City of Lino Lakes
Environmental Board Meeting

October 25, 2017
6:30 p.m.

AGENDA

1. Call to Order

2. Approval of Agenda

3. Approval of Minutes

4. Open Mike

5. Action Items

   A. Public Hearing NE Drainage Area CSMP

6. Discussion Items

   A. Wollan's Park Wetland Bank Status Report. Jason Husveth
   B. Recycling Updates

7. Adjourn

CITY OF LINO LAKES
ENIVORMENTAL BOARD MINUTES

DATE	**: September 27, 2017**
TIME STARTED	**: 6:30 P.M.**
TIME ENDED	**: 7:54 P.M.**
MEMBERS PRESENT	**: Steve Heiskary, Paula Andrzejewski, Nancy Klebba, Liz Kaufenberg, Alex Schwartz, John Sullivan**
MEMBERS ABSENT	**: Shawn Holmes**
STAFF PRESENT	**: Marty Asleson, Madelyn Pelon**

Pre meeting Wollan's Park Wetland Restoration at 5:30PM

1. CALL TO ORDER AND ROLL CALL:

Chair Heiskary called the Lino Lakes Environmental Board meeting to order at 6:30 p.m. on September 27, 2017.

2. APROVAL OF AGENDA

The Agenda amended

ADD under Discussion Items Item B. Emerald Ash Borer

Ms. Andrzejewski made a MOTION to approve amended agenda. Ms. Klebba seconded the motion. Motion carried 6 - 0

5. APPROVAL OF MINUTES:

August 30, 2017

Mr. Sullivan made a MOTION to approve the August 30, 2017 Meeting Minutes with a few changes. Ms. Andrzejewski seconded the motion. Motion carried 6 - 0

6. OPEN MIKE

Mr. Heiskary declared Open Mike at 6:34 p.m. There was no one present for Open Mike.

Open Mike closed at 6:35 p.m.

7. ACTION ITEMS

A. 2040 Comprehensive Plan Update, WSB & Associates

a. Local Surface Water Management Plan

Ms. Thompson from WSB is working on the draft of the Local Surface Water Management section of the 2040 Comprehensive plan. Ms. Thompson reviewed the Goals and Policies section of the plan.

She wanted to make sure everything the Environmental Board wanted is contained in the section. In addition, to get feedback to see if there were any questions or comments from the board.

Ms. Thompson discuss the high points of the update using Power Point that included information on:.

- Water Rate & Quality Issues, Goals & Policies
- Water Quality Issues, Goals & Policies
- Wetland Management Issues, Goals & Policies
- Floodplain Management Issues, Goals & Policies
- Public Ditch System Issues, Goals & Policies
- Groundwater Management Issues, Goals & Policies
- Natural Resources Issues, Goals & Policies
- Erosion and Sediment Control Issues, Goals & Policies
- Regulations, Permitting and Reporting Issues, Goals & Policies
    - Monitoring, Maintenance, and Inspection Issues, Goals & Policies
        - Public Participation, Information and Education Issues, Goals & Policies
        - Financing Issues, Goals & Policies

Following the presentation, the following was discussed:

- Plan was to generic
- Promote wise water usage
- Provide necessary funds to plan and collaborate for conserving, protecting our water supply and infrastructure
- Collaborate to produce better results by working together
- Use our Wellhead Protection Plan to protect ground water from pollution
- Reduce chloride contamination of groundwater
- More public education

Ms. Thompson did mentioned that the Environmental Board would be able to review the 2040 Comprehensive plan again. She also said if you have ideas or

thoughts about the comp plan please email her so she can make additions to the plan.

8. DISCUSSION ITEMS

A. Recycling Updates

a. Simple Recycling

It was postively received by City Council at the September 5 work session. The city attorney is looking over the contract.

b. Organics

Ms. Pelon has emailed the four haulers to see if there is interest in curbside organics pick up. Walters is interested in starting a service for Lino Lakes residents. Ms. Pelon thought the cost would be $80.00/year which would included the blue bags for the organics which is then place with your other garbage. She will give us an update.

B. Emerald Ash Borer

Mr. Heiskary read an articile on the Emerald Ash Borer that was published in the September 14, 2007 newspaper. The article had to do with the five species of Ash trees that are on the brink of extinciton due to the Emerald Ash Borer.

9. ADJOURNMENT

Ms. Andrzejewski made a MOTION to adjourn the meeting at 7:54 p.m. Ms. Klebba seconded motion. Motion carried 6 - 0

Respectfully submitted,
Mary Fogarty
Office Specialist

ENVIRONMENTAL BOARD
AGENDA ITEM 5A

STAFF ORIGINATOR: Marty Asleson

MEETING DATE: October 25, 2017

TOPIC: Public Hearing: NE Drainage Area Comprehensive Stormwater Management Plan

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BACKGROUND

The Northeast Lino Lakes Drainage Improvement Project is in the northeast area of Lino Lakes bounded by Main Street to the south, the City of Hugo to the east, and Peltier Lake to the west, and Rehbein Street to the north. The site is approximately 1,350 acres and largely agricultural or undeveloped within the City of Lino Lakes.

The surface water in this area is nearly landlocked, inhibiting site improvements and future development in line with the City of Lino Lakes' 2030 Comprehensive Plan. The area was historically landlocked until the installation of agricultural field drains in the early 20th century. These agricultural drains are now at capacity and are incompatible with the proposed land uses within the watershed. In addition, these agricultural drains do not provide any water quality benefits to the receiving waterbody, Peltier Lake, an impaired water of the state.

As allowed under RCWD Rule C.5(f), this Comprehensive Stormwater Management Plan (CSMP) is presented as an alternative means to meet the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) for the development of this area, which will be done in several phases, using a regional stormwater system. This CSMP is intended to streamline RCWD permit approvals for future development in the Northeast Lino Lakes Drainage Improvement area, as well as to distribute the regional treatment benefits amongst future developments, so no single project is burdened with more challenges in meeting the RCWD requirements.

Projects in this area will conform to the design requirements in the CSMP detailed in Section 8, or will be allowed to demonstrate how the stormwater runoff will be treated to meet the applicable RCWD Rules.

Katie Thompson of WSB will go through the plan, and this will be followed up with a public hearing to solicit comments on the plan.

ENVIRONMENTAL DIRECTION

Discussion of the CSMP and Public Hearing

ATTACHMENTS

1. Northeast Lino Lakes Drainage Area – Comprehensive Stormwater Management Plan

NORTHEAST LINO LAKES DRAINAGE AREA

COMPREHENSIVE STORMWATER MANAGEMENT PLAN

Final Draft October 19, 2017

Prepared for:
City of Lino Lakes
600 Town Center Parkway
Lino Lakes, MN 55014

WSB PROJECT NO. 02029-790

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List of Appendices

EXECUTIVE SUMMARY

The Northeast Lino Lakes Drainage Improvement Project is in the northeast area of Lino Lakes bounded by Main Street to the south, the City of Hugo to the east, Peltier Lake to the west, and Rehbein Street to the north. The site is approximately 1,350 acres and is largely agricultural or undeveloped within the City of Lino Lakes.

The surface water in this area is nearly landlocked, inhibiting site improvements and future development in line with the City of Lino Lakes' 2030 Comprehensive Plan. The area was historically landlocked until the installation of agricultural field drains in the early 20th century. These agricultural drains are now at capacity and are incompatible with the proposed land uses within the watershed. In addition, these agricultural drains do not provide any water quality benefits to the receiving waterbody—Peltier Lake—an impaired water of the state.

As allowed under Rice Creek Watershed District (RCWD) Rule C.5(f), this Comprehensive Stormwater Management Plan (CSMP) is presented as an alternative means to meet the requirements of Rule C.6 (Water Quality Treatment) and Rule C.7 (Peak Stormwater Runoff Control) for the development of this area, which will be done in several phases, using a regional stormwater system. This CSMP is intended to streamline RCWD permit approvals for future development in the Northeast Lino Lakes Drainage Improvement area, as well as to distribute the regional treatment benefits amongst future developments, so no single project is burdened with more challenges in meeting the RCWD requirements.

Projects in this area will conform to the design requirements in the CSMP detailed in **Sections 6 through 8**, or will be allowed to demonstrate how the stormwater runoff will be treated to meet the applicable Lino Lakes ordinances and current RCWD Rules and requirements.

1 INTRODUCTION

The City of Lino Lakes submits this CSMP to the RCWD for the Northeast Lino Lakes Drainage Improvement Project. The goal of this CSMP is to document how future development within the project area will meet RCWD Rule C requirements using a regional stormwater management approach. This CSMP presents the approach for meeting the water quality treatment and peak stormwater runoff control requirements. The RCWD Rules adopted at the time of printing were effective on January 1, 2017.

This CSMP documents the existing and proposed stormwater-related impacts for the Northeast Lino Lakes Drainage Improvement Project. The main components of this plan include a detailed analysis of the existing site conditions and limitations, as well as a conceptual design of the proposed regional best management practices (BMPs). These BMPs have been modeled based on recently-submitted development plans, ghost plats and discussions with landowners. The goal of this plan is to document a conceptual design that will guide future development of the area, while alleviating stress on the existing drainage system, and meeting the intent of the RCWD Rules C.6 and C.7.

1.1 Project Location

The Northeast Lino Lakes Drainage Improvement Project is in Anoka County primarily within the City of Lino Lakes, Minnesota, but includes portions of the City of Hugo. The site is a 1,350-acre area that is bounded by Main Street to the south, the City of Hugo to the east, Peltier Lake to the west, and Rehbein Street to the north (**Figure 1, Appendix A**). The City of Lino Lakes is the largest municipality by percentage of area within the RCWD and project site is located entirely within the RCWD boundary in the Middle Rice Creek planning region (RCWD 2016).

Land use in this area is predominantly agricultural (**Figure 2, Appendix A**). Much of this watershed currently drains to the south to Clearwater Creek via field drains. Clearwater Creek is impaired for aquatic life and has had a history of significant bank erosion problems. Additional information and discussion of existing conditions is provided in **Section 2**.

1.2 Drainage Areas and Resources of Concern

The CSMP area is located within the Clearwater Creek Drainage Area and the Peltier Lake Resource of Concern (RCWD Drainage System Data 2017) (**Figure 3, Appendix A**). The area is currently serviced by three Anoka County drainage systems:

- Anoka County Ditch (ACD) 72 in the north
- Judicial Ditch (JD) 2 in the north
- ACD 55 in the south

ACD 72 and JD 2 discharge directly to Peltier Lake, while ACD 55 enters Clearwater Creek (also known as JD 3), to the south before discharging to Peltier Lake. The remainder of the study area surface flows directly to Peltier Lake.

Peltier Lake has been listed as an impaired waterbody within the greater Anoka Chain of Lakes since 2002 for aquatic recreation, with the main pollutant identified as excess phosphorus from watershed runoff and internal loading (Minnesota Pollution Control Agency 2013). RCWD has an average total phosphorus concentration within the lake of 224 µg/L, average chlorophyll *a* of 107.0 µg/L, and a transparency of 1.0 meters, all indicating relatively opaque water and poor water quality (RCWD 2016). Additionally, the Anoka Chain of Lakes has limited flood storage capacity (Houston Engineering, Inc. 2013). Any improvements to the drainage system will need to show no adverse impacts to receiving waters, as defined below:

- No damage to structures, buildings, and infrastructure as a result of an increase in flooding (increased water surface elevations, velocities, or number of days of inundation);

- No property damage or increased maintenance costs resulting from an increase in the amount of erosion, bank failure, or accelerated sedimentation;
- No decrease in water quality resulting from an increase in phosphorus and sediment loads; and
- No permanent loss of the use of flood storage volume during the flood peak within the Anoka Chain of Lakes.

1.3 Water Resources Design Criteria

A number of documents, studies, and guidelines are already in place to guide the development within the CSMP study area. It is expected that portions of the study area may be developed by the Cities of Lino Lakes and Hugo, Anoka County, Minnesota Department of Transportation (MnDOT), and yet to be determined private developers. The following sections outline the supporting planning, studies and regulations, leading to the development of this CSMP, as well as regulatory agencies' roles during development.

1.3.1 Lino Lakes Comprehensive Plan

The City of Lino Lakes' 2030 Comprehensive Plan (Lino Lakes 2010) has defined the Land Use Plan (**Figure 4, Appendix A**) which was prepared in conjunction with the Resource Management System Plan (**Figure 5, Appendix A**), the City's Parks, Natural Open Space/Greenways and Trail System Plan (**Figure 6, Appendix A**), and the City's Local Surface Water Management Plan to manage and protect community resources. As part of this process, the Land Use Plan was analyzed to determine impacts to the natural environment and identify appropriate mitigation measures, which are identified in the Resource Management System Plan. This process ensures that adequate infrastructure is in place to accommodate the community's growth and that natural resources are protected. The ultimate purpose of this Land Use Plan is to implement the community vision developed by the Citizen Vision Committee, and to manage future growth in an efficient manner while protecting Lino Lakes' valuable natural resource and community assets.

The land use plan is in the process of being updated for the City's 2040 Comprehensive Plan. While it is not expected to change significantly, the Northeast Drainage area is expected to play a prominent role in the Local Surface Water Management Plan and the prioritization of future infrastructure funding.

1.3.2 Northeast Lino Lakes Alternative Urban Areawide Review

The I-35E Corridor Alternative Urban Areawide Review (AUAR) was a proactive, citizen driven environmental review process that comprehensively assessed the environmental impacts of development in a 4,600-acre growth area in the City (**Figure 7, Appendix A**) and was completed in 2005. The overarching goal of the whole project was to balance development with natural resource conservation. The result of the AUAR process was a Mitigation Plan that documents the actions the City will take to mitigate environmental impacts. The foundation of the Mitigation Plan is the Conservation Design Framework (CDF). The goals of the CDF are to:

1) Conserve the most ecologically significant natural resources within the AUAR area
2) Protect ecologically sensitive natural resources from adjacent land uses by through buffering
3) Connect ecologically significant resources via multifunctional greenway corridors - corridors for wildlife, trails, and surface water management features

The AUAR defined Stormwater Management Areas to address stormwater issues by implementing an integrated system of bio-swales, wet prairie, and wetlands aligned in series to effectively reduce post-development runoff rates and volume, as well as to enhance water quality.

1.3.3 Resource Management Plan

In partnership with RCWD, the City of Lino Lakes developed a Resource Management Plan (RMP) to provide a watershed-based approach to wetland management and evaluation of the Clean Water Act Section 404 permit applications. As part of the RMP, a Wetland Preservation Corridor was identified, linking high priority wetlands to enhance multiple wetland functions and reducing habitat fragmentation; it has been incorporated within this CSMP study.

1.3.4 Special Area Management Plan

Prepared for the City of Lino Lakes and the RCWD, this Special Area Management Plan (SAMP) facilitates the U.S. Army Corps of Engineers' Clean Water Act Section 404 permit evaluations within the subwatersheds addressed by the SAMP and prioritizes future restoration projects and management of aquatic resources. Areas within the CSMP study area were identified as having medium to high restoration potential. It also recognized that the existing ACD 55 and ACD 72 tile systems are ineffective for traditional urban runoff volumes and were preliminarily scoped for wetland restoration and volume credits for future development. The Peltier RMU ACD 72 and ACD 55 tile systems scored second and third, respectively, of all preferred projects for their roles in urban runoff management and a conceptual restoration plan was developed. Due to the uncertain nature of future development, the SAMP suggested to wait until a more-concrete development plan was presented for the area (Lino Lakes 2010).

1.3.5 Regulations and Policies

A great number of rules, ordinances, regulations and policies are expected to govern the development of land within the CSMP study area. The following is not intended to be an exhaustive list, but provide a summary of the prominent stormwater and flood control policies.

1.3.5.1 Main Street Shoppes RCWD Permits #13-029 and #13-040

In 2013, a landowner within the CSMP study area applied for a RCWD permit to develop an 18.5-acre lot located at the northeast corner of Main Street (CSAH 14) and Otter Lake Road in Lino Lakes. Under this permit, stormwater treatment was provided for the street development and a future commercial site. RCWD informed the applicant that the downstream drainage system (ACD 55 Branch 8) was constrained and under 2008 Rule C.5(d), adverse impact requirements must be met by one of the following methods:

- Meet the volume control standard of 1.1-inches over the proposed impervious surface (Rule C.6) and show no increase in runoff volume for the 2-year 24-hour event (6,511 cubic feet per Rule C.5(d)); or
- Reduce the peak runoff rate for the 2-year 24-hour design event to 0.03 cfs, as determined by the District Engineer (2008 Rule C.5(d) and Houston Engineering 2013), from the proposed 1.5 cfs. This would result in a nearly 99 percent reduction in peak rate from the existing runoff rate of 2.5 cfs.

The developer chose to meet the volume control option and designed a water reuse system to irrigate 0.65 acres of existing agricultural land with water from the Nationwide Urban Runoff Program (NURP) pond, installed for rate control. The irrigation pool volume was established between elevations 908 and 911, to be drawn down over three weeks of irrigation during a period without rainfall. This volume (6,607 cubic feet) is equivalent to the increase in volume generated from the 2-year 24-hour design event. As companion permit to RCWD #13-029, #13-040 approved the development of the present-day McDonald's site on the commercial site and used the volume reduction from Permit #13-029 to offset the proposed impervious surface.

1.3.5.2 RCWD Resolution #2015-31

The RCWD Board of Managers approved Resolution #2015-31 on September 23, 2015, recognizing the limitations on the existing regional drainage system in the Northeast Lino Lakes area and affirming that should the proposed projects be constructed as proposed, the RCWD would be able to issue permits in line with their Rules and standards based on this CSMP.

1.3.5.3 City of Lino Lakes Overlay District

The City of Lino Lakes will update Chapter 1011: Stormwater, Erosion, and Sediment Control of the City Code to reflect the requirements of this CSMP, define the Northeast Drainage Overlay District, and the regulations and policies for development within it.

1.3.5.4 Rice Creek Watershed District Rules

The RCWD Rules in effect at the time of writing this CSMP are dated January 1, 2017. Future rule revisions will require detailed review of this CSMP for compatibility with the proposed rule revisions and may require updates to the CSMP itself.

1.3.5.5 Minnesota Statute 103E

Minnesota Statute 103E defines the drainage authority powers, benefitted party rights and procedures for petitioning maintenance, alterations, diversions, impoundments and abandonment of the ditch and tile system in the CSMP area. The RCWD is the drainage authority for ACD 55 and ACD 72 and any proposed modifications or abandonment of the ditch system will require a petition by the benefitted landowner to begin the public hearing proceedings.

1.3.6 Regulatory Requirement Overview

The approval of this CSMP does not waive any regulatory requirements for development within the study boundaries, it simply provides a framework to review development projects within this area as part of a greater regional system. All future projects must obtain all necessary and required permits prior to construction from the appropriate regulatory agencies.

2 EXISTING CONDITIONS

The CSMP area is almost entirely within the City of Lino Lakes, however the CSMP does include upstream contributing land from the City of Hugo. This section provides a brief overview of the existing conditions used in the conceptual design of this CSMP.

