TETRA TECH EBA

OQM | Organizational Quality Management Program

# FITZSIMMONS CREEK FLOOD PROTECTION METHOD STATEMENT

PRESENTED TO

**Resort Municipality of Whistler**

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CONSULTING ENGINEERS & SCIENTISTS · www.eba.ca

Tetra Tech EBA Inc.
Oceanic Plaza, 9th Floor, 1066 West Hastings Street
Vancouver, BC V6E 3X2 CANADA
Tel 604.685.0275 Fax 604.684.6241

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## LIMITATIONS OF REPORT

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# 1.0 INTRODUCTION

The Resort Municipality of Whistler is the diking authority for Fitzsimmons Creek and is responsible for ensuring that the creek and dike structures are managed in a way that enables the dikes to perform as designed to protect public safety. As part of this responsibility the RMOW has a program of removing gravel from the creek, typically annually, to work towards achieving a design flood profile that is contained by the dikes.

The Fitzsimmons Creek Technical Committee (FCTC) was formed in late 2010 to facilitate communications and the approval process among the different agencies involved in managing Fitzsimmons Creek. It comprises representatives from the RMOW; the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO); and Fisheries and Oceans Canada (DFO). Typically a gravel removal plan is developed by the RMOW's engineering and environmental consultants and reviewed by the FCTC and adjusted accordingly prior to submission of the approval applications, along with the engineering report. In 2011 a standardized Environmental Management Plan (EMP) was developed to cover the various types of work required for gravel removal.

A meeting was held on October 29, 2013 between the RMOW, DFO and MFLNRO in which it was agreed that a multi-year approval process would be beneficial for future flood maintenance activities in Fitzsimmons Creek. This would increase the available time for the required surveys, analysis and reporting prior to the gravel removal and simplify the approval process.

The gravel management plans are based on hydraulic modelling of Fitzsimmons Creek. Each year, RMOW's engineering consultant develops recommendations for removal of gravel in a number of locations designed to work towards achieving the required freeboard during the 200-year return period discharge, taking into account fisheries, geomorphological and other issues, such as accessibility and the limitations of working within the EMP. A hydraulic engineering analysis report is prepared justifying the rationale for the proposed locations and quantities of gravel removal. A completion report is prepared following implementation of the recommended mitigation works. The requirement to submit these engineering reports would remain.

In order to accomplish this simplification, a Method Statement is required, which will form the basis of analysis and reporting for future maintenance plans. This Method Statement will become part of the Memorandum of Understanding (MoU) among the members of the FCTC for flood maintenance works in Fitzsimmons Creek. The following sections present the component parts of the Method Statement.

# 2.0 METHOD STATEMENT

## 2.1 Surveys and Field Assessment

Cross section surveys will be undertaken for pre and post construction works for the entire reach of Fitzsimmons Creek that is deemed critical. The study reach extends from Blackcomb Way Bridge to Green Lake, approximately 4 km downstream, as identified from previous studies of the Creek. The project area includes Whistler Village, portions of the Upper Village, residential zones such as White Gold Estates and Greenside Village, the Mons Road area, and the golf course/residential properties at Nicklaus North.

The study reach of Fitzsimmons Creek is subject to ongoing deposition of boulders, cobbles, gravel and debris that are delivered from upstream. These materials raise the bed of the channel in certain areas, exceeding the target elevations established in the various operation and maintenance plans for the existing dikes within the study area. When these target elevations are exceeded, the RMOW is required to excavate gravel from the creek under the current management plan for Fitzsimmons Creek. Cross section surveys will include bank and bed elevations including individual gravel bars. Past studies and hydraulic analysis reports will be reviewed to identify critical dike locations with insufficient freeboard. Details of the freeboard requirements are provided in Section 2.3.

The RMOW's engineering consultant will undertake a site visit to examine the nature of erosion and deposition along the stream and to identify some key options for gravel. In addition, the data collected from the site visit will be utilized to verify the existing condition hydraulic analysis. Details of hydraulic analysis are provided in Section 2.2.2.

