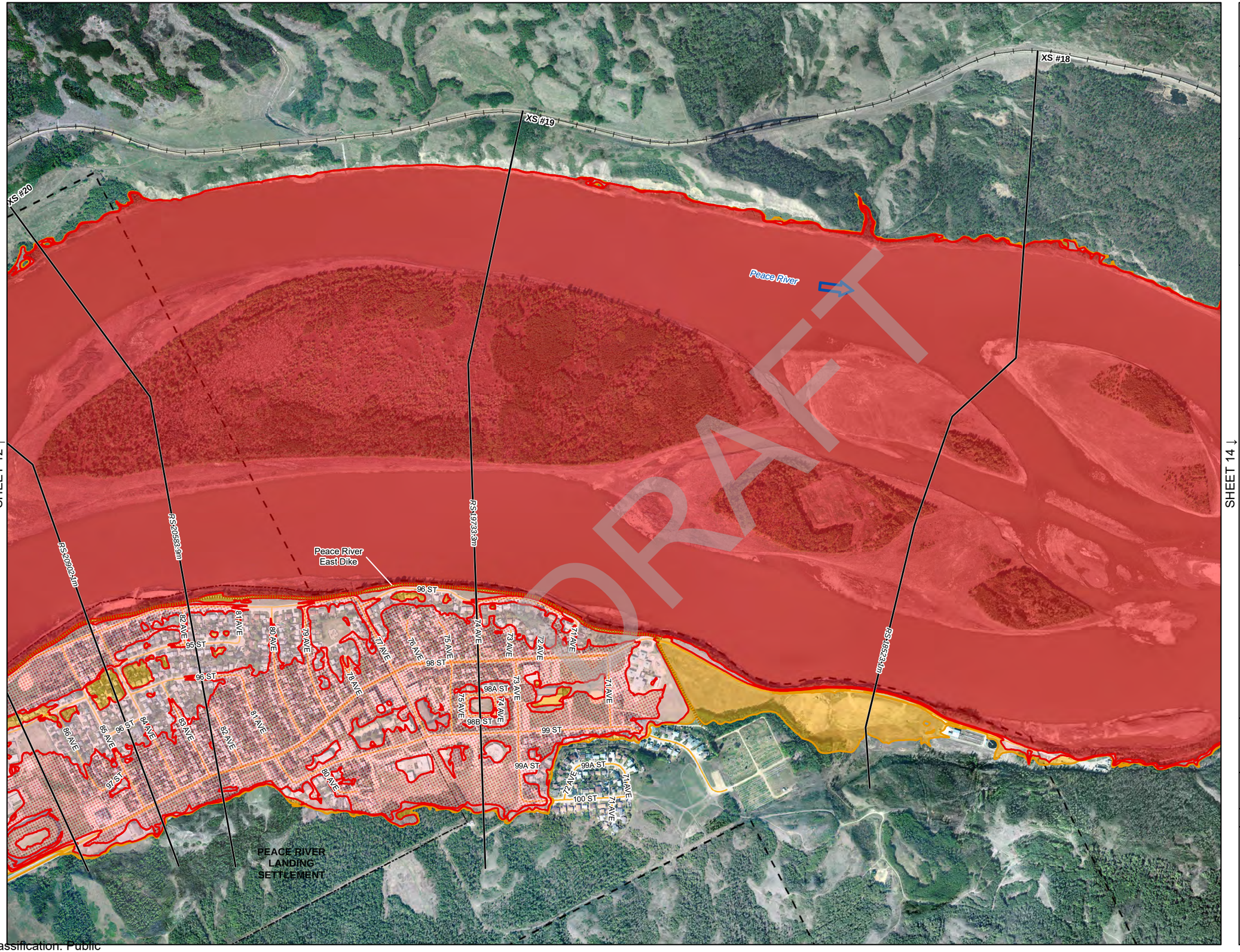
MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd



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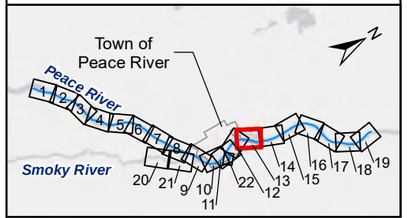