2.1 City of Hugo

The City of Hugo contributes 215 acres of the nearly 1,350-acre area and has an existing flow rate of 50.3 cfs into the City of Lino Lakes and ACD 55 drain tile system. Hugo has existing stormwater infrastructure and storage related to commercial and residential development east of Elmcrest Avenue. These sites were permitted under the City of Hugo's permit program, followed RCWD rules, and instituted a more stringent rate control standard of 0.1 cubic feet per second (cfs) per acre limit on the 100-year event (Hugo 2002).

2.2 City of Lino Lakes

The majority of the CSMP area is located within the City of Lino Lakes and serviced by the agricultural drain tile systems, ACD 55 and ACD72. ACD 55 and ACD 72 drain tiles were designed to provide drainage for agricultural lands and are already at capacity, limited by the existing crossings under I-35E. The City of Lino Lakes has also identified this area as being a Runoff Sensitive Area for stormwater rate and volume control given the limitations of the existing ditch system (Lino Lakes 2005). Low points in the area can remain inundated for weeks following the 100-year event due to the limited pipe capacity in the County Ditch systems. Because the low-lying areas take so long to drain back to their normal water levels, the next rain event may compound flooding beyond the 100-year flood level.

Constraints of the drain tile system have limited landowners' ability to develop their land consistent with the City of Lino Lakes' Comprehensive Plan. Development must meet RCWD Rule C for Stormwater Management Plans, which includes water quality and rate control. However, since the existing drainage system is at capacity under existing conditions, RCWD has established reduced peak rates for the maximum discharge rate under development on all sites draining to ACD 55 and ACD 72 (Houston Engineering, Inc. 2013). Unfortunately, the soils underlying most the area are poorly suited for infiltration, have a high groundwater table, or are wetlands, all of which limit stormwater management opportunities and the volume reduction requirement of Rule C.

As discussed in **Section 1.3.5.1** there is a small commercial development in Lino Lakes at Main Street and Otter Lake Road. Due to the limited capacity of the existing ACD 55 Branch 8 drain tile system, the McDonald's development was required to install a water reuse and spray irrigation system in addition to meeting the standard RCWD rules to reduce the stormwater runoff volume for the 2-year event from their site (RCWD Permits #13-029 and #13-040) and alleviate some of the burden on ACD 55 Branch 8.

2.3 Existing Land Uses

Most the land in the CSMP area is agricultural or undeveloped (**Table 2-1** and **Figure 2, Appendix A**) (Metropolitan Council 2017) and drains to one of the county ditch systems via unbuffered surface inlets.

Table 2-1. Metropolitan Council Generalized Existing Land Use within the CSMP

Land Use	Hugo	East	Central	West	Lino Total	CSMP Total
Agricultural	59.2	385.8	400.6	98.4	884.8	944.1
Farmstead	4.7	7.5	0.0	0.0	7.5	12.2
Institutional	0.5	0.0	0.4	0.0	0.4	0.9

Land Use	Hugo	East	Central	West	Lino Total	CSMP Total
Major Highway	0.0	13.6	24.8	0.0	38.4	38.4
Park, Recreational, or Preserve	15.4	0.0	0.0	0.0	0	15.4
Retail and Other Commercial	0.0	1.5	0.0	0.0	1.5	1.5
Single Family Attached	21.2	0.0	0.0	0.0	0	21.2
Single Family Detached	32.5	6.0	7.8	4.2	18.0	50.5
Undeveloped	82.1	119.5	13.7	49.9	183.1	265.2
Total Areas	**215.6**	**533.9**	**447.3**	**152.5**	**1,133.7**	**1,349.3**

2.4 Soils and Geology

Soils in the CSMP area are mapped as primarily loam and sandy loam. Depressions and areas adjacent to Peltier lake are mapped as peat or muck (**Figure 8, Appendix A**) (Soil Survey Staff 2017).
The surficial geology of the CSMP area is loamy till with peat and muck around Peltier Lake and in isolate pockets (**Figure 9, Appendix A**). The loamy till is from the New Ulm formation and is chiefly loam texture with unsorted sediment. Peat and muck was deposited in the quaternary era and is composed of partially decomposed organic matter deposited in marshes. Peat and muck also includes fine grained organic matter laid down in ponded water and marl (Setterholm 2013).

2.5 Groundwater

Groundwater within the CSMP is generally close to the ground surface. The Minnesota Department of Natural Resources (MnDNR) modeled much of the project area as having a depth to the water table as 0-10 feet (MnDNR 2017) and the NRCS soils data shows the annual minimum depth to groundwater table to be less than 2.3 feet below the ground surface for the entire study area (NRCS 2017). Groundwater reaches the surface at Peltier Lake, the wetlands around Peltier Lake and within closed depressions.

2.6 Surface Water Hydrology

Surface water in the study area ultimately drains to the Rice Creek Chain of Lakes through Peltier Lake, Rice Creek, Hardwood Creek (Jurisdictional Ditch 2), Clearwater Creek (Jurisdictional Ditch 3), Anoka County Ditch 55 and Anoka County Ditch 72, as shown on **Figure 1, Appendix A**.

2.6.1 I-35E Construction

I- 35E, running from Burnsville, through Lino Lakes, and ending in Columbus was constructed in 1970. The construction of the four-lane highway effectively separated the East and Central CSMP regions by placing fill to elevate the roadway through swamp sections (Minnesota Department of Transportation 1972). While the two regions remain connected by the 10-inch and 12-inch drain tiles on ACD 55 Branch 8 and Main Trunks, Interstate I-35E acts as a berm preventing overland flows from flowing downstream from the east to west.

2.6.2 Drain tile systems

The ditch and tile network was developed to manage stormwater runoff and to keep fields dry during the growing season. They have significantly altered drainage basins and changed the pre-settlement subwatershed divides. The existing capacity of the tile networks are insufficient to convey stormwater runoff from future development within the Northeast Drainage Area.

Alterations to the ditch and drain tile system must go through legal proceedings as defined under Minnesota Statutes 103E, to ensure ditch capacity and landowner drainage rights are preserved. The properties that are serviced by the ditch system are entitled to the benefits of the drainage system and, in effect, own the drain tile system under Minnesota Statutes 103E. The drainage of the systems must be

maintained in perpetuity, until such time the assessed land owners choose to petition RCWD for the abandonment of the drain tile on their property.

2.6.3 Wetlands

There are a number of wetlands within the CSMP area. Wetlands range in size from an extensive wetland complex that fringes Peltier Lake to wetlands in small farm field depressions. Wetlands range in type from seasonally flooded depressions to shallow and deep marshes. The quality of wetlands likely varies. Some of the wetlands appear to be farmed and are likely degraded. Wetland delineations have been completed for the West and Central regions of the CSMP area (WSB & Associates, Inc. 2017 and Kjolhaug Environmental Services 2014).

2.7 Cultural Resources

A cultural resources survey was completed for the West region of the CSMP area (Blondo 2016). The survey reviewed historical records and past surveys. An archaeological systematic surface survey was conducted and concluded in the finding of no previously unidentified cultural resources. No additional cultural materials were identified during this survey. No further investigation or evaluation of the project area is required at this time.

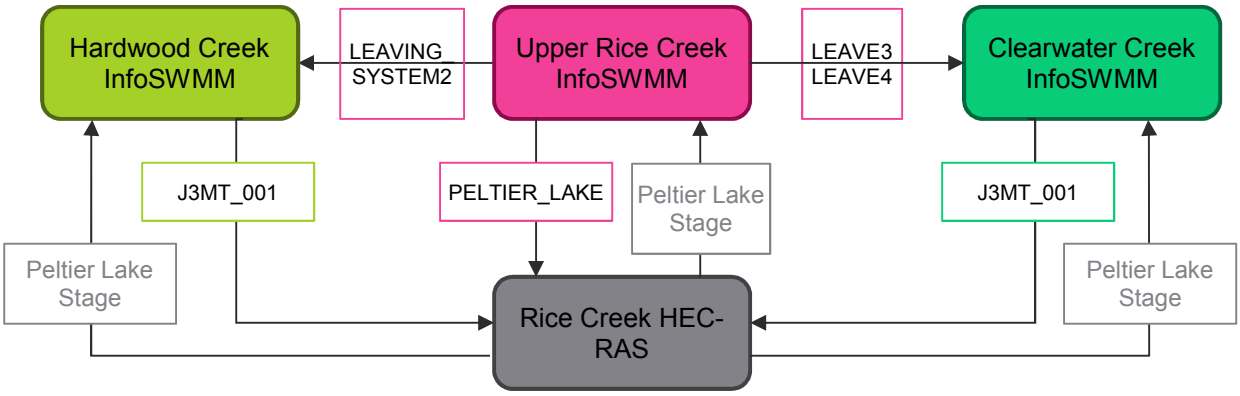
3 HYDROLOGIC AND HYDRAULIC ANALYSES

The models used in the CSMP have been derived from the RCWD district-wide modeling efforts for Rice Creek. InfoSWMM models for Upper Rice Creek (URC), Hardwood Creek (HWC), and Clearwater Creek (CWC) (**Figure 11, Appendix A**) were refined to be divided along the boundaries of the study area (**Figure 12, Appendix A**). The hydrographs from the revised InfoSWMM models were incorporated into the Rice Creek unsteady state HEC-RAS model.

The models used in the CSMP have been derived from the RCWD District-wide modeling efforts for Rice Creek. InfoSWMM models for URC, HWC, and CWC were refined to include the boundaries of the study area. The hydrographs from the revised InfoSWMM models were incorporated into the Rice Creek unsteady state HEC-RAS model.

There are several interactions between the different models, **Figure 1** highlights the model interactions, the following discussion attempts to clearly state the specific changes made to each of the received RCWD models.

Figure 1. Hydraulic Model Interactions



3.1 Hydrology

A total of 40 subcatchments from the three RCWD InfoSWMM models are part of the Northeast Lino Lakes CSMP. To compare the CSMP existing and proposed conditions directly, subcatchments along the CSMP boundary were required to be subdivided. The InfoSWMM and HEC-RAS models were updated to reflect this change, and the revised existing conditions modeling is discussed in detail by model below.

For all the InfoSWMM models, the hydrologic inputs for the 40 subcatchments were revised based on recent land use data from the City of Lino Lakes, City of Hugo, and the Minnesota Land Cover Classification System (MLCCS) (Table 3-1). All areas were recalculated based on the GIS data and weighted curve numbers and depression storage were recalculated for all the subcatchments within the CSMP area as well (Table 3-2).

Table 3-1. Existing Land Uses, Impervious Percentages, Curve Numbers, and Total Phosphorus Concentrations.

LAND USE DESCRIPTION [1]	ESTIMATED IMPERVIOUS PERCENTAGE [2]	A [3]	B [3]	C [3]	D [3]	TP [4] [MG/L]
AGRICULTURAL	0%	67	78	85	89	0.32
FARMSTEAD	10%	59	74	82	86	0.46
INSTITUTIONAL	65%	49	69	79	84	0.18
MAJOR HIGHWAY	75%	83	89	92	93	0.25
PARK, RECREATIONAL, OR PRESERVE	10%	39	61	74	80	0.04
RETAIL AND OTHER COMMERCIAL	75%	89	92	94	95	0.22
SINGLE FAMILY ATTACHED	65%	77	85	90	92	0.40
SINGLE FAMILY DETACHED	40%	51	68	79	84	0.30
UNDEVELOPED	0%	30	58	71	78	0.04

[1] Metropolitan Council Generalized Land Use 2016

[2] Lino Lakes 2030 Comprehensive Plan

[3] NRCS National Engineering Handbook

[4] MPCA Minnesota Stormwater Manual

Table 3-2. Existing Land Uses by Region (in acres)

Land Use Description	HUGO	EAST	CENTRAL	WEST	TOTAL
Agricultural	59.2	385.8	400.6	98.4	944.1
Farmstead	4.7	7.5	0.0	0.0	12.2
Institutional	0.5	0.0	0.4	0.0	0.9
Major Highway	0.0	13.6	24.8	0.0	38.4
Park, Recreational, or Preserve	15.4	0.0	0.0	0.0	15.4
Retail and Other Commercial	0.0	1.5	0.0	0.0	1.5
Single Family Attached	21.2	0.0	0.0	0.0	21.2
Single Family Detached	32.5	6.0	7.8	4.2	50.5
Undeveloped	82.1	119.5	13.7	49.9	265.2
Totals	**215.6**	**534.1**	**447.3**	**152.6**	**1,349.6**

3.2 Upper Rice Creek

The URC model was updated to split existing catchments MRC_RC_001 into MRC_RC_001 and MRC_RC_001.5 along Peltier Lake Drive on the west CSMP boundary. Existing catchment MRC_RC_002 was also split into two subcatchments (MRC_RC_002 and MRC_RC_002.5) along the southwest CSMP boundary. A nearly five-acre discrepancy in drainage area between the received model input and GIS data was noticed at CWC_RC_PELTIER_008. As a precaution, all drainage areas were recalculated, but this subcatchment appeared to be an anomaly.

The URC model was re-run and the inflow hydrograph at junction PELTIER_LAKE was exported from InfoSWMM and inserted into the existing conditions Rice Creek HEC-RAS model at storage area SA

Peltier Lake. The URC model contains three interactions between the CWC and HWC InfoSWMM models. **Table 3-3** summarizes the URC model interaction results.

Table 3-3. Upper Rice Creek Model Outflow Summary [cfs]

URC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
LEAVING_SYSTEM2				
RCWD 2014	NOT INCLUDED	NOT INCLUDED	13.5	4.5
Revised Existing	0	1.7	30.0	5.9
Difference [cfs]	*0*	*1.7*	*16.5*	*1.4*
LEAVING_SYSTEM3				
RCWD 2014	0	0	0.6	0
Revised Existing	0	0	0.7	0.6
Difference [cfs]	*0*	*0*	*0.1*	*0.6*
LEAVING_SYSTEM4				
RCWD 2014	0	0	0	0
Revised Existing	0	0	0.1	0
Difference [cfs]	*0*	*0*	*0.1*	*0*
PELTIER_LAKE				
RCWD 2014	1,389.5	2,417.5	4,515.7	883.7
Revised Existing	1,448.8	2,523.1	4,726.6	896.4
Difference [cfs]	*59.3*	*105.6*	*210.9*	*12.8*

3.3 Clearwater Creek

The CWC model was updated to split existing catchment ACD55MT_007 into ACD55MT_007 and ACD55MT_007.5 along the south central CSMP boundary. Inflows from the Upper Rice Creek model at LEAVE3 and LEAVE4 were input at storage areas SA55MT_009 and SA55MT_028.

The CWC model was re-run and the inflow hydrograph at junction J3MT_001 was exported from the InfoSWMM model and replaced in the existing conditions Rice Creek HEC-RAS model at RS 125483.9. A summary of the CWC model interactions is provided in **Table 3-4**.

Table 3-4. Clearwater Creek Model Outflow Summary [cfs]

CWC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
J3MT_001				
RCWD 2014	201.8	337.8	563.9	446.0
Revised Existing	217.3	350.0	566.0	443.6
Difference [cfs]	*15.5*	*12.2*	*2.2*	*-2.4*

Finally, the CWC model includes the existing flows entering Lino Lakes from Hugo under Elmcrest Avenue. **Table 3-5** summarizes the existing flows entering the CSMP study area.

Table 3-5. City of Hugo Existing Outflows [cfs]

CWC LINK	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
CA55MTL_013	2.7	3.8	5.0	4.3
CA55MTL_012	0.3	1.2	3.6	1.6
CA55MTL_011	1.8	6.8	21.5	6.4
CA55MTL_014	5.2	9.9	16.4	12.5
CA55MTL_014B	0.0	0.8	5.9	2.8
TOTAL HUGO	**10.0**	**22.5**	**52.4**	**27.6**

3.4 Hardwood Creek

The HWC model was updated to split existing catchment SMT_002 into SMT_002 and SMT_002.5. The soils data for subcatchment SMT_004A was updated to reflect the subcatchment hydrologic input data. The HWC model was unstable when first run, the initial water surface elevation at the outlet node OUT (El. 885.67) was higher than the next two upstream nodes' starting water surface elevations, creating a backflow from Peltier Lake into Hardwood Creek. The lower HWC model nodes were adjusted, per **Table 3-6**, to prevent water from backing up into the system at the start of the model runs.

Table 3-6. HWC Initial Water Surface Elevation Corrections

INFOSWMM NODE	RCWD 2014 INVERT ELEV	RCWD 2014 INITIAL WSEL ELEV.	REVISED INVERT ELEV	REVISED INITIAL WSEL ELEV.
OUT	860	885.67	882	885.67
JMT_001	882.44	885.19	882.44	885.67
JMT_002	881.66	885.18	881.66	885.67
JMT_003	883.1	883.96	883.1	885.96

INFOSWMM NODE	RCWD 2014 INVERT ELEV	RCWD 2014 INITIAL WSEL ELEV.	REVISED INVERT ELEV	REVISED INITIAL WSEL ELEV.
JMT_004	883.25	886.11	883.25	886.11
JMT_005	883.64	886.114	883.64	886.114
JMT_006	884.49	886.357	884.49	886.357

Finally, the inflow hydrograph from the URC model node LEAVING_SYSTEM2 was input at junction node JM_016 in the HWC model as ACD72_LEAVE2_100YR. The HWC model was re-run and the total inflow hydrograph at junction JMT_001 was exported from InfoSWMM and imported into the existing conditions HEC-RAS model at RS 125004.6.

Table 3-7. Hardwood Creek Model Outflow Summary [cfs]

HWC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
JMT_001				
RCWD 2014	80.7	202.5	685.6	932.0
Revised Existing	99.8	214.3	669.3	903.2
Difference [cfs]	*19.1*	*11.7*	*-16.3*	*-28.8*

3.5 Rice Creek HEC-RAS

The existing conditions HEC-RAS model was updated with the inflow hydrographs from all the InfoSWMM models and re-run to establish the existing water surface elevations in Peltier Lake for the CSMP study and the results are summarized in **Table 3-8**.

Table 3-8. Peltier Lake Stage Summary [ft]

	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
PELTIER LAKE STAGE				
RCWD 2014	885.73	886.28	887.20	887.53
REVISED EXISTING	885.76	886.41	887.22	887.51
DIFFERENCE [FT]	*0.03*	*0.13*	*0.02*	*-0.02*

Due to the relatively minor changes in stage at Peltier Lake, it was assumed that re-importing the stage hydrograph into the InfoSWMM models would result in negligible changes to the overall InfoSWMM results. As a result, the Peltier Lake stage data was not updated in the revised existing conditions InfoSWMM modeling and the models presented above were used as the baseline existing conditions. Detailed input and result tables from the existing conditions modeling may be found in **Appendix B**.

4 PROPOSED IMPROVEMENTS

The City of Lino Lakes proposed to improve drainage in the Northeast Area by developing a regional stormwater management plan, accomplished through improving stormwater conveyance, adding water quality BMPs, and managing stormwater runoff rate and volume control. The proposed improvements will benefit not only the landowners within the Northeast Area, but also the downstream waterbodies by improving stormwater runoff water quality, increasing to the extent feasible water reuse and irrigation practices, and maintaining existing flood elevations throughout the Rice Creek Chain of Lakes.

