



## Memorandum

**To:** Board of Managers, Nine Mile Creek Watershed District  
**From:** Janna Kieffer  
**Subject:** Lake Edina- Evaluation of Water Levels  
**Date:** July 10, 2015  
**c:** Kevin Bigalke, Nine Mile Creek Watershed District Administrator  
Bob Obermeyer, Barr Engineering Co.

### Background

Lake Edina is an approximately 23-acre lake located south of 70<sup>th</sup> Street and east of Trunk Highway 100 (T.H. 100) in the city of Edina. Lake Edina receives stormwater from the outflow from Lake Cornelia and runoff from its direct watershed. Figure 1 shows the 1,365-acre drainage area to Lake Edina, including the 971-acre Lake Cornelia watershed and 394 acres of direct tributary area. The Lake Cornelia watershed is primarily comprised of commercial (including the Southdale Shopping Center area), highway, and high and low density residential land use. The Lake Edina direct watershed is primarily low density residential land use. The normal elevation of Lake Edina is controlled by a weir structure at elevation 822 Mean Sea Level (MSL). Discharge from Lake Edina flows through a 36-inch storm sewer system underneath T.H. 100 and into the North Fork of Nine Mile Creek.

In the past, the Southdale Shopping Center pumped groundwater through their heating and cooling system. The continuous discharge from the system flowed to Lake Cornelia through the City's storm sewer system, and ultimately to Lake Edina. Based on historic records, the Southdale cooling water totaled approximately 30 to 40 million gallons of water per year, ranging from 1.0 million to 6.8 million gallons per month. In 2011, the Minnesota Department of Natural Resources (MDNR) did not renew the Southdale groundwater appropriation permit, which required Southdale to abandon the use of groundwater in their heating and cooling system and eliminate the discharge of cooling water to Lake Cornelia and downstream Lake Edina.

### Spring 2015 Conditions

During the spring of 2015, water levels in Lake Edina were well below typical springtime lake levels. The attached photos depict the low lake levels observed on April 17, 2015 by Barr staff. Continued low lake levels throughout April and early-May prompted lakeshore residents to express concern to the City and Nine Mile Creek Watershed District (NMCWD). In turn, Barr was asked to conduct a water balance analysis for Lake Edina to evaluate the reason(s) for the low springtime water level conditions.

## Study Objectives

The objectives of the Lake Edina water balance were to gain a better understanding of the water level fluctuations in the lake and determine if the low 2015 springtime water levels were a result of lower-than-average spring snowmelt or other factors such as the elimination of the Southdale cooling water discharge.

## Methodology

A water balance spreadsheet model was developed that tracks daily inflows to and outflows from the lake. Inflows of water to the lake included direct precipitation, watershed runoff from the area directly tributary to Lake Edina, discharge from upstream Lake Cornelia, and Southdale cooling water (for years prior to 2011). Outflows from the lake included evaporation from the lake surface, discharge from the outlet structure, and seepage losses. A P8 watershed loading model, originally developed as part of the City of Edina Comprehensive Water Resources Management Plan and later adapted for the NMCWD Lake Cornelia Use Attainability Analysis, was used to estimate watershed runoff and discharge from Lake Cornelia. Hourly precipitation data from the Minneapolis/St. Paul International (MSP) Airport was used to generate runoff. Discharge from the Lake Edina outlet structure was estimated using a rating curve developed based on XP-SWMM modeling results that account for tailwater conditions from the North Fork of Nine Mile Creek.

The water balance model was used to predict preliminary daily water levels based on estimated inflows and outflows. Through comparison of preliminary water level predictions with observed lake levels, the rate of seepage of water from the lake was estimated and the discharge rating curve was adjusted. Figure 2 shows the predicted water levels in Lake Edina in comparison with the observed water levels for the time period of April 2004 through June 2015. While the predicted water levels do not match up exactly with observed water levels at times throughout the modeling period, the water balance model provides a reasonable approximation of water levels throughout the past decade. Numerous factors can result in differences between the predicted and observed water levels, including differences in precipitation between Lake Edina and the MSP airport, timing of modeled versus actual snowmelt runoff, variation in seepage rates as localized groundwater levels fluctuate, variation in discharge from upstream Lake Cornelia, changes in the rate of Southdale Cooling water discharge, and impacts of Nine Mile Creek water levels on surface discharge from Lake Edina.

## Study Conclusions

Results of the Lake Edina water balance indicate that low water levels in the spring of 2015 were primarily a result of the lower-than-average snowpack during the winter of 2014-2015, which yielded less snowmelt runoff than typical years. Since mid-May, water levels in Lake Edina have rebounded, with a June 26, 2015 water level observation of elevation 821.9 MSL, just below the normal water level of the lake.

