



January 10, 2018

Ms. Rita Weaver, PE, CFM
Floodplain Action Hydrologist
Minnesota Department of Natural Resources
Division of Ecological and Water Resources
500 Lafayette Road
St. Paul, MN 55155

Re: FEMA Modeling Updates for the Twin Cities HUC8 Watershed – Bassett Creek Watershed Management Commission Scope

Dear Ms. Weaver:

On behalf of the Bassett Creek Watershed Management Commission (BCWMC), we submit the following scope and cost estimate for updating the Federal Emergency Management Agency (FEMA) hydrologic and hydraulic modeling, and creating the supporting GIS files for the Bassett Creek watershed (see attached Figure for FEMA study areas).

Introduction

The previous FEMA-approved modeling for the Bassett Creek watershed was completed in 1997 using the United States Army Corps of Engineers (USACOE) HEC-1 hydrologic and HEC-2 hydraulic modeling software. In 2012, the BCWMC converted these HEC-1/HEC-2 models to an XP-SWMM hydrologic and hydraulic model (Phase 1 XP-SWMM model), preserving the same resolution and scale as in the approved FEMA models. In 2015-2017, the BCWMC funded a second effort to further refine the Phase 1 XP-SWMM model (Phase 2 XP-SWMM model). This effort included incorporating more detail in the upper watershed, including increasing the number of subwatersheds, accounting for the storage in ponds, wetlands, and lakes throughout the watershed, and incorporating storm sewer conveyance and outlet structures based on data provided by the BCWMC member cities. The Phase 2 XP-SWMM model was calibrated to available monitoring data at 4 locations within the watershed and was used to evaluate the Atlas-14 design storm events.

The FEMA model update will utilize the BCWMC Phase 2 XP-SWMM model.

The following section outlines the anticipated scope of work for the FEMA model update, based on the scoping document provided by Minnesota Department of Natural Resources (MnDNR) staff on October 24, 2017 and follow-up meetings and communications with staff.

Scope of Services

Work Task 1: Hydrologic Analysis

Barr will utilize the existing BCWMC Phase 2 XP-SWMM model to calculate peak flood discharges for the Atlas 14 10%, 4%, 2%, 1%, and 0.2% annual chance events, using the MSE3 rainfall distribution. Because

the 0.2% annual chance event was not evaluated as part of the BCWMC Phase 2 XP-SWMM modeling effort, we anticipate needing to “capture” water at various locations throughout the watershed.

Barr completed internal QAQC of the model during the development of the Phase 2 XP-SWMM model; as part of this task, Barr will develop the documentation of that QAQC process. Additionally, we will develop a project hydrology narrative that describes all inputs and their sources, modeling methodology, and results of the calibration/validation. The model report developed for the BCWMC Phase 2 XP-SWMM model will be included as an attachment to the project narrative.

We will submit the models and the hydrology narrative to the Interagency Hydrology Review Committee (IAHRC) for review and approval. We will address any IAHRC comments before final submittal; however, we assume that there will be no revisions required for the hydrology portion of the XP-SWMM model.

Assumptions

- Hydrologic methods used in the development of the BCWMC Phase 2 XP-SWMM model are acceptable
- No re-modeling or recalibration of the Phase 2 XP-SWMM model is required
- No statistical analysis of the Bassett Creek WOMP data will be required
- No modifications will be made to Phase 2 XP-SWMM hydraulics (unless needed to route overflows during the capture of the 0.2% event) at time of IAHRC submittal

Deliverables

- Project hydrology narrative
- Documentation of internal QAQC; FEMA review of QAQC will happen at a later date, outside the scope of this project
- Interagency Hydrology Review Committee-approved hydrologic models, submitted in electronic format.

Work Task 2: Hydraulic Analysis

The data used to develop the existing Phase 2 XP-SWMM model was based on the previously approved HEC-2 model and GIS storm sewer data and plans provided by member cities. Much of the data utilized does not have the level of documentation required to meet FEMA review standards.

We will provide the MnDNR with as-built drawings compiled during the Phase 2 model development within the study area. However, we understand that the MnDNR will coordinate as-built/record drawing requests with the member cities, review available plans/data provided, and coordinate survey of those crossings where record drawings are not available. Additionally, the MnDNR would like 10 percent of the existing cross sections surveyed to confirm there are not significant differences between the original cross-sections in the approved HEC-2 model and the existing field conditions. Per our 12/6/2017 and 1/4/2018 discussions with MnDNR staff, we assume that the MnDNR will coordinate all survey work (spot-check and crossings/structures) and the MnDNR will provide the as-built/record drawing and survey data (in FEMA format) to us for our use in the model updates.