The proposed improvements to the CSMP area include:

- Replacement of the existing culvert under Peltier Lake Drive
- Open channel system from Peltier Lake Drive to 20th Avenue, including a public greenway corridor with additional water quality features, such as iron-enhanced filtration or biofiltration within the floodplain areas
- Regional storage facilities, phased with future developments, to provide flood control storage and additional water quality treatment opportunities
- Outlet control structures with gates on selected regional storage facilities to minimize the risk of adversely impacting flood levels on Peltier Lake
- New 60-inch storm drain crossing under I-35E to the proposed regional storage facility sited between 20th Avenue and I-35E
- Construction of new storm sewer along the future Otter Lake Road extension
- Preservation of the agricultural drain tile system to maintain drainage rights until all land within the study area develops. Drain tile may be abandoned or realigned as development progresses, at the benefitted landowners' expense and discretion.

A conceptual layout and system details are provided in **Appendix C**. Additional design requirements proposed for land development within the CSMP area are outlined in **Sections 6** through **8**.

5 PROPOSED CONDITIONS MODELS

After establishing the revised existing conditions models to use as a baseline for comparison in **Section 3**, we developed the proposed conditions modeling in cooperation with RCWD to ensure compatibility with the District modeling procedures. The proposed conditions reflect future land uses in the study area, assumed site grading to drain the study area to the central storm drainage system, assumed private disconnection of agricultural drain tile within the study area, and conceptual regional stormwater storage BMPs connected by a new open conveyance system and revised outlet to Peltier Lake (**Figure 13, Appendix A** and **Appendix C**).

5.1 Hydrology Updates

Curve numbers were estimated using the MLCSS, City of Lino Lakes, and City of Hugo 2030 projected land uses, NRCS soil data, recent wetland delineations, and the National Wetland Inventory. The following assumptions were made:

1. Hugo and Lino Lakes will be fully built out per their 2030 approved land use plans
2. Future development will be graded to drain to a regional BMP; this may include the use of drain tile or imported fill to improve drainage in clay soils. A hydrologic soil group type B was assumed for new development.
3. Existing wetlands within the RCWD Wetland Management Corridor (WMC) will be preserved or restored per RCWD Rules within the WMC in Lino Lakes. Many of the existing wetlands have been drained and are currently farmed. By protecting and improving the quality of the existing wetlands, the proposed curve number is reduced in several subcatchments.

Tables 5-1 and **5-2** provide a summary of the land uses and curve numbers used in the modeling:

Table 5-1. Proposed Land Uses, Impervious Percentages, and Curve Numbers

LAND USE DESCRIPTION [1]	MAX. IMPERVIOUS PERCENTAGE [1]	A [2]	B [2]	C [2]	D [2]	TP [3] [MG/L]
Large lot residential	10%	59	74	82	86	0.46
Low density residential	40%	47	65	76	82	0.50
Medium density residential	50%	54	70	79	84	0.30
High density residential	65%	70	81	87	90	0.40
Commercial	75%	86	91	93	94	0.22
Industrial	75%	81	88	91	93	0.25
Public semi-public	65%	39	61	74	80	0.18
Vehicular right-of-way	75%	83	89	92	93	0.25
Mixed use	75%	77	85	90	92	0.22
Wetland management corridor	0%	30	58	71	78	0.03

[1] Lino Lakes 2030 Comprehensive Plan

[2] NRCS National Engineering Handbook

[3] MPCA Minnesota Stormwater Manual

Table 5-2. Proposed Land Uses by CSMP Region (in acres)

LAND USE DESCRIPTION	HUGO	EAST	CENTRAL	WEST	TOTAL
Right-of-Way	0	14.1	27.9	2.5	44.5
Large Lot Residential	46.1	0.2	0	0	46.3
Low Density Residential	150.6	0.3	0	42.8	193.7
Medium Density Residential	3.9	0.1	15.9	51.1	71
High Density Residential	0	0	0	18.9	18.9
Commercial	0.3	82.1	1	0	83.4
Industrial	0	346.7	29.9	0	376.6
Mixed Use	0	0	353.7	0	353.7
Public/Quasi-Public	14.7	0	0	0	14.7
Wetland Protection Zone	0	90.6	18.9	37.3	146.8
Totals	215.6	534.1	447.3	152.6	1,349.6

Like the revised existing conditions, the proposed models were updated and model interactions were evaluated.

5.2 Hydraulic Updates

5.2.1 Upper Rice Creek InfoSWMM – Proposed Conditions

The URC model contains the vast majority of the CSMP study area, so this model was updated to include the re-routed ACD55 subcatchments from the CWC model and the re-routed ACD72 subcatchments from the HWC model (**Table 5-3** and **Figure 13, Appendix A**). It was assumed that future site grading would eliminate the existing outflows into each of these systems.

Table 5-3. Proposed Upper Rice Creek Outflows

URC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
LEAVING_SYSTEM2				
Revised Existing	0	1.7	30.0	5.9
Proposed	0	0	0	0
Difference [cfs]	*0*	*-1.7*	*-30.0*	*-5.9*
LEAVING_SYSTEM3				
Revised Existing	0	0	0.7	0.6
Proposed	0	0	0	0
Difference [cfs]	*0*	*0*	*-0.7*	*-0.6*
LEAVING_SYSTEM4				
Revised Existing	0	0	0.1	0

URC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
Proposed	0	0	0	0
Difference [cfs]	*0*	*0*	*-0.1*	*0*
PELTIER_LAKE				
Revised Existing	1,448.8	2,523.1	4,426.6	896.4
Proposed	1,069.3	2,032.3	4,128.4	856.4
Difference [cfs]	*-379.5*	*-490.8*	*-598.2*	*-40.1*

With the reconfiguration of the URC model now including the re-routing of ACD 55 main trunk and Branch 8, the flows entering from the City of Hugo are now included in this model. A summary of the Hugo flows entering the City of Lino Lakes is presented in **Table 5-4**.

Table 5-4. City of Hugo Proposed Outflows [cfs]

URC LINK	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
CA55MTL_013	2.0	3.5	5.0	4.3
CA55MTL_012	0.3	1.2	3.3	1.6
CA55MTL_011	2.1	7.3	17.7	6.4
CA55MTL_014	3.6	8.3	13.9	12.5
CA55MTL_014B	0.0	0.1	3.9	2.8
TOTAL HUGO	**8.0**	**20.4**	**43.8**	**27.6**

The flows leaving the City of Hugo are somewhat decreased from the existing conditions due to the conversion of agricultural lands to low density residential, as the slightly lower curve numbers provides more infiltration and less runoff.

5.2.2 Clearwater Creek InfoSWMM – Proposed Conditions

The CWC model was updated to reflect the re-routing of ACD 55 mainline and Branch 8 into the CSMP study area, contained in the URC model discussed above. The result is a minor decrease in flows through the Clearwater Creek system for all design events (**Table 5-5**).

Table 5-5. Clearwater Creek Proposed Outflows

CWC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
J3MT_001				
Revised Existing	217.3	350.0	566.0	443.6
Proposed	219.7	349.0	593.5	439.1

Difference [cfs]	*2.4*	*-1.0*	*27.5*	*-4.5*

5.2.3 Hardwood Creek InfoSWMM – Proposed Conditions

The HWC model was updated to reflect the re-routing of ACD 72 into the CSMP study area, contained in the URC model discussed above. The result is a negligible change in flows through the Hardwood Creek system for all design events (**Table 5-6**).

Table 5-6. Hardwood Creek Proposed Outflows

HWC NODE	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
JMT_001				
Revised Existing	99.8	214.3	669.3	903.2
Proposed	101.5	212.5	669.3	902.9
Difference [cfs]	*1.7*	*-1.8*	*0.02*	*-0.3*

5.2.4 Rice Creek HEC-RAS – Proposed Conditions

The proposed conditions HEC-RAS was updated with the inflow hydrographs from the InfoSWMM models and run to establish the proposed water surface elevations in Peltier Lake for the CSMP study (**Table 5-7**).

Table 5-7. Peltier Lake Stage Summary [ft]

	2-YR 24-HR	10-YR 24-HR	100-YR 24-HR	100-YR 10-DAY
PELTIER LAKE STAGE				
Revised Existing	885.76	886.41	887.22	887.51
Proposed	885.73	886.27	886.98	887.51
Difference [ft]	*-0.03*	*-0.14*	*-0.24*	*0.00*

The detailed input and result tables from the proposed modeling is provided in **Appendix D**.

6 RCWD RULE C REQUIREMENTS

6.1 Rule C Overview

The Northeast Lino Lakes CSMP area is located within a single resource of concern drainage area (**Figure 3, Appendix A**). General drainage patterns as documented in this CSMP will be maintained with any future developments so that stormwater runoff will remain within the Peltier Lake ROC drainage area and be managed to meet RCWD's Rule C requirements.

As allowed for under RCWD Rule C.5(f), this CSMP has been prepared as an alternative means to meet the requirements of Rule C.6 Water Quality Treatment and Rule C.7 Peak Stormwater Runoff Control for the development of the area, which is anticipated to be completed in several distinct phases. The peak runoff control and water quality treatment requirements will be met, in aggregate, for the area as a whole.

6.2 Water Quality Treatment [RCWD Rule C.6]

RCWD's water quality treatment requirements will be met through a variety of measures, including stormwater detention ponds, biofiltration, and infiltration, as is feasible. **Figure 14, Appendix A** shows the locations and suggested types of regional BMPs. It is anticipated that the study area will include water quality treatment trains with sedimentation BMPs located in upland areas designed to remove solids and particulate matter. These will be combined with surface and media filtration to remove dissolved particulates, nitrogen, and phosphorus prior to entering the new system and discharging into the regional BMPs.

Total phosphorus loading under existing and proposed land use conditions was estimated using event mean concentrations from the Minnesota Stormwater Manual (Minnesota Pollution Control Agency 2016). Under existing conditions, the CSMP area contributes approximately 12.6 pounds of total phosphorus annually to Peltier Lake. With the proposed full-build out land uses, in absence of any stormwater treatment, the CSMP area loading would increase to approximately 14.4 pounds per year (**Table 6-1** and **Appendix E**).

Table 6-1. Summary of Total Phosphorus (TP) Loading by Region without Stormwater Treatment

REGION	Area [ac]	Existing TP Load [lb]	Proposed TP Load [lb]	TP Load Change [lb]
HUGO	215.6	0.72	1.36	+0.64
EAST	553.9	4.90	6.43	+1.53
CENTRAL	447.3	5.89	6.30	+0.41
WEST	152.5	1.06	0.31	-0.75
TOTALS	**1,349**	**12.6**	**14.4**	**+1.83**

The proposed land uses in the West region, including the wetland management corridor and medium density residential have a lower total phosphorus concentration (0.03 and 0.3 mg/L, respectively) than the existing land use of agricultural row crops (0.32 mg/L) and contribute to the reduction in the proposed total phosphorus loading. However, as required by RCWD Rule C.6, water quality treatment is a necessary component of development and we expect the TP loading to be reduced significantly with the required stormwater treatment practices in place.

A challenge for the CSMP area will be to infiltrate stormwater to meet the water quality volume reduction in Rule C.6. Review of the CSMP area led to the development of **Figure 15, Appendix A** (Infiltration Suitability). This map was developed using the following four criteria:

1. Located outside of a vulnerable Drinking Water Source Management Area (Minnesota Department of Health 2014);
2. Must have a type A or B hydrologic soil group;
3. Depth to water table greater than 24-inches; and
4. Located outside of the National Wetland Inventory wetlands.

Only 19.3 percent of the CSMP area meet the majority of these four criteria for infiltration. RCWD Rule C.6 requires that, where feasible, infiltration must be used. However, most the CSMP area will need to use alternative BMPs to treat stormwater runoff. For the purposes of this conceptual analysis, we have assumed NURP stormwater ponds, with a TP removal factor of 0.50 will be used. The summary of the required water quality volumes is presented in **Table 6-2**.

Table 6-2. Assumed Water Quality Treatment Summary (Lino Lakes)

Impervious Surface Constructed to Date	38 acres
Proposed Impervious Surface	706 acres
Area Suitable for Infiltration	218.5 ac
Required Volume Reduction [1.1" runoff from impervious]	11.8 ac-ft
Required NURP Volume [2.5" runoff from drainage area]	89.4 ac-ft
Required Water Quality Volume for Lino Lakes Full Build Out	**101.2 ac-ft**
Estimated TP Reduction through Infiltration and Ponding	**60%**
Proposed TP Loading with Stormwater Treatment	**6.62 lbs**

6.2.1 Volume Reduction Practices

As discussed above, Rule C.6 requires that where feasible, infiltration must be provided for stormwater runoff from new and/or reconstructed impervious surfaces. The proposed impervious surface area is based on the City of Lino Lakes 2030 Comprehensive Plan.

Water quality treatment volume required for phosphorus removal is calculated as follows:

$$\textit{Required WQ Treatment Volume [ac-ft]} = A_{impervious} * 1.1 \textit{ inches / TP Removal Factor / 12 in/ft}$$

Infiltration practices are allocated a TP Removal Factor of 1.0.

On-site infiltration is not feasible for most of the CSMP are due to poor soils, high groundwater and the presence of wetlands. Using NRCS soils data and the National Wetland Inventory, only 19 percent of the area may be suitable for infiltration practices within Lino Lakes. As development proceeds within the CSMP area, developers will be required to demonstrate that infiltration is not feasible on-site before utilizing the regional NURP basins or other BMP alternatives (**Appendix F** for infiltration requirements by parcel).

6.2.2 NURP Basins

Stormwater ponds used for water quality treatment must use a TP Removal Factor of 0.5, per Rule C.6, and sized per the NURP criteria, which includes a permanent dead pool sized to store the runoff volume from a 2.5-inch rainfall event of the tributary area.

6.2.3 Additional BMPs for Consideration of Future Development

Additional onsite water quality practices will be encouraged as part of future development, and as part of the Lino Lakes AUAR requirements. The following may be considered, if feasible:

- Stormwater reuse for irrigation – initial estimates indicate that up to 36 acre-feet of stormwater could be used for irrigation purposes over public open spaces, however the actual amount of volume infiltrated will be defined based on RCWD Rule C.6
- Soil amendments – consistent with the RCWD Soil Amendment Guidelines
- Small-scale BMPs such as tree trenches, raingardens, cisterns, etc.
- Mechanical separators
- Media filtration to improve water quality

6.3 Peak Stormwater Runoff Control [RCWD Rule C.7]

All stormwater runoff from the area either surface flows directly to Peltier Lake or is conveyed to the lake via the county ditch system (**Figure 1, Appendix A).** As discussed in **Sections 3** and **5**, InfoSWMM and HEC-RAS models were developed to evaluate the existing discharge rates entering Peltier Lake. The proposed land uses will result in more impervious surface and higher runoff rates and volumes leaving the CSMP study area and entering Peltier Lake. The regional BMPs will include outlet control structures to regulate the flood releases from the BMPs so they do not impact flood levels on Peltier Lake.

6.3.1 Allowable Peak Discharges

Per RCWD Rule C.7, the proposed discharge rates are limited to the existing discharge rates from a site; however, because this area has been identified as a Runoff Sensitive Area, the City will impose a restriction of 0.1 cfs per acre on new private developments for the 100-year peak discharge rate, which is also the same rate requirement the City of Hugo implemented in 2003 as part of their Comprehensive Stormwater Management Plan. This will result in a maximum peak discharge rate from the CSMP area into Peltier Lake of no more than 135 cfs.

Table 6-3. Northeast Lino CSMP Allowable Peak Discharge Rates

Storm Event	Rainfall Depth [in]	Discharge to Peltier Lake [cfs]
2-year 24-hour	2.83	68
10-year 24-hour	4.21	133
100-year 24-hour	7.06	135
100-year 10-day	7.20	135

Future development in the CSMP area must not exceed the NOAA Atlas 14 permitted rates to Peltier Lake, as shown in **Table 6-3**.

6.3.2 Flood Control Storage

To meet the proposed discharge rates, a significant amount of land is needed to provide live storage for flood control. As part of the City's land use practices, the existing wetlands are intended to remain in place where possible and will provide some incidental flood storage capacity. **Table 6-4** shows the live storage assumed for flood reduction used in the modeling.

Table 6-4. Required Live Storage by Region

BMP ID	Estimated Live Storage Required [ac-ft]	Allowable Bounce [ft]	Min. Area for Live Storage [ac]	Max. Release Rate [cfs]
EAST	250	4	63	75
CENTRAL	260	4	65	120
WEST	50	4	13	135
TOTAL	**560**		**141**	**135**

6.3.3 Outlet Control Structures

Each regional NURP pond's water levels will be controlled by an outlet control structure and operable gate. In the event of a 100-year design storm, the gated will be closed to minimize the risk of increasing flood stage on Peltier Lake, the ponds will be sized to include enough live storage to hold the water until the gates are reopened after the flood threat on Peltier Lake has passed. The exact location and design of these facilities will be determined as development in the CSMP area progresses. It will be expected that the storage areas will experience a significant bounce in elevation during the 100-year storm event and will need to be planted with a suitable planting palette that can tolerate periodic inundation to maintain the vegetated buffer around the pond. The estimated peak discharges and timing of the 100-year 24-hour event is shown in **Table 6-5**.

Table 6-5. 100-yr 24-hr Maximum Discharge Rate between Regions

BMP ID	Estimated Peak Discharge [cfs]	Estimated Event Runoff Volume [ac-ft]	Timing of Peak Elevation [hrs. after start of rainfall]
EAST	75	257	77.8
CENTRAL	120	470.2	78.0
WEST	135	526	78.2

The gates will be operated by the City of Lino Lakes and shall be placed to control the release of water from each regional storage facility. Each gate must be closed when Peltier Lake reaches an elevation one foot below the 100-year flood elevation of 887.7 [NAVD88] on the rising limb of the lake stage hydrograph and remain closed until the flood elevation on Peltier Lake recedes below the 100-year flood elevation of 887.7, on the falling limb of the lake stage hydrograph.

6.3.4 Low Floor and Low Entry Freeboard Requirements

The lowest floor and lowest opening of future buildings and structures near the regional BMPs must adhere to the freeboard requirements presented in RCWD Table C6 and Chapter 1011: Stormwater, Erosion, and Sediment Control of the City Code.

7 CSMP STORMWATER MANAGEMENT

7.1 Regional BMP Capacity Analysis

Since the area is not fully developed, it is the goal of this CSMP to lay the framework for future developments within the City of Lino Lakes CSMP area to utilize the regional BMPs to meet the RCWD stormwater management requirements. **Table7-1** summarizes the existing impervious surfaces and the proposed infiltration requirements based on the City of Lino Lakes' Comprehensive Plan land uses (**Figure 4, Appendix A**) and applicable RCWD Rules at the time of development. The details of the water quality volume calculations can be found in **Appendix E**.

