The City of Ramsey
Surface Water Management Plan

Project 14-31
October 21, 2015

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: _____

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Date: October 21, 2015 Registration No. 21112

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_____

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I. PURPOSE OF PLAN

The purpose of this Surface Water Management Plan (SWMP) is to promote, preserve and enhance the natural resources within the City of Ramsey. The City will protect water quality and unique and fragile environmentally sensitive land from adverse effects that can potentially be caused by poorly sited development or incompatible activities. The City proposes to accomplish this by regulating land disturbances and development activities.

This plan was originally prepared in 2008 by Bolton and Menk, Inc. (the "2008 Plan"). This document is intended to update the 2008 Plan as required (the "2015 Update"). The City has prepared the 2015 Update utilizing the 2008 baseline data prepared by Bolton and Menk.

Minnesota Rules Chapter 8410 (Metropolitan Area Local Water Management) requires specific elements to be addressed in local water management plans. The various chapters of this report are designed to address each element required under these rules. In addition, this plan follows the Metropolitan Council's 2040 Water Resources Management Policy Plan requirements. At the time of drafting of this report, the Metropolitan Council was in the process of completing the 2040 Water Resources Policy Plan, which replaces the plan mentioned in this paragraph. As part of the City's 2040 Comprehensive Plan Update, the City will review the need to update this document. IN 2002, the Minnesota Pollution Control Agency designated the City of Ramsey as a mandatory Municipally Separate Storm Sewer System (MS4) community needing to submit a National Pollutant Discharge Elimination System (NPDES) permit regulating its storm water runoff. As such, the City submitted a Storm Water Pollution Prevention Plan (SWPPP) with its permit application in 2003. The permit was reissued in 2006 and 2013. The City has update the SWPPP to meet the requirements of each reissue. Accordingly, an additional purpose of this SWMP is to control or eliminate storm water pollution. Key contributors to storm water pollution are soil erosion and sedimentation. The city-wide SWPPP incorporates ordinance changes that address erosion control, sedimentation associated with construction activities as well as illicit discharges to surface waters, all primary contributors of storm water pollution.

The City's goal is to minimize conflicts and encourage compatibility between land disturbing activities, water quality and environmentally sensitive lands. This will be accomplished through detailed development ordinances, plan review standards and recommended pollution control procedures in an effort to strike a balance between urban growth and the protection of water quality and natural areas. This SWMP, in conjunction with the policies set forth in the City ordinances, establishes standards and specifications for conservation practices and planning activities to minimize storm water pollution, soil erosion and sedimentation.

This submittal is a culmination of research, mapping, land use analysis/planning and hydraulic design. The end product is a detailed design tool that can be used by the City of Ramsey in planning growth and infrastructure replacement. This summary report represents only a small part of the total work product created through the master planning process. The current City ordinances have also been revisited as part of this process, as they are the best means to implement the recommendations made in this report.

Following the approval of this SWMP by the Lower Rum River Watershed Management Organization (LRRWMO), the City will have administrative authority for the approved SWMP and ordinances. The City will also have the duty to enforce the SWMP and associated ordinances. The City places a high priority in improving impaired waters and intends to work with the LRRWMO and other agencies to achieve water quality goals by reducing the impact created by the City.

II. EXECUTIVE SUMMARY

A. Plan Purpose and Background

Storm water regulations have changed significantly since the original Comprehensive Storm Drainage Plan was approved in 1980 and the southeast growth area was revisited in 1997 and 2002. The plan was updated in 2008 and renamed the Storm Water Management Plan. The following is a listing of those regulatory changes:

1. 1982

   The *Metropolitan Surface Water Management Act* was passed. The Act was originally included in Minnesota Statute Chapter 509. The Act was recreated and modified in 1990 and became Minnesota Statue 103B.205 to 103B.255.

   Originally, the former State of Minnesota Water Resources Board oversaw implementation of the act. When that board was merged with two other boards to form the Minnesota Board of Water and Soil Resources in 1987, the Board of Water and Soil Resources assumed responsibility for the act. Forty-six watershed management organizations (36 joint powers Watershed Management Organizations and 10 Watershed Districts) were originally responsible for preparing plans to:

   - protect, preserve, and use natural surface and groundwater storage and retention systems
   - minimize public capital expenditures needed to correct flooding and water quality problems
   - identify and plan for means to effectively protect and improve surface and groundwater quality
   - establish more uniform local policies and official controls for surface and groundwater management
   - prevent erosion of soil into surface water systems
   - promote groundwater recharge
   - protect and enhance fish and wildlife habitat and water recreational facilities
   - secure the other benefits associated with the proper management of surface and groundwater [1]

2. 1985

   The Lower Rum River Water Management Organization (LRRWMO) was formed to meet the requirements of the Metropolitan Surface Water Management Act.

[1] Excerpt taken from the Minnesota Board of Water & Soil Resources Website: http://www.bwsr.state.mn.us/watermgmt/metroareasurface.html

3. 1987

The Federal Clean Water Act was amended to address storm water as a pollution source. This resulted in the EPA developing a NPDES Phase I permit that targeted Cities with populations in excess of 100,000. As a result, in 1991, Minneapolis and St. Paul were required to apply for permits. One permit requirement was the development of a city-wide Storm Water Pollution Prevention Plan (SWPPP) that included approximately 30 mandatory Best Management Practices (BMPs) addressing everything from education and good housekeeping for municipal operations to mandatory city ordinances.

4. 1991

The Minnesota Legislature passed the Wetlands Conservation Act (WCA). The WCA is administered according to Minnesota Rules Chapter 8420 to implement the purpose of the Act, which is to:

- Achieve no net loss in the quantity, quality, and biological diversity of Minnesota's existing wetlands
- Increase the quantity, quality and biological diversity of Minnesota wetlands by restoring or enhancing diminished or drained wetlands;
- Avoid direct and indirect impacts from activities that destroy or diminish the quantity, quality, or biological diversity of wetlands
- Replace wetland values where avoidance of activities is not feasible and prudent. [2]

5. 1992

The Board of Soil and Water Resources (BWSR) developed Minnesota Rules Chapter 8410. This set of rules consists of 18 parts that define the scope, general structure and content required for BWSR approval of a Local Surface Water Management Plan. The table of contents of this report and the content within each chapter has been structured to meet MN Rule 8410 as well as the specific requirements of the City of Ramsey.

6. 2003

NPDES Phase II, the second round of the 1987 Federal Clean Water Act amendment, targeted cities with populations over 10,000. The City submitted a permit application and SWPPP in accordance with MPCA deadlines.

The City finalized its most recent SWPPP in 2013. That SWPPP is attached in Appendix A to this report.

[2] Excerpt taken from the University of Minnesota Duluth website: http://www.d.umn.edu/fm/safety_envir/wetlands/pdf_pages/4.0%20Wetland%20Regulations.pdf

7. 2005

   The Metropolitan Council has requirements for local governments to include local water management plans as part of their Comprehensive Plans. The Metropolitan Council does not have authority to set policy or administer local storm water regulations. This Surface Water Management Plan Update is designed to address current requirements governing local water management plans. The general boundary of the plan includes all property within the City limits of Ramsey. When accepted by all local, regional, state and federal agencies having jurisdiction, the City of Ramsey will be the sole responsible party for administering this plan.

8. 2012

   The Lower Rum River Watershed Management Organization adopted their Third Generation Plan. The new plan requires infiltration for new and redeveloped sites, use of the Atlas-14 rainfall distributions and reductions in Total Suspended Solids (TSS) and Total Phosphorus (TP) for runoff discharged from new permitted projects.

B. General Content of Required Local Plans

This SWMP follows the general report structure listed in Minnesota Rules Chapter 8410.0170, the general requirements in Minnesota Statute sections 103B.205 - 103B.255, and the Metropolitan Council's requirements for local water management plans as adopted May 2005 as part of the Metropolitan Council's *Water Resources Management Plan*. As stated above, the City will update this plan subsequent to the adoption of the Metropolitan Council's 2040 Water Resources Policy Plan.

C. Summary of the Goals, Problems, and Potential Solutions

The general findings of this Surface Water Management Plan report are summarized as follows:

1. Ramsey is located in the Anoka Sand Plain. The area is well known for its highly permeable soil. As such, the runoff from significant rainfalls is generally reduced to the extent that the existing drainage network functions well with no significant flooding outside the Mississippi River, Rum River, Trott Brook, Ford Brook, County Ditch 43 and County Ditch 66 flood plains.

   Because of the pervious nature of the Anoka Sand Plain, the City will need to review its development ordinances to mitigate the adverse effect that a significant increase in impervious surfacing and mass grading can have on runoff conditions. The addition of significant amounts of impervious surfaces and the reduced permeability associated with the soil compaction in mass grading without a reasonable attempt to restore or duplicate the current infiltration pattern could create very significant increases in runoff volumes and downstream flooding. This is especially true in the Trott Brook, D66, EMISS and WMISS watersheds (see Figure 9), where improvements in uppermost watershed limits must flow a significant distance to the ultimate watershed outlet. The longer flow path associated with each of these watersheds allows greater opportunities for peak flows from conventional detention ponds to coincide.

   One solution to the problem of coincident peak flows is the use of low impact development techniques. There are a variety of low impact development

techniques. The current low-density residential developments in northern Ramsey are a close approximation of what a low impact development can be like. This area has a noticeably lesser storm water impact than that of either high-density residential developments or commercial/industrial developments.

However, Ramsey's land use plan creates a variety of land use types in which low-density residential is not planned for all areas of the community. With these development plans in mind to balance low impact development with the City's economic development goals, the City must consider other techniques to encourage maximized infiltration of storm water.

This report recommends modifying the current development ordinances to encourage infiltration and soil ripping of mass grading to compensate for lost infiltration conditions as well as requiring oversized retention ponding to mitigate and compensate for increases in runoff. Innovative solutions to the storm water runoff increases associated with the increase in impervious surface will be investigated and encouraged when deemed appropriate. Potential solutions include pervious pavements, rain gardens, infiltration basins and low impact development among others.

2. An integral part of this SWMP is updating the comprehensive storm water runoff modeling performed in 2008. The 2008 modeling effort captured the existing conditions throughout the entire city. This modeling includes:

   a. Mapping out the small watersheds draining to general collection points such as low points in roadways and intersections, wetlands or ponds.

   b. Estimating the runoff from the 2, 10 and 100-year rainfall events.

   c. Routing the runoff through the existing system.

   The existing system may be a pipe network, a pond, a wetland or a waterway. The modeling predicts the high water levels and flows associated with each rainfall event modeled.

   This modeling provides a baseline for comparison purposes as new developments change the drainage pattern. With this modeling information, City staff can readily review the cumulative impacts of large developments for effects on the baseline conditions across the entire watershed.

   Storm and Sanitary Analysis (SSA) software was used in the comprehensive modeling. This software is based on the industry standard EPASWMM process and the St. Vennant equations. The model can be used to input actual rainfall events from rain gauges and can model the transport of pollutants through the system. This will be very useful in evaluating the BMP measures to address future TMDLs.

3. Where the cumulative effect of regulated development is potential flooding, the recommended practice is the construction of retention ponds or detention basins, including infiltration, as a requirement of further development of the outlying growth areas. It is further recommended that the post construction peak outflows from new developments be limited to no more than the existing peak flow for the 2-, 10-, and 100-year storms. The Third Generation Lower Rum River Watershed Management Plan requires infiltration of the first 1" of runoff from new

impervious surfaces. This will better mitigate the cumulative effects of increased impervious surfacing and increased runoff volume from new developments.

Because the majority of the area is served by large stream/wetland complexes, regional ponding is not possible for a significant part of the city. Where they are possible, the creation of regional ponds is preferred because of the limited maintenance (compared to a multitude of individual development ponds) and the opportunity to control larger drainage areas. By contrast, a multitude of scattered ponds associated with each individual site development may be designed to reduce the peak outflow for its smaller area, by storing the excess runoff and releasing it at a lesser rate for a longer duration. This longer pond outflow duration may coincide with the reduced peak flows from other individual site ponds and create a larger combined peak flow than the original undeveloped condition. Hence, regional ponds are recommended where physically possible, because of the opportunity to control the runoff on a larger scale and ensure that the downstream system is not adversely impacted by uncoordinated development that meets a typical runoff ordinance. The greater control afforded by regional ponds may also reduce the flows to the downstream system and allow for decreased costs in downstream infrastructure improvements.