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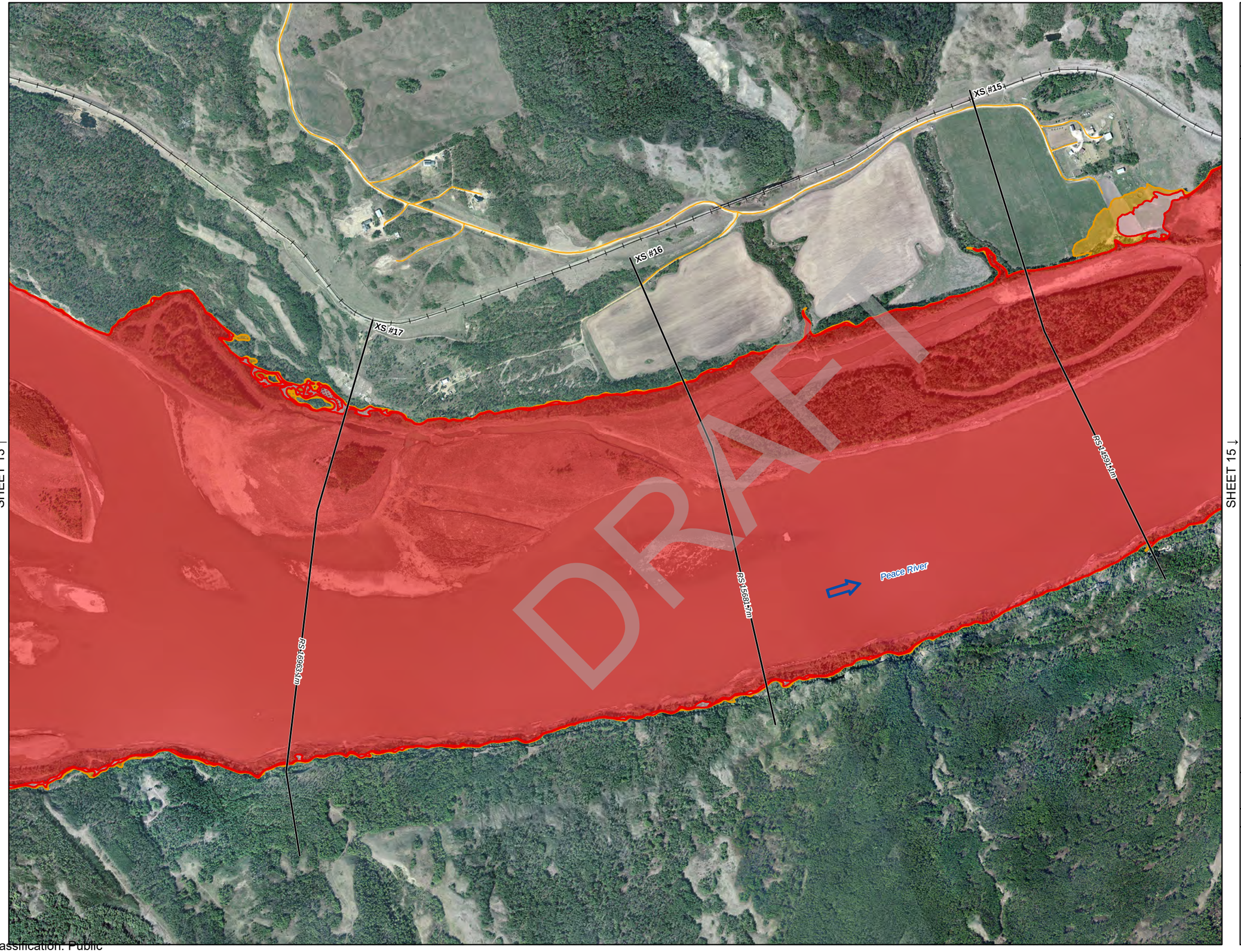
Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 13 OF 22

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd



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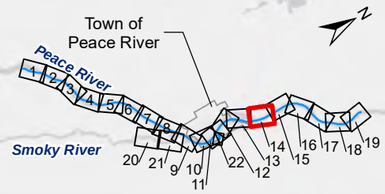