We will update the Phase 2 XP-SWMM model with the latest as-built and/or surveyed cross sections and crossing information (bridges, culverts, and other structures) as provided by the MnDNR. We will also

update the Phase 2 XP-SWMM model to meet other FEMA requirements, such as incorporation of additional cross sections to account for expansion and contraction losses near crossings.

Once the models have been updated, we will perform internal QAQC on the models and will provide documentation of the QAQC to the MnDNR. Barr will rerun the models for the original Phase 2 calibration events and compare the model results with the monitoring data; however, we assume no recalibration will be needed. Barr will then run the updated BCWMC XP-SWMM model to evaluate the hydraulics for the Atlas 14 10%, 4%, 2%, 1%, and 0.2% annual chance events, based on flood discharge rates computed under Work Task 1.

Once the model has been updated, the QAQC performed, and we have confirmed the model calibration, we will modify the cross-sections in the XP-SWMM model to reflect the existing effective floodway (2016 FIRM) extents and will run the model for the Atlas 14 1-Percent-Annual-Chance event. We will provide the initial floodway model, based on the existing effective floodway, to the MnDNR staff, who will then complete any revisions to the floodway modeling to achieve the following standards: the MnDNR will allow greater than the Minnesota maximum surcharge of 0.5 ft, and up to the Federal maximum surcharge of 1.0 ft (if no new structures are impacted), due to the increased discharge associated with Atlas 14.

Assumptions

- MnDNR will request as-built/record drawings from member communities and will perform (or contract for) the survey of 10 percent of cross-sections in the existing model (~50 cross sections) and crossings/structures (~90 crossings/structures). MnDNR will complete the comparison of existing model cross-sections to survey data to determine if any further survey is required. MnDNR will provide as-built/record drawings and survey data to Barr, along with all required FEMA documentation.
- Locations along the detailed model reaches that are modeled as storage nodes will remain as storage nodes in the model update and no new cross-sections will be required in these areas.
- No additional calibration will be needed after the model is updated with acquired as-built and survey data.
- Barr will revise the updated XP-SWMM model to incorporate the width of the existing floodway to all cross sections as an initial run. We will provide the model to MnDNR staff who will perform the necessary iterations of floodway modeling as needed to meet the following standards: the MnDNR will allow greater than the Minnesota maximum surcharge of 0.5 ft, and up to the Federal maximum surcharge of 1.0 ft (if no new structures are impacted), due to the increased discharge associated with Atlas 14. MnDNR staff will also compare the proposed floodway surcharge with the existing FIS tables and summarize as needed in a brief memo.
- Development of floodway data tables, flood profiles, BFE lines, and other FIS tables are not included in this scope.
- Cross sections added upstream and downstream of bridges, culverts, and other structures to meet FEMA model requirements may be copies of adjacent cross sections. The mapped inundation top width at these cross sections may not match the modeled top width; however, the MnDNR will accept the discrepancy to avoid additional survey.

Deliverables

- Documentation of internal QAQC; FEMA review of QAQC will happen at a later date outside the scope of this project.
- Hydraulic models that meet FEMA's standards for approximate or detailed studies submitted in electronic format.
- Hydraulic model with existing floodway incorporated into all cross sections for use by MnDNR staff to complete floodway modeling analysis.
- GIS and electronic data compilation (model cross sections, as-builts, survey)

Work Task 3: Developing Floodplain, Floodway, and Cross-Section Shapefiles

Barr will delineate the 1-percent-chance and 0.2-percent-chance floodplains and the floodway for the detailed study areas. We will generate inundation areas by linearly interpolating flood elevations between cross sections.

Barr will provide shapefiles to the MnDNR in the format supplied by the MnDNR. We will perform internal QAQC on the shapefiles and will provide documentation of the QAQC to the MnDNR.

Assumptions

- MnDNR will provide a blank shapefile to Barr for the *Special Flood Hazard Areas* and the cross-sections that will show the format required for submittal, along with step-by-step guidance that the MnDNR uses for cleaning up the floodplain shapefile (removing holes, smoothing edges, etc.).