4. The proposed infiltration requirements and pond network is part of the goal of accommodating continued responsible growth. Revisions will be required as formal developer layouts are presented to the City. Although this plan forms a sound basis for future development, it is important to remain flexible in finding ways to manage runoff while still accommodating the continued development of the city.

5. The maps attached at the end of this report are for general illustration purposes. As part of the plan development, large scale maps and GIS compatible files have been prepared as part of the 2008 SWMP and updated with preparation of this plan. The GIS maps and files show more detailed information including watershed areas, proposed pond areas and storage volumes, estimated flow rates into and out of the proposed ponds for both the existing and developed conditions, proposed interconnecting pipe sizes between ponds, etc.

6. The City will pursue outside funding to help finance the recommended capital improvements described in this plan. Local financing will most likely come from a combination of storm sewer trunk fees and the City's storm water utility fund.

   Any determined storm water management charges or area charges to new developments should be reviewed on an annual basis to ensure that changes in land acquisition, construction cost, bonding cost, legal cost, etc. are included in the computed fee.

7. The 2008 SWMP included a complete wetland functions and values assessment as part of a greater wetlands management plan.

   The wetland buffers recommended in the Wetlands Function assessment were approved by City Council when the 2008 SWMP was approved. Further review of the buffers by the City Council resulted in a policy decision to delay the implementation of the wetland buffers recommendations.

   Wetlands are to be further protected by controlling discharges from developing areas. The proposed controls include pretreatment BMPs and runoff controls

designed to maintain the current hydrology and maintain or improve the current functions and values of the wetland.

D. Amendments and Updates

This report is intended for the coverage period to 2022. It should be considered as a working document that should be updated and amended in accordance with the procedures described in Section IX. Amendment will be needed as development progresses and actual new development data is integrated into the overall model.

The Minnesota Pollution Control Agency (MPCA) has not completed total maximum daily load (TMDL) studies for the impaired waters within the city boundaries of Ramsey (see Table 15 for the list), and is still completing the TMDL study of Lake Pepin (downstream from Ramsey). The Lake Pepin TMDL may have a major impact on all NPDES permittees in the metro area. The City of Ramsey is aware of the potential need to amend the local water management plan prior to 2022 based on the implications and requirements of the Lake Pepin TMDL and the TMDLs for the impaired waters within the city.

The City has updated the SWPPP in accordance with the reissuance of the MS4 permit in 2013. The SWPPP addresses the education components required by the surface water management plan.

III. REGULATORY REQUIREMENTS AFFECTING PLAN

The following is a brief summary of the primary Statutes and Rules governing storm water management in the 7-County metropolitan area. These requirements establish and control the content of this plan and cite objectives regarding surface water management:

A. Minnesota Rules Chapter 8410.0170

These rules outline the structure of a SWMP. Each SWMP must have the following at a minimum:

1. A purpose statement outlining the purposes of the water management programs required by MN Statute sections 103B.205 - 103B.255.
2. A section of water resource related agreements
3. A land and water resource inventory (required by part 8410.0060)
4. A section on the establishment of policies and goals
5. A section on assessment of problems
6. A section on corrective actions
7. A section on financial considerations
8. An implementation program discussing which components of the implementation program the City will prioritize
9. A section on the City's amendment procedures

This document is intended to meet these rules and hence each requirement is included.

B. Minnesota Statute 103B.235

This state law predates Minnesota Rule 8410 and includes additional requirements as follows:

1. Subdivision 1 - *Requirement* states that the City of Ramsey is required to submit a watershed management plan because it is within the 7-County metropolitan area.
2. Subdivision 2 - *Contents* states that the SWMP shall:
    a. Describe existing and proposed physical environment and land use;
    b. Define drainage areas and the volumes, rates, and paths of storm water runoff;
    c. Identify areas and elevations for storm water storage adequate to meet performance standards established in the watershed plan;
    d. Define water quantity and water quality protection methods adequate to meet performance standards established in the watershed plan;
    e. Identify regulated areas; and
    f. Set forth an implementation program, including a description of official controls and, as appropriate, a capital improvement program.
3. Subdivision 3 - *Review* states that, after consideration but before adoption by the governing body, the City shall submit its SWMP to the area water management

organization (WMO) for review for consistency with the watershed plan adopted pursuant to section 103B.231. The Lower Rum River Water Management Organization (LRRWMO) has WMO jurisdiction in Ramsey. According to the statute, the LRRWMO must approve or disapprove the plan or parts of the plan. The LRRWMO has 60 days to complete its review; provided, however, that the LRRWMO shall, as part of its review, take into account the comments submitted to it by the Metropolitan Council pursuant to subdivision 3a. If the WMO fails to complete its review within the prescribed period, the SWMP shall be deemed approved unless the City agrees to an extension.

3a. Subdivision 3a - *Review by Metropolitan Council* states that the City shall submit its SWMP to the Metropolitan Council for review and comment. The council shall have 45 days to review and comment upon the SWMP or parts of the plan with respect to consistency with the Metropolitan Council's comprehensive development guide for the metropolitan area. The Metropolitan Council's 45-day review period shall run concurrently with the 60-day review period by the LRRWMO. The Metropolitan Council shall submit its comments to the LRRWMO and shall send a copy of its comments to the City. If the Metropolitan Council fails to complete its review and make comments to the LRRWMO within the 45-day period, the LRRWMO shall complete its review as provided in subdivision 3 of State Statute 103B.235.

4. Subdivision 4 - *Adoption and Implementation* requires the City to adopt and implement its plan within 120 days after approval of the SWMP by the LRRWMO and to amend its official controls accordingly within 180 days.

5. Subdivision 5 - *Amendments* states that to the extent and in the manner required by the LRRWMO, all major amendments to the SWMP shall be submitted to the LRRWMO for review and approval in accordance with the provisions of State Statute 103B.235, subdivisions 3 and 3a for the review of plans. All minor amendments will be reviewed and approved by the City Council.

All of these required MS 103B.235 items are covered in this document.

C. **Local Ordinances**

The City of Ramsey will administer and enforce the water resource-related ordinances under the direction and control of, and subject to the powers expressly reserved to, the City Council. Following approval of this SWMP and ordinances, the City shall have administrative authority for the approved SWMP and ordinances. The Applicant, permittee or any other person or political subdivision with an interest in the determination of the City's interpretation or application of these ordinances may file a written appeal to the City Council within fifteen (15) business days of said determination. Said appeal shall state the specific grounds upon which the appeal is based. Within thirty (30) days of the date of receipt of the appeal, the City shall schedule the appeal for a regular or special meeting of the City Council. The City Council shall make its decision to affirm, reverse, or remand the determination by adopting a resolution stating findings of fact.

D. **Total Maximum Daily Loads and Impaired Waters**

The 1987 amendment to the Federal Clean Water Act required all impaired waters to be corrected. In making rules to meet the 1987 Amendment, the Environmental Protection Agency (EPA) first set criteria to determine a list of impaired waters depending on the potential use of the water. The Minnesota Pollution Control Agency (MPCA) worked to set guidelines to establish intended uses for the waters of the state and then set acceptable water quality criteria. After testing to determine the water quality, waters failing to meet the water quality criteria are placed on the 303d Impaired Waters list that is submitted to the EPA. Table 15 in Section IV, page 16 of this report, lists the current (2006) MPCA 303d Impaired Waters in Ramsey. It should be noted that, as of 2007, only about 25% of the waters of the State of Minnesota had been tested. Hence, the impaired waters list is likely to increase in the Ramsey area.

The process to remedy the impairment includes establishing a Total Maximum Daily Load (TMDL) allocation to each contributor to the problem. A TMDL is a calculation that determines the allowable pollutant load that can be discharged into the impaired water so that the limited load will ensure that the water improves to levels where it is no longer impaired. The typical process is initiated by the MPCA and includes a series of stakeholder meetings to formulate viable solutions and mutually work out a reasonable allocation of acceptable pollutant loading.

E. **Specific Lakes and Streams with Water Quality Problems**

Since a TMDL study has not been completed for the known impaired waters in Ramsey and downstream from Ramsey (such as Lake Pepin), the City should identify the priority it places on addressing impaired waters and how the City intends to participate in the development or implementation of TMDL projects. The Rum River and Mississippi River watersheds are too large for the City of Ramsey to take the lead on the TMDL Stakeholder process for these two waters. It is recommended that the City volunteers to participate in the Stakeholder process for these waters. Through this SWMP, the City of Ramsey has the capability of modeling contaminant transport using the SSA model. The City will work with the LRRWMO and the MPCA to formulate a TMDL for the impaired Rogers Lake.

Once a TMDL study is completed for the impaired water, the City must include, in this SWMP and its City-wide SWPPP, an implementation strategy including funding mechanisms that will allow the implementation of the TMDL requirements. As MPCA completes its TMDL process for each impaired water, the implementation of the measures to meet the TMDL will immediately become a priority item for the City of Ramsey.

F. **Lower Rum River Water Management Organization**

The City of Ramsey entered into a Joint and Cooperative Agreement for the Establishment of the *Lower Rum River Watershed Management Organization to Plan, Control and Provide for the Development of the Lower Rum River Watershed* in June of 1995. The Minnesota Board of Water and Soil Resources officially signed the Findings of Fact, Conclusions and Order accepting the Second Generation Watershed Management Plan on August 26, 1998. The LRRWMO updated its plan in 2012. The LRRWMO's plan update will trigger the mandatory re-evaluation and potential need for an update of the City's SWMP within two years from the date the LRRWMO's plan is approved by

BWSR. Update of the City's SWMP was delayed to incorporate the requirements associated with the reissuance of the MS4 permit in 2013.

G. **NPDES Requirements**

In 1987, the US Congress amended the Clean Water Act to include storm water pollution and directed the Environmental Protection Agency (EPA) to initiate rulemaking. The first round of EPA rules were implemented in 1991 when NPDES Phase I permits were required for all cities exceeding 100,000 in population. Phase II was implemented in 2003 and targeted all cities with populations exceeding 10,000. The Minnesota Pollution Control Agency (MPCA) assumed responsibility for implementing the rules and issuing all Phase II permits. The City of Ramsey was required to submit a permit for its Municipally Separate Storm Sewer System (MS4) in March of 2003. The permit was reissued in 2006 and 2013. The permit required the City of Ramsey to meet six minimum storm water control measures as follows:

1. Public education and outreach
2. Public participation and involvement
3. Detection and elimination of illegal discharges
4. Control of large construction sites runoff
5. Post construction storm water management
6. Pollution prevention or housekeeping for municipal operations

To show that the City of Ramsey is committed to implementing its Phase II permit, it was required to submit a Storm Water Pollution Prevention Program (SWPPP), which is essentially a list of promised steps the City proposes to make to meet these minimum control measures. The promises are in the form of Best Management Practices (BMPs) to be implemented at specified times over the life of the permit.

In general, the NPDES storm water discharge permit program is designed to reduce adverse impacts to water quality. The primary targets of acceptable storm water management plans are urban runoff and construction runoff. This is because urban runoff carries pollutants from cars, lawn fertilizers, pesticide spills and other contaminants into our lakes, wetlands and streams without entering wastewater treatment systems. Construction runoff is often laden with sediment caused by large amounts of un-vegetated soil that is loosened by excavation and grading.

The MPCA mandates are intended to regulate these sources of continued environmental degradation. To comply with the NPDES permit requirements, the City's SWPPP was drafted to establish measurable goals using the Best Management Practice (BMP) approach and to be able to track performance and progress.

Erosion and sediment control measures must be included in the City-wide SWPPP. The minimum standard is the General Permit Authorization to Discharge Storm Water Associated With Construction Activity Under the National Pollutant Discharge Elimination System/State Disposal System Permit Program Permit MN R040000 (NPDES/SDS Permit) issued by the Minnesota Pollution Control Agency on August 1, 2013, as amended. Some components of the NPDES/SDS Permit include:

1. If land disturbing activity is taking place on a site where the soils are currently disturbed (e.g., a tilled agricultural site that is being developed), areas that will

not be disturbed as part of the development and areas that will not be disturbed according to the time frames and slopes specified in the NPDES General Construction permit Part IV.B.2, shall be seeded with temporary or permanent cover before commencing the proposed land disturbing activity.

2. Where one (1) or more acres of disturbed soil drain to a common location, a temporary (or permanent) sediment basin must be provided prior to the runoff leaving the site or entering surface waters. The basins must be designed and constructed according to the standards in the NPDES General Construction Permit Part III.B.

