Notes to Users:

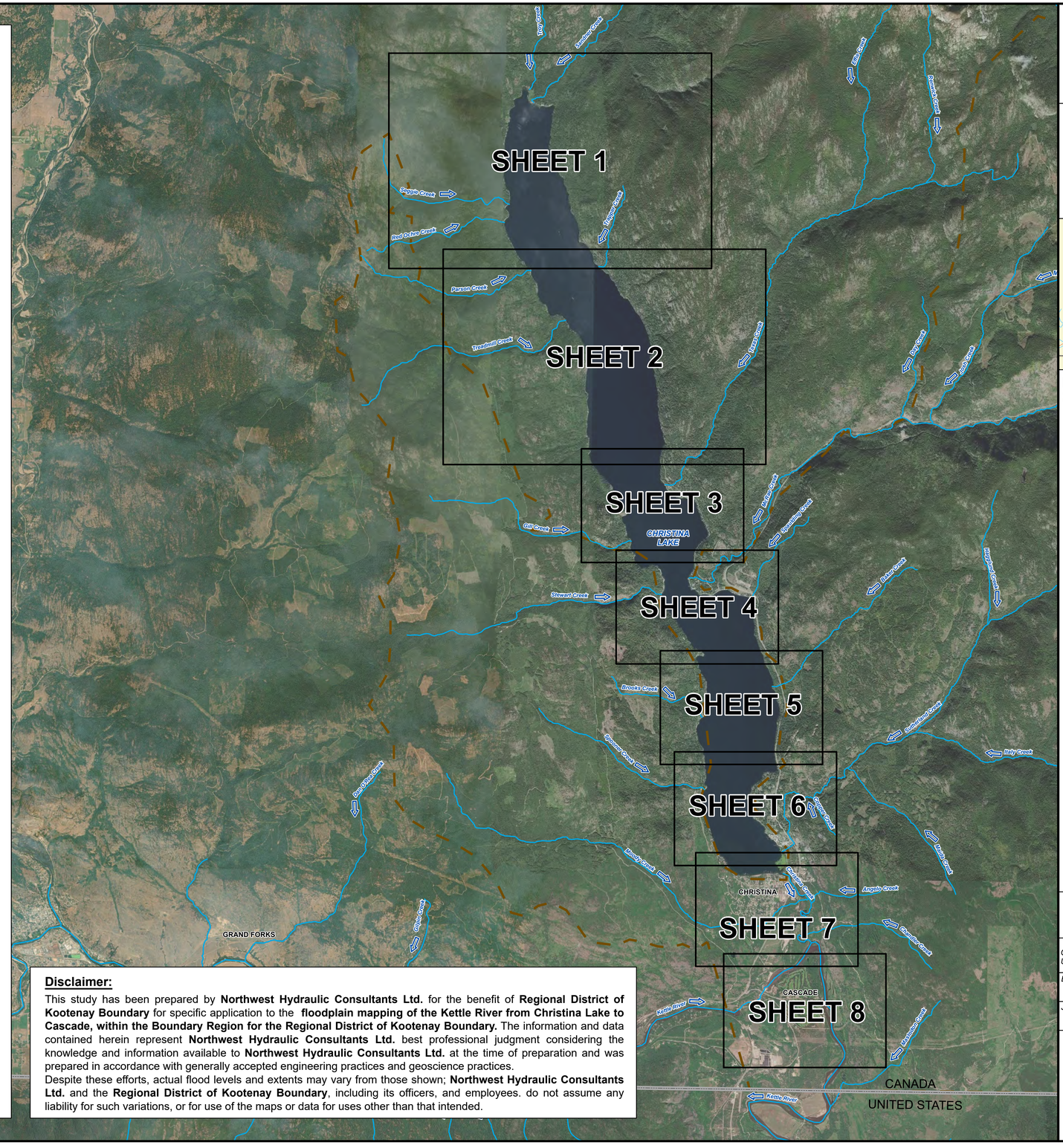
1. The associated report should be read and understood prior to use of the floodplain maps:
   Northwest Hydraulic Consultants Ltd. (NHC). 2022. 'Regional District Kootenay Boundary (RDKB) - Floodplain Mapping for Boundary Region. Christina Creek & Kettle River – Christina Lake to Cascade'. 2022 Nov 04. NHC reference number 3006322.
2. Floodplain maps delineate flood construction level (FCL) extents under the design flood.
   a. The mapped FCLs include a freeboard allowance added to the calculated flood water elevation. It has been added to account for local variations in water level and uncertainty in channel conditions, data, and analysis.
   b. FCLs are shown on the map as smoothed isolines to create a user-friendly interpretation of FCL. The upstream face or point of any structure should be used to determine the structure's FCL. The FCL can either i) be determined as the next upstream isoline (next greatest) or ii) calculated through interpolation by distance between the isoline upstream and downstream of the upstream face or point of the structure.
3. The FCL shown on Christina Lake includes the wave runup based on co-occurrence of 200-year wind event. The wind and wave effects extend 15 m shoreward from the 200-year lake level to delineate the expected limit of wave effects (lake zone). Beyond this limit the FCL is based on inundation of the flood event without wave effects (shore zone).**Shore zone FCLs take precedence over lake zone FCLs. Wave effects have been calculated based on generalized shoreline profile and roughness for each shoreline reach. Site specific runup analysis by a Qualified Professional may be warranted to refine the generalized wave effects should the shoreline slope be significantly different than those summarized in the project report. The site-specific analysis could increase or decrease the FCL by as much as a metre.**
4. Floodplain maps include the floodway, flood fringe, and high fluvial hazard setback guides. Floodway is considered the primary flow path during a flood event. Flood fringe is considered part of the active floodplain that does not contribute substantially to conveyance. The high fluvial hazard setback defines the area that is expected to be most susceptible to erosion, scour, and channel migration.
5. Alluvial fans are identified in the maps. Depending on the level of assessment and findings from the assessment, the fans can be classified as ***active*** (i.e., unconfined depositional zone susceptible to rapid aggradation, channel migration, and avulsion across the fan under the contemporary geoclimatic conditions), ***inactive*** (i.e. the fan was developed under a different regime, and fluvial hazards are expected to currently be confined to a defined route across the historic fan), or ***unrated*** (i.e., it has not been determined if the entire fan or just the current channel area is susceptible to fluvial geomoprhic hazards under current geoclimatic conditions). In this level of assessment, fans areas were classified as ***active*** or ***unrated***.
