

Project Name | BCWD 2024 H&H Model Update Phase 2**Date** | 6/6/2024**To / Contact info** | BCWD Board of Managers**Cc / Contact info** | Karen Kill / BCWD Administrator**From / Contact info** | Ryan Fleming, PE & Alec Olson**Regarding** | Scope of Services for Phase 2 of the BCWD H&H Model Update

Background

The Brown's Creek Watershed District hydrologic and hydraulic (H&H) model has been maintained as a "living model" since 2004, meaning the model is updated when new information such as hydraulic structure survey and land altering development data becomes available. Since the last major update to the model in 2015, several changes within the watershed have occurred which require updating the model to provide the most accurate assessment of rainfall runoff characteristics and impacts in the watershed. These updates ensure the model contains the latest information available to assess existing conditions to provide technical assistance to communities and developers within the BCWD.

The 2024 budget recommendation memorandum (presented & reviewed in July 2023) included several tasks associated with updating the BCWD's H&H model to assist in planning and policy decisions toward drafting the next generation of the watershed management plan. Some of the proposed updates rely upon datasets for which the release date has been delayed. Due to the effort and duration required to update the model, a phased approach is required ahead of the data availability to keep in step with the watershed management plan timeline.

Phase 1 of the 2024 H&H Model update was approved by the Board in October of 2023, and completed earlier in 2024. It consisted of the following updates:

1. Update climatology and precipitation data:
 - a. Updated climatology and rainfall data library to include the growing season data collected at the BCWD's weather station, as well as recent complete year data at nearby bias-corrected gauges using as-it-happened radar data to ready the model for multi-year continuous simulations.
2. Update model hydraulics:
 - a. Review of as-builts of thirty developments with significant changes and addition of these developments to the BCWD H&H model.
3. Drainage survey at 13015, 13093, and 13131 Keystone Ave N, Hugo, MN¹

¹ Task 3 of Phase 1 was not anticipated during the budget planning process in July 2023, though it is tangentially related to the model, as it may be used in a future model update, the primary objective was to understand the drainage in this area, the residents' concerns, and collaborate with Washington County.

Scope of Services

As previously mentioned, some of the proposed updates relied upon datasets that were not yet available at the time that Phase 1 of the update began, namely the updated, higher resolution MN state LiDAR elevation, and the land cover data prepared by the University of Minnesota Remote Sensing and Geospatial Analysis Laboratory. The new higher resolution LiDAR data is now available, and the University of Minnesota has predicted the land cover data to become available in June 2024 at the earliest.

Prior to release of the land cover data, the following tasks may commence, and the data can be processed in preparation for that release. If release of the land cover data does not occur within a timeframe to coincide with the watershed management plan, alternative options for updating the model will be presented. These may include using the 2011-2014 land cover dataset, which would be an update from the 2008 Farm Service Agency aerial photography currently used in the model.

The following is a scope of services to conduct Phase 2 of updating the BCWD H&H model.

1. As-Built Hydraulic Updates

Since completion of Phase 1, the BCWD has received as-built documentation for hydraulic structures in the following permits. Because these permits resulted in significant hydraulic and land cover changes, or due to their proximity to flood prone areas, it is recommended they be added to maintain the model's useful function for simulating current conditions and for maintaining an up-to-date inventory of hydraulic structures throughout BCWD.

- Ponds at Heifort Hills (16-03)
- Trunk Highway 36 & Manning Interchange (20-08)²
- White Pine Ridge (20-12)
- Caribou Coffee (22-10)

2. Process LiDAR Data

The current model drainage areas are based on the 2011 LiDAR data. In early 2024, new higher resolution LiDAR data has become available that can be used to refine drainage divides and storage throughout the model. However, the raw LiDAR data needs to be processed into a digital elevation model (DEM) before it can be used as input in model. Typically, the Minnesota Geospatial Advisory Council 3D Geomatics (3DGeo) Data Acquisition Committee processes the raw LiDAR data into a DEM and releases it to the public on the MN Lidar Hub website. However, the committee has indicated that the digital elevation model (DEM) for Washington County will not be available until later this year. As such, EOR proposes processing the raw LiDAR data into a DEM in-house so that the higher resolution data can be used to update the model to current conditions. Processing of the LiDAR was

² The model includes the hydraulic structures that were proposed for Permit 20-08. These will be updated with the as-built information, including updating the pond storage volume reflected in the survey data.

not anticipated when EOR drafted the budget recommendations in July of 2023, however this task is anticipated to take 21 staff hours to complete including coordination with 3DGeo, quality control review, and documentation.