3. The Permittee or applicant must ensure final stabilization of the site in accordance with the NPDES General Construction Permit requirements. The site will be considered as having achieved final stabilization following submission of Certificate of Completion by the permittee or applicant, and inspection and approval by the City.

H. Non-Degradation Rulemaking

The MPCA is currently going through due process to update its non-degradation rulemaking effort and amend the state rules governing the non-degradation of waters (Minn. R. 7050.0180 and 7050.0185). Rules protecting Outstanding Resource Value Waters were adopted in 1984, while rules governing non-degradation of all waters were adopted in 1988. Since then, there have been many changes to the state and federal structure for water protection and to the understanding of water quality. The MPCA intends, with the assistance of a significant stakeholder effort, to thoroughly investigate the issues associated with non-degradation of waters, and to adopt rules that will address those concerns.

The MPCA has already taken the first steps in the rulemaking process by publishing two Requests for Comments regarding our intent to amend the current non-degradation rules. These Requests for Comments were published in the *State Register* on January 29, 2007, May 29, 2007 and February 25, 2013.[3]

This language was copied from the MPCA website in January 2015. The City of Ramsey will incorporate the non-degradation policies into this SWMP when they are formally adopted into the state rules.

[3] Excerpt taken from MPCA website: http://www.pca.state.mn.us/http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/nondegradation-rulemaking.html

IV. LAND AND WATER RESOURCES INVENTORY

Each plan must contain an inventory of water resource and physical factors affecting the water resources based on existing records and publications. If data publications and maps are available at a convenient central location, they may be included by reference. The plan must include a brief summary of the data and must identify where the publication can be obtained. The following subsections are required.

A. Precipitation

The state climatology office has records of all official rain gauges throughout Anoka County. The monthly precipitation totals and county-wide monthly averages for Anoka County are available online at:

http://climate.umn.edu/HIDENannual/

The two closest high-density rain gauges are:

1. No. 211785, Coon Creek
2. No. 217308, Saint Francis

Information is readily available from 1971 to the present. Over this time period, the aggregate annual precipitation ranged as follows:

Lowest annual precipitation..... 16.5 inches in 1976

Highest Annual Precipitation..... 39.09 inches in 1983

Average Annual Precipitation ..... 29.54 inches per year

The following is the average annual precipitation per decade:

1970s..... 26.8 inches per year

1980s..... 29.9 inches per year

1990s..... 31.2 inches per year

2000s..... 29.6 inches per year

2010s……29.2 inches per year

On the average, June is the wettest month, followed by July and May.

B. General Geology and Topographic Data

The City of Ramsey is nestled between the Rum and Mississippi Rivers and within 2 miles of the confluence of these rivers. The general terrain is relatively flat and is often called the Anoka Sand Plain. The elevations range from approximate elevation 920 feet above mean seal level in northwestern Ramsey to near 840 feet at the lower Rum River. The straight-line distance between these points is approximately 60,000 feet, making the average slope less than 1 percent. In general, the land slope is in the 2 to 5 percent range.

There are steep slopes within the shoreland protection zone of the Rum and Mississippi Rivers, as well as scattered locations throughout the City. From the aerial photographic contour map, the slopes near the rivers can be as high as 65 percent. A map showing the areas with slopes between 12 and 18 percent and separately showing the areas with slopes greater than 18 percent is attached as Figure 1.

Virtually all of the Ramsey city limits is within the Anoka Sand Plain, which consists of highly permeable soils. Figure 2 shows the general subsurface geology of aquifers in the vicinity of Ramsey. The Anoka Sand Plain is part of the undifferentiated drift (Layer 1). The Minnesota Department of Natural Resources and the Minnesota Geological Survey generated Figure 3 as part of the Regional Hydrogeologic Assessment for the Anoka Sand Plain.[4] Based on Figure 3, waterborne contaminants in the Ramsey area can reach upper aquifers within hours or months of release, necessitating additional care in regulating surface water contamination. The majority of Ramsey is rated with the highest geologic sensitivity to pollution in the uppermost aquifer.

The Board of Water and Soil Resources website indicates that Anoka County, though not participating in the official metropolitan groundwater planning process, has prepared a "groundwater protection assessment." The county public health department coordinates the county groundwater planning and management activities.[5] However, there is no mention of the assessment on Anoka County Health and Environment Department website.

The City Wellhead Protection Plan was completed in the September of 2007. The final draft of Part 1 was accepted by all review agencies and City staff is currently working on Part 2. Figure 4 shows the 10-year capture zone (Well Head Protection Area, WHPA) as well as the Drinking Water Supply Management Area (DWSMA) for the seven municipal drinking water wells in Ramsey. Storm water infiltration will not be allowed inside the 10 year capture zone.

C. Surface Water Resource Data

1. Public Waters

A map of the public waters, streams, lakes, and public ditch systems established under Minnesota Statutes, chapter 103D or 103E, including the location of existing dams and control structures is shown in Figure 5. A map of the natural drainage routes is also attached as part of the Parks Map in Figure 6.

The Minnesota Department of Natural Resources (DNR) uses the U.S. Fish and Wildlife classification system (Circular 39) for wetlands and currently requires a permit for alteration of wetland types 3-5 which are 2.5 acres or larger. Ramsey City Code Section 117-124, Environmental Protection Overlay Districts includes provisions designed to further protect wetlands. . As stated previously, this section of code does not include required vegetative buffers for new developments around the perimeter of wetlands.

[4] Minnesota Dept. of Administration / Office of Geographic and Demographic Analysis / Land Management Information Center. Website: http://www.lmic.state.mn.us/chouse/metadata/asp.html

[5] http://www.bwsr.state.mn.us/watermgmt/metrogroundwaterplans.html

In addition to the protected waters list, the Mississippi River has a designated Critical Area Corridor and the Rum River is designated as a Wild & Scenic Outstanding Resource Value Water (see Figure 6 – Parks Map).

2. Shoreland

In order to control the development and utilization of shoreland along protected waters thereby preserving the water quality, natural characteristics, economic values and the general health, safety and welfare, the following waters in the city limits have been given a shoreland management classification. These protected waters within the city limits have been classified by the Commissioner of Natural Resources as follows:

	Natural Environment Lakes	**DNR I.D. #**
1.	Lake Eddy	2-109
2.	Itasca	2-110
3.	Rogers	2-104

	Recreational Development Lakes	**DNR I.D. #**
1.	Jeglens Marsh	2-111
2.	Peltzer Pond	2-112
3.	Grass (Sunfish)	2-113

	General Development Lakes	**DNR I.D. #**
1.	Ramsey Terrace Pond	2-114
2.	Magnesium Street Pond	2-116
3.	Industry Avenue Pond South	2-117
4.	Industry Avenue Pond North	2-118

	General Development Streams	**Locations**
1.	Trott Brook	Sections 1, 2, 3, 7, 8, 9, T32N, R25W
2.	Ford Brook	Sections 1 & 2, T32N, R25W

The above shorelands of the city are designated as a Shoreland Overlay District. The purpose of the Shoreland Overlay District is to control the utilization of shoreland areas and to preserve the quality and natural character of these protected waters within the City. The shoreland overlay districts are shown on the City's Mississippi/Rum River Overlay Districts Map. Boundaries of the overlay districts can be determined by scaling distances off the official environmental overlay map.

All wetlands on the National Wetlands Inventory map are shown on Figure 7. The National Wetlands Inventory Map is not all inclusive, wetlands exist in the

City of Ramsey that are not shown on the map. Each site proposed for development must be evaluated for wetlands as required in City Code.

Pretreatment of all storm water from new developments is required prior to discharge into any wetlands. Wetlands may be, and are currently being used for storm water storage for larger rainfall events. They may continue to be used for this purpose – even after upstream development, provided that:

1. There is acceptable Best Management Practice pretreatment of the runoff in accordance with the MPCA NPDES/SDS Construction Permit, Section III.D., Permanent Stormwater Management System.
2. The impacts of stormwater from new development discharging into a wetland will be determined through a Minnesota Routine Assessment Methodology (MnRAM) assessment of the wetland.

The Minnesota Wetland Conservation Act (WCA) requires the designated Local Governmental Unit (LGU) in charge of administering the WCA to generate a Notice of Wetland Conservation Act Decision for any impact to wetlands within the City of Ramsey. In all but minor decisions, the LGU will call for a Technical Evaluation Panel (TEP) review of the application or impact prior to issuing a decision. The LGU must give notice of proposed actions affecting wetlands to all of the following:

a. The Minnesota Board of Water and Soil Resources
b. The Soil and Water Conservation District
c. The Minnesota Department of Natural Resources
d. The Lower Rum River Watershed Management Organization
e. The U.S. Army Corps of Engineers
f. Interested citizens requesting notification of such actions

If a TEP meeting is required, all listed parties are invited to review the proposed action. However, it is not uncommon for a TEP meeting to consist of only a small contingent of this list, as some invitees may have no jurisdiction over the proposed action.

3. Watersheds

A general watershed map breaking the City of Ramsey into seven primary watersheds is attached as Figure 8. The naming convention for the nodes (i.e., pipes, channels, junctions, manholes, and ponds) is based on the county section and quadrant numbers and is described in Figure 9. The subsequent Figure Nos. 10 through 23 show the subwatersheds and drainage pattern within each of the separate primary watersheds. Storm water ponds, 100-year peak pond elevations and outfalls are also shown on these maps.

The City Storm Sewer infrastructure is also shown on the individual primary watershed maps. In the GIS database for these maps, the pipe network is color coded to reflect the various pipe sizes.

4. Flood Levels

Floodplains are covered by City of Ramsey Code Section City Code Chapter 117, Article II, Division 4, Subdivision III. A comprehensive map showing all of the FEMA Flood Insurance Rate Map (FIRM) flood plains is attached as Figure 24. Flood studies have been performed for the following waterways:

a. Mississippi River

b. Rum River

c. Trott Brook

d. Ford Brook

Copies of the flood studies are available at the office of the City Engineer or online at the FEMA Map Service Center. These studies have been incorporated into the Official Zoning Map in accordance with Ramsey City Code Section II Chapter 117, Article II, Division 4, Subdivision III... The Official Zoning Map is on file in the Office of the City Administrator and the City Zoning Administrator.

In addition to the flood levels predicted by the FEMA flood studies, Bolton & Menk performed a flood study of County Ditch 66 using the HEC-RAS stream modeling program. This information has been coordinated with the SSA modeling software and submitted to FEMA for agency acceptance as a flood plain elevation. The 100-year flood plain has been recorded on the map along with the FEMA data. The color-coded legend of Figure 24 helps to differentiate between the federally modeled floodplain and the unofficial City flood plain.

In addition to the flood map, Tables 1 through 7, located in the Tables Appendix of this report summarize the modeled 100-year flood levels and peak discharges of existing storm water ponds and natural depressions that correspond to the peak discharges of channel flow passing through the watershed.

After a detailed review of the new and available flood profile information, the results appear consistent and provide a reasonable hydraulic grade from the upper reaches of the various flood channels to the ultimate confluence with the Rum and/or Mississippi Rivers.

5. Water Quality Information

Section 303d of the Clean Water Act requires that each state submit a list of Impaired Waters. The MPCA website lists the impaired waters as officially designated in 2014. Table 15 lists the impaired waters found in Ramsey:

Table 15

303d Impaired Waters List Excerpt from MPCA

Name	Affected Use	Pollutant or Stressor	Year Designated	Target Start	Target Completion
Rogers Lake	Aquatic Recreation	Excess Nutrients	2006	2013	2017
Rum River	Aquatic Consumption	Mercury, FCA	1998	2008	2025
Mississippi River	Aquatic Consumption	Mercury, FCA	1998	2008	2025
	Aquatic Consumption	PCB, FCA	2002	2002	2025

The Minnesota DNR maintains a database on all Minnesota lakes. Some of this data is very limited or not available, while other lakes have been studied in great detail. To find the most current data on the lakes in Ramsey, access the Lake Finder on the DNR Website.

The WMO document has a list of monitoring locations. The Anoka Conservation District (ACD) has water quality information. The ACD has also published a water atlas.