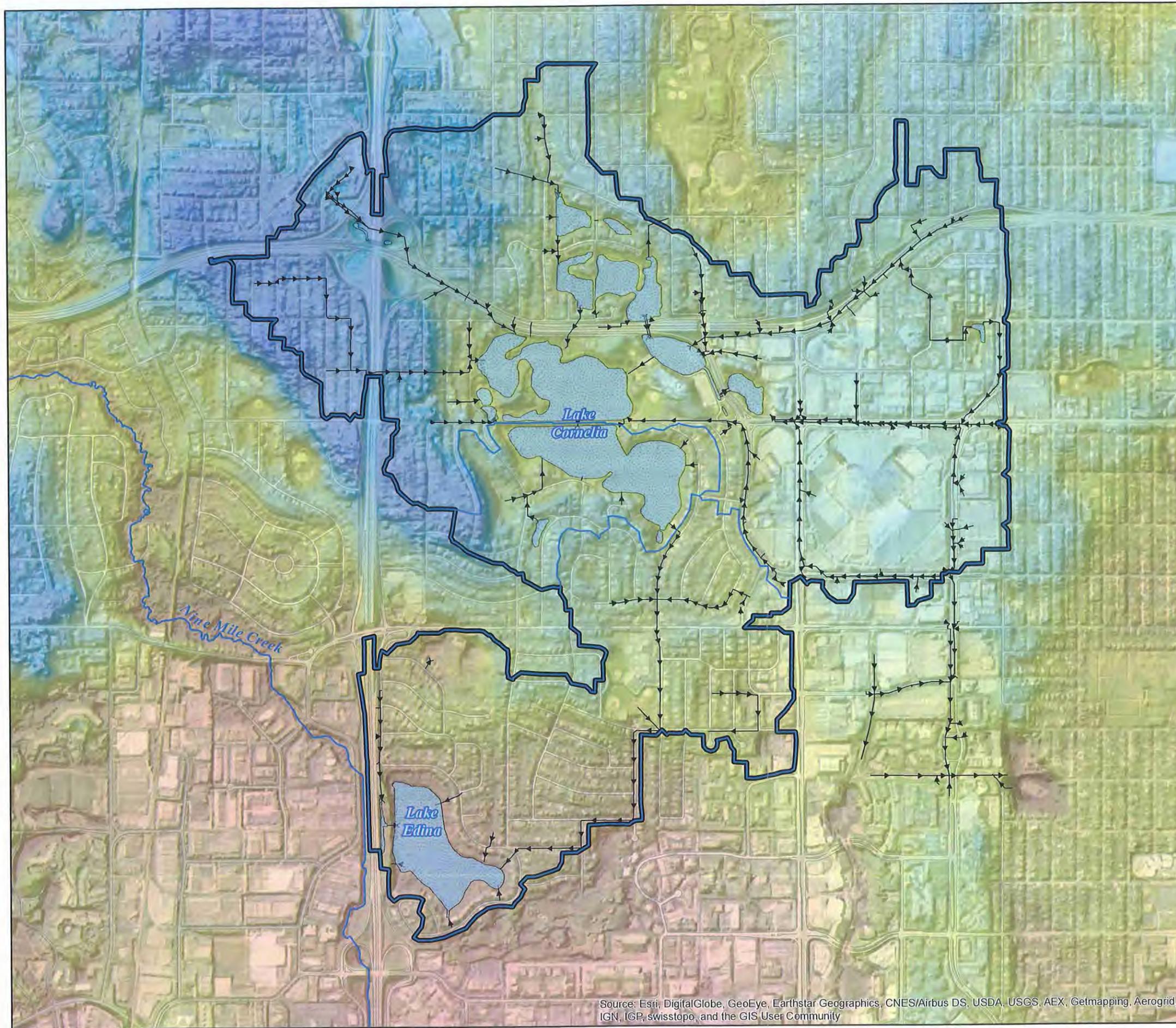
The impact of the discontinuation of the Southdale cooling water discharge on Lake Edina water levels was also evaluated using the water balance model. Figure 3 shows the predicted water levels with discontinuation of the Southdale cooling water discharge in 2011 in comparison with predicted water levels if the Southdale discharge was continued through 2015. Model results indicate that continuation of

Southdale cooling water discharge through 2015 results in periods where higher water levels are maintained for longer durations (notably the fall of 2013 and 2014), but does not prevent the decline of water levels that often occurs during the winter months.

