TECHNICAL MEMORANDUM

DATE: May 15, 2018
TO: Jessica Mehigan - Vancouver Fraser Port Authority
CC: Tanya Hayes - FGT
FROM: Geraldo Araujo - FWS Bulk Materials Handling
RE: PER No. 15-041 - FGT Flood Vulnerability Review

Dear Jessica,

A flood inundation assessment study for the proposed Fraser Grain Terminal (FGT) was conducted by Northwest Hydraulic Consultants in May 2018 (Appendix 1 to this memorandum).

The study produced an inundation map for the proposed FGT layout (FGT Drawing P003) based on the 0.5% AEP event as requested by VFPA.

The study results show that under the 0.5% AEP event, only the layout’s western side is in contact with flooded ground.

The western side of the layout is the existing FSD dock (berths 3 and 4) where the new three tower stationary shiploader for the project will be installed. The only elements of the shiploader that could be under 0-100 cm of water are static structural elements that should not be affect by short term flooding.

In conclusion, based on a 0.5% (1:200 year) AEP event as assessed by Northwest Hydraulic Consultants and the design prepared by FWS, no areas of the Project are at risk of flooding that would result in adverse effects to the value and vulnerability of commodities to be handled by the Project. In addition, no contaminated risk due to accidental release of commodities or other Project components are anticipated.

We trust this information suits your needs. Feel free to contact me by phone at 604.454.2488 or by email at garaujo@fwsgroup.com for any questions or clarifications regarding the above.

Sincerely,

Manager, Projects – Bulk Material Handling
FWS Group of Companies
Dear Mr. Araujo:

1 INTRODUCTION

A flood inundation assessment study for the proposed Fraser Grain Terminal (FGT) development located on Vancouver Fraser Port Authority (VFPA) property in the City of Surrey was conducted by Northwest Hydraulic Consultants Ltd. (NHC) in 2016. The study involved reviewing existing information and producing an inundation map for the site. The proposed facility design and site layout have since been revised. FWS Group of Companies (FWS) has retained NHC to update the inundation map for the revised layout.

The following new information were used to generate the updated inundation map:

- New terminal overall site plan – FWS file “08-17-075CP001RC.dwg” received from FWS on April 30th, 2018
- Finished grade surface – “32022_FGT_FINISHED SURFACE.dwg” received from ISL Engineering on May 8th, 2018.

2 SITE DESCRIPTION

Fraser Surrey Dock (FSD) is located on the left bank (facing downstream) of the Fraser River, in Surrey, British Columbia. The site is within the provincially designated Fraser River floodplain (NHC, 2008), as
shown in Figure 1. The City of Surrey (CoS) also shows the property to be within their 200-year\(^1\) floodplain boundary (Figure 2). The site is not protected by a dike, and no other structural mitigation protects the site from Fraser River flood hazards. Trifurcation Training Walls I and II reduce flow velocities at the FSD berths. The FSD site is zoned industrial (City of Surrey, 2016), and is characterized by a high percentage of impervious surface (Delcan, 2004; NHC, 2016a).

Figure 1. FSD is within the Ministry of Environment Fraser River floodplain boundaries (NHC, 2008). The flood profile shown here does not include freeboard or climate change allowances.

\(^1\) It is unclear if CoS has adopted the 200-year flood profile (contrary to provincial recommendations), or if this information actually represents the Fraser River design flood (1894 flood of record) and is mis-labelled on their website.
3 INUNDATION MAPPING

The standard design event for flood hazard on the Fraser River is the 1 in 500 year flood event (i.e., 0.2% Annual Exceedance Probability (AEP) event) with moderate climate change (CC) allowance and 1.0 m Sea Level Rise (SLR). The Project & Environmental Review Application Submission Requirements from VFPA specifies that the flood protection assessment be conducted using the 1 in 200 year flood event or 0.5% AEP, with moderate CC allowance and 0.5 metre SLR as presented in “Simulating the Effects of Sea Level Rise and Climate Change Scenarios on Fraser River Flood Scenarios” (FLNRO, 2014). Flood levels for this scenario range from El. 3.98 m CGVD28 in the downstream end of the property near Berth 2 to El. 4.10 m CGVD28 in the upstream end of the property near Berth 6.