6. Water Appropriations

Upon approval by all of the review authorities, the City's approved Wellhead Protection Plan will be incorporated into this plan by reference. At present, the draft includes all of the current municipal ground water appropriations. The City is considering obtaining surface water appropriations from the Mississippi River for a 20 MGD water treatment plant. The scope of the project will require Regional Participation. The City is working with the Metropolitan Council and other regional partners to explore a regional funding solution to locally operated surface water supply treatment plant. The water treatment plant is intended to supply water for the anticipated population growth of the City. When the new water treatment plant is approved and constructed, the existing City wells and permitted groundwater appropriations are planned to remain unchanged to be readily available as backup for water needs.

7. Soil Data

Ramsey City Code, Section 117-424 covers types of soil that are adequate for septic systems. According to Ramsey City Code, the City adopts the Anoka County Soil Survey, 1977 (Soil Survey) and supplemental operational soil surveys as its official soil survey and makes it a part of the City Code. The Anoka County soil survey map of the Ramsey area is attached as Figure 25. In general, the City of Ramsey has soils in SCS Hydrologic Soil Type A. Table 16 lists the recommended infiltration rates based on SCS hydrologic soil types.

Table 16
Infiltration Rates per Soil Type

Hydrologic Soils Type	Unified Soil Classification	Infiltration Rate	Soil Texture
A	GW, GP	1.63 inches/hour	Gravel, sandy gravel, and silty gravels
A	GM, SW, SP	0.8	Sand, loamy sand, and sandy loam
B	SM	0.45	Silty Sand
B	ML, OL	0.3	Silt loam, loam
C	GC, SC	0.2	Sandy clay loam
D	CL, CH, OH, MH	0.06	Clay, clay loam, silty clay loam, sandy clay, and silty clay

Source: Minnesota Stormwater Manual.

8. Land Use and Public Utility Services

Necessary land use and public utility services information is limited to information that existed at the time the plan or plan amendment was developed, including:

a. A general map of existing land uses (Figure 26A);

b. A general map showing anticipated land uses (Figure 26B); and

c. A reference to the location of the metropolitan urban service area.

Land use is one of the primary mechanisms that affect flooding and water quality. As prairie and forested areas are converted to agricultural and urban uses, the volume and rate of storm water runoff increases. This increase in storm water runoff can cause a change in the bank full flow of area streams and conveyances. This can cause stream bank erosion and deterioration of the stream. In addition, increased area runoff can cause erosion in steep areas. The conversion of natural land cover also increases the amount of pollutants in storm water runoff such as the levels of pesticides and nutrients from agricultural land use, and trace metal concentrations from urban land use. Pollutant loading analysis has not been included within this report. This plan estimates the future land use throughout the study area in order to evaluate the drainage system needs.

Although pollutant concentrations may not vary greatly between land uses, pollutant loadings are a function of both runoff volume and concentration. The volume of runoff is directly related to the amount of impervious surface from a particular land use. For example, if a fictitious *Area A* has twice the runoff due to higher impervious land cover as *Area B* with the same pollutant concentration, *Area A* will have twice the pollutant loading. This is the basis for the major difference in water quality between residential and commercial land uses and affects surface water planning strategies for the different land uses. The Minnesota Land Cover Classification System (MLCCS) cover types for the Ramsey area are shown in Figure 26C.

9. Water-based Recreation Areas and Land Ownership

Figure 6 – Parks Map shows the location of all Parks and the location of all DNR public water accesses within the City of Ramsey.

10. Fish and Wildlife Habitat

The City of Ramsey has applied to the DNR for an updated list and description of the conclusions and recommendations of biological surveys or reconnaissance studies in December of 2014. The list has been received. Since this list is sensitive it is not included in this report, but is on file in the office of the City Engineer.

11. Unique Features and Scenic Areas

The Mississippi and Rum River Corridors within the City are unique and valuable local, state, regional and national resources. The rivers are an essential element in the local, regional, state and national transportation, sewer and water and recreational systems and serve important biological and ecological functions.

The prevention and mitigation of irreversible damage to these resources and the preservation and enhancement of their natural, aesthetic, cultural and historic values is in furtherance of the health, safety and general welfare of the City. The Mississippi River Corridor Critical Area and the Rum River Scenic River are protected under Ramsey City Code Chapter 117, Article II, Division 4, Subdivisions II and V Respectively.

Ramsey City Code Section 117-252 regulates bluff land and river land development in order to protect and preserve the outstanding scenic, recreational, natural, historical, and scenic values of the Rum River in the city of Ramsey in a manner consistent with Minnesota Statutes, §104.31 - 104.40, Minnesota Regulations NR78-81, and the Management Plan for the Rum River (6 MCAR 1.2700 - 12720).

The City has an Environmental Policy Board that has been actively documenting and mapping the City's existing natural features, through a Natural Resources Inventory and a Wetland Functions and Values Assessment, including:

a. Native prairie communities

b. Woodlands

c. Functions and values of wetlands

d. Rare and endangered species

e. Historic and heritage buildings and features

Their report, which may be found on the City website, is included in this document by reference. The link is: http://cityoframsey.com/environmental-services.

The Scenic River Land Use District is divided into two areas designated as the Urban Area Overlay District, or Rural Area Overlay District and are covered under City of Ramsey Code Section 117-254.

Pollutant Sources

The City of Ramsey has one closed landfill (the Anoka Regional Solid Waste Facility). The MPCA keeps the records. The City is not aware of any other landfills.

There was a high nitrate area east of Armstrong Boulevard between 158th Avenue and 161st Avenue that was attributed to agricultural activity. There was a hog farm west of TH47 at 157th Avenue. The City does not have any permitted wastewater discharges.

The City does not keep a list of storage tanks. These records are currently kept at the Anoka County Environmental Services office.

The MPCA "What's in My Neighborhood?" website lists known and potential sources for soil and groundwater contamination. The majority of the sites listed are Voluntary Investigation and Cleanup (VIC) sites. There are 215 sites listed in Ramsey. A text based search for Anoka County and Zip code 55303 will list over 600 permits; however, some of the addresses were in the Cities of Anoka or Andover which share a zip code with Ramsey. Additionally many sites had multiple permits at the same address. These are listed in Table 17.

Table 17

Known or Potential Sources of Soil or Groundwater Contamination

Activity ID	Activity Name	Address	
VP20690	14140 Azurite	14140 Azurite St NW	Ramsey
VP24480	A1O0143 - Alpine Park	6600 Alpine Dr NW	Ramsey
MND985724061	Aca Management 367	5195 142nd Ave NW	Ramsey
MNR000058230	Accent Precision Wood Products	6250 McKinley St NW	Ramsey
MNR000118802	Accurate Auto Inc.	9716 Highway 10	Ramsey
MND982220089	Accurate Auto Inc.-Ramsey	9617 Highway 10 W	Ramsey
VP18690	Ace Solid Waste - Ramsey	6601 McKinley St NW	Ramsey
MND985702851	Adrien Mechanic Services	6021 Bunker Lake Blvd NW	Ramsey
MNR000079889	Aero Restoration & Repair Co	7101 143rd Ave NW Ste B	Ramsey
MNRNE35D6	All-Brite Graphics LLC - ISW	6320 Highway 10 NW	Ramsey
MNS000177972	Allina Health Ramsey Clinic	7231 Sunwood Dr NW	Ramsey
MNR000060970	Allina Medical Clinic - Ramsey - Alpine Drive	5300 Alpine Dr NW	Ramsey
MND985752047	Alloy Recovery Co Inc.	7060 142nd Ave NW	Ramsey
MNR000027722	Alpha Power & Technology	14000 Unity St	Ramsey
SA7044	Alsil Stephens Dump	See location description	Ramsey
MND089476451	Altron Inc.	6700 Bunker Lake Blvd NW	Ramsey
MNR000081067	Amcor Precast Inc.	6640 Industry Ave	Ramsey
MND982071714	American Trade A Bus Inc.	14000 Sunfish Lake Blvd NW	Ramsey
MNR000078246	Anderson & Dahlen Inc.	6850 Sunwood Dr NW	Ramsey
MNR000015057	Anderson Wade	15031 Hematite St NW	Ramsey
SA7100	Anoka County State Hospital Demo Fill	See location description	Ramsey

Activity ID	Activity Name	Address	
SA7111	Anoka Municipal Regional Landfill	14730 Sunfish Lake Blvd NW	Ramsey
MND985705292	Anoka Ramsey Automotive - Hwy 10	6262 Highway 10 NW	Ramsey
MND985753730	Anoka Ramsey Dental	5300 153rd Ave NW Ste 3	Ramsey
MNR000032169	Anoka Ramsey Sport Center	6760 Highway 10 NW	Ramsey
MNS000177618	Anoka-Ramsey Dental	5400 140th Ave NW Ste 104	Ramsey
MNR000114918	AR Honing	6250 Bunker Lake Blvd NW Ste 219	Ramsey
MNS000143404	Arrow Components Corp	6230 McKinley St NW Ste A	Ramsey
3789	Auto Ranch	7665 Highway 10 NW	Ramsey
MN0000036038	Auto Truck Hydraulics	7445 Highway 10 NW Ste 3	Ramsey
MNR000115139	Automated EDM Inc.	6231 McKinley St NW	Ramsey
MNR000023234	B & A Cylinder Head - Ramsey	14165 Ramsey Blvd NW	Ramsey
MND985684406	B & D Auto	14966 Nowthen Blvd NW	Ramsey
MND982642936	B & D Repair - Ramsey	9451 Highway 10 NW	Ramsey
MNS000172445	B&K Swiss Inc.	14220 Basalt St NW	Ramsey
MNR000115022	Bailey Woodworking	6250 Bunker Lake Blvd NW Ste 216	Ramsey
MNR000101824	Baker White Inc.	6111 Highway 10 NW	Ramsey
MNS000131292	Barnett Family Dentistry	7962 Sunwood Dr NW Ste 200	Ramsey
VP4771	Barnett Olds #2	6415 Hwy 10 NW	Ramsey
MNS000178897	B-Brothers Auto	7103 Highway 10 NW	Ramsey
VP8482	BK Ramsey Site	7205 Hwy 10 NW	Ramsey
MND985709401	Blass Automotive	6100 Industry Ave	Ramsey
MND982212045	Blatz Automotive	7105 Highway 10 NW	Ramsey

Activity ID	Activity Name	Address	
MND985720952	Blue Line Collision Center	6260 Highway 10 NW	Ramsey
VP8481	BNSF R-O-W #2	See location description	Ramsey
MN0000380881	Boart Longyear Co - Anoka	6300 Industry Ave	Ramsey
MNR000064659	C & F Race Cars	7101 143rd Ave NW Ste P	Ramsey
VP18650	Cabinetry Concepts	14410 Azurite St	Ramsey
MNRNE35J5	Carbon Products/ Division of Graphel Corp - ISW	6251 McKinley St NW	Ramsey
MN0000043513	Champlin Towing	14300 Sunfish Lake Blvd NW	Ramsey
MNS000133942	Chips Tool Repair Inc.	6250 Bunker Lake Blvd Ste 206	Ramsey
MND985695808	Cjs Auto Repair	17600 Gibbon St NW	Ramsey
MNS000135558	Class C Components Inc.	6825 Sunwood Dr NW	Ramsey
MND985738293	Coated Abrasive Products Co	14059 Sunfish Lake Blvd	Ramsey
MNS000174011	Coborn's Pharmacy 33	7900 Sunwood Dr NW	Ramsey
MNS000118869	Collision 2000 Inc.	3345 Viking Blvd	Ramsey
MNR000042424	Command Tooling Systems	13931 Sunfish Lake Blvd NW	Ramsey
MND985680040	Commercial Asphalt Co - Plant 906	6640 141st Ave NW	Ramsey
MNS000141010	Concrete Masonry Unlimited	9411 Alpine Dr NW	Ramsey
MNR000033787	Connexus Energy	14601 Ramsey Blvd NW	Ramsey
MNRNE373P	Countryside Printing Inc. - ISW	6250 Bunker Lake Blvd NW Ste 113	Ramsey
MNS000186908	Courage Kenny Sports & Physical Therapy Center Ram	7231 Sunwood Dr NW Ste A	Ramsey
VP26500	CSAH 116 Reconstruction - ROW	6100 Industry Ave NW	Ramsey
VP25020	CTT Properties, LLC	6600 Sunwood Dr NW	Ramsey
MNS000140152	Cullinan Rigging & Erecting Inc.	6815 McKinley St NW	Ramsey