Deliverables

- The 1-percent-chance floodplain, 0.2-percent-chance floodplain, and floodway boundaries for detailed areas and the 1-percent-chance floodplain and 0.2-percent-chance floodplain for approximate areas submitted as shapefiles in the example format provided by the MnDNR.
- Cross-section shapefile submitted in the format provided by the MnDNR.

Work Task 4: Developing Depth Grids

Barr will develop depth grids for the 10%, 4%, 2%, 1%, and 0.2% annual chance events in detailed study areas and for the 1-percent-chance event in approximate study areas. We will perform internal QAQC on the grids and will provide documentation of the QAQC to the MnDNR.

Assumptions

- MnDNR will provide step-by-step guidance for formatting and cleaning up the depth grids.

Deliverables

- Final depth grids submitted as rasters for all return periods in detailed areas and the 1-percent-chance depth grid in approximate areas.

Work Task 5: Flood Risk Review Meetings and Development of Work Maps

The MnDNR will hold Flood Risk Review meetings throughout the Twin Cities HUC8 between October 2019 and February 2020. Barr will attend up to two (2) Flood Risk Review meetings. The MnDNR will

prepare Work Maps showing the new Special Flood Hazard Areas, the cross-section locations and other pertinent information and will print hard copies of the maps as needed for the meetings.

Assumptions

- MnDNR staff will develop and print work maps.
- MnDNR staff to coordinate flood risk review meetings
- Two Barr staff will attend up to two flood risk review meetings

Deliverables

- Participation in two (2) flood risk review meetings

Work Task 6: Developing Project Narrative

Barr will provide a project narrative that describes the methodology used to develop the hydrologic and hydraulic model inputs for XP-SWMM. The narrative will include results of calibration/validation and all QA/QC processes and results for the previous work tasks. The project narrative will also highlight areas where further evaluation or modeling may be required under future studies.

Assumptions

- MnDNR will provide a folder structure and naming conventions for electronic documents.
- Project will be considered complete upon MnDNR review and approval of models and deliverables; work tasks do not include response to FEMA comments at a future date.

Deliverables

- Project Narrative submitted as a Word document
- All project documentation, in electronic format

Work Task 7: Community Meetings

We anticipate holding two meetings with the BCWMC technical advisory committee (TAC) during the model update process. The TAC is comprised of staff from BCWMC member cities. We expect one meeting with the TAC to review the results of the updated modeling and discuss the floodway modeling approach. At the second meeting, we will present the results of the floodway modeling and the impacts to the effective floodway.

Additional meetings (up to three (3)) with the individual member cities or groups of member cities are anticipated.

Budget and Schedule

The following table outlines the estimated budget, hours, and schedule to complete the scope of work outlined above. The schedule assumes the MnDNR authorizes the work by March 2018. The schedule also assumes that MnDNR staff will coordinate and complete the spot-check survey and crossings/structure survey and that survey data will be provided to Barr by October 2018. If the start date is later or the survey data is received later than stated, the schedule will shift accordingly.

Work Task	Description	Estimated Hours	Amount	Anticipated Completion
Work Task 1	Hydrologic Analysis	76	\$7,500	June 2018
Work Task 2	Hydraulic Analysis	470	\$41,500	February 2019
Work Task 3	Developing Floodplain, Floodway, and Cross-Section Shapefiles	152	\$14,700	April 2019
Work Task 4	Developing Depth Grids	72	\$7,400	April 2019
Work Task 5	Flood Risk Review Meetings and Development of Work Maps	20	\$2,400	October 2019 – January 2020
Work Task 6	Developing a Project Narrative	74	\$8,000	May 2019
Work Task 7	Community Meetings	54	\$7,000	June 2019
Project Total		918	\$88,500	

It is our understanding that the MnDNR will enter into an agreement with the BCWMC if this proposal is acceptable to you. All work will be completed and invoiced on a time and expenses basis.