Table 7-1. Maximum Impervious Area at Full Development

	Existing Impervious [ac]	Proposed Impervious [ac]
EAST	14.5	332.3
CENTRAL	22.0	317.3
WEST	1.69	56.8
TOTAL	38.1	706.4

As conceptually designed, the regional BMPs provide enough water quality volume to mitigate the proposed impervious surface per the requirements in the RCWD Rule C.6.

7.2 Operation and Maintenance

The outlet control gates will be operated by the City of Lino Lakes and shall be placed to control the release of water from each regional storage facility. The gates will be operated by the City of Lino Lakes and shall be placed to control the release of water from each regional storage facility. Each gate must be closed when Peltier Lake reaches an elevation one foot below the 100-year flood elevation of 887.7 [NAVD88] on the rising limb of the lake stage hydrograph and remain closed until the flood elevation on Peltier Lake recedes below the 100-year flood elevation of 887.7, on the falling limb of the lake stage hydrograph.

The City of Lino Lakes will maintain permanent easements for all regional stormwater facilities to perform routine and periodic maintenance activities as required by their MS4 permit.

8 FUTURE DEVELOPMENT SUBMITTALS

It should be noted that the design standards outlined in this document will only be applied to the parcels in Lino Lakes. Developments within the City of Hugo must obtain permit approvals from their respective government and regulatory agencies independent of this CSMP.

Future developments will be responsible to submit a proposal to the City first. The submittal will document which parcel (or portion of a parcel) will be developed. The application must document that the land use proposed and proposed impervious area are consistent with this CSMP (**Figure 4, Appendix A**) and the planned impervious areas as shown in **Appendix F**. If future developments wish to deviate from the standards outlined in this CSMP, it is the responsibility of the developer to prepare an application documenting the proposed deviation(s) and how that difference will be mitigated.

The developer's application must include:

- Name of the parcel or portion of the parcel(s) proposing development
- Name of the CSMP Region
- Existing and proposed topography and narrative of infrastructure proposed to convey stormwater
- Document the total area for existing and proposed conditions, broken down by pervious and impervious areas
- Document infiltration potential on site based on soil boring data
- Name of the regional BMP (if constructed) to which the proposed project is tributary
- Proposed method of pre-treatment prior to stormwater discharge entering the regional system
- Requested water quality allocations from regional BMP (if constructed) and maximum allocated to proposed development (**Appendix F**)

Developers also must meet current Lino Lakes and RCWD Rules to the extent practicable, including:

- Compliance with maximum post-development discharge rate for the 100-year event to be less than or equal to 0.1 cfs per acre
- Maximize volume reduction practices on site and infiltrate where practicable and in accordance with RCWD Rules
- Compliance with current RCWD Rule C.6 Water Quality

If the development exceeds the CSMP planned impervious area (**Appendix F**), the applicant must demonstrate how the additional runoff will be treated to meet the applicable RCWD rules and does not cause adverse impact as defined below.

- No damage to structures, buildings, and infrastructure as a result of an increase in flooding (increased water surface elevations, velocities or number of days of inundation);
- No property damage or increased maintenance costs resulting from an increase in the amount of erosion, bank failure or accelerated sedimentation;
- No decrease in water quality resulting from an increase in phosphorus and sediment loads; and
- No permanent loss of the use of flood storage volume during the flood peak within the Anoka Chain of Lakes.

If developers choose to exceed the impervious limits or request any other deviations to the assumptions laid out herein, they will be required to address any additional stormwater requirements on that parcel at their own expense to ensure all applicable RCWD rules and requirements are met. Any such BMPs will be considered private and be maintained by, and at the expense of, the owner/developer of the parcel.

8.1 Interim Conditions

The intent of this CSMP is to define the final build-out conditions for the Northeast Lino Lakes Drainage Area; however, it is highly unlikely the entire study area would develop at once. At this point in time, it is anticipated that the proposed stormwater conveyance system would be built from the downstream outlet at Peltier Lake to the east as private landowners choose to develop their property and abandon the agricultural drain tiles. The City will review all proposed development projects in this area against the CSMP design standards and require a detailed hydraulic review of temporary construction conditions from the developer.

It is expected that developers may wish to utilize the existing drain tile system to discharge stormwater until the downstream regional BMPs and outlet are constructed. This hydraulic review will be at the developer's expense, must utilize the modeling presented in this CSMP for consistency, and will summarize the following information:

- Identification of the drain tile system and existing allocation of drain tile capacity
- Incorporation of any watershed changes since the previous modeling was completed, including update of curve numbers, time of concentration, and man-made infrastructure changes
- Current capacity of the drain tile system, reflective of the watershed updates, for the 2-, 10-, and 100-year 24-hour design storms, as well as the 100-year 10-day snowmelt event.
- Proposed discharge rates for the 2-, 10-, and 100-year 24-hour design storms, as well as the 100-year 10-day snowmelt event.
- Identification of any proposed impacts to upstream or downstream benefitted landowners and Peltier Lake

Compliance with the design standards outlined in this CSMP does not alleviate the developer from obtaining all necessary and required permits. It is highly recommended that developers submit permit applications to RCWD and the City of Lino Lakes early to facilitate the design review, especially for any variances or temporary use of the existing drain tile system.

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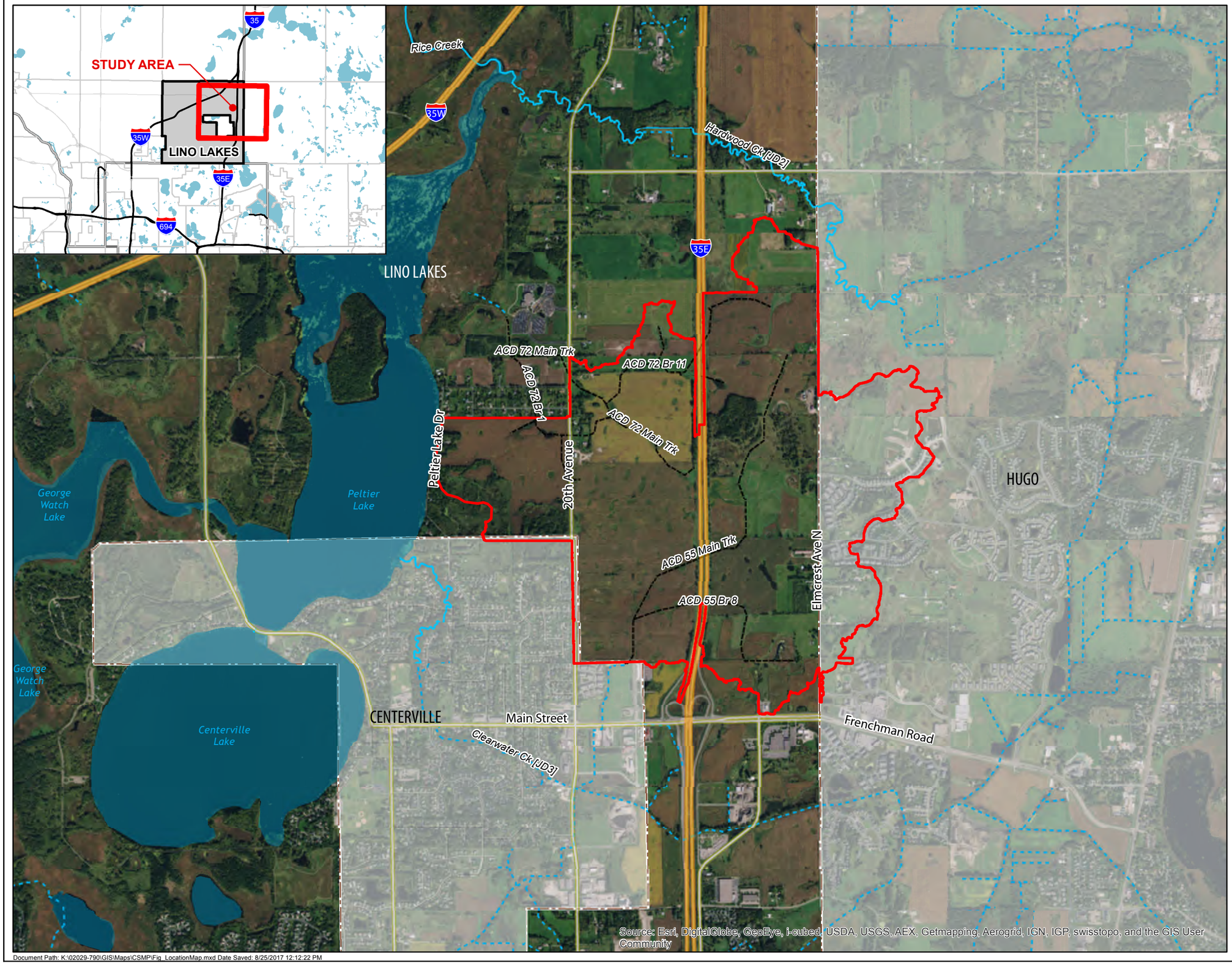
Appendix A – Figures



CITY OF LINO LAKES

Figure 1 - Project Location
Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary
- RCWD Watercourses
- Drain Tile
- Open Ditch
- Stream
- Lakes

N

0 2,000 Feet
1 inch = 2,000 feet

WSB

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Figure 2 - Existing Land Uses

Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary
- Farmstead
- Single Family Detached
- Single Family Attached
- Retail and Other Commercial
- Institutional
- Park, Recreational or Preserve
- Major Highway
- Agricultural
- Undeveloped

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

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1 inch = 1,153 feet

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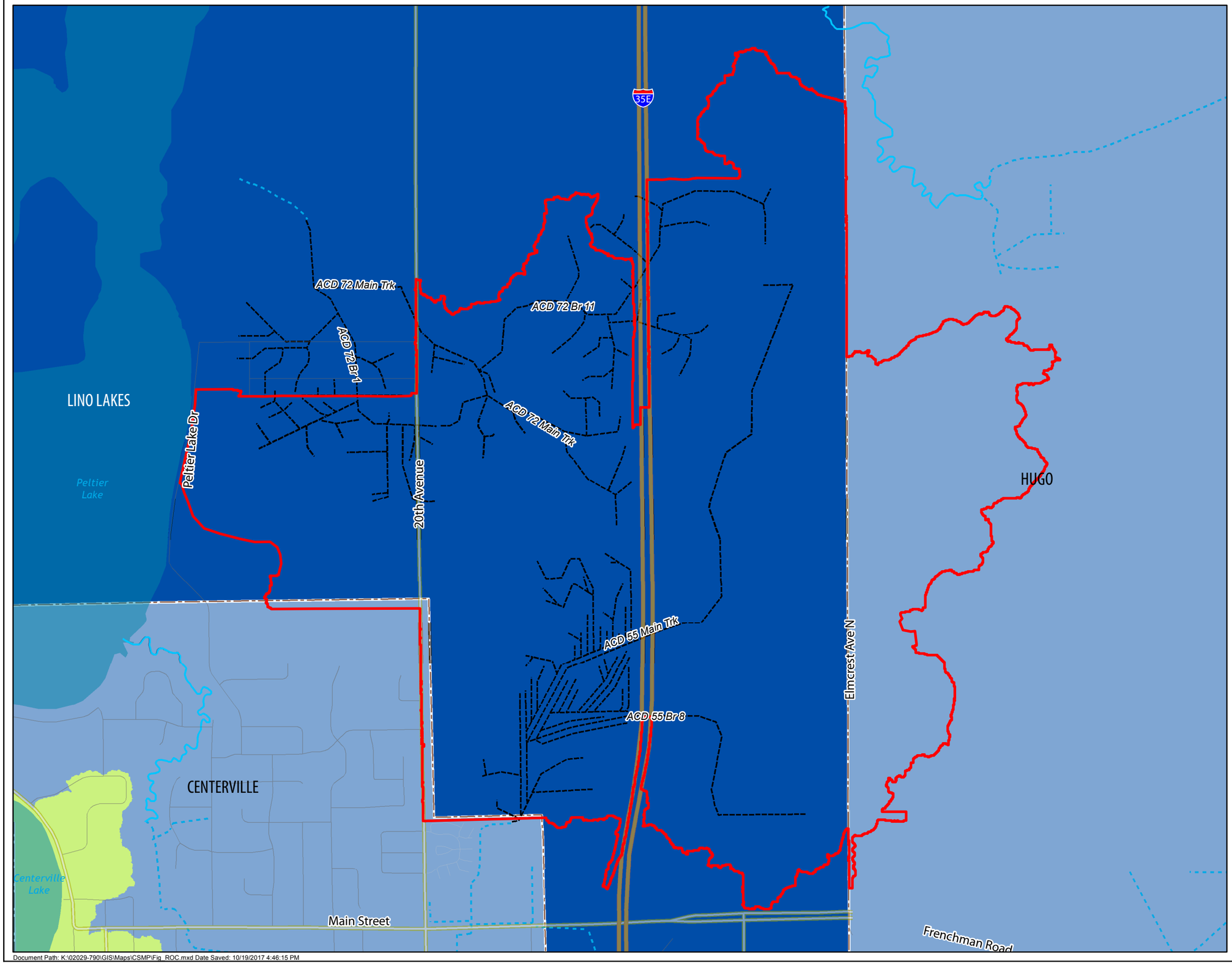

CITY OF LINO LAKES

Figure 3 - Drainage Areas and Resources of Concern

Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary

RCWD Resources of Concern

- Centerville
- Peltier

RCWD Watercourses

- Drain Tile
- Open Ditch
- Stream
- Lakes

N

0 2,000 Feet

1 inch = 1,153 feet

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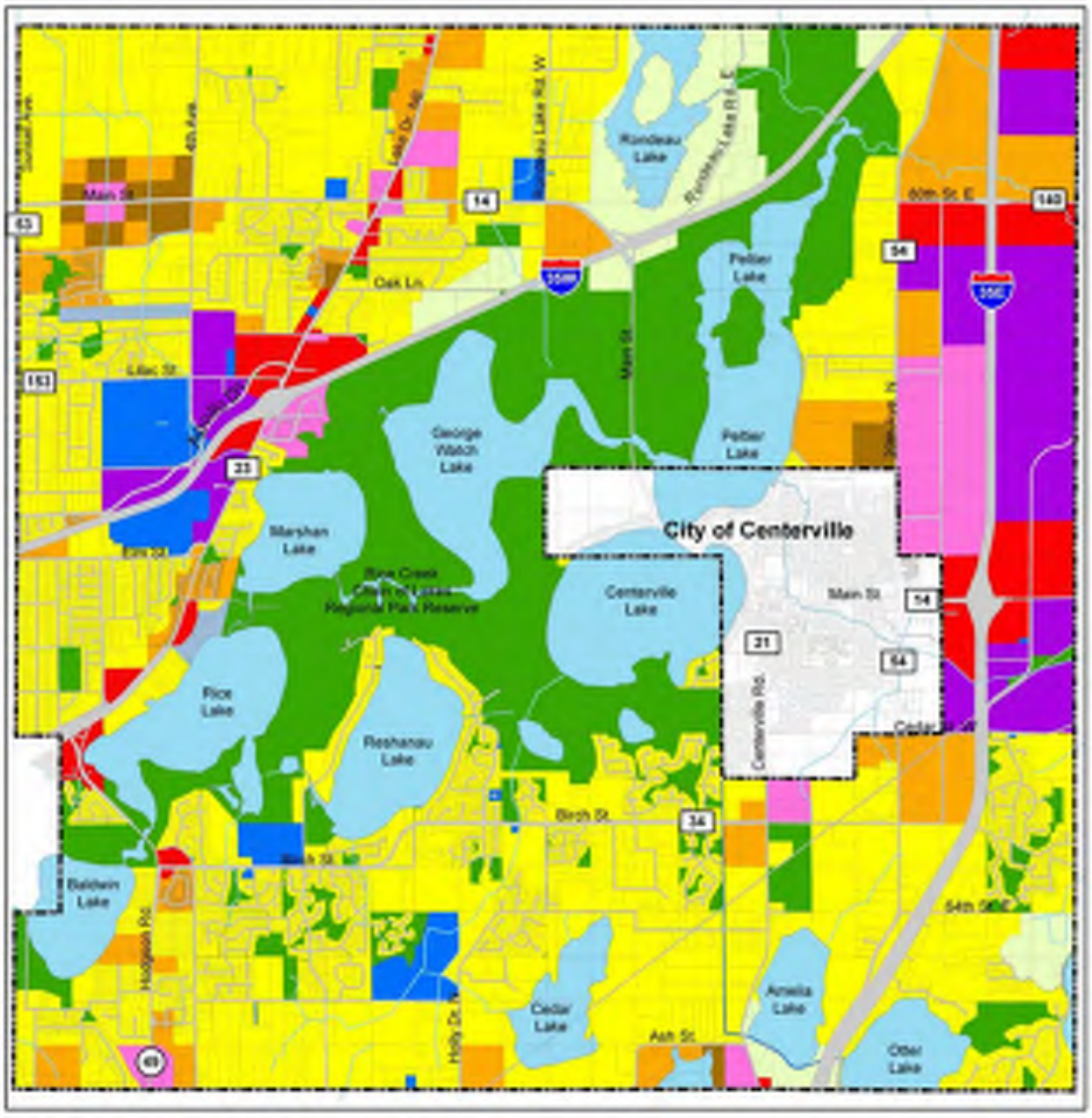


