

## **DRAFT TECHNICAL MEMORANDUM**

**TO:** Mr. James Wisker and Mr. Michael Hayman, Minnehaha Creek Watershed District

**FROM:** Todd Shoemaker, P.E., C.F.M.  
Mike Panzer, P.E.

**DATE:** November 1, 2013

**SUBJECT:** 325 Blake Road Market Analysis Pollutant Loading Study

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### **INTRODUCTION**

The purpose of this memorandum is to summarize a pollutant loading study Wenck Associates, Inc. (Wenck) conducted for the Minnehaha Creek Watershed District (MCWD). MCWD retained Wenck to evaluate the potential total phosphorus (TP) load reduction due to MCWD rules in the next 30 years and compare that reduction to a planned MCWD capital project in the same area.

### **BACKGROUND**

MCWD recently acquired the Cold Storage property at 325 Blake Road in Hopkins, MN (Figure 1). MCWD plans to construct a regional water quality treatment practice on the parcel. A feasibility study conducted by Wenck (2013) recommends construction of a filtration basin on the property and estimates TP reduction by 181 pounds per year.

MCWD contracted with Maxfield Research (Maxfield) to evaluate the redevelopment timeframe and future land use of parcels within the Cold Storage drainage area. Among the data provided to MCWD and Wenck by Maxfield was existing land use, expected future land use after redevelopment (as anticipated by Maxfield), and a timeline for that redevelopment.

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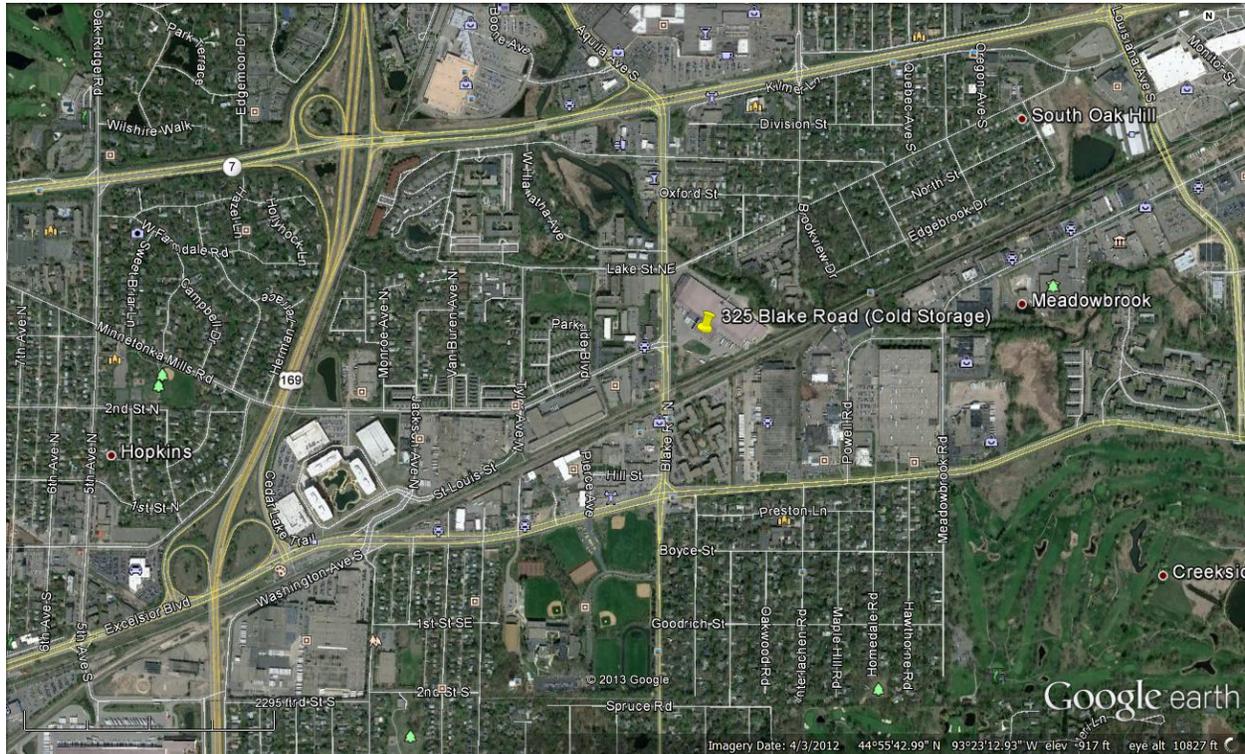


Figure 1. Location of 325 Blake Road (Cold Storage) parcel in Hopkins, MN.