An inundation map was produced based on the 0.5% AEP event as requested by VFPA to assist with the application. While industry best practices were followed to produce the map, depths and extents of inundation may vary from those shown on the map as a result of uncertainty in data and assessment (i.e. discharge measurement, stage-discharge rating, estimates of historical flood frequency distribution, estimates of projected SLR and CC effects, numerical modelling of river flows, and topographic data collection) as well as variations in local hydraulics and site elevation.

The inundation map does not account future changes or emergency measures taken in anticipation of a flood, such as dikes and berms. Such measures are laid out in FSD’s Emergency Response Plan (Fraser Surrey Docks, 2014).
Error! Reference source not found. (at the back of the report) shows the predicted depths and extents of flooding. Direct ingress from the Fraser River is limited to the area fronting Berths 2 through 6. Most of the area between the berths and rail lines would experience ponding of water up to 1.0 m deep. The footprint of the proposed administration building, parking, rail receiving shed, conveyors and storage silos remains mostly dry, but its western side is in contact with flooded ground.

4 STUDY LIMITATIONS

The study provides an assessment of local flood level and inundation extents for a prescribed flood event. It is not a Flood Hazard Assessment, and specifically will not include assessment of hydrotechnical hazards such as scour and erosion, or the 0.2% AEP event.

5 CLOSURE

We trust this information suits your needs. Feel free to contact me by phone at 604-980-6011 or email at ewang@nhcweb.com if you have comments or questions.

Sincerely,

Northwest Hydraulic Consultants Ltd.

Prepared by: Reviewed by:

Edwin Wang, MEng, PEng
Hydrotechnical Engineer

Dale Muir, PEng
Principal
DISCLAIMER

This document has been prepared by Northwest Hydraulic Consultants Ltd. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of FWS Group of Companies and their authorized representatives for specific application to the inundation mapping of the 200-year Fraser River flood at Fraser Grain Terminal in Surrey, BC, Canada. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Northwest Hydraulic Consultants Ltd. No other warranty, expressed or implied, is made. Northwest Hydraulic Consultants Ltd. and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than FWS Group of Companies.
REFERENCES


This document has been prepared by Northwest Hydraulic Consultants Ltd. for the benefit of FWS Group of Companies and their authorized representatives for specific application to the Fraser Grain Terminal. The information and data contained herein represent Northwest Hydraulic Consultants Ltd.'s 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. 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 FWS Group of Companies and their authorized representatives, its officers and employees. Northwest Hydraulic Consultants Ltd. denies any liability whatsoever to other parties who may obtain access to this document 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.

FLOOD INUNDATION
1 IN 200 AEP
“MODERATE” CLIMATE CHANGE EFFECT
0.5 M SLR

References:

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Data Sources:
Background image from Esri World Imagery
Index basemap from National Geographic and Esri.
Infrastructure Labels Adapted from Delcan (2004).

Notes:
Inundation map was produced for review of existing flood protection planning at Fraser Surrey Docks as described in NHC (2015). They do NOT represent floodplain mapping and should not be used as such. Industry best practices were followed to generate the flood maps, however actual flood levels and extents may vary from those shown and Northwest Hydraulic Consultants Ltd. (NHC) does not assume any liability for such variations. For limitations in the modelling, Digital Elevation Model (DEM), and mapping refer to NHC (2016).

FLOOD DEPTHS (CM)

0 to 50
most houses are dry; walking in moving water or driving is potentially dangerous; basements and underground parking flooded; potentially causing evacuation; vehicles are commonly carried off roadsides

50 to 100
water on ground floor; basements and underground parking flooded; potentially causing evacuation; electricity failed; vehicles are commonly carried off roadsides

100 to 200
ground floor flooded; residents evacuate

200 to 500
first floor and often roof covered by water; residents evacuate

> 500
first floor and often roof covered by water; residents evacuate

FWS GROUP OF COMPANIES
northwest hydraulic consultants

FRASER GRAIN TERMINAL
FLOOD INUNDATION ASSESSMENT
FLOOD INUNDATION
1 IN 200 AEP
"MODERATE" CLIMATE CHANGE EFFECT
0.5 M SLR

FIGURE 3