The field assessment will include a walkover of the entire reach of Fitzsimmons Creek by RMOW's engineering and environmental consultants. All critical dike locations identified through past studies will be revisited to assess current conditions and recurring issues. Photographs of critical locations will be taken and used to support hydraulic analyses and quantification of gravel removal required for the year. Environmental issues regarding critical locations and potential gravel removal sites will be assessed.

In order to prevent potential damages to any utilities from proposed flood protection works in Fitzsimmons Creek, a detailed inventory of all utilities in the vicinity of the proposed project area will be obtained.

In order to determine the annual aggradation or degradation in the creek, past and current survey data sets at the target/monitoring sections will be compared. The annual sediment deposition volume will be determined and compared with the long term average for the Creek, currently taken to be 10,400 cubic metres.

## 2.2 Hydrology and Hydraulic Analysis

### 2.2.1 Design Flood

Ward (1992) recommended peak flows in Fitzsimmons Creek downstream of Blackcomb Creek confluence during a 200-year return period event should be decreased from the recommended value of 400 $m^3/s$ to 200-235 $m^3/s$. Golder (2004) estimated the peak instantaneous flow to be in the order of 200 $m^3/s$. Based on this information and further study, the BC Provincial Government adopted 250 $m^3/s$ as the peak instantaneous 200-year flood design flow (Golder 2004). Consideration should be given to updating this value periodically.

The design flood that will be used for future studies is presently proposed to be the 200-year return period event peak discharge rate of 250 $m^3/s$, as in the 2011 to 2013 studies. The design flow will be modelled as a steady state clear water flow. Although steady state flow analysis is the preferred method for quick assessment of peak water levels in the channel to identify deficiencies in dike freeboard, future studies may consider unsteady flow conditions to assess the implications of bank overflows.

### 2.2.2 Hydraulic Model

The HEC-RAS water surface profile model developed by the Hydrologic Engineering Center has been used for the hydraulic analysis of Fitzsimmons Creek for all past gravel removal studies and at this stage, this model is considered appropriate for future studies for estimation of water surface elevations. The downstream boundary condition is taken as the 200-year water level in Green Lake of El. 635.6 m in line with the previous studies. It was identified during the 2013 Fitzsimmons Creek Flood Protection Study that the current 1-Dimensional hydraulic model does not accurately represent the available floodplain storage in some critical areas near Highway 99. It was agreed in the April 30th FCTC meeting that in future this reach be incorporated as a 2-Dimensional model component into the hydraulic model. For this purpose, additional survey information and 2-Dimensional modelling using LiDAR data, where available, will be investigated. Also, additional analyses will be carried out to determine if raising the dike in this area would be a more efficient solution in the long term.

The 2011 hydraulic model was roughly calibrated in April 2011, based on a discharge of 1 $m^3/s$, during preparation of the 2011 gravel removal plan. Subsequently, in-channel roughness coefficients were further calibrated based on a relatively high flow of 8.6 $m^3/s$ measured on July 28th, 2011, combined with the corresponding water surface elevations surveyed at major bridge crossings. The calibrated in-channel Manning

roughness coefficients for the hydraulic model ranged from 0.03 to 0.05. A roughness value of 0.1 will be utilized for the over-bank flow areas. It is proposed that the model calibration be repeated for a major flow event to update the assessment of roughness coefficients for the current channel configuration. The hydraulic model will be developed for pre and post construction scenarios.

Table 2.1 provides basic inputs that are proposed for the 1-Dimensional hydraulic model.