Activity ID	Activity Name	Address	
MN0000012450	D Cobey Co Inc.	9340 Highway 10 NW	Ramsey
MND006220719	Dahlheimer Beverage LLC	13554 Tungsten St NW	Ramsey
MND982640476	Danny's Trannys Inc.	14050 Basalt St NW	Ramsey
MNR000004036	Detail Tool & Engineering Inc.	6511 Industry Ave	Ramsey
MND985669936	Diamond Automotive Inc./ Auto Fitness & Service Ctr	7029 Highway 10 NW	Ramsey
MNS000141085	Diamond Graphics	14350 Azurite St NW	Ramsey
PW6124218640	Dickenson Diesel	NW Highway 10	Ramsey
MNR000119271	Die Concepts Inc.	13915 Radium St NW Ste F	Ramsey
MNR000077495	Digital Tool & Automation	6501 McKinley St NW	Ramsey
MNR000103978	Dynamic Group Inc. - Ramsey	13911 Unity St NW	Ramsey
MND985729847	E & L Machine	5944 168th Ln NW	Ramsey
MNS000168625	Eddy's Auto & Body Repair Inc.	6845 Highway 10 NW	Ramsey
MNR000076554	Egan Oil Co	500 Bunker Lake Blvd NW	Ramsey
MNR000013532	Erin Contracting	8050 147th Ave NW	Ramsey
MNR000119669	E-Z Auto Sales Inc.	7751 Highway 10 Ste 6	Ramsey
MNR000115501	Falcon Machine Inc.	7101 143rd Ave NW Ste N	Ramsey
MNR000060186	Ferrellgas - Anoka	7255 Highway 10 NW	Ramsey
MNR000100057	First Cut Products Inc.	6250 Bunker Lake Blvd NW Ste 104	Ramsey
MNNONGEN1170	Flavor Midwest Inc.	9459 Highway 10 NW	Ramsey
MN0000275925	Food N Fuel C15	13939 Saint Francis Blvd	Ramsey
MN0000196147	Galindo Electric	15645 Traprock St NW	Ramsey
MN0000083741	GEC Auto Service ink - Ramsey	7129 Highway 10 NW Site C	Ramsey
MND985722420	Gerdes Racing	7321 152nd St	Ramsey

Activity ID	Activity Name	Address	
MNS000177170	Gibbs Lawn	6300 Bunker Lake Blvd NW	Ramsey
MNR000080655	Gibbs Lawn - Radium Street	13915 Radium St NW Ste D	Ramsey
MNRNE39NX	Graphel Carbon Products ISW	6251 McKinley St NW	Ramsey
MNR000015867	H Ten Sports	8110 Highway 10 NW	Ramsey
VP26700	Harber Industries	6690 Sunwood Dr NW	Ramsey
MND985749530	Harold's Our Own Hardware	6000 167 Ave NW	Ramsey
MNRNE39BB	Health Care Marketing Inc. dba Perry Products ISW	6023 167th Ave NW	Ramsey
MNS000147306	Heartland Tire	7151 Riverdale Dr	Ramsey
MND982642894	Heichel Brian	6933 164th Ln NW	Ramsey
MN0000036061	Hi Tech Collision Frame	7445 Highway 10 NW Ste 2	Ramsey
3700	Hills Property	7443 Highway 10	Ramsey
MNR000066407	Hitech Motorsport Inc. - Ramsey	13915 Radium St NW Ste C	Ramsey
3473	Hi-Ten Sports Center	8110 Highway 10 NW	Ramsey
MNS000117358	Home Dame Brothers Painting	15621 Barium St NW	Ramsey
MNR000117317	Import Auto Sales Inc.	7443 Highway 10	Ramsey
MNR000115113	Intech Industries Inc.	7180 Sunwood Dr NW	Ramsey
MNR000051607	Integrity Tool & Engineering	6221 McKinley St NW	Ramsey
MNR000022061	Intercity Oil	6021 Highway 10 NW	Ramsey
MNR000076778	ISD 11 Ramsey Elementary	15000 Nowthen Blvd NW	Ramsey
MND985704634	Jac Auto Repair & Sales	6336 Highway 10 NW	Ramsey
MND985764141	Jacks Auto Repair	14290 Sunfish Lake Blvd NW	Ramsey
MNS000130245	JDI Signs & Graphics	6451 McKinley St NW Ste P	Ramsey

Activity ID	Activity Name	Address	
MNR000112235	JR Data Solutions Inc.	6250 Bunker Lake Blvd NW Ste 204	Ramsey
MN0000367144	Julian M Johnson Construction Corp	6191 140th Ave NW	Ramsey
MNR000078725	Just Precision Inc.	6250 Bunker Lake Blvd Ste 213	Ramsey
MND071773733	Kens Automotive	15415 St Francis Blvd	Ramsey
MNR000111534	Kit Masters Inc.	6250 Industry Ave NW Ste 211	Ramsey
MNS000214106	Kovar Sales	14047 Azurite St NW	Ramsey
MND985721208	Ksiazek Charles	15710 Juniper Ridge Dr NW	Ramsey
MND981535230	Lamey Dave	15940 Sodium St NW	Ramsey
MND981802390	Lano Equipment Inc.	6140 Highway 10 NW	Ramsey
MNR0534DB	Life Fitness Div of Brunswick Corp - SW	14150 Sunfish Lake Blvd NW	Ramsey
MN0000190736	Links At Northfork	9400 153rd Ave NW	Ramsey
A00002353	Listul Industries Inc. - SW	13900 Sunfish Lake Blvd NW	Ramsey
MNR000007898	Mach 5 Auto Service	7129 Highway 10 NW	Ramsey
MND985714658	Marshall Concrete Products Inc. - Ramsey	14141 Unity St NW	Ramsey
MNR000058859	Mat Inc.	6230 McKinley St NW Ste E	Ramsey
MND057087678	Mate Punch & Die Co	6400 Industry Ave	Ramsey
MND022705834	McKay's Auto Sales	6415 Highway 10 NW	Ramsey
MNS000191544	Metro Dentalcare - Ramsey	7600 Sunwood Dr NW	Ramsey
MNR000078980	Midwest Car Care - Ramsey	6745 Highway 10 NW	Ramsey
MNR000027802	Midwest Overhead Crane Corp	13900 Sunfish Lake Blvd NW	Ramsey
MN0000625962	Minnesota Sawdust & Shavings Co Inc.	14100 Jasper St NW	Ramsey

Activity ID	Activity Name	Address	
MNR000069252	Minnesota Tool & Die Works Inc.	6220 McKinley St NW	Ramsey
VP22410	Minnesota Waterjet	See location description	Ramsey
MNS000111344	Mississippi West Regional Park	13935 Traprock St NW	Ramsey
VP21480	MNDOT TH 10 & CTY RD 56	Ramsey Blvd & Hwy 10	Ramsey
MND982605495	MPCA Ramsey Municipal Center	15153 Nowthen Blvd NW	Ramsey
MNS000172833	Multisource Manufacturing LLC Ramsey	6690 Sunwood Dr NW	Ramsey
MND982613234	Noard Machine Tool Inc. - Anoka	6760 Highway 10 NW	Ramsey
MND008797938	Noons RV Center	7405 Highway 10 NW	Ramsey
MNR000069179	North Country Concrete	7040 143rd Ave NW	Ramsey
MN0069396	Northern Lights 2009-2010 Zone EF	Address Unknown	Ramsey
MNS000174284	Northwest Metro VA Clinic	7545 Civic Center Dr NW	Ramsey
MNU000661	Oak Terrace Mobile Home Park	6545 Highway 10 NW	Ramsey
MNR000016972	Oil Change Anywhere Inc.	14620 Fluorine St NW	Ramsey
MNS000138859	Oldcastle Precast Inc.	6820 143rd Ave NW	Ramsey
MNS000179796	Optimum Appliance & Recycling Center LLC	9539 Highway 10 W	Ramsey
MN0000998948	Outside Services Inc.	14140 Azurite St	Ramsey
MNS000107490	PACT Charter School - Ramsey	7250 Ramsey Pkwy E	Ramsey
MNR000119677	Park RV	9919 Highway 10 W	Ramsey
MND982212532	Pearsons Trucking Inc.	14050 Azurite Blvd	Ramsey
4542	Peck Construction	13900 Sunfish Lake Blvd NW	Ramsey
MNR000026880	Pine Ridge Pet Care - Ramsey	7245 Highway 10 NW	Ramsey

Activity ID	Activity Name	Address	
MNR000080648	Plateworks Inc. - Ramsey	6230 McKinley St NW Ste B	Ramsey
MNS000162735	Pleasureland RV Center	7900 Riverdale Dr	Ramsey
MN0068691	Prairie Meadows/Kelly Acres	Armstrong Blvd NW & Tiger St NW	Ramsey
MNR000023374	Pro Power Sports & Marine Inc.	6781 Highway 10 NW	Ramsey
MND985717925	Production Products Inc.	14161 Basalt St NW	Ramsey
VP15161	QDP and JBT Alliance Site (see Waste Management Site)	See location description	Ramsey
MNS000100776	Quail Manufacturing Co Inc.	6250 Bunker Lake Blvd NW Ste 222	Ramsey
MNS000147835	Qwest - Ramsey Garage	6651 141st Ave NW Ste 2	Ramsey
MNS000147546	Rain for Rent	9550 156th Ave NW	Ramsey
MNS000113290	Ramsey Brake & Exhaust Inc.	5143 179th Ln NW	Ramsey
MNR000013086	Ramsey city of Public Works	14100 Jasper St NW	Ramsey
MND985703941	Ramsey Dental Center	15243 Nowthen Blvd NW	Ramsey
MNS000177782	Ramsey Police Department	7550 Sunwood Dr NW	Ramsey
MND985677723	Ramsey Public Works Shop	St Francis Blvd & 142nd Ave	Ramsey
VP26860	Ramsey School Site	See location description	Ramsey
VP22580	Ramsey Vacant Land Parcel	See location description	Ramsey
MND985764968	Renolette Trucking	6100 Industry Ave Ste 201	Ramsey
MNS000210823	Residence - 9131 178th Ave	9131 178th Ave NW	Ramsey
4573	Rivenwick Village North	6897 139th Ln NW	Ramsey
3591	Rivenwick Village Outlot B	Riverdale Dr & Highway 10	Ramsey
MNS000123760	RJM General Paper Products Inc.	6650 143rd Ave NW	Ramsey
MND982219297	Rockford Autobody	14000 Basalt St NW	Ramsey
VP19380	Rotary Systems	Azurite St NW	Ramsey
MND985700012	Royal Concrete Pipe Ramsey	6640 Industry Ave	Ramsey

Activity ID	Activity Name	Address	
MND138781364	Rum River Hills Golf Club Inc.	16600 Saint Francis Blvd	Ramsey
MNR000109751	Sauter & Sons Inc.	6651 141st Ave NW Ste 2	Ramsey
MND099055691	Sauter & Sons Inc. - Azurite St	14050 Azurite St NW	Ramsey
VP19550	Senior Housing Parcel	County Road 116	Ramsey
MNR000059618	Shorewood RV Center	8390 Highway 10 NW	Ramsey
MNR000103952	Signature USA Inc.	8781 162nd Ln	Ramsey
MNR000078733	Simhof Manufacturing Tech	6250 Industry Ave Ste 112	Ramsey
A00022596	Solo Manufacturing Inc. - ISW	6230 McKinley St NW Ste C	Ramsey
MN0000341545	Sorby Jan	16301 Azurite St NW	Ramsey
MNR000080069	Specialized Coatings Inc.	6250 Bunker Lake Blvd NW Ste 214	Ramsey
MN0001025162	Spider Staging Corp	6250 Industry Ave Ste 108	Ramsey
VP19590	St. Anthony Gun Club	16128 Variolite St NW	Ramsey
VP18800	St. Paul Terminals - Ramsey	14050 Basalt St NW	Ramsey
MNR000055376	Star Auto Sales Inc.	7009 Highway 10 NW	Ramsey
MNR000023036	State Of Minnesota Weigh Scale	9225 Highway 10 NW	Ramsey
VP16770	Sunfish Business	See location description	Ramsey
MNR000017889	SuperAmerica 4508	14000 Saint Francis Blvd	Ramsey
MNR000004333	Superior Striping Inc.	14021 Basalt St NW	Ramsey
MNR000056010	Tech One Motorsports Inc.	6250 Industry Ave Ste 106	Ramsey
4270	The Lighthouse Bar And Grill	6937 Highway 10	Ramsey
MND985749522	Tim’s RV Service	14050 Azurite St NW	Ramsey
MND922222135	Trade A Bus	Sunfish Blvd	Ramsey
MNR000056887	Utili Trax Contracting Partnership	6300 Industry Ave	Ramsey