## METHODS

**Existing Conditions.** Using the existing land use and the computer model WinSLAMM, Wenck calculated the existing pollutant loading for each parcel in the Cold Storage drainage area. WinSLAMM is an empirical model that allows the user to calculate TP and total suspended solids (TSS) loading and runoff volume based on very specific land use criteria. Besides differentiating between commercial, industrial, institutional and residential land uses, WinSLAMM loading calculations also differ for flat and sloped roofs; for connected and disconnected impervious; and for streets, parking lots, driveways and sidewalks.

The loading rates used in WinSLAMM for different land uses are based on research developed throughout the Midwest Region. The software also ties phosphorus loading to sedimentation rates because half of the total phosphorus in runoff is attached to suspended solids (Pitt et al.). Using the database of measured runoff, WinSLAMM calculates the total runoff and pollutant loads from the identified watershed by routing a hydrograph (also generated from regional historic data) through the series of land uses and control structures. Compared to the P8 water quality computer model, WinSLAMM requires a much larger amount of input data but is a useful tool for a parcel-scale analysis.

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Using Maxfield's report, Wenck found land use in the watershed to be broken down as shown in Table 1. Other land use consists right-of-way and bike paths.

**Table 1. Land-use breakdown in the Cold Storage watershed.**

Land Use	Total Acres	Percent of Total Land in Study Area	Impervious Acres	Percent of Landuse that is Impervious
Residential	102.14	34%	36.53	36%
Commercial	70.37	23%	26.40	38%
Industrial	112.96	39%	80.76	69%
Other	13.23	4%	1.49	11%
<b>Total</b>	<b>298.70</b>	<b>100</b>	<b>145.18</b>	<b>49%</b>

Future Conditions. Wenck evaluated Maxfield's expected future land use condition and redevelopment timeline. Based on parcel area and the existing impervious area, Wenck predicted which MCWD stormwater management requirements would apply for each parcel and the subsequent pollutant load and runoff volume reductions as a result of the stormwater management requirements.

MCWD stormwater management requirements vary by the type of land use, size of site, amount of disturbance, and amount of added or reduced impervious surface. Based on these variables, the stormwater management requirements in the study area are listed in Table 2.

**Table 2. MCWD stormwater management requirements due to predicted future development in the study area.**

Performance Standard	Pollutant Reduction	Applicability
None	None	No change in land use
Best Management Practices	10% runoff volume, TSS & TP	Site size < 1 ac, or sites that reduce or don't change impervious and disturb < 40% of site
Volume Control	87% volume, 86% TSS, 78% TP	Sites that reduce or don't change impervious and disturb > 40% of site
Volume Control, Phosphorus Control, Rate Control	87% volume, 86% TSS, 78% TP	Sites > 1 acre and increase impervious

The pollutant reduction values for volume control and volume control, phosphorus control and rate control in Table 1 were obtained from the Capitol Region Watershed District *Statement of Need and Reasonableness* (2005). These values assume infiltration of runoff from the first inch of rainfall on impervious surfaces.

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## RESULTS

Existing Conditions. WinSLAMM predicts the existing Cold Storage drainage area produces 273 pounds per year TP, 122,908 pounds per year TSS and an annual runoff volume of 308 acre-feet. The predicted amount of TP is greater than that reported in the Wenck feasibility study (201 lb/yr) for two reasons:

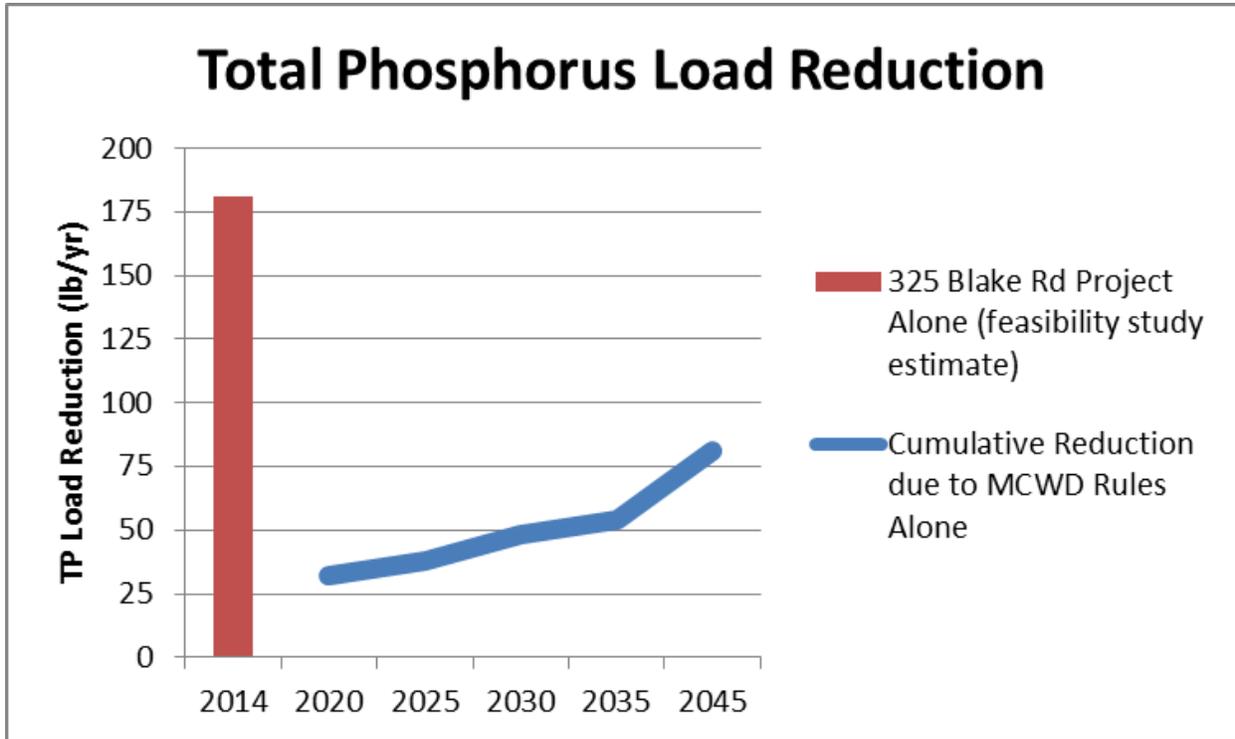
1. The Wenck feasibility study assumed an average loading factor of 0.75 lb/ac/yr for all impervious surfaces. This was acceptable as a planning document, but the project has now moved beyond that scale in order to better estimate loading and subsequent costs and benefits. As described above, WinSLAMM predicts pollutant loading based on each type of impervious surface: for example, loading from the Cold Storage site itself is 1.27 lb/ac/yr; loading from residential areas is as low as 0.6 lb/ac/yr; and loading from industrial areas is over 2 lb/ac/yr.
2. The total area draining to the Cold Storage site was reported as 267.6 ac in the feasibility study. The total area provided by Maxfield is 298.7 ac.

Pollutant Load Reduction. Based on the Maxfield future redevelopment predictions, Wenck calculated pollutant loading in year 2045 as 188 pounds per year TP, 86,633 pounds per year TSS, and an annual runoff volume of 228 acre-feet per year. These values are reduced from existing values due to MCWD stormwater management requirements. TP loading is reduced by 85 pounds per year, TSS loading by 36,275 pounds per year, and volume by 80 acre-feet per year. The feasibility study conducted by Wenck found that the Cold Storage project is estimated to reduce TP by 181 pounds per year. A graphical comparison of these reduction techniques can be seen in Figure 2.

To accomplish these reductions, Wenck estimated the amount of land needed to develop stormwater control measures for each property based on the performance standard that would apply. For sites that require volume control (including those that also require phosphorus and rate control), Wenck assumed three percent of the site's impervious area would be used for stormwater management. On sites that require best management practices, one percent of the site's impervious area would be used for stormwater management. Based on these assumptions, the amount of land needed for stormwater management throughout the Cold Storage drainage area is approximately 4.0 acres. For comparison, the *Stormwater Management Feasibility Study for 325 Blake Road North, Hopkins, MN* estimates the area of the on-site filtration basin as 3.3 acres.

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**Figure 2. Predicted total phosphorus (TP) load reduction as a result of the 325 Blake Road project and MCWD rules associated with future redevelopment.**

Cost Analysis. Implementing stormwater management on each site requires a significant cost for each developer. The Capitol Region Watershed District estimates that volume control practices cost approximately \$30,000 per acre of impervious surface. If redevelopment ultimately results in disturbance of 40 to 70% of the study area, this will result in approximately 60 to 100 acres of new or reconstructed impervious surface. This will cost property owners between \$2,000,000 and \$3,000,000 (excluding maintenance costs) to implement these practices, which is approximately \$23,500 to \$35,300 per pound of phosphorus removal. By comparison, the per-pound cost of TP removal for the Cold Storage project is \$13,800 based on a TP load reduction of 181 pounds per year and a total cost of \$2,495,000 (excluding maintenance costs).

**RECOMMENDATIONS**

Wenck recommends that the MCWD proceed with final design of the Cold Storage capital project. This study demonstrates that the Cold Storage project provides immediate TP load reduction and is more cost effective than waiting for practices to be constructed as redevelopment occurs.

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If the project is constructed, future load reductions as a result of MCWD rules are still necessary. These load reductions will further reduce TP loading to Minnehaha Creek and Lake Hiawatha and improve the treatment efficiency and possibly reduce the maintenance frequency of the Cold Storage project.

**REFERENCES**

*Statement of Need and Reasonableness*. Capitol Region Watershed District. 2006.

*Stormwater Management Feasibility Study for 325 Blake Road North, Hopkins, MN*. Wenck Associates, Inc. June 2013.

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