Full Build Out Future Land Use Map

City of Lino Lakes 2030 Comprehensive Plan

Figure 4. Lino Lakes Full Build Out Land Use

Resource Management System Plan

City of Lino Lakes 2030 Comprehensive Plan

Figure 5. Lino Lakes Resource Management Plan

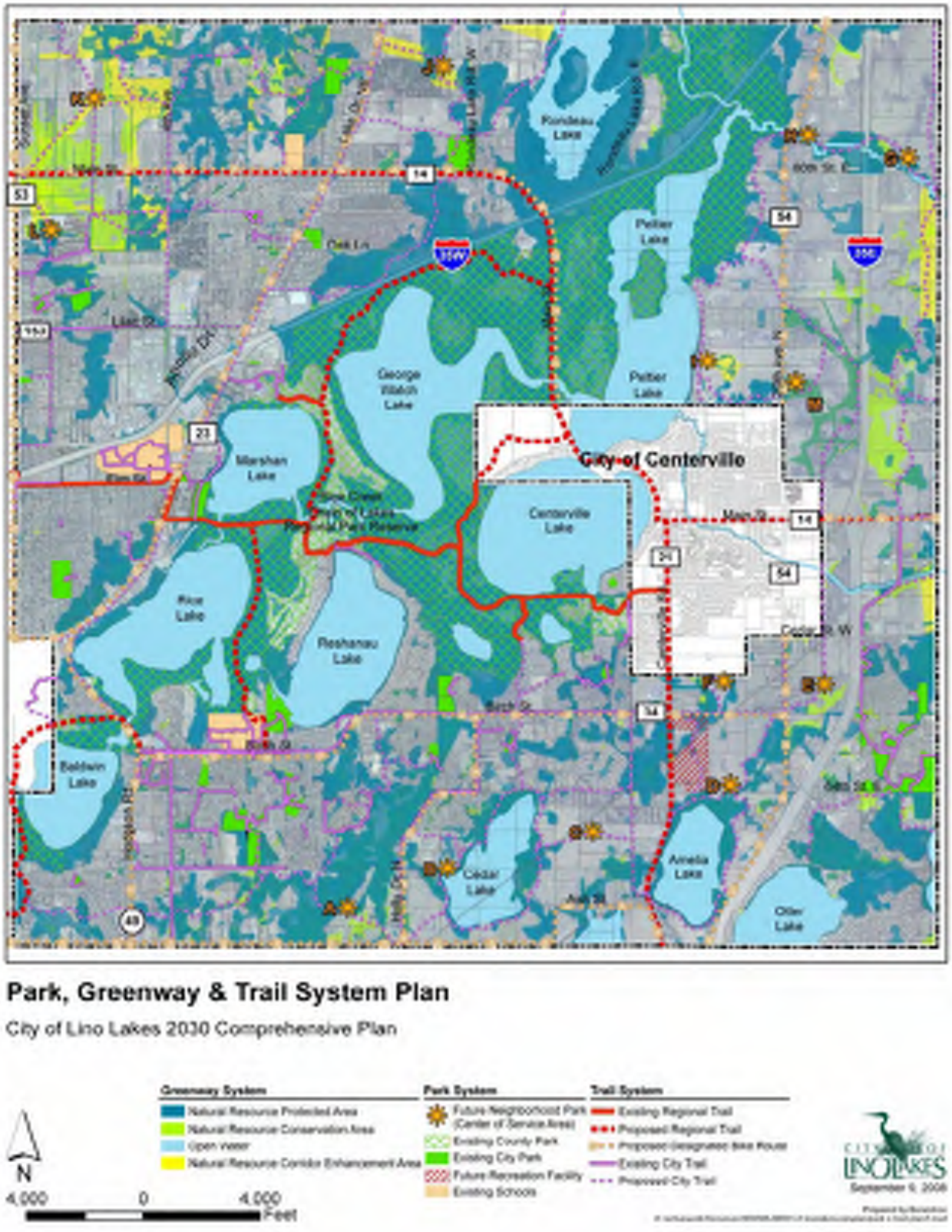


Figure 6. Lino Lakes Park, Greenway, and Trail Plan

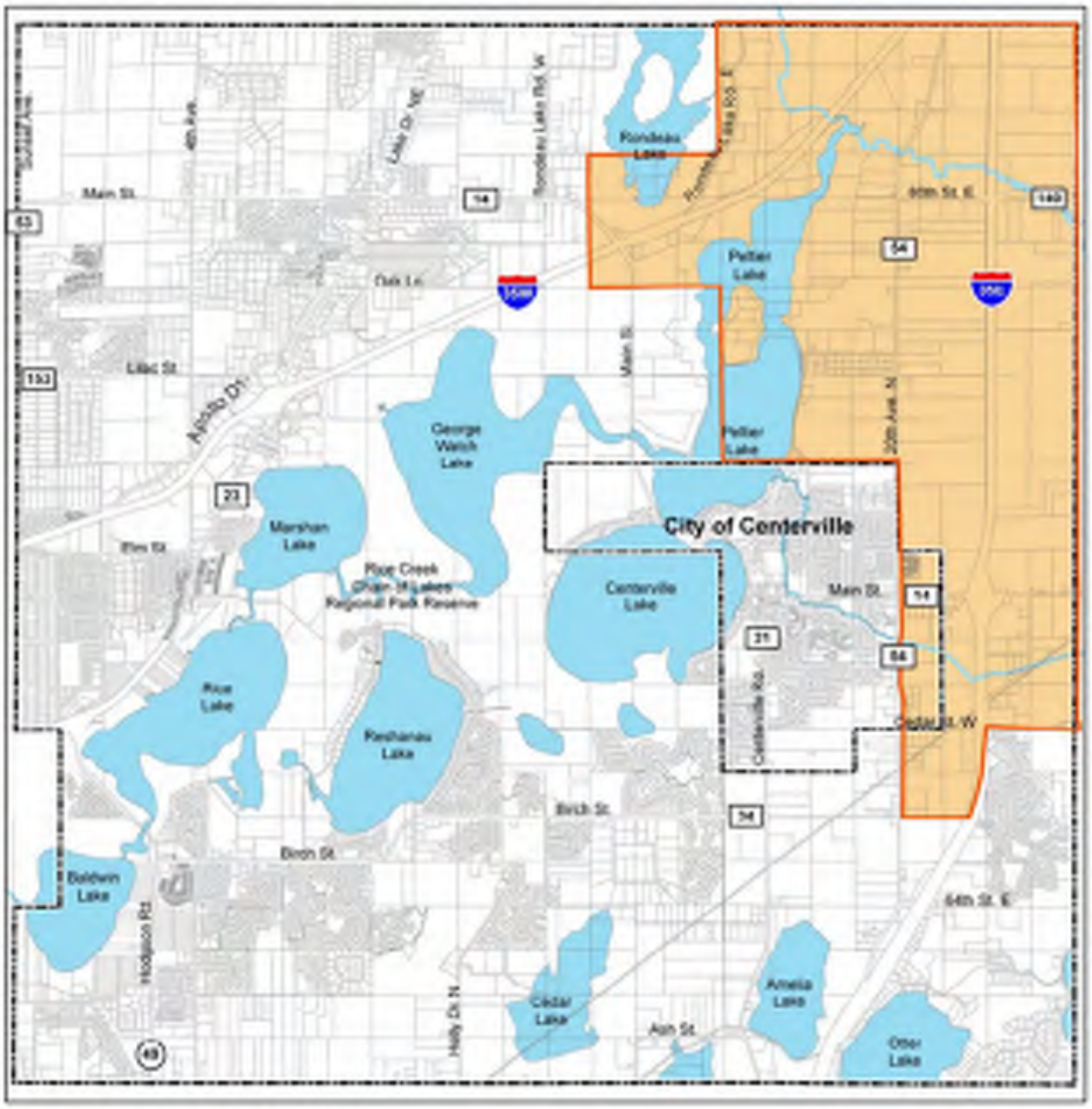
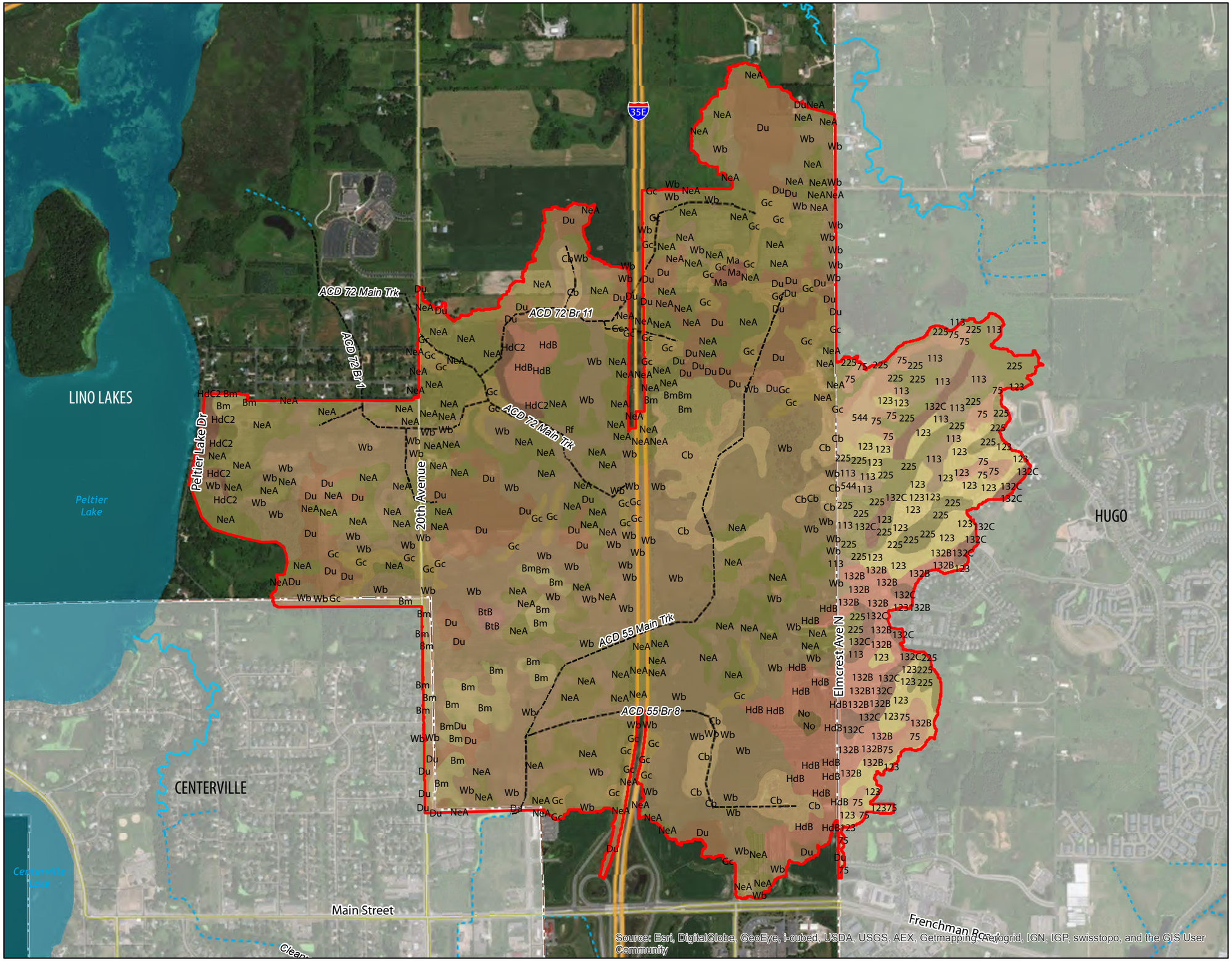


Figure 7. I-35E Corridor AUAR Area



CITY OF LINO LAKES

Figure 8 - NRCS Soils

Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary
- RCWD Watercourses
- Drain Tile
- Open Ditch
- Stream
- Lakes

NRCS Soils Data

113/Wb	Webster loam
123	Dundas fine sandy loam
132B/HdB	Hayden fine sandy loam, 2-6% slopes
132C/HdC2	Hayden fine sandy loam, 6-12% slopes
225/NeA	Nessel fine sandy loam, 1-4% slopes
544/Cb	Cathro muck
75	Bluffton loam
Bm	Blomford loamy fine sand
BtB	Braham loamy fine sand, 2-6% slopes
Du	Dundas loam
Gc	Glencoe loam
Ma	Markey muck
No	Nowen sandy loam
Rf	Rifle mucky peat

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2,000
Feet
1 inch = 1,200 feet

WSB

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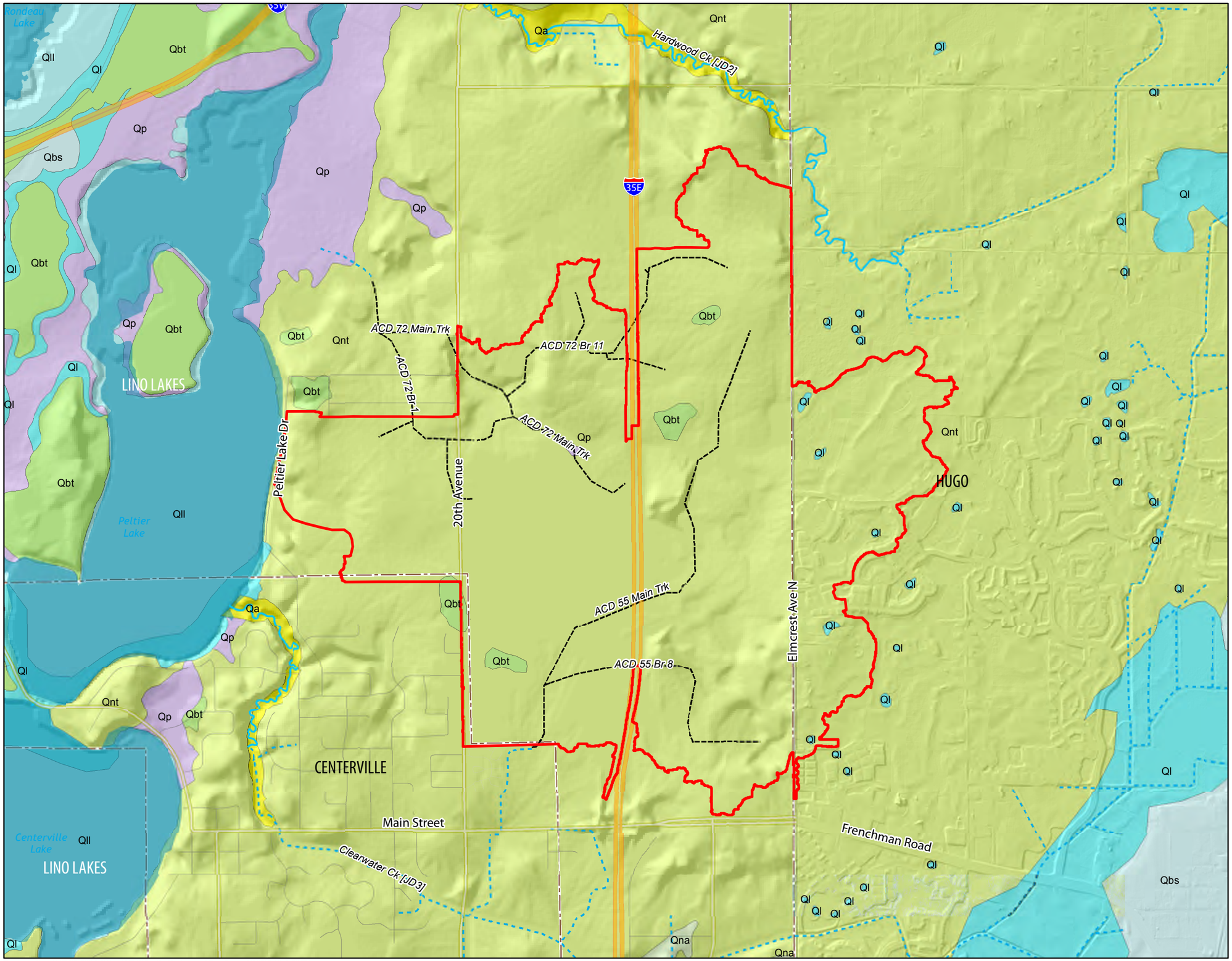

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CITY OF LINO LAKES

Figure 9 - Surficial Geology

Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary
- RCWD Watercourses
- Drain Tile
- Open Ditch
- Stream
- Lakes

Surficial Geology

QUATERNARY UNITS

Hudson Episode

- Qa — Alluvium
- Ql — Lake sand
- Qll — Lake silt and clay
- Qp — Peat and muck

New Brighton Formation

- Qbs — Sand facies
- Qbt — Sand over gray loamy to sandy till

New Ulm Formation

- Qnt — Loamy till
- Qna — Sandy till
- Qnd — Mixed till

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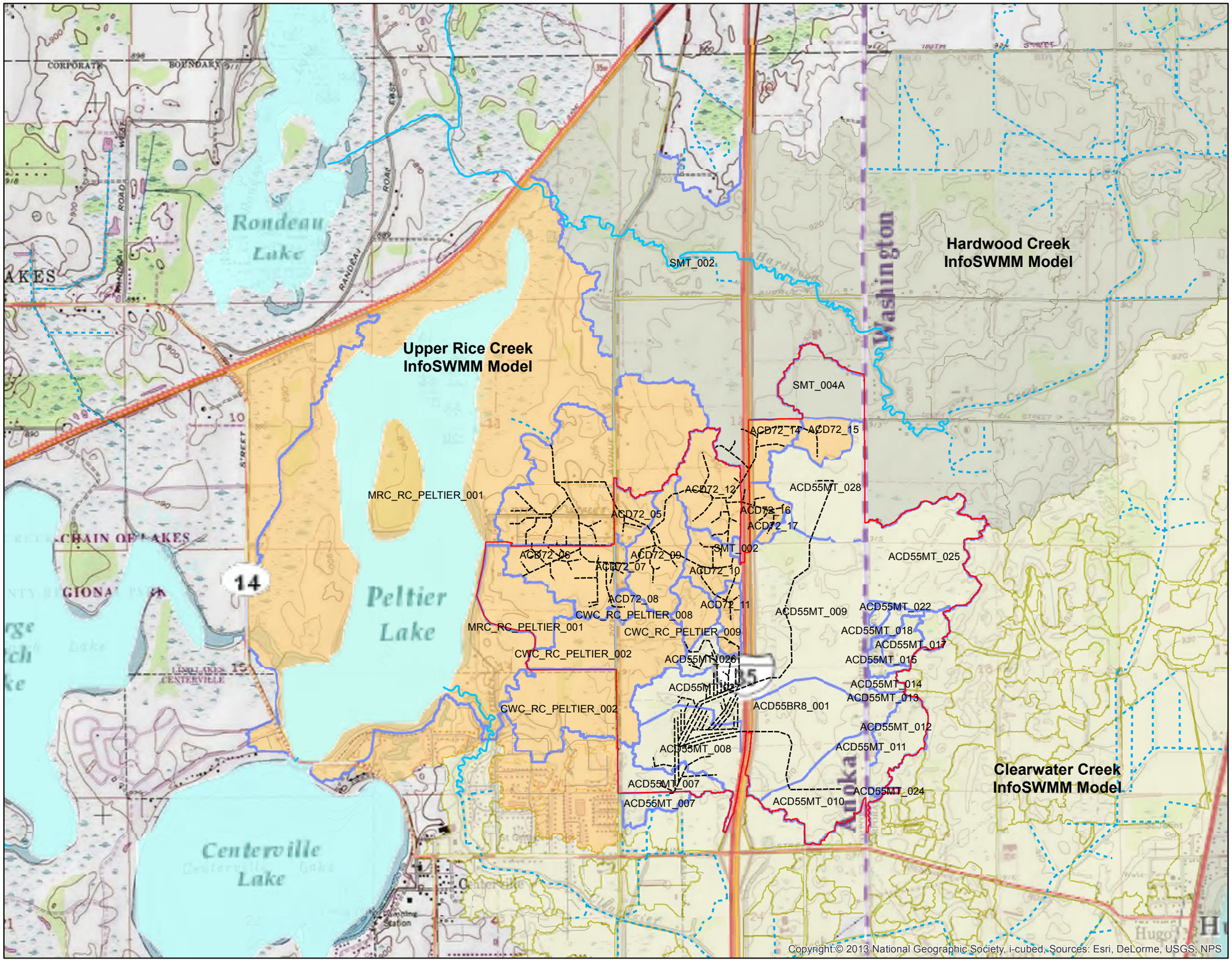
0 2,000 Feet

1 inch = 1,500 feet

WSB



CITY OF LINO LAKES

Figure 11 - InfoSWMM Updates
Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary

RCWD Watercourses

- Drain Tile
- Open Ditch
- Stream
- Revised CSMP Subcatchments
- Existing URC Subcatchments
- Existing HWC Subcatchments
- Existing CWC Subcatchments