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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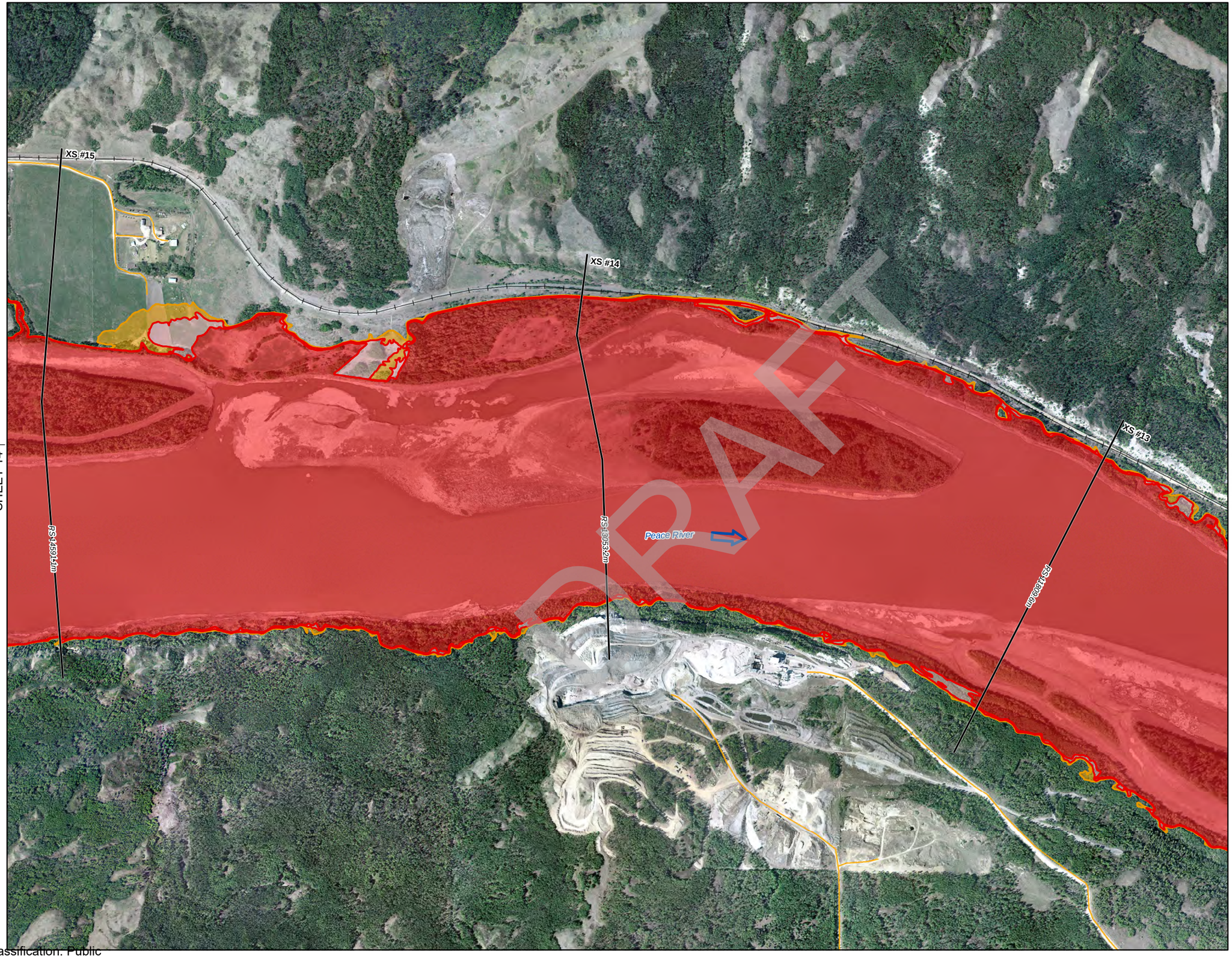
MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd



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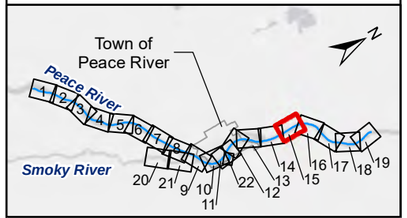