6. Level of assessment for active fans that were mapped is consistent with Class 1 as per Engineers and Geoscientists BC (EGBC) Legislated Flood Hazard Assessment guidelines for rainfall and snowmelt generated floods and Class 0 for debris flows, debris floods and alluvial fans (EGBC, 2018). Anything above these would require a site-specific assessment.
7. Within an active fan, the hazard has been classified as moderate, high or very high. Areas classified as moderate typically reflect a clearwater flood event greater than a 1 in 500 year return period and/or the element may be exposed to moderate inundation and overland flow; high hazard reflects clearwater event magnitude with a return period equal to or greater than 1 in 500 year return period. The element can be exposed to moderate inundation and overland flow, potential avulsions, debris jams, or flood more extreme than typical design flood. Areas classified as very high hazard where clearwater flood magnitude is equal to or greater than 1 in 500 year return period include areas where there is active migration, active sediment sources, possible channel blockages, and potential avulsion points. Any of the hazard areas can be exposed to worse hazards than those listed during larger or more rare events. This may include debris floods, outburst floods or debris flows.
8. FCL, floodway, flood fringe, and high fluvial hazard setback has been delineated based on reach scale study of the Kettle River using hydraulic modelling, air photo interpretation, site observations, and geometric analysis. Hazards from other sources may exist. Local hazards may change over time. Underlying hydraulic analysis assumes channel geometry is stationary. Erosion, deposition, degradation, and aggradation are expected to occur and may alter actual observed flood levels and extents. An increased or decreased level of obstruction will result in different flood extents and elevations for the same flow event. Local storm water inflows, temporary diking, drainage, and groundwater may further alter flood extents and elevations from those indicated on the maps.
9. The accuracy of simulated flood levels is limited by the reliability and extent of water level, flow, and climate data. The accuracy of the floodplain extents is limited by the accuracy of the design flood flow, the hydraulic model, and the digital surface representation of local topography. Localized areas above or below the FCL may be generalized by the inundation mapping. Therefore, floodplain maps should be considered an administrative tool that indicates flood elevations and floodplain boundaries for a designated flood. A Qualified Professional is to be consulted for site-specific hazard analysis and mitigation. Accuracy of the maps may deteriorate with time as hydrology, channel and crossing geometry, and land use changes differ from that assessed.
10. Industry best practices have been followed to generate the floodplain maps. However, actual flood levels and extents may vary from those shown. Residual flood risk beyond that mapped exists for flood events more extreme than the design flood. RDKB and NHC do not assume any liability for variations of flood levels and extents from that shown.