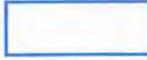
Based on the lake level observations and water balance modeling, it appears that Lake Edina has a seepage rate of approximately 10-12 inches per month. The North Fork of Nine Mile Creek is located approximately 400 feet west of Lake Edina, with a creek bottom elevation of approximately 817 MSL near the storm sewer outfall from Lake Edina. Given the proximity of the lake to the creek, the minimal difference in water surface elevation, and the observed seepage, it is likely that localized groundwater elevations and associated seepage rates from Lake Edina are highly influenced by the creek.

### **Study Recommendations**

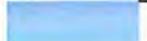
- Continue monthly monitoring of lake levels in Lake Edina
- Install a continuous lake level monitor in Lake Cornelia (South) prior to future water quality study of Lake Edina to better track inflows from Lake Cornelia
- Conduct a field survey of the Lake Edina outlet to verify existing conditions and inspect for potential debris that would modify the normal outlet elevation or restrict discharge



**Legend**

-  Major Watersheds
-  Tributary Drainage Area to Lake Edina
-  Creek/Stream
-  Lake/Wetland
-  Trunk Storm Sewer

**Surface Elevation**

-  High : 965.596
-  Low : 812.027

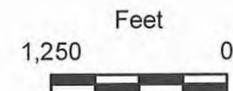


Figure 1

LAKE EDINA WATERSHED  
 Lake Edina Water Balance  
 Nine Mile Creek Watershed District  
 Edina, Minnesota

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

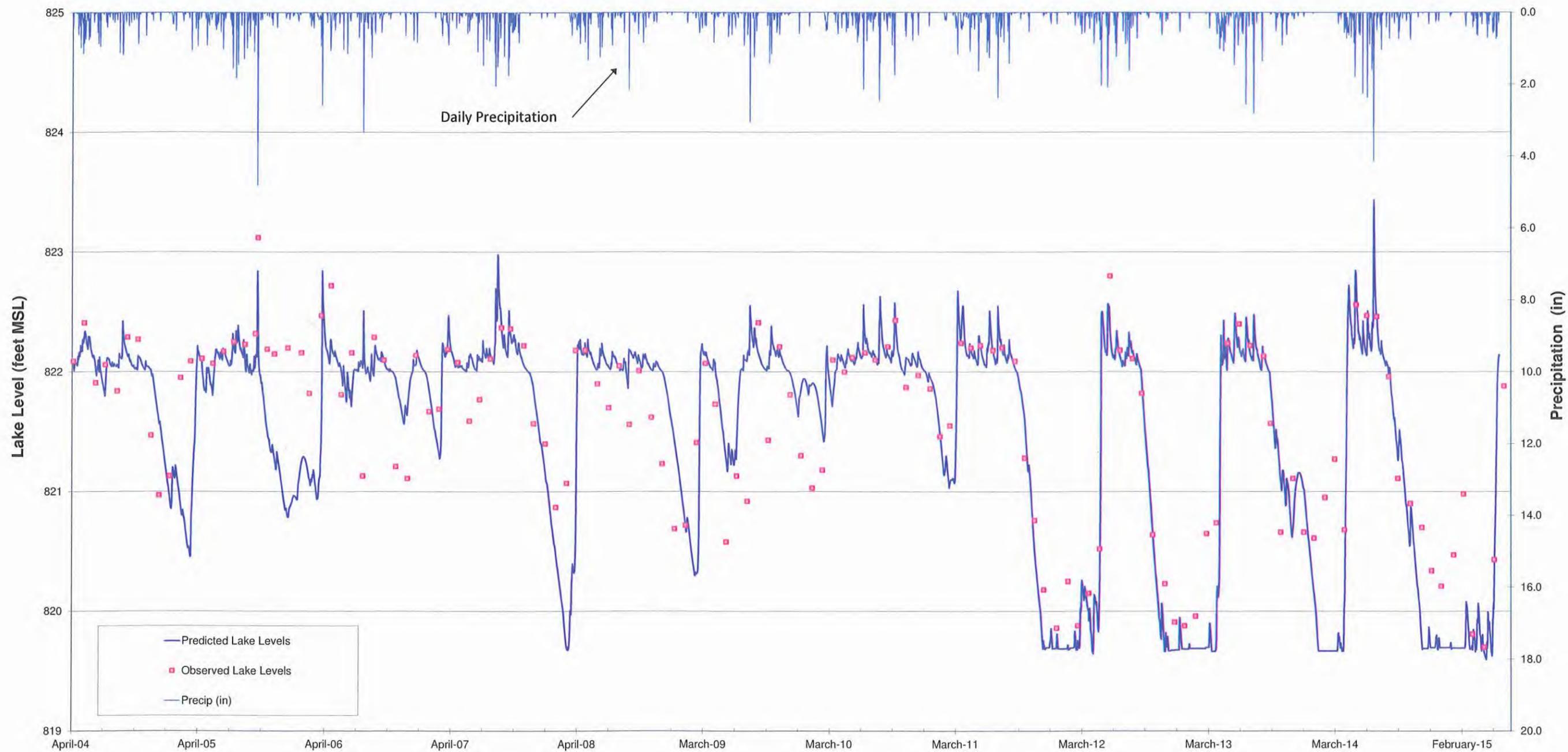


Figure 2. Comparison of Predicted and Observed Water Levels Lake Edina, Minnesota