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Units: METRES

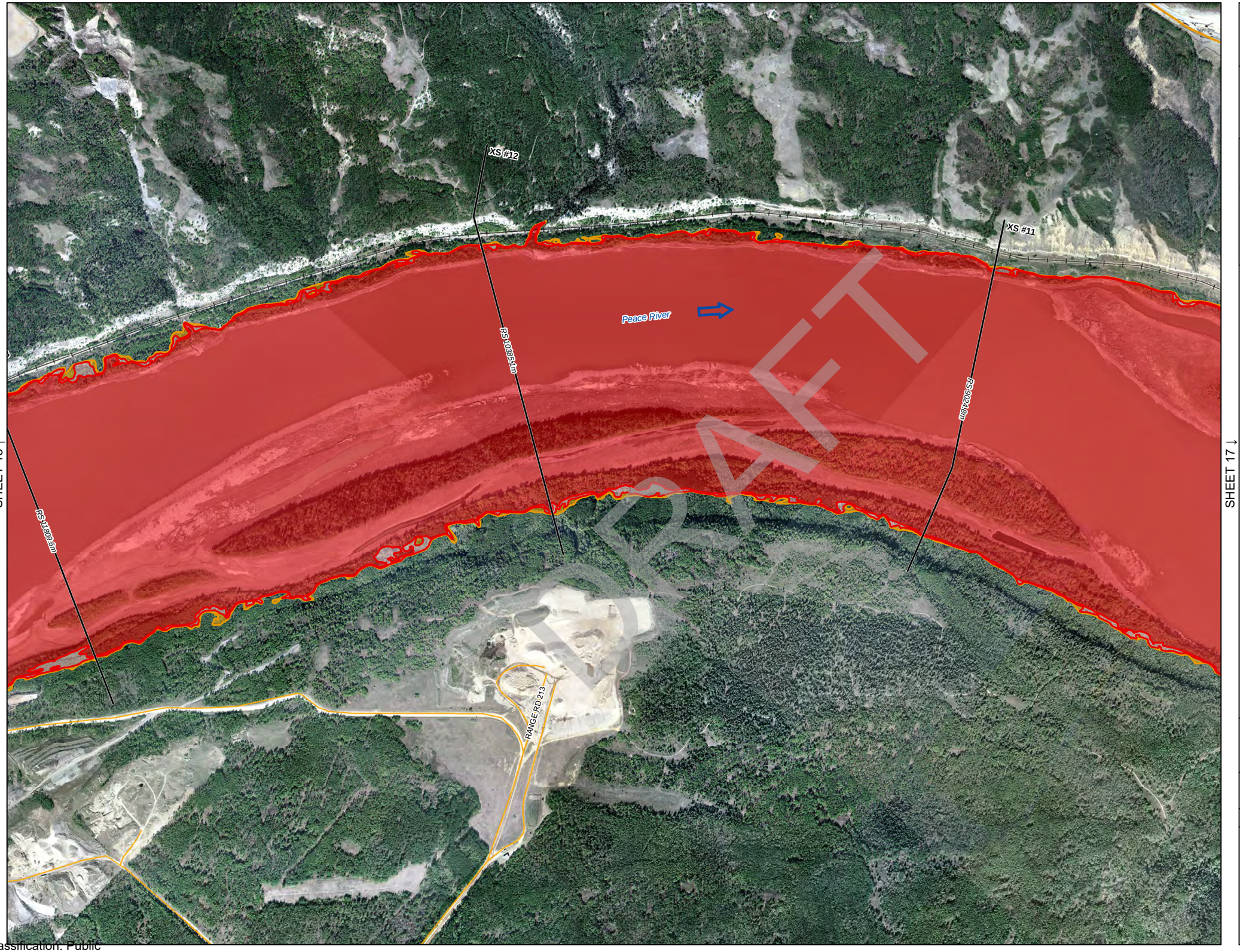
Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 15 OF 22

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd



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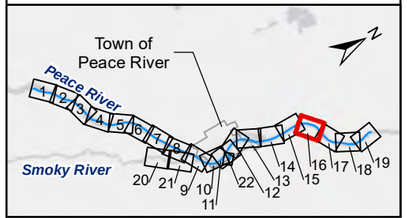