Data Sources and References:

1. The design flood is the 200-year (almost identical to the 2018 flood of record) adjusted for changes in land use and climate to the end of century (2050-2100). The 20-year peak instantaneous flow adjusted for future conditions was also plotted. The follow table presents these flows.

Event	Christina Lake Levels (Elev. m)	Christina Creek (m^3/sec)	Kettle River (m^3/sec)
20-year	447.3	69	942
200-year	448.3	95	1267

2. FCL includes a 0.6 m freeboard. The 20-year flood levels do not include freeboard. All elevations are provided in the Canadian Geodetic Vertical Datum of 2013 (CGVD2013a).
3. The hydraulic response is based on a 2D numerical model developed by NHC using HEC-RAS software, and ArcGIS software for pre- and post -processing. The hydraulic model was calibrated to the 2018 flood event.
4. The digital elevation model (DEM) used to develop the model and mapping is based on a previously compiled DEM, bare-earth (no buildings or structures) LiDAR , and a channel survey (NHC, 2021). The LiDAR data was collected in September 2015 for the upper half of Christina Lake and July 2018 for the lower half of the reach at Christina Lake and Cascade and provided by RDKB and LiDARBC. Contour lines are derived from the DEM.
5. Orthophoto imagery was acquired from RDKB (collected August 2015 and 2018) and Esri base mapping imagery (collected August 2016 & October 2017 in the northern extent and Sept 2018 in the southern extent). National Railway Network and Digital Atlas Road lines were acquired from Natural Resources Canada. Stream layers were acquired from Freshwater Atlas Data, GeoBC.



MAP EXTENT AT 1:10,000 OR 1:5,000 SCALE
ORTHOPHOTO BOUNDARY
NATIONAL BOUNDARY
FLOW DIRECTION
STREAM

DRAFT INDEX MAP

SCALE - 1:50,000
0 1,000 2,000 3,000 m
N

Coordinate System: NAD 1983 CSRS UTM ZONE 11N
Units: METRES; Vertical Datum: CGVD2013

Engineer	GIS	Reviewer
VCM	RLM	DPM

Job Number	Date
3006322	04-NOV-2022

REGIONAL DISTRICT OF KOOTENAY BOUNDARY FLOOD MAPPING
CHRISTINA LAKE SHEET INDEX

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Disclaimer:

This study has been prepared by **Northwest Hydraulic Consultants Ltd.** for the benefit of **Regional District of Kootenay Boundary** for specific application to the **floodplain mapping of the Kettle River from Christina Lake to Cascade, within the Boundary Region for the Regional District of Kootenay Boundary.** The information and data contained herein represent **Northwest Hydraulic Consultants Ltd.** best professional judgment considering the knowledge and information available to **Northwest Hydraulic Consultants Ltd.** at the time of preparation and was prepared in accordance with generally accepted engineering practices and geoscience practices.
Despite these efforts, actual flood levels and extents may vary from those shown; **Northwest Hydraulic Consultants Ltd.** and the **Regional District of Kootenay Boundary**, including its officers, and employees. do not assume any liability for such variations, or for use of the maps or data for uses other than that intended.