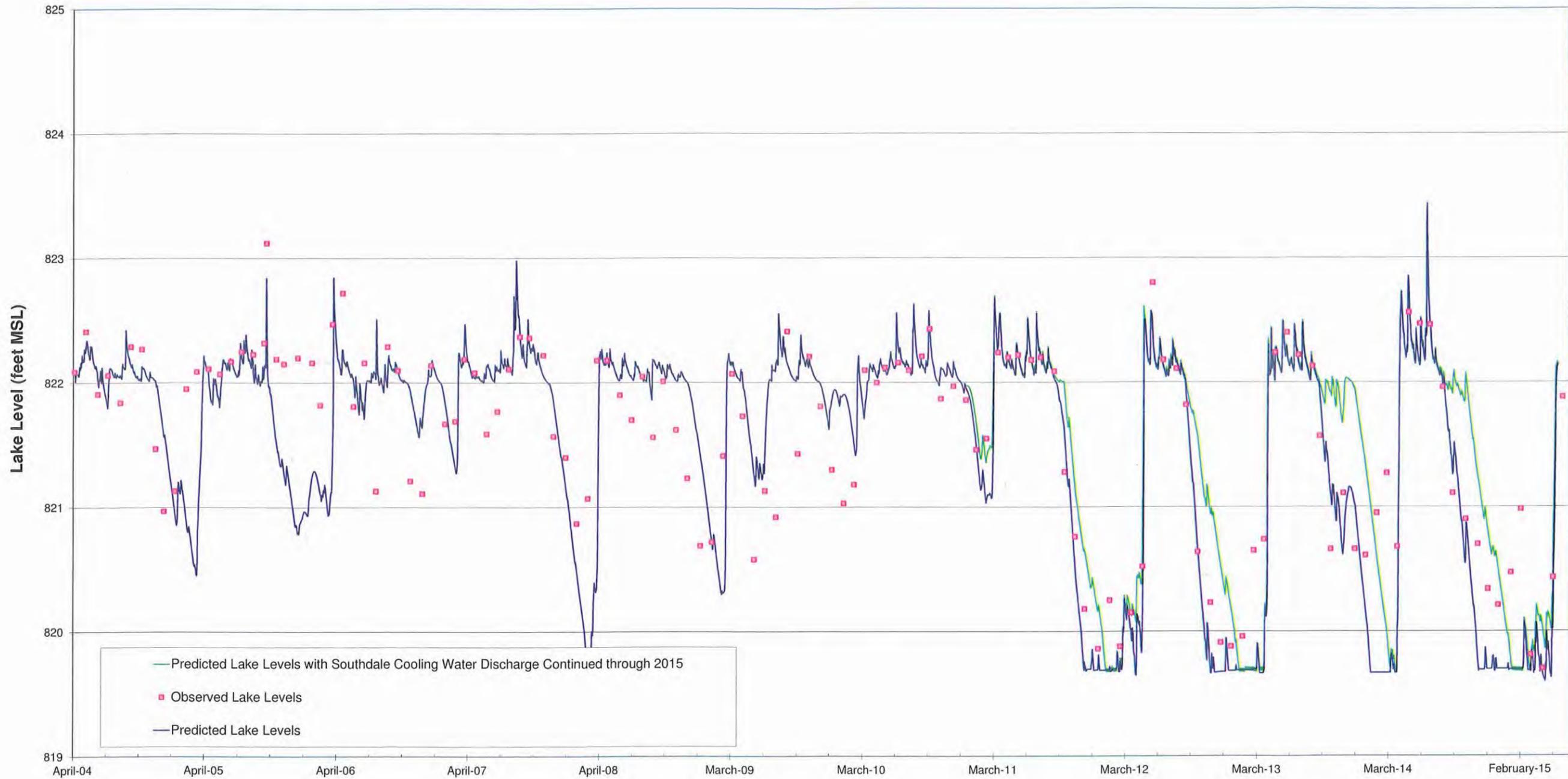


Figure 3.  
 Comparison of Predicted Water Levels With and Without  
 Southdale Cooling Water Discharge Continued through 2015  
 Lake Edina, Minnesota

**Photos**