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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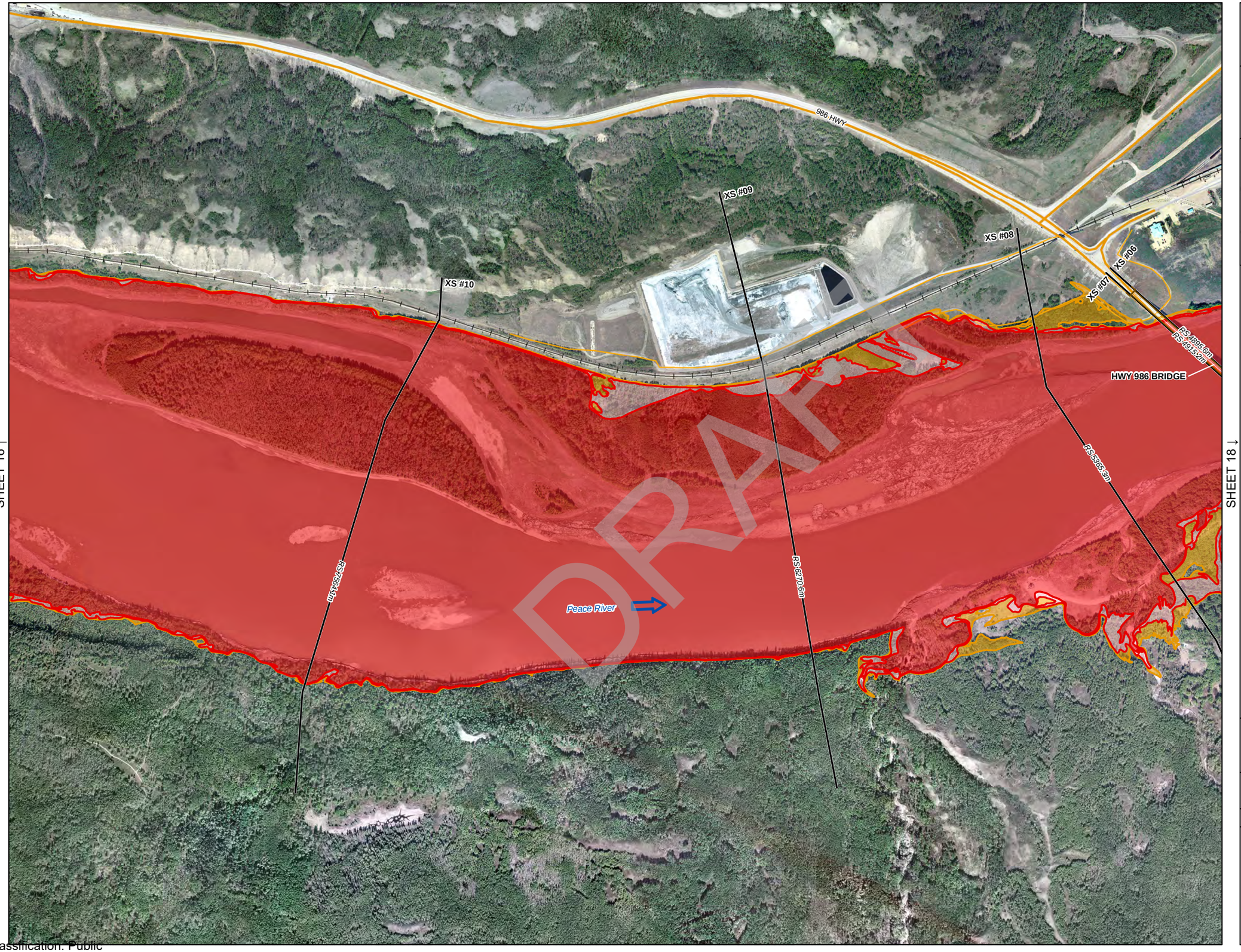

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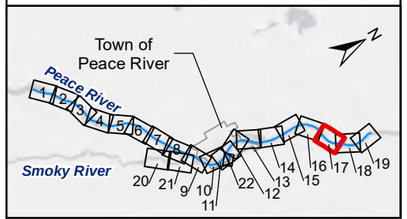

