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October 19, 2007

Judie Anderson, Administrator
Elm Creek Watershed Management Commission
3235 Fernbrook Lane
Plymouth, MN 55447

Re: Final Report
Elm Creek Channel Study
Bonestroo File No.: 001866-05001

Dear Judie,

We've enclosed 40 copies of the final report for this project as discussed. We appreciate the opportunity to work with the Commission on this project. Please contact Chad Voigt at 651-967-4668, or Bob Barth at 651-604-4740 if you need any additional information.

Sincerely,

BONESTROO

Chad Voigt, P.E.

Table of Contents

Summary

Many of the natural stream channels within Elm Creek Watershed have been impacted by land development. Communities are faced with a growing number of expensive stream repair projects and loss of natural resources. In this study, the ECWMC seeks to quantify current conditions and identify management practices to address these concerns. This study included the following steps:

- Field survey of existing stream channels
- Analysis of stream channel capacity
- Estimate of stormwater runoff from the watershed
- Conceptual stabilization planning for five priority stream channel locations
- Watershed management recommendations

This report recommends that the standards of the watershed are updated to require channel protection measures in land development plans. The watershed management recommendations in Section 6 propose that developing sites be required to manage a specified volume of runoff to reduce impacts to downstream channels. The specified volume can be managed through extended detention or on-site infiltration. Section 6 demonstrates the feasibility and benefits of this approach. The proposed rule revision is restated below.

Proposed revision to Section A of the current Watershed Standards:

1. Development and redevelopment projects shall provide extended detention and/or runoff volume reduction to protect stream channels in the watershed. The minimum runoff volume to be controlled shall be the channel protection volume (Vcp) in inches, obtained from Table 6.2.

2. Extended detention storage time is defined as the time between the center of mass of the inflow and outflow hydrographs. The minimum storage time shall be obtained from Table 6.4.

3. The minimum recommended outflow orifice diameter is 3". Lower release rates will require infiltration, filtration or alternative practices to provide control of the channel protection volume Vcp.

4. Infiltration, permanent storage or other volume reduction methods are encouraged and may be applied to reduce or eliminate the need for extended detention storage.

Section 1 – Introduction

ELM CREEK WATERSHED DESCRIPTION

Elm Creek Watershed covers 130 square miles in northern Hennepin County. The watershed is bordered on the north by the Crow River and the Mississippi River, and covers all or portions of Medina, Maple Grove, Champlin, Dayton, Hassan, Rogers, Corcoran and Plymouth. The watershed includes Elm Creek, Rush Creek, North Fork Rush Creek and Diamond Creek.

The Elm Creek Watershed Management Commission (ECWMC) was formed through a Joint Powers Agreement between the eight municipalities and the Hennepin Conservation District. The ECWMC bears the responsibilities and authority defined for Watershed Management Organizations in Minnesota Statutes, Chapter 103B.

The ECWMC adopted its second generation Watershed Management Plan in 2004, outlining goals, policies and priorities within the watershed. Channel stability and bank erosion are listed as high priority concerns to be addressed by the ECWMC. (Section V, Table V-1A.)

The Hennepin Conservation District (HCD) completed a set of reports in 2002, titled "Physical and Ecological Classification of Elm Creek and its Tributaries." The project documented the condition of stream channels and riparian corridors within Elm Creek, Rush Creek and Diamond Creek. The project identified natural areas and potential greenways and buffers, and provided recommendations for restoration, preservation and land use management within the watershed. The report notes, "Elm Creek in its lower reaches is experiencing system wide instability caused by changes in the hydrology of the upstream communities." (Final Report, page 14.)

PURPOSE AND SCOPE

The second generation ECWMC Watershed Management Plan identifies stream bank instability as the top priority issue to be addressed by the Commission. Development within the watershed has resulted in widespread stream bank erosion, channel migration and loss of streamside habitat. As a result, communities are faced with a growing number of expensive stream stability projects and adverse impacts to natural resources. In this study, the ECWMC seeks to quantify the current watershed conditions, overall stream stability and expected impacts from future watershed changes, and to develop long-term policies and practices to address these concerns.