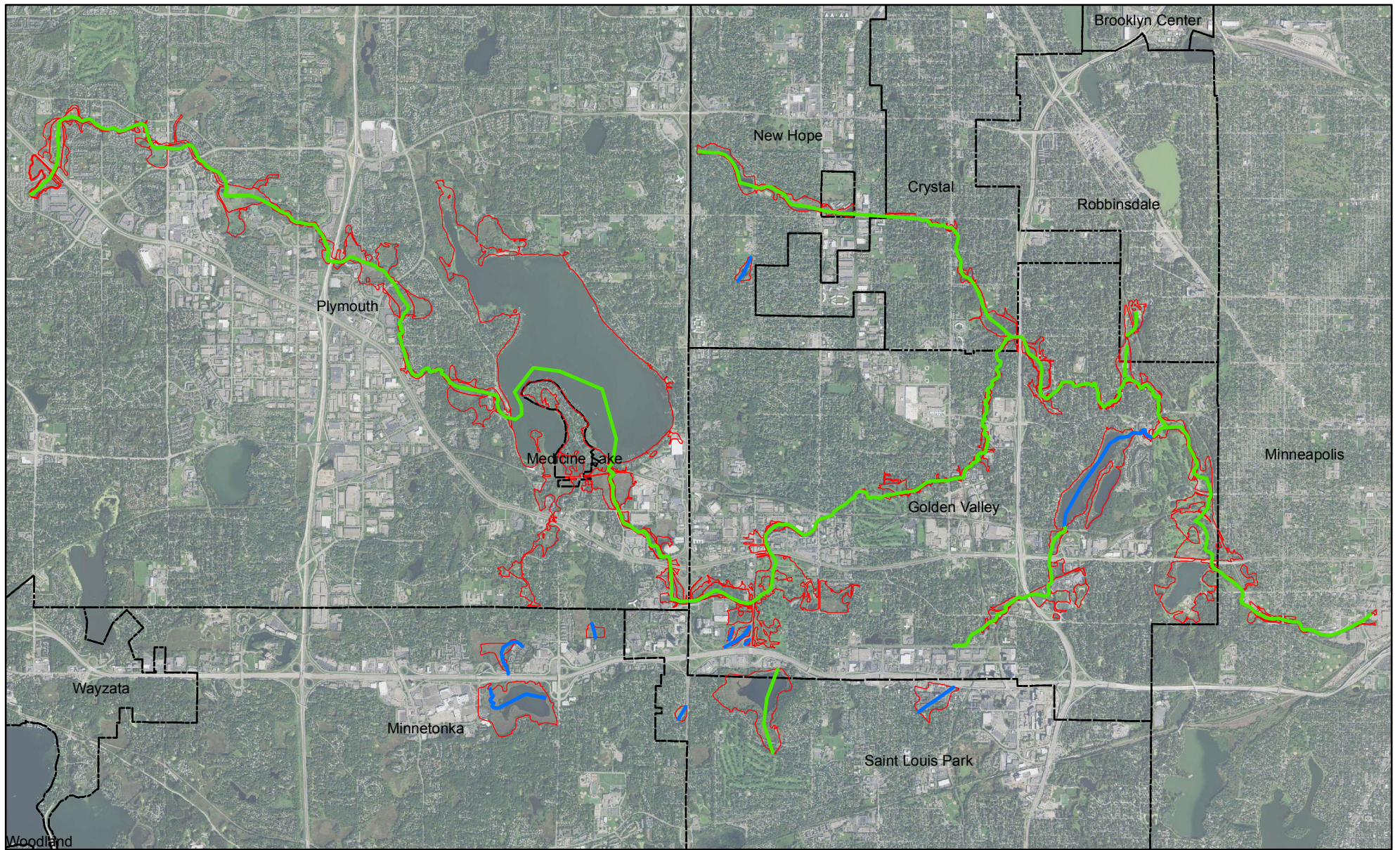
We look forward to working with you on this project. If you have scope questions, please contact Jennifer Koehler (952-832-2750 or jkoehler@barr.com) or me (952-832-2813 or kchandler@barr.com). If you have contracting questions, please contact Laura Jester, the BCWMC administrator (952-270-1990 or laura.jester@keystonewaters.com).

Sincerely yours,



Karen Chandler, PE
Barr Engineering Co.
Engineers for the Bassett Creek Watershed Management Commission (BCWMC)

Attachments: Figure FEMA Study Areas in the BCWMC Hydrologic Boundary



FEMA Study Areas in the BCWMC Hydrologic Boundary

Twin Cities HUC 8 Flood Risk Project

Legend

- Zone A - approximate study area
- Zone AE - detailed study area
- Effective Special Flood Hazard Area
- City Boundaries