Activity ID	Activity Name	Address	
MND982619983	Vance Brothers Inc.	14021 Azurite St NW	Ramsey
SA7043	Ve-Ve, Inc. Caustic Soaps	See location description	Ramsey
MN0065501	Vision-Ease LP dba Vision-Ease Lens	7000 Sunwood Dr NW	Ramsey
MNR000109900	V-Tech Motorsports Inc.	14000 Sunfish Lake Blvd Ste I	Ramsey
MNR000100792	Walser Outlet Center	7955 Riverdale Dr NW	Ramsey
VP5021	Waltek Inc. II	14310 Sunfish Lake Blvd	Ramsey
VP15160	Waste Management Site	Sunfish Lake Boulevard	Ramsey
MN0000234179	Welsh Engine Sales	6150 Highway 10 NW	Ramsey
MND985677970	Welsh Engine Sales	15443 Ramsey Blvd NW	Ramsey
VP31280	Wendell's Inc.., Ramsey	6601 Bunker Lake Blvd NW	Ramsey
MN0000010769	Westside Auto Body	6140 1/2 NW Highway 10	Ramsey
VP20930	Wildlife Research Center	Azurite St	Ramsey
PW6124274140	Wuorio Truck Sales	9619 Highway 10 W	Ramsey
MNRNE35LF	Zero Zone Refrigeration - ISW	6151 140th Ave NW	Ramsey

D. **Design Requirements**

The Ramsey SWMP has a dual purpose: 1) It will serve as a guide for the construction of storm drainage facilities, and 2) It will provide a basis for a consistent approach to the preservation of lakes, wetlands, streams, and the Mississippi and Rum Rivers. The following issues have been incorporated into this plan:

1. Division of the City into major watersheds based on contour maps, grading plans and natural topography
2. Determination of storm water runoff problems under current land use conditions
3. General layout and sizing of trunk storm sewers and open channels
4. Tributary areas, storage volumes, and high water levels of all existing ponding areas
5. Recommendations to accommodate the ultimate land use conditions
6. Recommendations for the revision of the current development ordinances
7. Recommendations for standard Operations and Maintenance procedures
8. Recommendations for specific construction site erosion control practices
9. Estimated construction and implementation costs of the SWMP
10. Recommendations for education of City residents, staff, and development community.

The primary function of an urban storm drainage system is to minimize economic loss and inconvenience due to periodic flooding of streets and other low-lying areas. Adequately designed storm drainage facilities provide flood control, minimize hazards and inconvenience associated with flooding, and protect or enhance water quality. The SWMP takes the entire drainage basin with future saturation development into consideration.

Design of stormwater facilities shall be governed by Appendix E of the LRRWMO Third Generation Plan and City Code. These standards are summarized below:

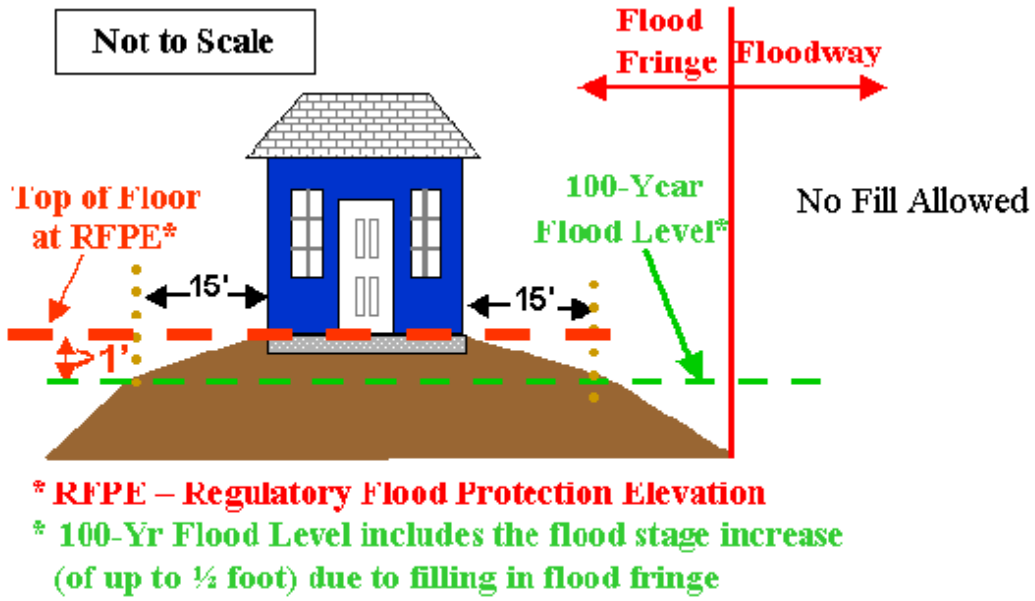
- Volume control – infiltration of the first 1 inch of runoff from all impervious surfaces on site.
- Peak Flow Rate Control – Post Development peak runoff rates shall not exceed existing rates for the 2, 10 and 100 year storm peak discharges.
- Water Quality – Storage areas shall be designed to NURP standards and provide annual removal efficiencies of 60% total phosphorus and 90% total suspended solids.
- Precipitation Data Sources – rainfall amounts for hydrologic analyses shall be based on NOAA Atlas 14.
- Storage Design – ponding areas shall be designed to retain the 100-year event. Ponding areas without a discharge shall be designed to retain runoff from the 100-year/10-day runoff or 100-year/10-day snowmelt, whichever is more restrictive.

Wet water quality ponds upstream of dry regional infiltration basins (where possible) will help control the rate and the volume of storm water runoff. To provide flood protection for adjacent property, the design storm interval for ponding areas is a 100-year storm as compared to a 10-year storm for design of storm sewer piping. Any new residential, commercial, industrial and other habitable structures shall be constructed with the following low floor elevation: The low floor elevation of all development, including basements, must be at least 3 feet above the highest anticipated ground water table, 2 feet above the designated or designed 100-year flood elevation, or 1 foot above the emergency overflow, whichever is higher. The area of a pond's HWL plus 1 foot of freeboard shall be contained entirely within an outlot that is owned and maintained by the City or within a drainage and utility easement.

In areas adjacent to designated flood plains as mapped on a Flood Insurance Rate Map, the Regulatory Flood Protection Elevation (RFE) applies. The RFE is defined as the mapped 100-year flood elevation plus 1 foot. However, the LRRWMO requires that the low floor elevation of structures be 2 feet above the calculated flood elevation. Therefore, all structures, including accessory structures, must be elevated on fill so that the lowest floor including basement floor is 1ft above the Regulatory Flood Protection Elevation or 2 foot above the mapped 100-year flood elevation. The finished fill elevation for structures shall be no lower than the Regulatory Flood Protection Elevation and the fill shall extend at such elevation at least fifteen (15) feet beyond the outside limits of the structure erected thereon. The following drawing better defines the Regulatory Flood elevations.[6]

[6] Taken from the Minnesota DNR website: http://www.dnr.state.mn.us/waters/watermgmt_section/floodplain/rfpe.html

The following exhibit applies <u>only when fill is required</u> to bring a structure at least two (2) feet above the 100-year flood level.



Minimum Standards for Structures in 100-year floodplain

The numerous natural depressions found throughout Ramsey have been incorporated into the SWMP as ponding areas. The effective use of ponding areas enables the installation of outflow sewers with reduced capacities since the design storm duration is effectively increased over the total time required to fill and empty the ponding reservoirs. Storm sewers represent a sizable investment for the community and this investment can be more efficiently utilized by ponding storm water in designated ponding areas and allowing smaller diameter pipes to be used as outfall lines.

Equally as important as flood control and cost considerations, is the use of ponding areas to:

1. Improve water quality;
2. Return storm water to the groundwater table;
3. Increase water amenities in developments for aesthetic, recreational and wildlife purposes.

For water quality ponds, the storage below the outlet is the most important consideration. The area and depth of the ponds may differ from the values presented here, storage below the outlet must be provided so that the prescribed pollutant loading of the system is not exceeded.

From time to time, local developers proposed enhancing required storm water ponds to also serve as an amenity for new development. Most frequently, this entails allowing the storm water pond to consistently maintain a certain level water. Amenity aspects are maximized by careful planning in the initial development of any residential or industrial

area and by integrating the ponding system into an overall comprehensive SWMP. However, care should be given to make the developer responsible for the design water level to serve as the amenity above and beyond the base storm water requirements. If development plans show a permanent water level, it is strongly advised that the City include a provision in its development agreements making the developer and ultimately the subdivision or development area responsible for maintaining the water level. The City's review should include wording that specifically addresses water quality and hydraulics and not the permanent water level. The Anoka Sand Plain is known for its high infiltration capacity as well as its fluctuating water levels. The City of Ramsey should not be involved in maintaining or engineering water level maintenance.

The wildlife aspects of the ponding areas shall be maximized in design and the proper location of the trail system will allow good access to these areas for wildlife observation.

It is extremely important that each area be re-evaluated at the time of final design to confirm the criteria used in this study and to make any changes that a proposed development may dictate. Special consideration must be given to areas that develop differently than shown in the Comprehensive SWMP, especially when a higher runoff coefficient (higher impervious surface ratio) is likely to result from development.

All storm sewer facilities, especially those conveying large quantities of water at high velocities, shall be designed with efficient hydraulic characteristics. Special attention shall be given during final design to those lines that have extreme slopes and create high hydraulic heads.

The Best Management Practices (BMPs) recommended by the MPCA shall be followed wherever necessary or plausible. Before the City would enforce any of these BMPs, they first need to be adopted by ordinance on a case by case basis. This paragraph is not intended to be a blanket adoption of BMPs.

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Rain gardens and infiltration basins are a viable alternative to storage ponds. These structures are encouraged by many review agencies as a way to mimic the original runoff conditions from a site. By incorporating infiltration, the basin provides volume and water quality management. A water quality basin does not need to have standing water, just a permanent "dead-pool" volume to meet the MPCA water quality requirements. The rain gardens and infiltration basins will assist in meeting MPCA regulations. However, rain gardens and infiltration basins are not recommended in a wellhead protection zone. Figure Nos. 3 and 4 show areas where rain gardens and infiltration may not be the best runoff management solution. City Policy adopted in conjunction with infiltration requirements of the LRRWMO Third Generation Plan permits infiltration in areas within the Drinking Water Supply Management Area (DWSMA), so long as it is not also within the 10-year capture zone.

The process outlined in the LRRWMO Third Generation Plan shall be followed when a development is proposed inside the 10-year capture zone and infiltration is not permitted on site.

The LRRWMO Third Generation Plan includes specific Wetland Protections that are stated below (refer to Appendix G of the LRRWMO plan for details):

- Temporary Wetland Protections During Construction – Areas within 16.5 feet of a wetland boundary must be protected from land grading and other disturbance during the construction process. The area shall be demarcated with properly installed heavy duty silt fence.
- Native Plant Seeding in Common Spaces at the Conclusion of Construction – Within common spaces, areas adjacent to wetlands that are disturbed through the construction process and ponding areas (stormwater management areas) should be seeded with a BWSR native seed mix that matches site conditions.
- Wetland Protections after Construction – Following construction, site stabilization, and vegetation establishment certain activities shall be prohibited within 16.5 feet of the wetland edge. Activities prohibited include:
    - Structures, excluding fences. Fences are not allowed inside the wetland boundary.
    - Paving, except projects with a public purpose such as public trails.
    - Retaining walls.
    - Filling, dumping or yard waste disposal.
    - Fertilization
    - Septic Systems.
- Relationship to Drainage and Utility Easement - Drainage and utility easements must encompass the area within 16.5 feet from the wetland edge.

The process outlined in the LRRWMO Third Generation Plan shall be followed when a development is proposed adjacent to wetlands.

E. Storm Water Modeling

1. Runoff

Storm water runoff is defined as that portion of precipitation, which flows over the ground surface during, and for a short time after, a storm. The quantity of runoff is dependent on the intensity of the storm, the length of storm, the amount of rainfall, the type of ground cover, and the slope of the ground surface.

The intensity of a storm is described by the amount of rainfall that occurs during a specific time interval. A specific rainfall amount occurring during a given time interval will statistically recur, on the average, at a certain frequency (usually measured in years). This is called a return frequency. A return frequency designates the average time span during which a single storm of a specific magnitude is likely to occur. For example, a 100-year rainfall event in Ramsey is that 24-hour rainfall amount (7.1 inches) that recurs, on the average, once in 100 years.