3. Update Subcatchment Boundaries

The 2011 LiDAR data that the current subcatchment boundaries are based on is believed to be relatively accurate, therefore large changes in the subcatchment boundaries in rural areas are not anticipated using the 2024 LiDAR elevation data. This will be confirmed by running a statistical comparison of the two datasets along the current boundaries to identify areas to focus our review. However, many subcatchments in the model will need to be adjusted to account for changes that have occurred since 2011, including new developments which the new LiDAR data will reflect. These areas will be the primary focus of the subcatchment update.

Many of the BCWD reports and studies refer to the current subcatchment areas and names, therefore the revised subcatchments will be defined to the same resolution, and discharge locations, as are currently defined in the model.

4. Update Waterbody Storage, Depressions, & Overland Channels

The current model includes DNR public waters and BMPs that were installed as of 2014 using the 2011 2-foot contour data (smoothed lines based on 3-meter square resolution). EOR proposes using the new sub-meter LiDAR data to refine storage throughout the model. The new higher resolution data will better define flood storage in the landscape (closed depressions), and around the waterbodies in the watershed. The benefits of these refinements include:

- An improved understanding of areas in the watershed that do, and do not contribute runoff to the waterbodies and watercourses.
- More refined flood footprints and mapping near infrastructure.

5. Calibration Data Review, Gap Identification, Selection, & Processing

Model calibration and validation is a process where model results are compared to observed data within the watershed and model parameters are adjusted to ensure the model predicts flows similar to observed conditions. Calibration is required with any major model update to correct for uncertainties inherent in the input data and in the model calculation methods. A well calibrated model increases confidence in the results from which policy and project related decisions are made.

Model calibration and validation will be included in a future scope of work, once the data becomes available and we are able to review and strategize using it for model hydrology parameterization.

A required step for model calibration is review of recent precipitation, streamflow, and waterbody level observed data to identify gaps and determine the best years for calibration and validation. This will be conducted in preparation for calibration and validation once updated land cover data has been made available and is included in the model. EOR will choose one warm season period for calibration, and two warm season periods for validation (a wet year and a dry year). As flooding and extreme precipitation events may be of interest in policy making decisions, periods with large volume events, or series of events will also be considered for calibrating the model. The selected observed datasets

will be formatted as time series files that are readable in the SWMM model for comparison to the modeled data.

Task and Cost Breakdown

Below is a summary of hours and costs for Phase 2 of the model update.

Table 1: Phase 2 Task and Cost Summary

Task	Description	Estimated Hours	Estimated Cost
1	As-Built Hydraulic Updates (4 permits)	34	\$5,115
2	Process LiDAR Data into DEMs	21	\$3,435
3	Update Subcatchment Boundaries	46	\$6,722
4	Update Waterbody Storage & Channels	50	\$7,510
5	Calibration Data Review & Processing	24	\$3,588
Totals		175	\$26,370

Alignment with 2023 Budget Recommendations & Next Steps

When the H&H model update was proposed in 2023, it was under the assumption that all necessary data would be available prior to the initiation of the project. Consequently, a phased approach was not initially anticipated. However, as detailed in the Background section, circumstances necessitated the adoption of a phased approach. This has implications for budget tracking, as it deviates from the original budgetary recommendations. To provide clarity on the remaining tasks, an outline of the subsequent steps is provided below.

Table 2: Phase Alignment with 2023 Budget Recommendations

Phase	July 2023 Budget Recommendation	2024 Scopes of Work	Notes
1	\$48,065	\$43,400	Includes \$4,840 – Keystone survey & map
2	\$14,981	\$26,370	Includes \$8,549 – LiDAR Process, Addn'l 4 permit as-builts
3	\$24,491	\$31,156 (estimated)	Includes balance of 2023 budget & unanticipated task amounts above
Totals	\$87,537	\$100,926	\$100,926 includes \$13,389 of unanticipated tasks above

Next Steps - Phase 3 of the H&H model update will include:

- Parameterize model hydrology using updated land cover and soil data
- Growing season model calibration and validation
- Model event running (rainfall events and continuous simulations to be determined)
- Scoping of alternative additional model enhancements such as incorporating groundwater, extreme rainfall/climate change prediction events, storm transposition

Based on our current projections and understanding of the tasks outlined above, we maintain that it is reasonable to anticipate that the associated costs will align with the estimates provided for Phase 3 in the 2024 scopes of work listed above.

Requested Action

Consider approval of scope of services for not to exceed cost of \$27,303, as outlined in Table 1 above, from account #923-0000.