**Table 2.1 Hydraulic Model Input**

| Parameter | Value | Details |
|---|---|---|
| Flow | 250 m³/sec | Golder, 2004<br>Recommended by Ministry of Forests Lands and Natural Resources Operations (MOFLNRO) in 2011 |
| Boundary Conditions | Upstream | Normal depth |
| | Downstream | 200-year water level in Green Lake (635.6 m) |
| Channel Cross Sections | Target/Monitoring<br>Post Excavation | Current channel survey<br>Model cross sections to be verified and refined in field assessment<br>Post construction bathymetry |
| Dikes | Existing | Existing model dike locations and elevations. Mons Road area reach will require incorporation of floodplain elevations. |
| Roughness Coefficient “n” | Calibrated to 0.03 - 0.055 (EBA Assessment 2011) | For in-channel roughness |
| | 0.1 | For over-bank area roughness |

## 2.3 Identification of Critical Dike Sections

The existing hydraulic model will be updated with most recent channel survey information. In 2012, the FCTC recommended that freeboards of 0.6 m and 0.5 m above the 200-year peak flood level should be applied upstream and downstream of Spruce Grove Bridge. The 2013 gravel management plan considered these recommended freeboards. It is proposed that the same freeboard allowances be applied in future analyses, unless otherwise directed by the FCTC.

The maximum water surface elevations and the freeboard available for existing conditions and for the proposed gravel removal plan will be investigated. Following the hydraulic analyses, a summary table for the modelled 200-year water surface elevations and available freeboard at representative target/monitoring sections will be developed. In addition, dike sections that do not meet the freeboard criteria will be identified, for example where:

- Channel deepening is limited by the presence of bedrock;
- There is need to preserve the existing conditions for environmental reasons;
- Narrow channel geometry precludes isolation of the work area; and
- Site access is restricted.

Other restrictions to flow such as bridge crossings, channel width/geometry and incorporation of floodplain conveyance for modelling will be considered.

## 2.4 Development of Gravel Removal Options

Hydraulic modelling will be carried out for a number of gravel removal options to determine the preferred locations and to quantify gravel volumes. Reductions in the design flood water surface profile as a result of each of the gravel removal options will be illustrated.

The gravel removal options will be designed to work towards achieving the minimum freeboard criteria, with the following constraints:

- Lowest environmental impacts;
- Geomorphological considerations;
- Practicality with regard to access; and
- Maintenance of the long term gravel budget.

The recommended gravel removal plan will focus on critical dike sections, maximized excavation geometry at selected gravel bars or excavation from bank to bank based on the available channel width while maintaining channel stability, and the practicality of construction with regard to site access, flow isolation and conveyance during gravel extraction.

Subsequent to the 2011 gravel removal works, the RMOW engaged Cascade Environmental Resource Group Ltd. to prepare standard operating procedures in the form of an Environmental Management Plan (EMP) to form part of the Fitzsimmons Creek Channel Maintenance Program. This EMP was created to be a planning tool that can be used during all subsequent Fitzsimmons Creek gravel management operations. This plan was prepared considering many different gravel extraction scenarios that may occur during gravel management, and each scenario is paired with optimal fish salvage protocols and existing access points, while also considering special situations, such as high creek flows. The 2013 proposed gravel removal plan was prepared based on the generalized terms and gravel extraction scenarios contained in this EMP. The EMP will be updated where required to reflect current conditions and utilized in the identification of mitigation options for future studies in the Creek. Therefore, general terms contained in the recent Environmental Management Plan will be applied in the proposed gravel removal plan where applicable.

## 2.5 Gravel Removal Plan Report Preparation

A hydraulic modelling report will be prepared to summarize the findings. The proposed gravel removal locations and layout will be shown on accompanying drawings superimposed on an air photo base plan. The proposed excavated channel geometry will be shown in section view including the existing channel geometry and the target geometry. The exact locations and volumes of the gravel bars to be excavated will be provided in plan and section layouts for the contractor for construction purposes. This will include a detailed inventory of the utilities that are located within the proposed work areas. The report will include locations, chainages, channel cross section shapes, and volumes of the proposed excavations.