N

0 2,000 Feet

1 inch = 2,000 feet

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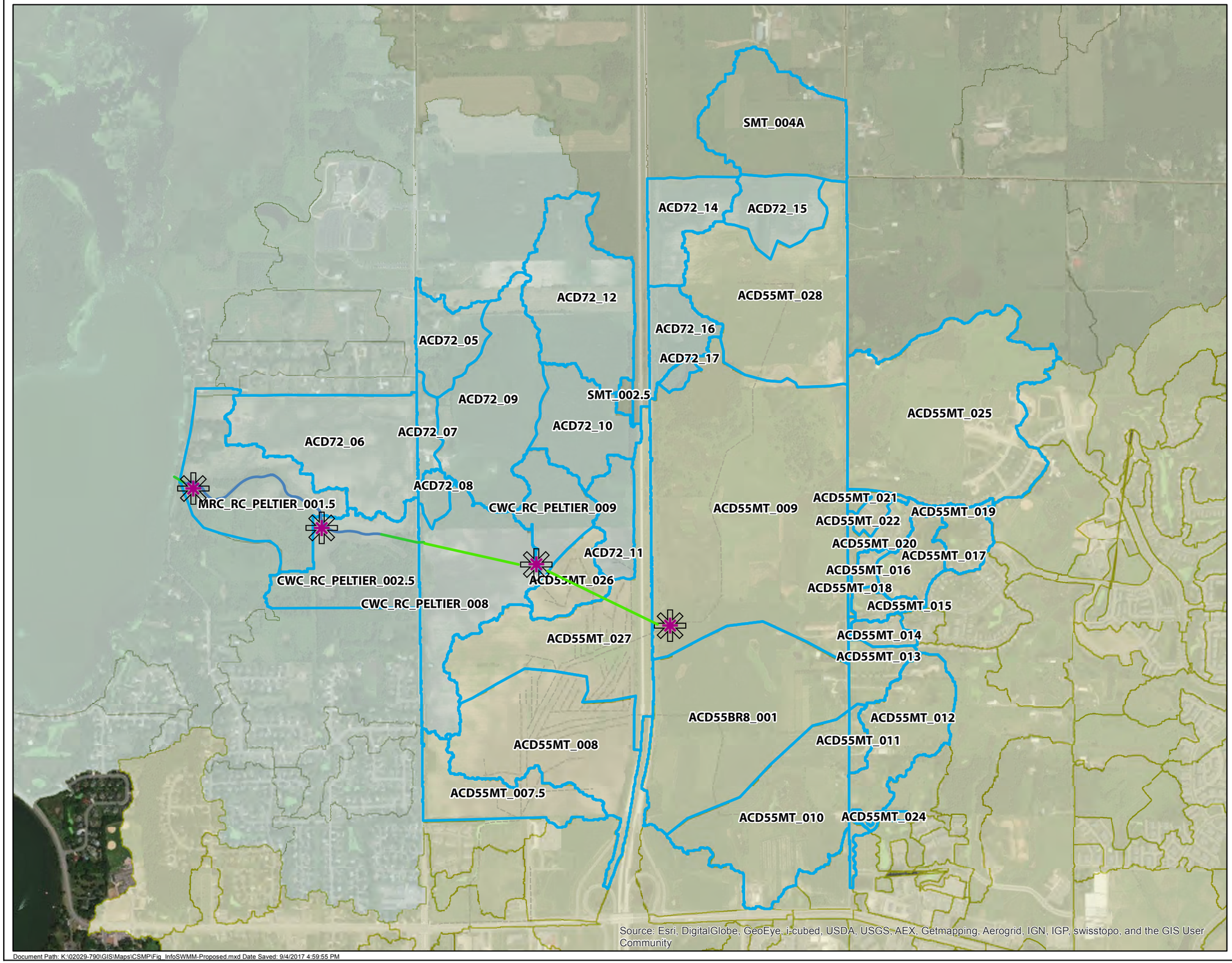

CITY OF LINO LAKES

Figure 12 - Proposed InfoSWMM
Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- CSMP Boundary
- Subcatchment
- URC Subcatchments
- HWC Subcatchments
- CWC Subcatchments
- Proposed Open Channel
- Proposed Culvert
- Proposed Regional BMP Location

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0 2,

1 inch = 1,153 feet

WSB

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SUMMARY OF INFILTRATION FEASIBILITY

	DRAINAGE AREA	FEASIBLE AREA
Hugo	215.6 ac	54.0 ac
East	533.9 ac	93.6 ac
Central	447.3 ac	94.1 ac
West	152.5 ac	30.8 ac
TOTAL	1,349.3 ac	272.3 ac

Peltier Lake

35E

Main Street

20th Avenue

Lehman Road

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

CITY OF LINO LAKES

Figure 13 - Infiltration Suitability

Northeast Drainage Area CSMP
City of Lino Lakes

Legend

- Depth to Groundwater < 24"
- Marginal Infiltration Suitability
- NWI Wetlands
- Unsuitable Soil Hydrologic Group
- DWSMA

N

0 1,200 Feet

1 inch = 1,153 feet

WSB

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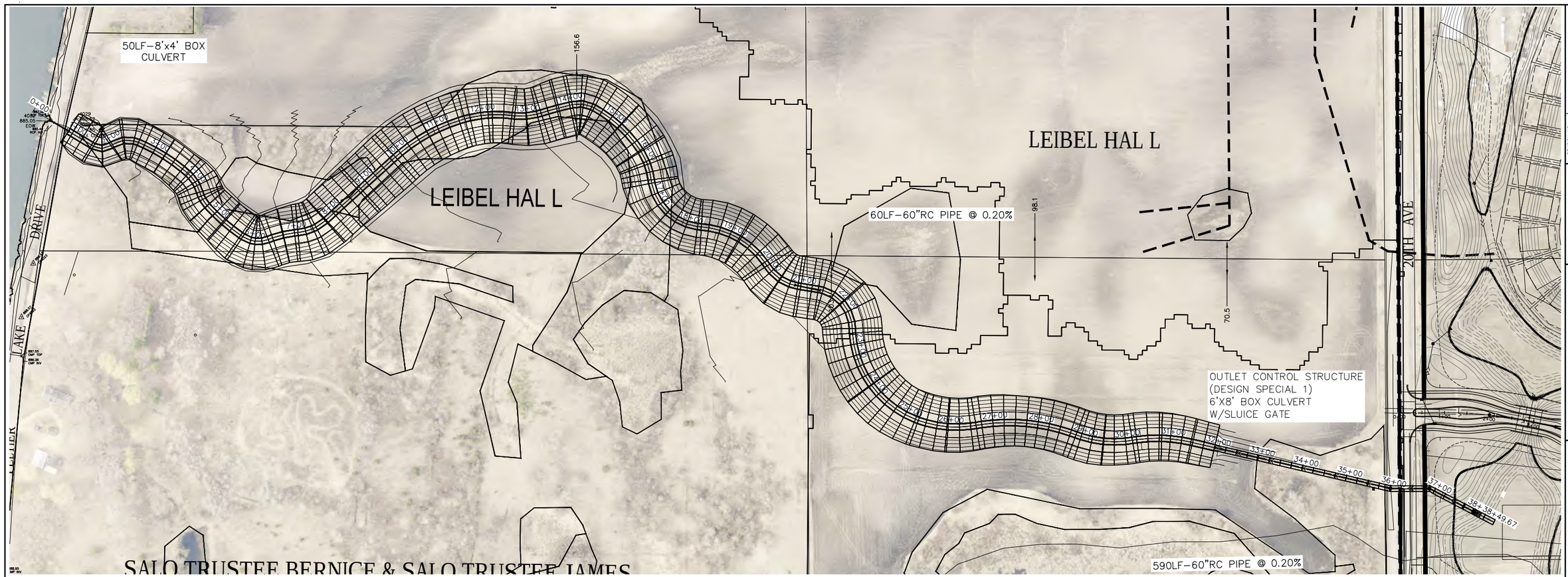
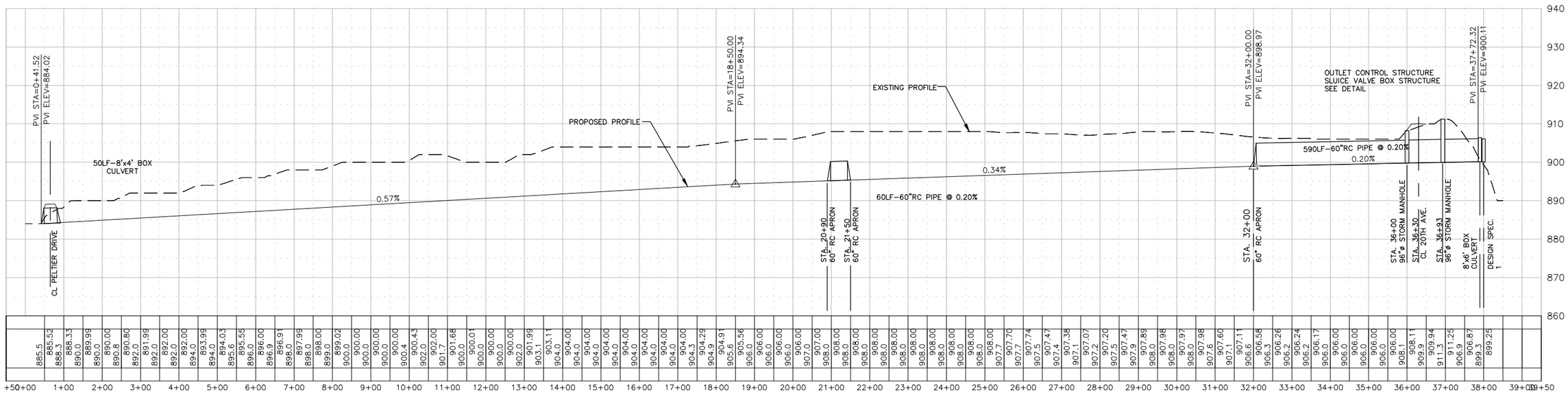
Appendix B – Existing Modeling Inputs and Results

Subcatchment ID	CSMP Region	Area [ac]	Impervious Calcs		WCN	Ia [in]	Slope [%]	Width [ft]	Tc [min]
			Area [ac]	%					
ACD55BR8_001	EAST	97.893	2.606	2.662	83.92	0.383	2.623	1448.157	48.943
ACD55MT_007		15.426	6.492	42.085	86.392	0.315	3.994	842.32	14.243
ACD55MT_007.5	CENTRAL	28.801	0.27	0.937	83.309	0.401	1.921	1432.659	41.07
ACD55MT_008	CENTRAL	67.641	2.929	4.33	83.661	0.391	2.211	1901.152	47.811
ACD55MT_009	EAST	183.161	4.941	2.698	80.744	0.477	2.732	2224.56	71.466
ACD55MT_010	EAST	62.93	1.756	2.79	81.159	0.464	2.69	1492.03	32.658
ACD55MT_011	HUGO	3.786	0.51	13.471	64.693	1.092	5.042	403.227	13.546
ACD55MT_012	HUGO	35.618	2.189	6.146	70.134	0.852	3.866	1734.4	52.683
ACD55MT_013	HUGO	11.098	0.849	7.65	64.529	1.099	4.518	680.302	22.179
ACD55MT_014	HUGO	5.4	2.785	51.574	79.447	0.517	5.124	412.514	11.946
ACD55MT_015	HUGO	5.531	1.051	19.002	67.218	0.975	6.032	505.331	15.851
ACD55MT_016	HUGO	3.326	1.903	57.216	84.489	0.367	4.547	372.214	7.245
ACD55MT_017	HUGO	13.926	2.738	19.661	70.353	0.843	4.733	757.112	14.894
ACD55MT_018	HUGO	3.327	1.748	52.54	85.141	0.349	8.157	551.035	11.84
ACD55MT_019	HUGO	10.416	2.803	26.911	74.272	0.693	5.082	688	19.414
ACD55MT_020	HUGO	6.666	3.746	56.196	84.303	0.372	4.571	605.766	8.784
ACD55MT_021	HUGO	0.94	0.597	63.511	87.103	0.296	8.891	145.006	5.002
ACD55MT_022	HUGO	4.717	2.644	56.053	84.883	0.356	5.321	462.272	6.886
ACD55MT_024	HUGO	1.905	0	0	78.97	0.533	5.759	377.6	12.071
ACD55MT_025	HUGO	108.941	5.54	5.085	75.944	0.634	3.413	2125.104	50.431
ACD55MT_026	CENTRAL	14.835	0	0	83.86	0.385	1.947	747.365	21.106
ACD55MT_027	CENTRAL	68.153	14.25	20.909	86.642	0.308	3.694	2562.48	35.808
ACD55MT_028	EAST	79.294	0.542	0.684	81.005	0.469	2.751	1642.512	54.456
ACD72_01		65.858	18.642	28.306	74.686	0.678	3.357	1859.984	50.243
ACD72_02		29.642	2.958	9.979	82.006	0.439	2.947	990.642	46.065
ACD72_03		14.011	5.599	39.961	75.735	0.641	4.667	714.949	35.11
ACD72_04		9.337	2.843	30.449	73.817	0.709	4.533	510.846	33.887
ACD72_04B		12.063	4.305	35.688	73.871	0.707	4.065	803.469	42.85
ACD72_05	CENTRAL	18.806	1.169	6.216	73.054	0.738	3.939	823.824	20.601
ACD72_06	WEST	58.465	0.042	0.072	84.663	0.362	1.918	1511.829	41.142
ACD72_07	CENTRAL	6.461	1.573	24.346	72.832	0.746	4.582	586.395	13.794
ACD72_08	CENTRAL	4.943	0	0	83.872	0.385	1.855	377.011	12.432
ACD72_09	CENTRAL	56.87	0.348	0.612	81.134	0.465	2.527	1526.32	34.619
ACD72_10	CENTRAL	29.044	0.519	1.787	83.141	0.406	2.477	1076.064	21.697
ACD72_11	CENTRAL	15.616	0.179	1.146	83.093	0.407	2.481	807.602	22.992
ACD72_12	CENTRAL	54.612	0.645	1.181	82.763	0.417	2.382	1535.963	43.825
ACD72_14	EAST	22.761	1.946	8.55	83.26	0.402	3.065	895.154	20.349
ACD72_15	EAST	20.515	0	0	76.274	0.622	2.248	705.899	26.563
ACD72_16	EAST	16.123	1.998	12.392	83.199	0.404	3.327	814.832	15.796
ACD72_17	EAST	2.514	0	0	75.592	0.646	3.275	286.424	8.357
CWC_RC_PELTIER_001		9.39	3.756	40	76.529	0.613	5.025	915.954	12.302
CWC_RC_PELTIER_002		81.513	19.035	23.352	72.982	0.740	3.913	1955.04	49.709
CWC_RC_PELTIER_002.5	WEST	41.091	0	0	75.001	0.667	1.69	1241.749	53.468
CWC_RC_PELTIER_003		14.456	5.443	37.652	74.82	0.673	4.31	1318.4	15.471
CWC_RC_PELTIER_004		19.176	7.67	39.998	76.572	0.612	4.81	1052.8	14.314
CWC_RC_PELTIER_005		4.37	1.481	33.89	79.956	0.501	4.698	383.493	10
CWC_RC_PELTIER_006		18.884	7.552	39.992	79.531	0.515	4.795	1049.6	18.963
CWC_RC_PELTIER_008	CENTRAL	58.298	0.003	0.005	85.479	0.340	1.831	1889.84	31.093
CWC_RC_PELTIER_009	CENTRAL	21.211	0	0	84.681	0.362	1.826	941.146	27.839
L_PELTIER_07		49.286	20.395	41.381	82.103	0.436	3.602	2052.512	34.637
MRC_RC_PELTIER_001		1273.83	87.291	6.853	84.246	0.374	1.555	10258.94	62.15
MRC_RC_PELTIER_001.5	WEST	52.956	1.646	3.108	75.591	0.646	2.576	1554.475	48.632
MRC_RC_PELTIER_002		126.454	18.542	14.663	66.827	0.993	3.293	3248	108.645
MRC_RC_PELTIER_003		13.412	4.543	33.873	80.493	0.485	7.193	710.306	11.773

Subcatchment ID	CSMP Region	Area [ac]	Impervious Calcs		WCN	Ia [in]	Slope [%]	Width [ft]	Tc [min]
			Area [ac]	%					
MRC_RC_PELTIER_004		3.183	1.273	39.994	71.109	0.813	4.325	373.661	13.445
MRC_RC_PELTIER_006		87.354	1.633	1.869	82.325	0.429	2.182	1788.768	47.406
MRC_RC_PELTIER_009		38.801	9.219	23.76	75.187	0.660	4.161	1315.488	10
SMT_002		314.096	38.51	12.261	81.019	0.469	3.556	5123.472	101.506
SMT_002.5	CENTRAL	1.986	0.067	3.374	78.479	0.548	1.827	278.718	10.515
SMT_004A	EAST	48.753	0.675	1.385	86.1	0.323	1.815	1186.091	34.849

Appendix C – Regional BMP Conceptual Layout





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City of Lino Lakes, MN

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SHEET 1 OF 4 SHEETS

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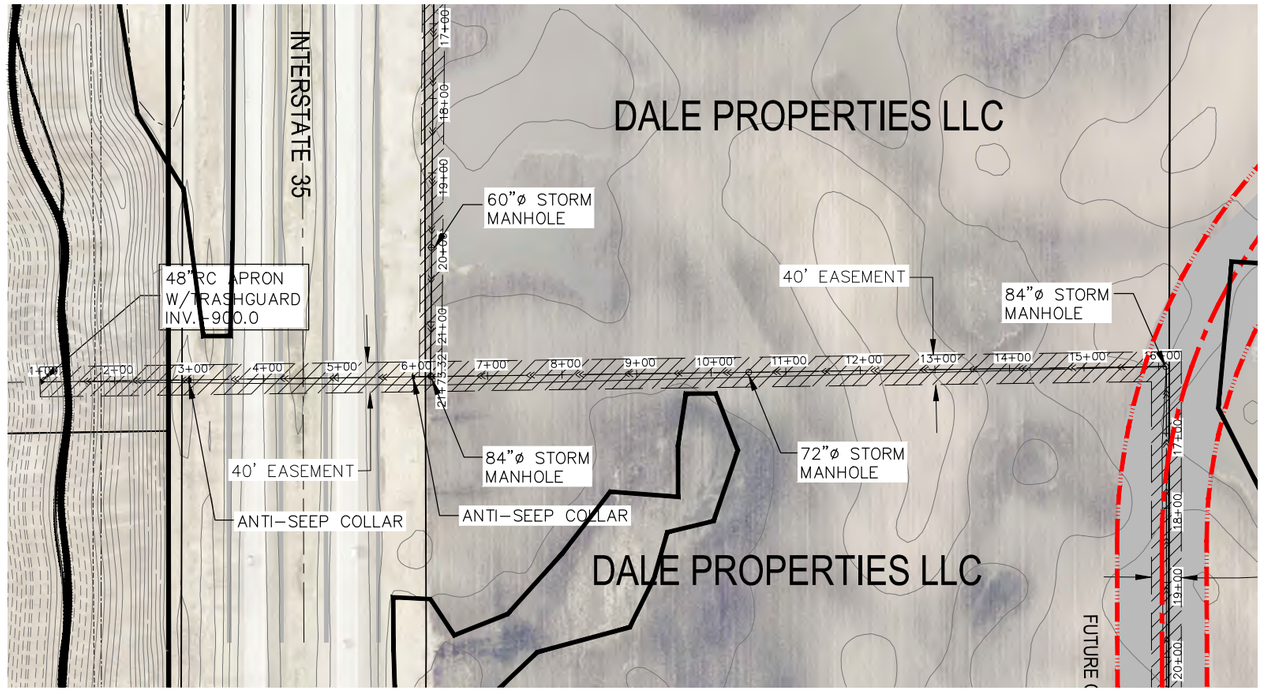