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Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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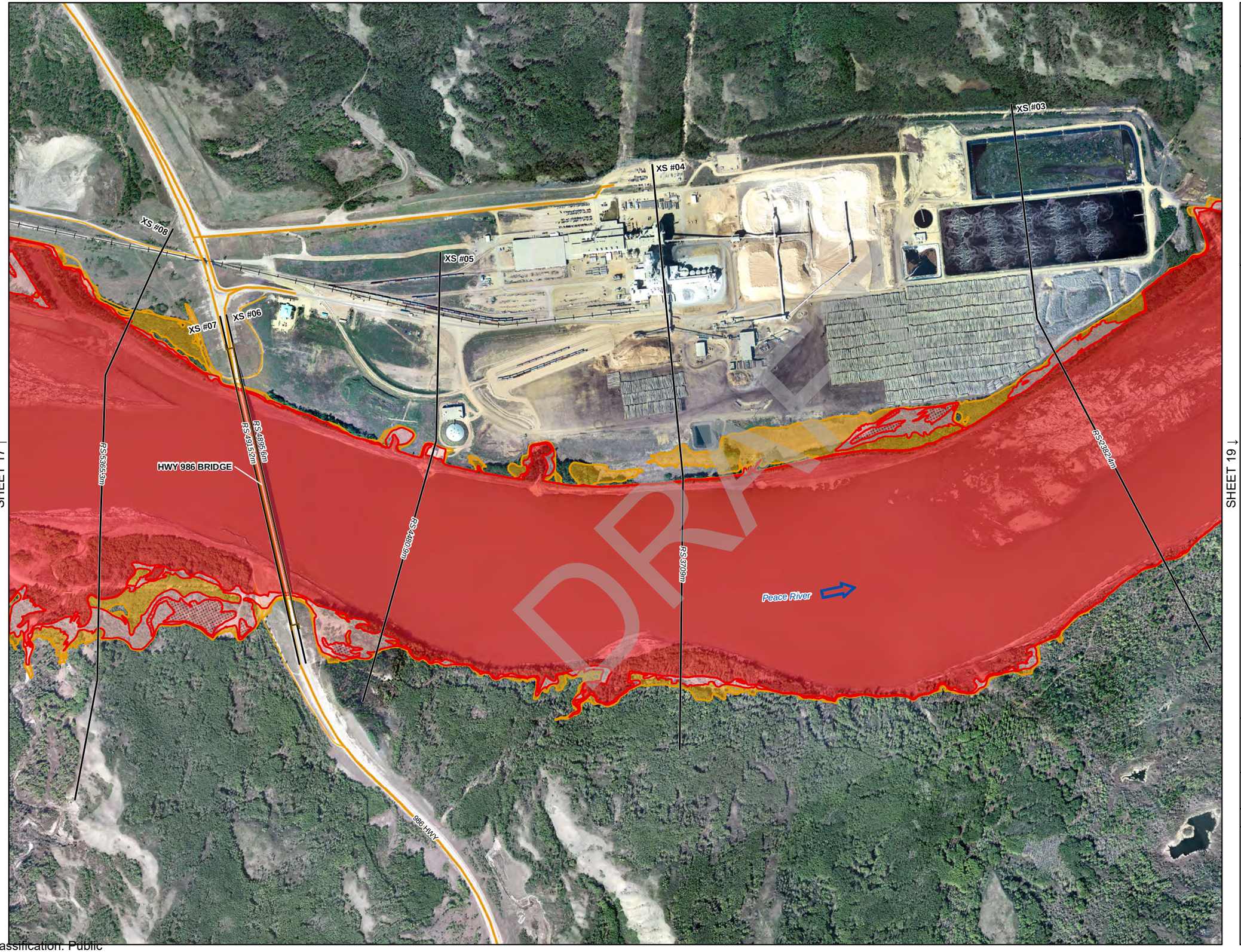

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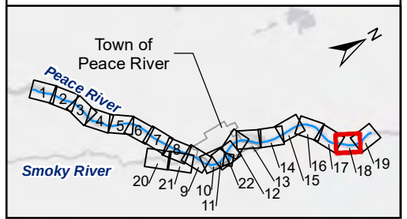