This study included the following steps:

1. Field survey of 45 stream channel locations, selected from the previous reports completed by the HCD.
2. Hydraulic analysis and determination of bankfull channel capacity at each surveyed location.
3. Hydrologic modeling of the current watershed to estimate the frequency of bankfull flow at each location.
4. Conceptual stabilization planning for five priority stream channel locations.
5. Assessment and recommendation of watershed management practices to reduce the impact of future watershed conditions on the stability and quality of streams.

Section 2 – Field Survey of Existing Channels

LOCATIONS SURVEYED

Forty-five channel reaches were surveyed for this project. Surveyed reaches were distributed throughout Elm Creek, Rush Creek, North Fork Rush Creek and Diamond Creek, as shown in Figure 2.1. Reach locations were provided by the Commission based on previous studies, and were found in the field using GPS coordinates. Surveys were conducted between August 2005 and June 2006.

COLLECTED DATA

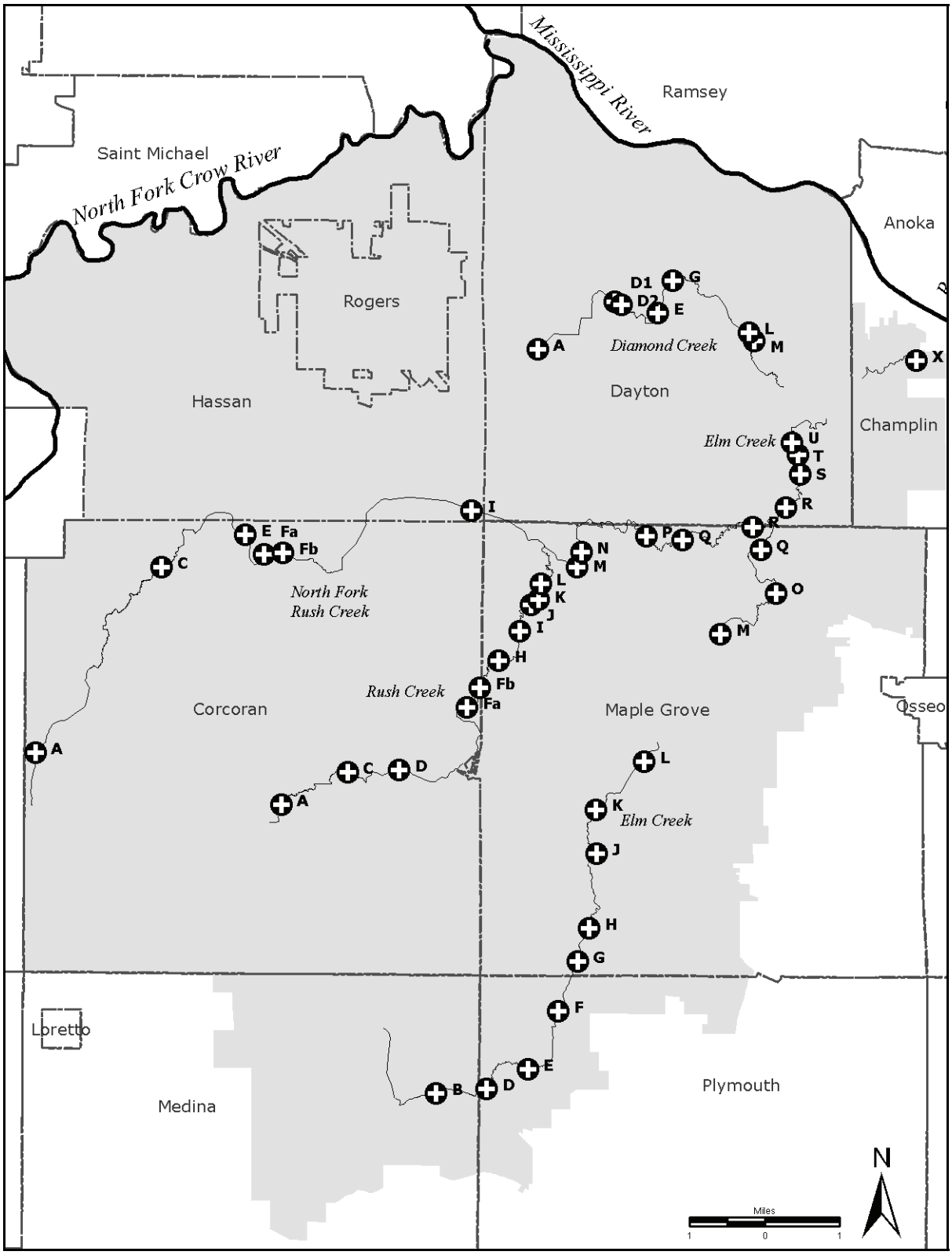
The following information was collected at each channel reach:

