

NHC Ref. No. 3006034

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OKANAGAN BASIN WATER BOARD

1450 KLO Road
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Attention: **Anna Warwick Sears, PhD**
Executive Director
Nelson R. Jatel, PhD (cand.), PAg
Water Stewardship Director

Via email: anna.warwick.sears@obwb.ca
nelson.jatel@obwb.ca

Re: **Okanagan Mainstem Floodplain Mapping Project**
Development of CGVD1928 Floodplain Mapping

Dear Dr. Warwick Sears and Dr. Jatel:

Floodplain maps completed for the Okanagan Floodplain Mapping Project (NHC, 2020) are in the current Canadian Geodetic Vertical Datum of 2013 (CGVD2013). Northwest Hydraulic Consultants Ltd. (NHC) is pleased to provide the Okanagan Basin Water Board (OBWB) with updates to the floodplain maps that include Flood Construction Levels in the Canadian Geodetic Vertical Datum of 1928 (CGVD1928), the former vertical datum for Canada.

1 INTRODUCTION

1.1 Background and Purpose

Natural Resources Canada (NRCan) has released CGVD2013 as the new reference standard for heights across Canada¹, and floodplain mapping developed by NHC for OBWB under the Okanagan Floodplain Mapping Project (NHC, 2020) is in this new standard. NHC (2020) provided floodplain mapping for the Ellison, Wood / Kalamalka, Okanagan, Skaha, Vaseux, and Osoyoos lakes, and Okanagan River from Okanagan Lake to Osoyoos Lake. While the CGVD2013 height reference system replaces CGVD1928 (commonly referred to as CGVD28), the implementation of CGVD2013 is in progress and a transition

¹ <https://www.nrcan.gc.ca/maps-tools-publications/tools/geodetic-reference-systems/height-reference-system-modernization/9054>, accessed 6 February 2021.

period is expected². Through discussions with local governments in the Okanagan River Basin, OBWB has determined that the floodplain mapping for the Okanagan Floodplain Mapping Project (NHC, 2020) is also required in CGVD1928 to assure a smooth and gradual transition period to the new height reference system.

1.2 Project Summary

The following tasks were undertaken to complete the development of CGVD1928 floodplain mapping based on NHC (2020):

- Conversion of Flood Construction Level (FCL) values from CGVD2013 to CGVD1928.
- Update of the original floodplain maps in portable document format (PDF) format to show FCLs in both CGVD2013 and CGVD1928. Map notes have also been updated.
- Update of floodplain mapping GIS layers and documentation to include FCL values in both CGVD2013 and CGVD1928.

2 METHODOLOGY AND RESULTS

2.1 Vertical Datum Conversion

Modelling and mapping data completed in NHC (2020) used the CGVD2013 vertical datum. This included the 2018 LiDAR data supplied by GeoBC, the LiDAR-based digital elevation model (DEM) used for hydraulic modelling and mapping, riverine and lake hydraulic model results, and elevations and FCLs shown on floodplain maps and in floodplain mapping GIS layers. FCLs were shown for river isolines and for lake zone and lake shoreline zone polygons.

As part of the current scope, NHC converted the FCLs reported in NHC (2020) from CGVD2013 to CGVD1928.

Vertical datum differences are not consistent across the region. Based on a 100 m horizontal resolution grid of 567,590 points across the region, differences range from 0.16 to 0.41 m with an average of 0.26 m and a standard deviation of 0.05 m. Elevation values in CGVD1928 are lower than values in CGVD2013.

² <https://www2.gov.bc.ca/gov/content/data/geographic-data-services/georeferencing/vertical-reference-system>, accessed 6 February 2021.

2.2 Vertical Datum Specifications

Datum specifications for modelling and mapping completed in NHC (2020) are based on the underlying 2018 LiDAR data used to build the DEM. GeoBC specifications for the 2018 LiDAR are as follows:

- Horizontal datum: North American Datum 1983 Canadian Spatial Reference System epoch 2002.0 (NAD83 CSRS (2002.0))
- Vertical datum: CGVD 2013
- Geoid model: Canadian Gravimetric Geoid model of 2013 (CGG2013)

Vertical datum specifications used for the conversion to CGVD1928 are as follows:

- Horizontal datum: NAD83 CSRS (2002.0)
- Vertical datum: CGVD 1928
- Geoid model: Height Transformation version 2.0 epoch 1997 (HTv2.0 (1997))

There are several epoch models of CGVD1928 HTv2.0. Based on the Province of BC's recommendations³, CGVD1928 HTv2.0 (1997) was used for this project.

The projection for all of the data is Universal Transverse Mercator (UTM) Zone 11-N.