For the purposes of habitat compensation, RMOW's three year bio-monitoring study (2011-2013), which determines the impacts of the ongoing flood protection maintenance work in Fitzsimmons Creek, will be reviewed. In particular, Spruce Grove channel was recognized during previous studies to not provide adequate aquatic habitat compensation. Therefore, once the three year bio-monitoring project is complete, a determination will be made regarding the need for more aquatic habitat compensation.

A stakeholder's consultation will be conducted, if required, to address other potential mitigative measures to support the gravel removal works in the Creek. This may include, but not be limited to, access requirements, bridge designs and channel sizing and reorientation, as required.

## 2.6 Environmental Monitoring Report

Gravel removal in Fitzsimmons Creek will conducted generally during the construction fish window in August each year. The gravel removal works will be administered by the Resort Municipality of Whistler (RMOW), which is the local Diking Authority and an environmental monitor will be on site at all times during the work. Environmental recommendations to be implemented will include preparatory works such as wet crossings, fish salvages and site isolation works.

Environmental impacts to Fitzsimmons Creek will be minimized, where possible, by implementing a number of mitigative strategies throughout the works as detailed in the Environmental Management Plan. This includes MFLNRO Water Act Section 9 Approval and DFO Fisheries Act 35(2) authorization conditions to ensure compliance with regulatory mitigation strategies. A pre-construction meeting will be held between the contractor, the environmental monitor and the RMOW and further on-site meetings and communications will be conducted on a daily basis during the works.

The Environmental Monitoring Report will include a detailed description of the limitations encountered during construction and any alternative measures undertaken. The exact location and associated gravel volumes removed will be provided. The gravel volumes extracted will be estimated from a count of truck loads removed from each site, with an estimated average volume of 7 $m^3$ per truck load. The EMP will also include other salient information monitored during construction including turbidity and fish logs. Where possible, turbidity increases in Fitzsimmons Creek will be minimized in duration and intensity to the extent possible for the works to be completed. All relevant mitigative measures will be discussed and approved by RMOW prior to construction. Recommendations will be developed following construction for future improvement works.

## 2.7 Construction Inspection

Construction inspection of the gravel removal work will include verification that the contractor is achieving the depth and size of excavation required by the gravel removal plan. It is proposed that a dedicated inspector from the company that developed the gravel removal plan carry out the inspection. As an alternative, RMOW will undertake inspection if this would better fit into the RMOW's budget for the construction work, with periodic visits from the engineering consultant.

## 2.8 Post Construction Survey and Project Completion Report

A post-construction survey will be conducted for all target gravel sections and any additional critical mitigation works completed. This will include surveyed cross sections of the creek from bank to bank and spot elevations at gravel bars excavated. Following construction phase, a project completion report will be prepared.

As part of this task, an estimate of the actual volumes extracted will be made by comparing the post-construction survey data with the pre-construction survey data using Civil3D software. A summary of the excavation volumes by location, based on the truck counts and on the survey information will be presented. The surveyed surfaces will include the isolation berms, (which remain in the river) so that these can be factored into the calculations. It is important to note that the pre-construction survey thalweg information derived from a surface is generally developed using target cross sections only, therefore does not provide an accurate basis for actual extracted volumes. In addition, high flow conditions could occur during the gravel removal period leading to deposition of additional gravel in the creek. The truck count volumes will be given priority for the reporting.

The project completion report will detail the actual gravel removal works, including the fish salvage works prior to isolation of the work areas, turbidity monitoring as necessary throughout the duration of construction, and any mitigative strategies that were developed for construction purposes.

## 3.0 CLOSURE

We trust this Method Statement meets your requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.


Prepared by:
Lawrence Francois, M.Sc. CWEM
Hydrotechnical Engineer
Water & Marine Engineering
Direct Line: 604.685.0275
Lawrence.Francois@tetratech.com

Reviewed by:
Adrian Chantler, Ph.D., P.Eng.
Principal Specialist,
Water & Marine Engineering
Direct Line: 604.685.0275
Adrian.Chantler@tetratech.com

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