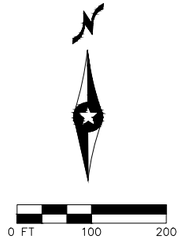

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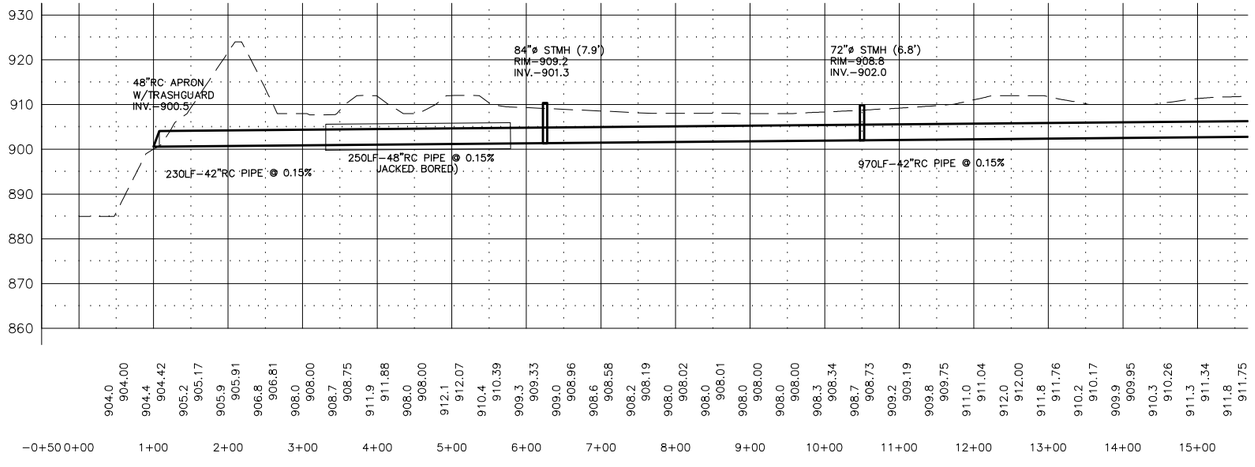

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SHEET 2 OF 4 SHEETS

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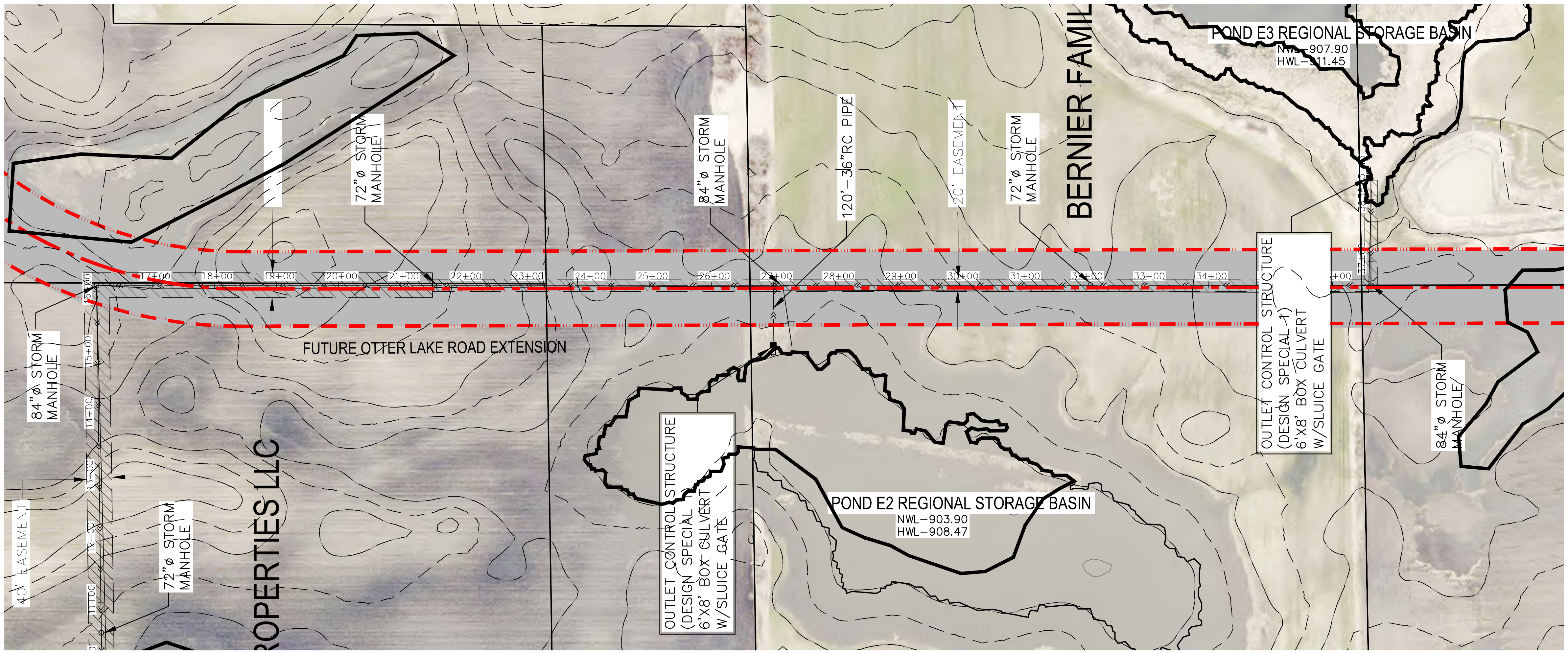

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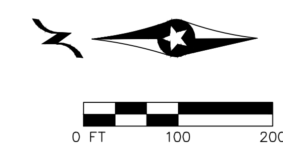

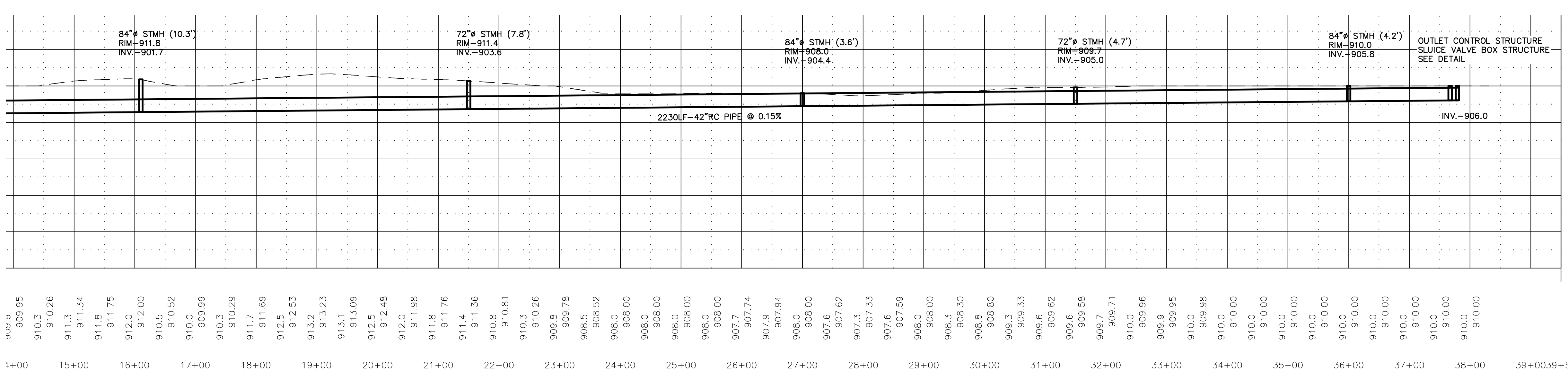

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SHEET 3 OF 4 SHEETS

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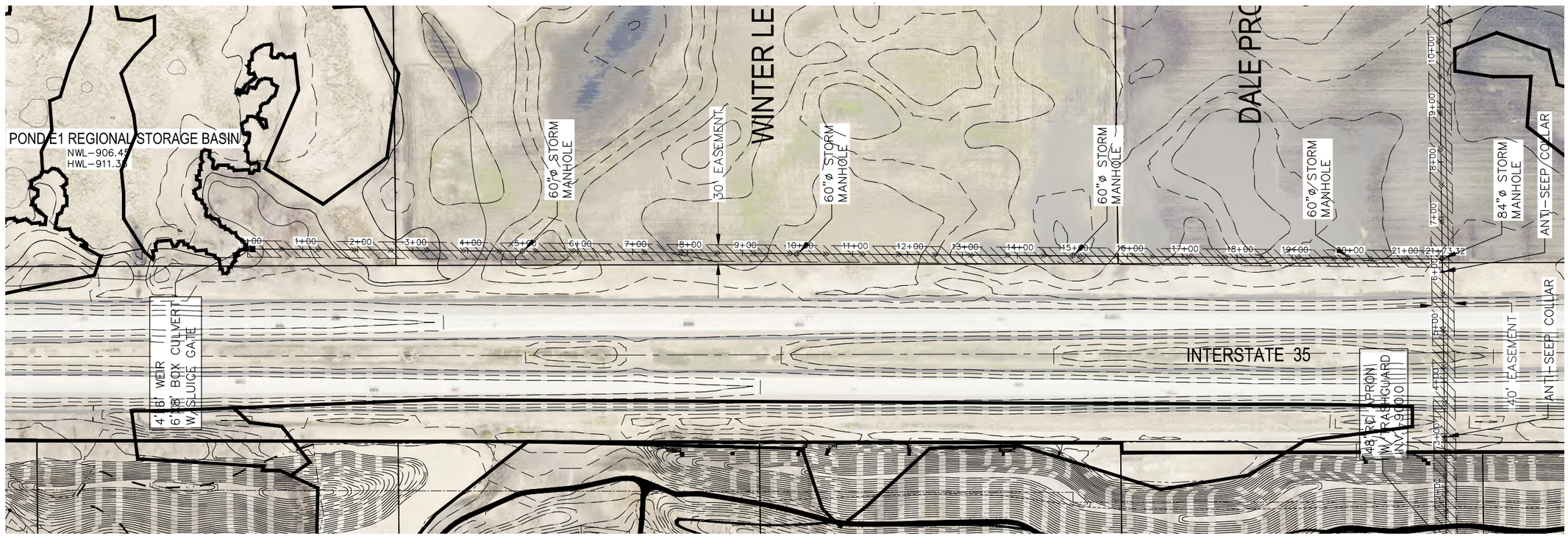

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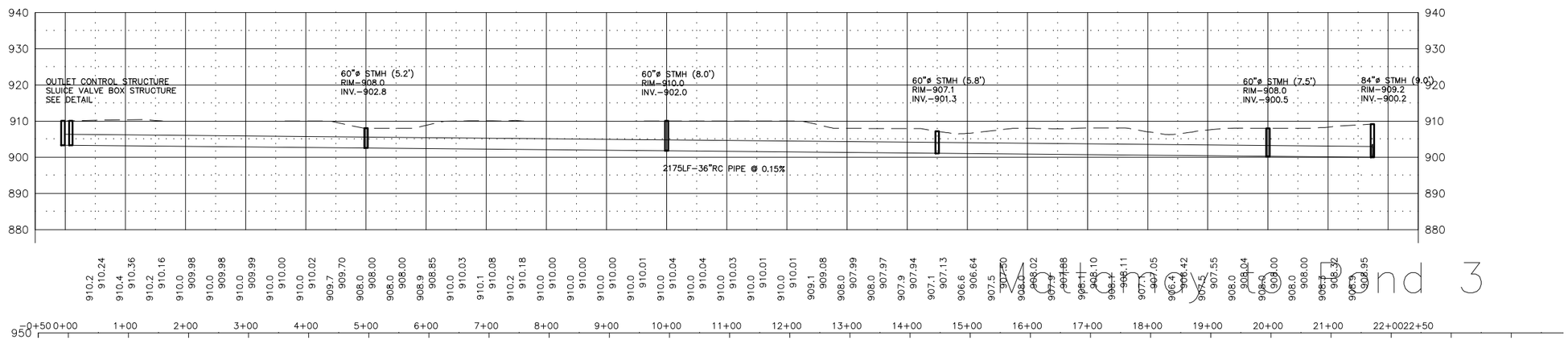

Sheet 3

PROJECT NUMBER 2029–790	SHEET 4 OF 4 SHEETS	

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Appendix D – Proposed Model Inputs and Results

Subcatchment ID	CSMP Region	Area [ac]	Impervious Calcs		WCN	Ia [in]	Slope [%]	Width [ft]	Tc [min]
			Area [ac]	%					
ACD55BR8_001	EAST	97.893	66.771	68.208	88.125	0.270	2.623	1448.157	42.056
ACD55MT_007		15.426	6.492	42.085	86.392	0.315	3.994	842.320	14.243
ACD55MT_007.5	CENTRAL	28.801	20.985	72.862	87.965	0.274	1.921	1432.659	34.770
ACD55MT_008	CENTRAL	67.641	50.731	75	88.151	0.269	2.211	1901.152	40.674
ACD55MT_009	EAST	183.161	99.514	54.331	83.626	0.392	2.732	2224.560	65.029
ACD55MT_010	EAST	62.93	38.407	61.031	88.768	0.253	2.69	1492.030	24.983
ACD55MT_011	HUGO	3.786	0.51	13.471	64.693	1.092	5.042	403.227	13.546
ACD55MT_012	HUGO	35.618	2.189	6.146	70.134	0.852	3.866	1734.400	52.683
ACD55MT_013	HUGO	11.098	0.849	7.65	64.529	1.099	4.518	680.302	22.179
ACD55MT_014	HUGO	5.4	2.785	51.574	79.447	0.517	5.124	412.514	11.946
ACD55MT_015	HUGO	5.531	1.051	19.002	67.218	0.975	6.032	505.331	15.851
ACD55MT_016	HUGO	3.326	1.903	57.216	84.489	0.367	4.547	372.214	7.245
ACD55MT_017	HUGO	13.926	2.738	19.661	70.353	0.843	4.733	757.112	14.894
ACD55MT_018	HUGO	3.327	1.748	52.54	85.141	0.349	8.157	551.035	11.840
ACD55MT_019	HUGO	10.416	2.803	26.911	74.272	0.693	5.082	688.000	19.414
ACD55MT_020	HUGO	6.666	3.746	56.196	84.303	0.372	4.571	605.766	8.784
ACD55MT_021	HUGO	0.94	0.597	63.511	87.103	0.296	8.891	145.006	5.002
ACD55MT_022	HUGO	4.717	2.644	56.053	84.883	0.356	5.321	462.272	6.886
ACD55MT_024	HUGO	1.905	0	0	78.97	0.533	5.759	377.600	12.071
ACD55MT_025	HUGO	108.941	5.54	5.085	75.944	0.634	3.413	2125.104	50.431
ACD55MT_026	CENTRAL	14.835	11.126	74.998	87.999	0.273	1.947	747.365	18.183
ACD55MT_027	CENTRAL	68.153	48.062	70.521	88.104	0.270	3.694	2562.480	33.893
ACD55MT_028	EAST	79.294	48.292	60.902	83.651	0.391	2.751	1642.512	49.918
ACD72_01		65.858	18.642	28.306	74.686	0.678	3.357	1859.984	50.243
ACD72_02		29.642	2.958	9.979	82.006	0.439	2.947	990.642	46.065
ACD72_03		14.011	5.599	39.961	75.735	0.641	4.667	714.949	35.11
ACD72_04		9.337	2.843	30.449	73.817	0.709	4.533	510.846	33.887
ACD72_04B		12.063	4.305	35.688	73.871	0.707	4.065	803.469	42.85
ACD72_05	CENTRAL	18.806	9.792	52.068	77.511	0.580	3.939	823.824	18.111
ACD72_06	WEST	58.465	26.355	45.078	71.683	0.790	1.918	1511.829	61.122
ACD72_07	CENTRAL	6.461	4.846	75.004	88.3	0.265	4.582	586.395	8.391
ACD72_08	CENTRAL	4.943	3.707	74.995	88.028	0.272	1.855	377.011	10.703
ACD72_09	CENTRAL	56.87	38.368	67.466	84.609	0.364	2.527	1526.320	30.841
ACD72_10	CENTRAL	29.044	21.251	73.168	87.84	0.277	2.477	1076.064	18.352
ACD72_11	CENTRAL	15.616	9.699	62.109	85.313	0.344	2.481	807.602	21.305
ACD72_12	CENTRAL	54.612	38.978	71.373	87.56	0.284	2.382	1535.963	37.003
ACD72_14	EAST	22.761	17.071	75.001	88.455	0.261	3.065	895.154	16.877
ACD72_15	EAST	20.515	12.668	61.75	83.046	0.408	2.248	705.899	21.514
ACD72_16	EAST	16.123	11.203	69.485	85.996	0.326	3.327	814.832	14.334
ACD72_17	EAST	2.514	1.824	72.554	87.037	0.298	3.275	286.424	5.766
CWC_RC_PELTIER_001		9.39	3.756	40	76.529	0.613	5.025	915.954	12.302
CWC_RC_PELTIER_002		81.513	19.035	23.352	72.982	0.740	3.913	1955.040	49.709
CWC_RC_PELTIER_002.5	WEST	41.091	11.984	29.165	75.745	0.640	1.69	1241.749	36.837
CWC_RC_PELTIER_003		14.456	5.443	37.652	74.82	0.673	4.31	1318.400	15.471
CWC_RC_PELTIER_004		19.176	7.67	39.998	76.572	0.612	4.81	1052.800	14.314
CWC_RC_PELTIER_005		4.37	1.481	33.89	79.956	0.501	4.698	383.493	10
CWC_RC_PELTIER_006		18.884	7.552	39.992	79.531	0.515	4.795	1049.600	18.963
CWC_RC_PELTIER_008	CENTRAL	58.298	42.354	72.651	87.418	0.288	1.831	1889.840	28.965
CWC_RC_PELTIER_009	CENTRAL	21.211	15.908	74.999	88	0.273	1.826	941.146	24.673
L_PELTIER_07		49.286	20.395	41.381	82.103	0.436	3.602	2052.512	34.637
MRC_RC_PELTIER_001		1273.83	87.291	6.853	84.246	0.374	1.555	10258.944	62.150
MRC_RC_PELTIER_001.5	WEST	52.956	18.452	34.844	73.035	0.738	2.576	1554.475	52.300
MRC_RC_PELTIER_002		126.454	18.542	14.663	66.827	0.993	3.293	3248.000	108.645

Subcatchment ID	CSMP Region	Area [ac]	Impervious Calcs		WCN	Ia [in]	Slope [%]	Width [ft]	Tc [min]
			Area [ac]	%					
MRC_RC_PELTIER_003		13.412	4.543	33.873	80.493	0.485	7.193	710.306	11.773
MRC_RC_PELTIER_004		3.183	1.273	39.994	71.109	0.813	4.325	373.661	13.445
MRC_RC_PELTIER_006		87.354	1.633	1.869	82.325	0.429	2.182	1788.768	47.406
MRC_RC_PELTIER_009		38.801	9.219	23.76	75.187	0.660	4.161	1315.488	10
SMT_002		314.096	38.51	12.261	81.019	0.469	3.556	5123.472	101.506
SMT_002.5	CENTRAL	1.986	1.489	74.975	88.166	0.268	1.827	278.718	7.574
SMT_004A	EAST	48.753	36.537	74.943	88.285	0.265	1.815	1186.091	32.125

NOTES:

1. Subcatchments in Hugo and outside the CSMP study area proided for reference only. No changes from existing conditions were made to these subcatchments.