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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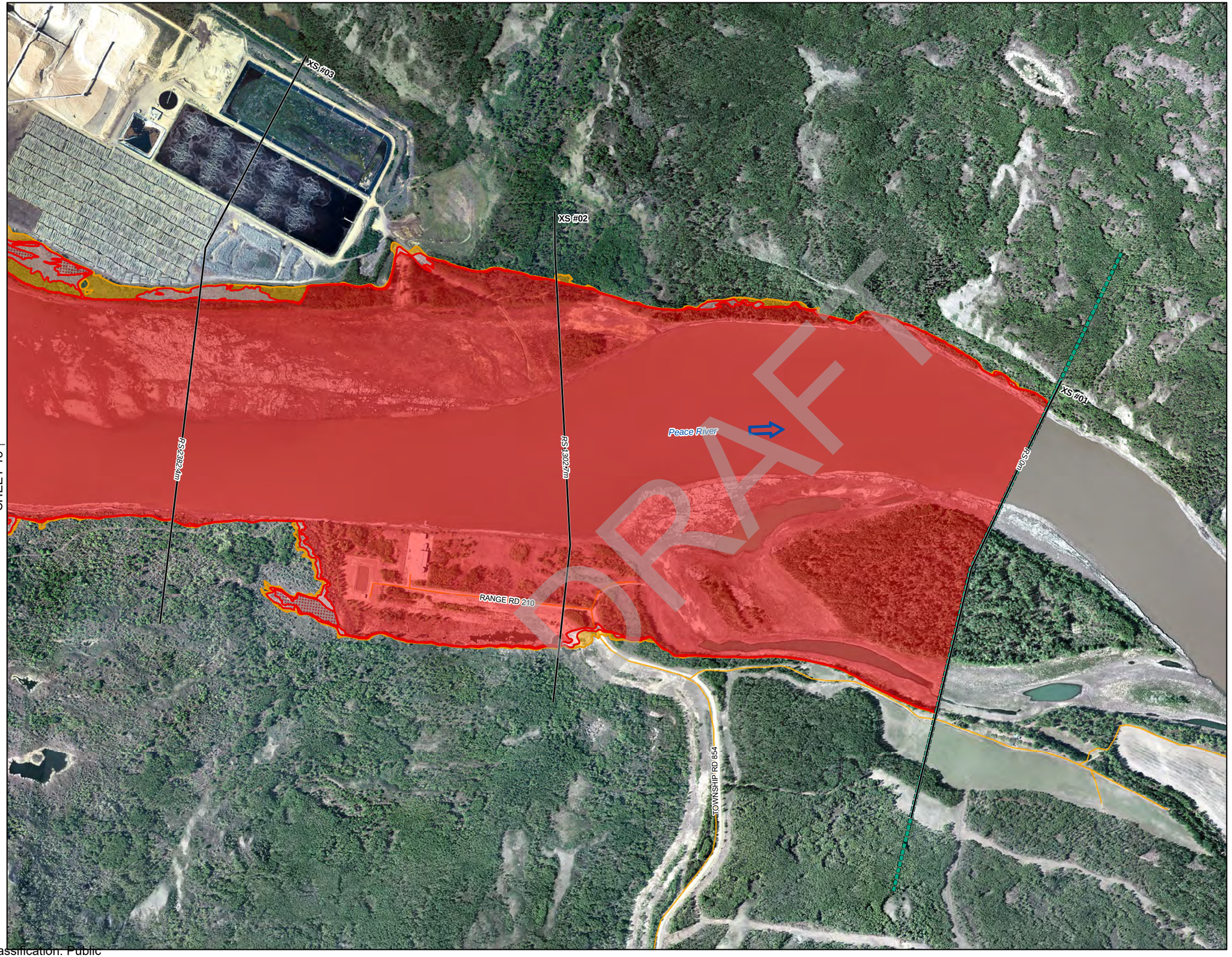

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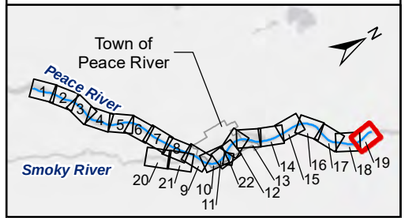

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 19 OF 22

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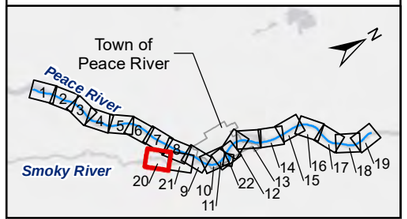

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Coordinate System: NAD 1983 CSRS 3TM 117
Units: METRES

Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

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MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd

SHEET 20 ↑

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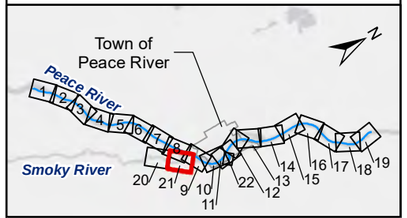

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SCALE - 1:10,000

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 21 OF 22

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd

Classification: Public

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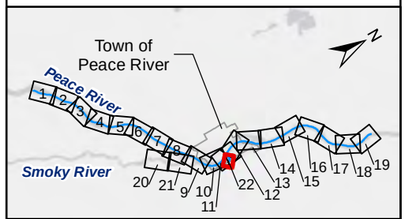

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SCALE - 1:5,000

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Job: 1001119	*Date: 07-OCT-2022*

PEACE RIVER HAZARD STUDY

GOVERNING DESIGN FLOOD HAZARD MAP

SHEET 22 OF 22

MSN, P:_Projects (Active)\1001119 Peace River Hazard Study\90_GIS_2022Update\PeaceRHS_Governing_Map_FloodHazard_2022Update.mxd

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