The degree of protection afforded by storm sewer facilities is determined by selecting a return frequency to be used for design based on good economic sense and current engineering practices. See section E.3 for further discussion.

2. Hydrographs

Storm sewer and associated detention basin design is typically based on hydrograph analysis. A hydrograph is graphical depiction of the time versus rate of runoff for a particular area. For example, if a rainstorm started at midnight, the first few minutes is spent with sprinkles and wetting the various surfaces. As the storm intensifies, the rainfall overwhelms the ability of the pavement and adjacent ground to absorb it, and water begins to runoff. At the peak of the storm, the water runs off at its greatest rate. Finally, as the storm passes, the runoff begins to slowly taper off. Figure 28 is an example of a typical runoff hydrograph.

The U.S. Soil Conservation Service (SCS) has performed extensive research in hydrograph analysis and developed a standard hydrograph. Technical Release No. 20 (SCS TR 20) describes a methodology that is generally accepted by the reviewing authorities and hydrologic engineers across the United States. The SCS procedure is based on a standard rainfall hydrograph that is modified by local parameters (i.e., rainfall, soil type, watershed size, watershed shape, the fall across the watershed, etc.). Based on local conditions, the SCS hydrograph was used for development of the Ramsey storm water models in this plan.

A SCS 24-hour Type II storm distribution with 100-year intensity was used for the design of ponds and drainage systems. The Soil Conservation Service has determined from National Weather Bureau data that a Type II distribution is the storm event recommended for the upper-Midwestern United States.

The SCS hydrograph method is based on sound hydrologic theory and is commonly used to analyze runoff for the design and analysis of flows and water levels. The detailed modeling computations for this plan have been performed using the SSA Modeling Software as developed by Boss International, Inc.

3. Rainfall Probability

Rainfall amounts for hydrologic analyses should be based on:

NOAA Atlas 14: Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin (2013). NOAA Atlas 14, Volume 8, Version 2, *Precipitation-Frequency Atlas of the United States, Midwestern States.* NOAA, National Weather Service, Silver Spring, MD.

More recent updates of these documents shall be used, if available.

The SCS National Engineering Handbook snowmelt data shows the 100-year, 10-day snowmelt event is 7.3 inches over 10 days.

4. Pond and Pipe Design Criteria

To provide reasonable protection of downstream facilities, analysis of flood levels, storage volumes and flow rates for water bodies and detention basins shall be based on the range of rainfall and snow melt durations producing the critical flood levels and discharges. This report recommends a 10-year frequency design for storm sewer pipe using the Rational Method[7]. It is further recommended that

[7] The Rational Method is markedly different than the SCS methodology in that it does not deal with runoff volumes, only flow rates. An explanation of the Rational Method is made later in this report.

pond design be based on the greater of the 100-year, 24-hour frequency SCS rainfall event, or the 100-year, 10-day snowmelt event for overland drainage and pond storage design. In comparing the peak pond elevations for each of these events, the 100-year SCS rainfall event, with the assumption that the infiltration rate was negligible, created the highest peak pond elevations. Hence, throughout the remainder of this report, the peak 100-year pond rates are discussed for typical pond High Water Levels (HWL). These design criteria were selected for the analysis and design of the drainage system for this SWMP. In addition, a 10-inch, 24-hour rain event has also been modeled over the entire city to analyze all ponds, overflow drainage ways and natural channels to evaluate whether the emergency over flows (EOFs) function as intended.

All detention facilities must be designed to limit discharge from to the existing rates for the 2, 10 and 100 year storm peak discharges.

Storm water detention facilities with peak discharge rates less than 2 cfs/40 acres are typically susceptible to high water levels during snowmelt conditions. Special consideration of the snowmelt condition becomes critical for areas, like the Anoka Sand Plain where infiltration dampens the effect of runoff from rainfall. These areas can accept high amounts of rainfall during the warm, summer months, but often remain frozen later in the season and are relatively impervious in the spring during the snowmelt. Hence, snowmelt runoff can be a greater flood hazard than a large summer rainfall due to the impermeable nature of frozen soil. Accordingly, final basin design must consider snowmelt conditions when sizing storage and outlet structures.

When rainfalls exceed the recommended 10-year storm sewer infrastructure design, the excess runoff will be accommodated by ponding in low spots in streets for short periods of time and outflow through overland drainage routes and/or EOFs. With proper planning, this short-term flooding and overland drainage should minimize damage to property that would occur if those facilities were not provided. Drainage routes and EOF locations should be protected and preserved either by ordinance or through recorded permanent easements. Where possible, storm water pond designs shall include an emergency overflow to provide an outlet one-foot below the lowest floor elevation of any adjacent structure for added safety.

The Rational Method is a flow rate design method that ignores volumes and assumes a peak flow to each pipe based on hydrologic parameters such as watershed area, time of concentration, and standard rainfall intensity curves. This design method requires the selection and/or computation of a time of concentration and a runoff coefficient. The time of concentration is the time required for the runoff from a storm to become established and for the flow from the most remote point (in time, not distance) of the drainage area to reach the design point. The time of concentration will vary with the slope and type of surface that the rain falls on. Rational Method design including design methodology and hydrologic references should be based on the Minnesota Department of Transportation Drainage Manual.

A minimum concentration time of fifteen minutes for residential areas and ten minutes for commercial/industrial areas shall be used for design of the trunk storm sewer systems. These minimum times shall be considered in the design of

lateral systems. As the storm water runoff enters the system, the flow time in the storm sewer is then added to the concentration time and compared to the downstream drainage area concentration time. The maximum of these values is used downstream, which results in a longer concentration time and peak runoff rate as the flow moves downstream from the initial design point.

5. Land Use Factors in Modeling (Runoff Coefficients)

The percentage of rainfall falling on an area that must be collected by a hydraulic facility is dependent on watershed variables such as soil permeability, ground slope, vegetation, surface depressions, type of development and antecedent rainfall. These factors are taken into consideration when selecting a runoff coefficient (C) for the Rational Method or a runoff curve number (CN) for use in SCS methodology.

Under ultimate (fully developed) conditions, the values of the coefficient will increase with increases in the amount of impervious surfaces caused by street surfacing, building construction, and grading.

The antecedent moisture condition (AMC) relates to the moisture content of the soil prior to a given storm event. Curve numbers based on land use can be adjusted based on an assumed moisture condition. For purposes of the model, normal antecedent moisture condition (AMC II) was assumed. Curve number values can be adjusted for dry conditions (AMC I) or wet conditions (AMC III).

Curve numbers are also dependent on the type of soil in a given drainage area. Soil types are classified into four basic hydrologic groups as follows:

- Group A - Includes well-graded gravels, sandy gravels, gap-graded or uniform gravels, sandy gravels, silty gravels, silty sandy gravels, well-graded gravely sands, gap-graded or uniform sands, gravelly sands.
- Group B - Includes silty sands, silty gravelly sands, micaceous silts, diatomaceous silts, volcanic ash.
- Group C - Includes silts, very fine sands, silty or clayey fine sands.
- Group D - Includes clayey gravels, clayey sandy gravels, clayey sands, clayey gravelly sands, low plasticity clays, sandy or silty clays, organic silts and clays of low plasticity, highly plastic clays and silty sands, organic silts and clays of high plasticity.

Curve numbers that were assumed in the development of the model were based on the hydrologic soil group for each watershed based on the information contained in the County Soil Survey. Development plans shall consider post-development site soil conditions when choosing runoff curve numbers for final design.

Curve numbers (CN) are given in SCS TR-55. Average CN values for each land use type are used in the design of the storm drainage facilities in undeveloped areas. For the modeling of existing facilities, CN values were determined for each type of development and current zoned land use in each subwatershed. In general, the unpaved, non-wetland areas were modeled with curve numbers that

most closely represent the Anoka Sand Plain. The curve numbers were then adjusted to reflect the percentage of impervious surfacing.

It should be noted that if land use changes to more or less impervious surfacing than the model, it will affect the model and updates may be needed.

V. GOALS AND POLICIES

Problem Statement

The increase in developed areas within the community, with its associated runoff and sediment-related pollutants will have an impact on wetlands and other water resources including the Rum River and Mississippi River.

Mission Statement

The City of Ramsey, in cooperation with the LRRWMO, Anoka County, state and federal agencies, will prepare a watershed plan which will accommodate anticipated community development and redevelopment while providing clear direction to the developers for controlling the quality and quantity of storm water runoff and properly managing surface and groundwater resources and the physical habitat of existing wetlands, lakes and the Mississippi and Rum Rivers in a consistent fashion. The City is committed to a goal of no adverse impact to, and nondegredation of, its water resources.

Goals

This plan identifies several specific goals to control the City's water resources planning and management functions. The goals of this plan were established in accordance with the purposes of the water management programs required by Sections 103B.201 to 103B.251.

Policies

Each goal has several corresponding policies. A policy is a governing principle that provides the means for achieving established goals.

Standards

Standards are an extension of the policies. They provide specific, detailed guidance regarding water management practices. Plan standards are included in the Implementation Program (Section VIII) of this document.

A. Water Quantity

The following runoff quantity goals and policies are considered part of this plan.

Goal 1: Control flooding and minimize public capital expenditures.

- Policy 1.1: Natural storm water storage areas and manmade detention areas should be utilized to control flooding.
- Policy 1.2: The storage capacity of the natural drainage system will be utilized to control rates of runoff. The City will jointly define and adhere to flow rates at municipal boundaries as established in this plan.
- Policy 1.3: The City will pursue regional detention wherever targeted land acquisition opportunities arise.
- Policy 1.4: All hydrologic studies will be based on standard hydrologic criteria and ultimate or anticipated development of the entire tributary drainage area.

Policy 1.5: Major storm water facilities (i.e., ponds, pond outlet systems, and major conveyance systems) will be designed using a return period of 100 years.

Policy 1.6: The peak outflow from all new developments shall be limited to the existing peak outflow for the 2-, 10- and 100-year SCS 24-hour rainfall events.

Policy 1.7: All minor drainage system analyses and design (i.e., piped collection systems and minor conveyance systems) will be based on a return period of 10 years unless otherwise specified. The minor drainage system pipe will be sized using the full gravity flow capacity of the pipe. Pressure flow based on surcharging the upstream manhole or structure to near the street will not be allowed.

Policy 1.8: Where plausible, detention facility design will include a paved access route or a "Netlon" or approved equal stabilized access route; and dedicated right-of-way, outlot access and/or drainage and utility easement for maintenance of the outlet structure and to the facility in general. Construction and long-term maintenance of these accesses will need to be negotiated on a case-by-case basis.

Policy 1.9: Where plausible, fences will be restricted from crossing drainage and utility easements. The City will consider encroachment of fences; however, the Owner will be responsible for entering into an Encroachment Agreement to allow the City to remove obstructions for necessary maintenance and waives the City of any liability stemming from improvements within the easement.

Policy 1.10: The design of storm water facilities will consider and identify location(s) of overflow(s) that prevent property damage to adjacent properties from extreme water levels.

Policy 1.11: Minimum building elevations should be above designed designated flood levels. The minimum building floor elevation shall be two (2) feet above the 100-year level or 1-foot above the EOF. The 100-year level shall be on the highest 100-year level resulting from a single event analysis; the 100-year, 10-day snowmelt event; a multiple day runoff event analysis, or the critical event analysis. This will likely require that the City begin to require As-Built Certificates of Grading, a practice that is not currently required by the City.

Policy 1.12: Landlocked runoff basins shall be sized to handle back-to-back 100-year Atlas14 24-hour rainfall events, the 10-inch SCS 24-hour rainfall event or the 100-year, 10-day snowmelt snow melt event, whichever produces the higher peak pond elevation (Landlocked HWL). The minimum building floor elevation around landlocked basins shall be two (2) feet above the Landlocked HWL.

Policy 1.13: Emergency overflows or outlets to drainage systems will be provided to any landlocked area if the available storm water storage capacity is inadequate to prevent flooding of residences and if the available downstream conveyance system capacity is adequate to accept additional flow.

Policy 1.14: The City will have standard hydrologic design criteria for all storm water systems to assure consistency.

Policy 1.15: The City will perform maintenance measures to assure proper function of the drainage system.

Policy 1.16: The City will adopt ordinances that control peak runoff consistent with standards and recommendations in the Minnesota Stormwater Manual.