- Assumed benchmark
- Stream profile measurement
- Channel cross-section measurement
- Location and description of bankfull indicators
- Description of the stream bed, bank stability and vegetative cover
- Site photographs
- Narrative field description

Profile and cross-section dimensions were surveyed with level and tape, using an assumed elevation datum. Measured cross section and stream profile data were tabulated in spreadsheet format. The spreadsheets include calculation of the estimated bankfull flow based on field indicators, profile grade lines and plotted cross-sections. Appendix A contains a printout of the survey data and narrative field notes for all surveyed locations. Spreadsheets, documents and site photographs are included in Appendix C (digital files.)

GPS coordinates were collected for the benchmark, channel centerline and cross-section end points. These points were converted to GIS shapefiles and are also included in Appendix C for future reference.

FIGURE 2.1 FIELD SURVEY LOCATIONS



Section 3 – Hydrologic Model Update

SNOWMELT MODEL CONVERSION

Elm Creek Watershed was previously modeled using TR-20, a public-domain program developed by the Natural Resources Conservation Service (NRCS) in the 1980's. The Elm Creek model calculated snowmelt runoff; therefore land cover characteristics were not included in the input. For this channel study, the TR-20 model was transferred to HydroCAD, a proprietary program that provides expanded options and a graphical working format.

Additional input variables were estimated to complete the transfer to HydroCAD. The model was adjusted to provide elevation continuity between reaches and ponds; therefore use of the model in greater detail will require field verification of elevation inputs. Assumed channel dimensions were also added to replace the generalized reach routing parameters used in the TR-20 model.

The conversion process was verified by comparing input and output values at each node within the old and new models. This verification process is summarized in Table B-1 in Appendix B. The transferred model closely parallels the performance of the TR-20 source model.

CURRENT CONDITIONS HYDROLOGY

To facilitate modeling of variable rainfall events, the snowmelt model was expanded to include land cover characteristics for the current watershed. Land uses were compiled from Minnesota Land Cover Classification System data (MN Department of Natural Resources) for Medina, Maple Grove, Champlin, Dayton, Hassan and Rogers, and Metropolitan Council 2000 Generalized Land Use data for Corcoran and Plymouth. Land uses from these data sets were grouped and combined in a single land cover map for the watershed, shown in Figure 3.1.

Soil mapping was obtained from the NRCS *Soil Survey of Hennepin County Minnesota*, and the corresponding Soil Survey Geographic (SSURGO) database. Land uses and soil types were then combined to generate composite runoff curve numbers (capability of land to absorb rainfall) within each sub-basin in the watershed. Time of concentration values were taken directly from the TR-20 snowmelt model.

Table B-2 in Appendix B provides a summary of area and curve number for each sub-basin. GIS shapefiles for land cover, soil type and curve number are included in Appendix C for future reference. With land cover characteristics, the updated hydrologic model provides current watershed runoff estimates for any user-defined rainfall event.

FIGURE 3.1 ELM CREEK WATERSHED - CURRENT LAND COVER