Appendix E – Water Quality Calculations

Subcatchment ID	CSMP Region	Area [ac]	CN	S	TP Load [in]	1.1-in Event Runoff [in]	1.1-in Event Runoff [ac-ft]
ACD55BR8_001	EAST	97.893	83.92	1.92	0.384	0.19	1.55
ACD55MT_007		15.426	86.392	1.58	0.316	0.26	0.33
ACD55MT_007.5	CENTRAL	28.801	83.309	2	0.4	0.18	0.43
ACD55MT_008	CENTRAL	67.641	83.661	1.95	0.39	0.19	1.07
ACD55MT_009	EAST	183.161	80.744	2.38	0.476	0.13	1.98
ACD55MT_010	EAST	62.93	81.159	2.32	0.464	0.14	0.73
ACD55MT_011	HUGO	3.786	64.693	5.46	1.092	0	0
ACD55MT_012	HUGO	35.618	70.134	4.26	0.852	0.01	0.03
ACD55MT_013	HUGO	11.098	64.529	5.5	1.1	0	0
ACD55MT_014	HUGO	5.4	79.447	2.59	0.518	0.11	0.05
ACD55MT_015	HUGO	5.531	67.218	4.88	0.976	0	0
ACD55MT_016	HUGO	3.326	84.489	1.84	0.368	0.21	0.06
ACD55MT_017	HUGO	13.926	70.353	4.21	0.842	0.01	0.01
ACD55MT_018	HUGO	3.327	85.141	1.75	0.35	0.23	0.06
ACD55MT_019	HUGO	10.416	74.272	3.46	0.692	0.04	0.03
ACD55MT_020	HUGO	6.666	84.303	1.86	0.372	0.2	0.11
ACD55MT_021	HUGO	0.94	87.103	1.48	0.296	0.28	0.02
ACD55MT_022	HUGO	4.717	84.883	1.78	0.356	0.22	0.09
ACD55MT_024	HUGO	1.905	78.97	2.66	0.532	0.1	0.02
ACD55MT_025	HUGO	108.941	75.944	3.17	0.634	0.06	0.54
ACD55MT_026	CENTRAL	14.835	83.86	1.92	0.384	0.19	0.23
ACD55MT_027	CENTRAL	68.153	86.642	1.54	0.308	0.27	1.53
ACD55MT_028	EAST	79.294	81.005	2.34	0.468	0.13	0.86
ACD72_05	CENTRAL	18.806	73.054	3.69	0.738	0.03	0.05
ACD72_06	WEST	58.465	84.663	1.81	0.362	0.21	1.02
ACD72_07	CENTRAL	6.461	72.832	3.73	0.746	0.03	0.02
ACD72_08	CENTRAL	4.943	83.872	1.92	0.384	0.19	0.08
ACD72_09	CENTRAL	56.87	81.134	2.33	0.466	0.14	0.66
ACD72_10	CENTRAL	29.044	83.141	2.03	0.406	0.18	0.44
ACD72_11	CENTRAL	15.616	83.093	2.03	0.406	0.18	0.23
ACD72_12	CENTRAL	54.612	82.763	2.08	0.416	0.17	0.77
ACD72_14	EAST	22.761	83.26	2.01	0.402	0.18	0.34
ACD72_15	EAST	20.515	76.274	3.11	0.622	0.06	0.1
ACD72_16	EAST	16.123	83.199	2.02	0.404	0.18	0.24
ACD72_17	EAST	2.514	75.592	3.23	0.646	0.06	0.01
CWC_RC_PELTIER_002		81.513	72.982	3.7	0.74	0.03	0.2
CWC_RC_PELTIER_002.5	WEST	41.091	75.001	3.33	0.666	0.05	0.17
CWC_RC_PELTIER_008	CENTRAL	58.298	85.479	1.7	0.34	0.23	1.12
CWC_RC_PELTIER_009	CENTRAL	21.211	84.681	1.81	0.362	0.21	0.37
MRC_RC_PELTIER_001		1273.83	84.246	1.87	0.374	0.2	21.23
MRC_RC_PELTIER_001.5	WEST	52.956	75.591	3.23	0.646	0.06	0.26
SMT_002		314.096	81.019	2.34	0.468	0.13	3.4
SMT_002.5	CENTRAL	1.986	78.479	2.74	0.548	0.09	0.01

SMT_004A	EAST	48.753	86.1	1.61	0.322	0.25	1.02

Weighted TP	TP Load
[mg/L]	[lb]
0.277	1.17
0.356	0.32
0.318	0.37
0.316	0.92
0.201	1.08
0.248	0.49
0.174	0
0.142	0.01
0.084	0
0.326	0.04
0.137	0
0.355	0.06
0.124	0
0.338	0.06
0.18	0.01
0.363	0.11
0.399	0.02
0.381	0.09
0.192	0.01
0.214	0.31
0.32	0.2
0.298	1.24
0.299	0.7
0.266	0.04
0.32	0.89
0.281	0.02
0.32	0.07
0.311	0.56
0.318	0.38
0.282	0.18
0.305	0.64
0.309	0.29
0.279	0.08
0.308	0.2
0.241	0.01
0.188	0.1
0.145	0.07
0.307	0.94
0.32	0.32
0.051	2.94
0.19	0.13
0.229	2.12
0.317	0.01

0.319	0.88

Subcatchment ID	CSMP Region	Area [ac]	CN	S	TP Load [in]	1.1-in Event Runoff [in]	1.1-in Event Runoff [ac-ft]	Weighted TP [mg/L]	TP Load [lb]
ACD55BR8_001	EAST	97.893	88.125	1.35	0.27	0.32	2.61	0.221	1.57
ACD55MT_007		15.426	86.392	1.58	0.316	0.26	0.33	0	0
ACD55MT_007.5	CENTRAL	28.801	87.965	1.37	0.274	0.31	0.74	0.215	0.43
ACD55MT_008	CENTRAL	67.641	88.151	1.34	0.268	0.32	1.8	0.222	1.09
ACD55MT_009	EAST	183.161	83.626	1.96	0.392	0.19	2.9	0.189	1.49
ACD55MT_010	EAST	62.93	88.768	1.27	0.254	0.34	1.78	0.186	0.9
ACD55MT_011	HUGO	3.786	64.693	5.46	1.092	0	0	0.46	0
ACD55MT_012	HUGO	35.618	70.134	4.26	0.852	0.01	0.03	0.449	0.04
ACD55MT_013	HUGO	11.098	64.529	5.5	1.1	0	0	0.468	0
ACD55MT_014	HUGO	5.4	79.447	2.59	0.518	0.11	0.05	0.5	0.07
ACD55MT_015	HUGO	5.531	67.218	4.88	0.976	0	0	0.462	0
ACD55MT_016	HUGO	3.326	84.489	1.84	0.368	0.21	0.06	0.5	0.08
ACD55MT_017	HUGO	13.926	70.353	4.21	0.842	0.01	0.01	0.285	0.01
ACD55MT_018	HUGO	3.327	85.141	1.75	0.35	0.23	0.06	0.499	0.08
ACD55MT_019	HUGO	10.416	74.272	3.46	0.692	0.04	0.03	0.356	0.03
ACD55MT_020	HUGO	6.666	84.303	1.86	0.372	0.2	0.11	0.5	0.15
ACD55MT_021	HUGO	0.94	87.103	1.48	0.296	0.28	0.02	0.499	0.03
ACD55MT_022	HUGO	4.717	84.883	1.78	0.356	0.22	0.09	0.5	0.12
ACD55MT_024	HUGO	1.905	78.97	2.66	0.532	0.1	0.02	0.3	0.02
ACD55MT_025	HUGO	108.941	75.944	3.17	0.634	0.06	0.54	0.5	0.73
ACD55MT_026	CENTRAL	14.835	87.999	1.36	0.272	0.31	0.38	0.22	0.23
ACD55MT_027	CENTRAL	68.153	88.104	1.35	0.27	0.32	1.82	0.216	1.07
ACD55MT_028	EAST	79.294	83.651	1.95	0.39	0.19	1.26	0.21	0.72
ACD72_01		65.858	74.686	3.39	0.678	0.05	0.27	0	0
ACD72_02		29.642	82.006	2.19	0.438	0.15	0.37	0	0
ACD72_03		14.011	75.735	3.2	0.64	0.06	0.07	0	0
ACD72_04		9.337	73.817	3.55	0.71	0.04	0.03	0	0
ACD72_04B		12.063	73.871	3.54	0.708	0.04	0.04	0	0
ACD72_05	CENTRAL	18.806	77.511	2.9	0.58	0.08	0.13	0.229	0.08
ACD72_06	WEST	58.465	71.683	3.95	0.79	0.02	0.1	0.42	0.11
ACD72_07	CENTRAL	6.461	88.3	1.33	0.266	0.32	0.17	0.224	0.1
ACD72_08	CENTRAL	4.943	88.028	1.36	0.272	0.31	0.13	0.221	0.08
ACD72_09	CENTRAL	56.87	84.609	1.82	0.364	0.21	1	0.219	0.6
ACD72_10	CENTRAL	29.044	87.84	1.38	0.276	0.31	0.75	0.216	0.44
ACD72_11	CENTRAL	15.616	85.313	1.72	0.344	0.23	0.3	0.188	0.15
ACD72_12	CENTRAL	54.612	87.56	1.42	0.284	0.3	1.37	0.228	0.85
ACD72_14	EAST	22.761	88.455	1.31	0.262	0.33	0.63	0.25	0.43
ACD72_15	EAST	20.515	83.046	2.04	0.408	0.18	0.31	0.211	0.18
ACD72_16	EAST	16.123	85.996	1.63	0.326	0.25	0.34	0.234	0.22
ACD72_17	EAST	2.514	87.037	1.49	0.298	0.28	0.06	0.243	0.04
CWC_RC_PELTIER_001		9.39	76.529	3.07	0.614	0.07	0.05	0	0
CWC_RC_PELTIER_002		81.513	72.982	3.7	0.74	0.03	0.2	0	0
CWC_RC_PELTIER_002.5	WEST	41.091	75.745	3.2	0.64	0.06	0.21	0.19	0.11
CWC_RC_PELTIER_003		14.456	74.82	3.37	0.674	0.05	0.06	0	0
CWC_RC_PELTIER_004		19.176	76.572	3.06	0.612	0.07	0.11	0	0
CWC_RC_PELTIER_005		4.37	79.956	2.51	0.502	0.12	0.04	0	0
CWC_RC_PELTIER_006		18.884	79.531	2.57	0.514	0.11	0.17	0	0
CWC_RC_PELTIER_008	CENTRAL	58.298	87.418	1.44	0.288	0.29	1.41	0.215	0.82
CWC_RC_PELTIER_009	CENTRAL	21.211	88	1.36	0.272	0.31	0.55	0.22	0.33
L_PELTIER_07		49.286	82.103	2.18	0.436	0.16	0.66	0	0
MRC_RC_PELTIER_001		1273.83	84.246	1.87	0.374	0.2	21.23	0	0
MRC_RC_PELTIER_001.5	WEST	52.956	73.035	3.69	0.738	0.03	0.13	0.258	0.09
MRC_RC_PELTIER_002		126.454	66.827	4.96	0.992	0	0	0	0
MRC_RC_PELTIER_003		13.412	80.493	2.42	0.484	0.12	0.13	0	0
MRC_RC_PELTIER_004		3.183	71.109	4.06	0.812	0.02	0.01	0	0

MRC_RC_PELTIER_006		87.354	82.325	2.15	0.43	0.16	1.16	0	0
MRC_RC_PELTIER_009		38.801	75.187	3.3	0.66	0.05	0.16	0	0
SMT_002		314.096	81.019	2.34	0.468	0.13	3.4	0	0
SMT_002.5	CENTRAL	1.986	88.166	1.34	0.268	0.32	0.05	0.226	0.03
SMT_004A	EAST	48.753	88.285	1.33	0.266	0.32	1.3	0.248	0.88

Appendix F – CSMP Design Standards by Parcel

Proposed CSMP Allocations by Parcel

Parcel Identification Number	CSMP Region	Parcel Area [ac]	Planned Impervious [ac]	Area Suitable for Infiltration [ac]	Regional BMP Allocation	Live Storage Allocation [ac-ft]	Max. Rate [cfs]	Ex. Max Rate [cfs]
11-31-22-43-0005	WEST	1.05	0.16	0	0.3%	0.13	0.11	-
11-31-22-43-0006	WEST	1	0.22	0	0.4%	0.18	0.10	-
12-31-22-31-0001	CENTRAL	58.93	7.92	4.92	2.8%	7.3	5.89	0.15
12-31-22-31-0002	CENTRAL	19.8	7.41	5.29	2.4%	6.23	1.98	0.12
12-31-22-33-0001	CENTRAL	19.68	10.33	7.55	3.5%	9.1	1.97	0.19
12-31-22-33-0003	CENTRAL	9.88	4.67	6.98	2.2%	5.75	0.99	0.12
12-31-22-33-0004	CENTRAL	11.12	6.47	6.05	2.5%	6.47	1.11	0.13
12-31-22-34-0003	CENTRAL	39.21	27.69	18.57	8.8%	22.8	3.92	0.43
12-31-22-34-4GAP	CENTRAL	0.18	0.14	0.02	0.04%	0.11	0.02	0.00
12-31-22-41-0001	EAST	37.34	22.55	18.16	7.0%	17.49	3.73	0.20
12-31-22-41-0002	EAST	2.34	1.76	0	0.4%	1.1	0.23	0.01
12-31-22-42-0001	EAST	31.66	22.28	16.4	5.8%	14.58	3.17	0.13
12-31-22-43-0002	CENTRAL	5.16	0.004	0	0.001%	0	0.52	0.00
12-31-22-43-0003	EAST	30.65	20.16	10.69	5.7%	14.36	3.07	0.12
12-31-22-44-0001	EAST	39.64	23.32	8.58	7.4%	18.56	3.96	0.11
13-31-22-11-0001	EAST	39.52	17.94	0.03	7.4%	18.51	3.95	0.11
13-31-22-12-0002	EAST	30.39	4.18	0	5.7%	14.23	3.04	0.08
13-31-22-13-0002	EAST	30.22	22.66	2.85	5.7%	14.15	3.02	0.08
13-31-22-14-0001	EAST	39.33	24.41	11.49	7.4%	18.42	3.93	0.11
13-31-22-21-0003	CENTRAL	40.03	29	13.29	9.0%	23.27	4.00	0.48
13-31-22-21-0004	CENTRAL	34	24.33	14.4	7.6%	19.76	3.40	0.40
13-31-22-22-0002	CENTRAL	1.4	1.05	1.4	0.3%	0.81	0.14	0.00
13-31-22-22-0003	CENTRAL	4.76	3.58	2.9	1.1%	2.77	0.48	0.06
13-31-22-23-0003	CENTRAL	39.91	28.2	0	8.9%	23.2	3.99	0.35
13-31-22-23-0004	CENTRAL	39.97	29.54	7.61	8.9%	23.23	4.00	0.29
13-31-22-31-0001	CENTRAL	39.6	29.45	0	8.9%	23.02	3.96	0.62
13-31-22-31-0002	CENTRAL	20	15	0	4.5%	11.63	2.00	0.41
13-31-22-32-0001	CENTRAL	19.55	14.66	0	4.4%	11.36	1.96	0.28
13-31-22-33-0001	CENTRAL	39.01	28.72	0	8.7%	22.68	3.90	5.15
13-31-22-34-0001	CENTRAL	37.9	28.43	0	8.5%	22.03	3.79	2.71
13-31-22-41-0003	EAST	10.33	7.63	0	1.9%	4.84	1.03	0.04
13-31-22-41-0004	EAST	10.22	7.42	0.8	1.9%	4.79	1.02	0.04
13-31-22-41-0005	EAST	25.13	16.75	8.93	4.7%	11.77	2.51	0.09
13-31-22-42-0001	EAST	30.57	21.87	0	5.7%	14.32	3.06	0.11
13-31-22-43-0002	EAST	10.82	7.49	0	2.0%	5.07	1.08	0.04
13-31-22-44-0001	EAST	54.6	33.67	0	10.2%	25.54	5.46	0.23
14-31-22-11-0001	WEST	19.47	7.75	5.73	12.7%	6.35	1.95	0.24
14-31-22-11-0002	WEST	19.48	9.25	6.11	12.8%	6.39	1.95	0.22
14-31-22-12-0002	WEST	44.18	15.28	16.77	28.6%	14.3	4.42	0.21

Proposed CSMP Allocations by Parcel

Parcel Identification Number	CSMP Region	Parcel Area [ac]	Planned Impervious [ac]	Area Suitable for Infiltration [ac]	Regional BMP Allocation	Live Storage Allocation [ac-ft]	Max. Rate [cfs]	Ex. Max Rate [cfs]
14-31-22-13-0002	WEST	49.82	8.76	0	16.1%	8.06	4.98	-
14-31-22-14-0001	WEST	38.96	12.3	0	25.5%	12.77	3.90	0.04
14-31-22-21-0001	WEST	0.9	0.45	0.35	0.6%	0.29	0.09	-
14-31-22-21-0004	WEST	2.34	0.96	0.81	1.5%	0.77	0.23	-
24-31-22-11-0005	EAST	18	5.17	0	1.8%	4.45	1.80	0.04
24-31-22-11-0007	EAST	1.24	0.84	0	0.2%	0.52	0.12	0.01
24-31-22-11-0008	EAST	16.54	9.35	0	2.8%	7.06	1.65	0.06
24-31-22-12-0001	EAST	28.12	8.79	0	2.4%	5.9	2.81	0.05
24-31-22-21-0002	CENTRAL	5.45	0.28	0	0.1%	0.22	0.55	5.87
24-31-22-21-0003	CENTRAL	14.16	0.47	0	0.1%	0.36	1.42	6.97