2.3 Vertical Datum Conversion Tool

NHC converted FCLs from CGVD2013 to CGVD1928 using Natural Resource Canada's (NRCan) GPS-H tool online⁴, a screen capture of which is shown in Figure 2.1.

³ <https://www2.gov.bc.ca/gov/content/data/geographic-data-services/georeferencing/geoid-model-data/htv2-0-model-info>, accessed 28 October 2020.

⁴ <https://webapp.geod.nrcan.gc.ca/geod/tools-outils/gpsh.php>, accessed 28 October 2020.

Single Calculation
Batch Processing

Batch Processing

☒ **Convert**
☐ **Estimate Gravity**

Conversion

CGG2013a_HT2_1997

Reference Frame

NAD83(CSRs)

Select file for batch processing (required)

Browse...
No file selected.

Send File

Figure 2.1 GPS-H Tool Settings

Note that the geoid model available for conversion in the NRCan GPS-H tool, CGG2013a, is an update of the previous CGG2013 geoid model and has minimal differences in the Okanagan area.

2.4 FCL Conversion Parameters

The conversion of FCL values from NHC (2020) from CGVD2013 to CGVD1928 included the following methods and parameters:

- All FCLs are reported to a precision of one decimal place.
- For Lake Zones and Lake Shoreline Zones, each polygon has a single FCL value:
 - For smaller polygons, the value was calculated based on the approximate centre point of the polygon.
 - For larger polygons, values were calculated for points at multiple locations in the polygon, and the average value was used.
- For river isolines, FCL values were converted based on where the FCL isoline crossed the river centreline.
- Each FCL value is shown on the floodplain map in both CGVD2013 and CGVD1928.
- Each FCL value is stored in the corresponding GIS layer in both CGVD2013 and CGVD1928.

The following information has not changed from NHC (2020):

- Flood extents are unchanged, as the relative difference between modelled water surface elevations and ground elevations is unaffected by a change in vertical datum.

- Contours and spot elevations shown on the maps are unchanged. Both have elevations in CGVD2013, not in CGVD1928.
- GIS layers depicting water surface elevations are unchanged. These reflect values in CGVD2013, not CGVD1928. These layers are not shown on floodplain maps in PDF format.
- GIS layers depicting flood depths are unchanged, as the relative difference between modelled water surface elevations and ground elevations is unaffected by a change in vertical datum.

3 DELIVERABLES

The following deliverables have been provided:

- Floodplain index map with updated map notes, in PDF format.
- Floodplain maps including FCL values in CGVD2013 and CGVD1928, with an updated legend. There are a total of 116 map sheets in PDF format.
- GIS layers contained in an updated flood mapping Esri Geodatabase file:
 - Lake FCL shoreline zones – addition of FCL CGVD1928 value
 - Lake FCL inundation extent (design with freeboard) – addition of FCL CGVD1928 value
 - River FCL isolines – addition of FCL CGVD1928 value
- GIS files for map production:
 - ArcGIS 10.8.1 Map Packages for floodplain maps and index map, including FCL labels in both CGVD2013 and CGVD1928
- GIS documentation:
 - GIS Data Summary PDF
 - GIS Data Notes PDF
 - GIS Data Readme Text File

4 REFERENCES

NHC (2020). *Okanagan Mainstem Floodplain Mapping Project* (NHC PN3004430). Report prepared by Northwest Hydraulic Consultants Ltd. (NHC) for the Okanagan Basin Water Board (OBWB), 31 March 2020.

5 CLOSURE

DISCLAIMER

This document has been prepared by **Northwest Hydraulic Consultants Ltd.** for the benefit of **Okanagan Basin Water Board, Regional District of North Okanagan, Regional District of Central Okanagan, Regional District of Okanagan-Similkameen, Okanagan Nation Alliance** for specific application to the **Okanagan Mainstem Floodplain Mapping Project, Okanagan Valley, British Columbia, Canada (Ellison, Wood, Kalamalka, Okanagan, Skaha, Vaseux, and Osoyoos lakes and Okanagan River from Okanagan Lake to Osoyoos Lake)**. The information and data contained herein represent **Northwest Hydraulic Consultants Ltd.** best professional judgment in light of 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.

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Closing Statement

Thank you for the opportunity to continue working with OBWB on this project. Please feel free to contact Vanessa McMaster (vmcmaster@nhcweb.com), Sarah North (snorth@nhcweb.com), or Piotr Kuraś (pkuras@nhcweb.com), if you have any questions or comments.

Sincerely,

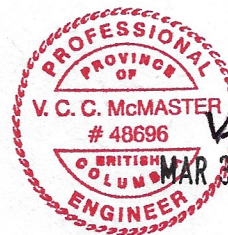
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