Policy 1.17: New or expanded stormwater discharges to the Rum River are not allowed because it is classified as an Outstanding Resource Value Water by the DNR.

B. **Water Quality**

Goal 2: Achieve water quality standards in City lakes, streams, rivers, and wetlands consistent with intended use and classification, which include quantifiable limits on specific pollutants (i.e., phosphorus, turbidity, excess nutrients, etc.). The City's ultimate goal is to meet the standards for the designated use of each water body.

Policy 2.1: The ranking system established by the LRRWMO shall dictate intended use and water quality standards. The City will adopt best management practices for development that will result in an annual removal efficiency of 60% total phosphorus and 90% total suspended solids.

Policy 2.2: Future outlets to DNR protected waters must first pass through a sediment pond/trap prior to discharging into the protected water body.

Policy 2.3: Phosphorus loading to a drainage system or water body will be reduced to the greatest practical extent through the use of Best Management Practices (BMPs).

Policy 2.4: All construction plans developed for the maintenance and/or improvement of water quality will include a detailed access and maintenance plan and shall require approval by the City.

Policy 2.5: A community education program relating to preserving and improving water quality will be developed and implemented.

Policy 2.6: All on-site waste water systems will be the responsibility of the owner.

Policy 2.7: A water quality plan outlining education programs, water quality monitoring needs, water quality modeling requirements, phosphorus budgets for subwatersheds, and any other water

quality issues should be developed and implemented. The City-wide SWPPP and MS4 permit already addresses the education, monitoring, maintenance, good housekeeping, illicit discharges and construction erosion control.

Policy 2.8: The LRRWMO and the City should take an active role in implementing the necessary policies to allow development of regional water quality ponds.

Policy 2.9: The City will perform maintenance measures to minimize pollutant loadings to local water bodies.

Policy 2.10: The City will adopt best management practices for development that will result in TSS and TP reductions of 90% and 60%, respectively.

Policy 2.11: The City will adopt best management practices for redevelopment that will result in TSS and TP reductions consistent with the Minnesota Stormwater Manual.

Policy 2.12: The City will integrate their Stormwater Pollution Prevention Plan into their local water management plan, in accordance with MPCA requirements and schedules.

Policy 2.13: The City will revise its Stormwater Pollution Prevention Plan to include the required nondegredation information and summarize or integrate that information into its local water management plan when the nondegradation rules are finalized and become a mandatory part the Municipally Separate Storm Sewer System (MS4) permit.

Policy 2.14: The MPCA is in the process of preparing a TMDL for Trott Brook for macroinvertebrates, fish, dissolved oxygen and E.coli. The City will work with the MPCA and other agencies to implement the TMDL(s).

C. **Recreation, Fish and Wildlife**

Goal 3: Protect and enhance water recreational facilities, fish and wildlife habitat.

Policy 3.1: Natural areas, wildlife habitat and wetlands to be protected during construction should be clearly marked and/or fenced in the field.

Policy 3.2: Buffer zones of natural vegetation are encouraged in privately-owned areas around existing ponds and wetlands located within current wildlife corridors to provide habitat for wildlife in accordance with the Wetland Management Plan.

Policy 3.3: The water level fluctuation of a wetland or pond shall be maintained consistent with the management function of the water body. Wetlands used for stormwater overflow purposes shall be limited to a maximum bounce of 2-feet between the NWL and HWL.

Policy 3.4: The City has already assessed the functions and values of all wetlands over ¼-acre in size. The City will not be updating this assessment as part of this SWMP update. When a logical time in the furtherance of future development warrants, likely coinciding with a future Comprehensive Plan Update, the City will consider updating this assessment.

Policy 3.5: The City supports programs to control aquatic invasive species.

Policy 3.5: Activities related to recreation, fish and wildlife should be consistent with the Anoka County Regional Park objectives and the City's comprehensive plan.

Policy 3.6 The City supports the establishment of native vegetation around sedimentation ponds and wetlands following disturbance, and when new ponds are created whenever possible.

D. **Public Participation, Information and Education**

Goal 4: Increase public participation and knowledge in management of the water resources of the community.

Policy 4.1: The City must call an annual meeting to discuss its SWPPP as part of its MS4 permit. This opportunity will be used to discuss water resource issues affecting the City. The City will explore avenues to increase notification and publicity of this annual meeting. The City will consider holding a special meeting coinciding with major flooding events.

Policy 4.2: The City will utilize available resources and input from the public to address local water resources issues.

Policy 4.3: Citizen lake water quality monitoring is encouraged and supported by the City.

Policy 4.4: The City supports Anoka County's recreation and educational programs related to the water resources of the community.

Policy 4.5: The City will support natural environment programs in the public schools.

Policy 4.5: The City will provide information regarding water resource management and a summary of the on-going activities of the LRRWMO through the City newsletter or web site.

E. **Public Ditch System**

Goal 5: Maintain the current ditch system to convey water and maintain the current defined maximum flood levels to protect businesses and residences.

Policy 5.1: The City will continue to maintain public ditches to provide protection of private property and structures from flooding, provided that such maintenance is in accordance with the Minnesota Wetlands Conservation Act, Minnesota Statute 103E governing agricultural drainage, is acceptable to the U.S. Army

Corps of Engineers, and does not adversely affect the value of wetlands or water quality.

Policy 5.2: With the exception of County Ditch 66 and County Ditch 43 which have been turned back to the City, Anoka County is recognized as having authority over all public ditches within the watershed in accordance with Minnesota Statute 103E.

F. **Groundwater**

Goal 6: Promote groundwater recharge and prevent contamination of the aquifers.

Policy 6.1: Anoka County is recognized as the lead agency regarding groundwater controls.

Policy 6.2: Recharge areas identified by Anoka County shall be protected from adverse development and from potential contamination.

Policy 6.3: Infiltration of the first 1.0-inches of runoff from new impervious areas will be required. This is subject to proximity to wellhead protection zones as noted earlier in this report whereby infiltration shall not be allowed within the 10-year capture zone.

Policy 6.4: Whenever practical, ponds shall be designed as "wet ponds" with storage volume below the outlet to promote infiltration and/or groundwater recharge.

Policy 6.5: The use of grassed waterways shall be encouraged to maximize infiltration. Proper grades shall be maintained insure positive drainage.

Policy 6.6: Any spring area should be identified in the field, denoted on maps by the City and protected from development within the watershed.

Policy 6.7: The appropriate jurisdiction shall use both regulatory (ordinances, permits, etc.) and non-regulatory (Best Management Practices) tools to protect the land area within designated wellhead protection areas.

G. **Wetlands**

Goal 7: Maintain the amount of wetland acreage and try to increase the wetland values within the watershed.

Policy 7.1: The LRRWMO is the Local Government Unit (LGU) administering the requirements of the Wetland Conservation Act in Ramsey.

Policy 7.2: Use and function of all wetlands greater than ¼-acre in size has been determined as part of the 2008 SWMP plan preparation.

Policy 7.3: Restoration of poor quality wetlands shall be prioritized.

Policy 7.4: The City or Anoka County shall identify areas that can be used for wetland mitigation.

Policy 7.5: Wetland mitigation criteria will be established consistent with the Minnesota Wetland Conservation Act of 1991 and subsequent amendments and associated rules thereto (e.g., Minnesota Rule 8420), state and federal regulations, the LRRWMO and the needs of the City.

Policy 7.6: Alteration of wetlands is discouraged unless for restoration. Alteration may be allowed on an individual basis if the alteration can be properly mitigated in accordance with the Wetland Conservation Act (WCA). Allowable alternatives must comply with WCA sequencing requirements including, in order, avoidance, minimization and mitigation. In general, it will require a full Technical Evaluation Panel meeting and majority approval before any wetland impact is allowed.

Policy 7.7: Wetland banking opportunities will be pursued by the City and/or the LRRWMO in accordance with the Wetland Conservation Act.

Policy 7.8: The use of native vegetation for buffers in undeveloped and previously developed areas is recommended.

Policy 7.9: The LRRWMO wetland buffer requirements will be enforced when properties adjacent to wetlands are developed.

Policy 7.10: The City will implement new buffer requirements as they are adopted by the State.

H. Erosion Control

Goal 8: Prevent soil erosion.

Policy 8.1: The City will protect natural vegetation to the greatest extent possible.

Policy 8.2: Soil erosion shall be prevented through the installation of erosion control practices in accordance with MPCA's Best Management Practices Handbook.

Policy 8.3: Topsoil stockpiled for reuse shall be protected from erosion.

Policy 8.4: It shall be the responsibility of the developer/contractor to keep streets and property adjacent to construction areas free from sediment carried by construction traffic at site entrances and access points, from sediment laden site runoff and blowing dust.

Policy 8.5: The MPCA Storm Water Permit Program for Construction Activities shall be followed.

Policy 8.6: The City has adopted an erosion and sediment control ordinance including provisions that are consistent with NPDES Construction Stormwater permit and its MS4 permit requirements.

I. **Development Standards**

Goal 9: Residential Grading

Policy 9.1: Residential lots shall have a minimum surface slope of 2-percent in all directions. Lesser slopes, between 1-percent and 2-percent may be allowed with a certificate of grading.

Policy 9.2: In acknowledgement of historical consumption data, the City will require water conservation measures for new development such as, but not limited to four inches of topsoil shall be placed in the turf restoration areas of all new residential lots.

Policy 9.3: Where residential lots are newly graded and there is no immediate plan for new housing within the lot, the entire lot shall be covered with 4-inches of topsoil and seeded in accordance with the following schedule:[8]

Type of Slope	Time*
Steeper than 3:1	7 days
10:1 to 3:1	14 days
Flatter than 10:1	21 days

* The maximum time an area can remain open when the area is not actively being worked.

Policy 9.4 Bluff protection ordinances and shoreland protection ordinances shall govern steep sloped areas.

J. **Regulatory Responsibility**

Goal 10: Recognize the regulatory authority of other local, state and federal entities.

Policy 10.1: The City is responsible for establishing and implementing a local permitting program for water resources management. For smaller projects, an administrative Grading Permit shall be sufficient. For larger projects, an Interim Use Permit (IUP) shall be required

[8] Minnesota Pollution Control Agency, National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS), Application for General Storm-water Permit for Construction Activity (MN R100001)

Policy 10.2: Other governmental agencies with watershed management responsibility include:

- The Lower Rum River Watershed Management Organization (LRRWMO)
- Minnesota Department of Natural Resources (DNR)
- United States Army Corps of Engineers (USCOE)
- Minnesota Board of Water and Soil Resources (BWSR)
- Minnesota Pollution Control Agency (MPCA)

Policy 10.3: The WMO and the City will require a permit for certain activities, as described in this plan.

Policy 10.4 The LRRWMO Third Generation Plan requires development of an ownership/ responsibility plan for the Anoka Dam. The Rum River Dam is owned by the City of Anoka, and as such has primary responsibility for the maintenance plan. The City of Ramsey will work with Anoka and Andover to implement the plan adjacent to the corporate boundary.

K. **Finance**

Goal 11: Equitably finance water resources.

Policy 11.1: All developments should, to an extent determined by the City, provide land, funding, or a combination of both for management of local water resources, which includes development of regional facilities and planning studies.

Policy 11.2: The City may establish a fee structure charged to developers for analyzing the impacts of the proposed development.

Policy 11.3: The City has established a fee structure charged to developers for constructing capital improvements (i.e., trunk conveyance systems).

Policy 11.4: The WMO should establish an equitable cost allocation formula for water resource project implementation that affects more than one unit of government.

Policy 11.5: Grants may be sought by the City to fund watershed related projects.

Policy 11.6: The City should investigate the feasibility of alternative funding sources, such as Ad Valorem Taxes, bond sales, and user charges (storm water utility).

Policy 11.7: The City should encourage donations and in-kind contributions of public and private organizations and the school systems for plan implementation.

Policy 11.8: The City shall investigate and evaluate other funding mechanisms that support implementation and enforcement. This

shall include but not be limited to pursuing grants with the LRRWMO, utilizing stormwater utility funds for the local match, for water quality improvement projects.

L. **Records Management and Documentation**

Goal 12: The City shall preserve historic data, records, and files pertaining to the water resources of the LRRWMO.

Policy 12.1: The City should develop a classification to be recorded for each new detention area, including the basis for the classification.

Policy 12.2: Engineering calculations will be required in a standard format.

Policy 12.3: Past studies will be documented and filed by the City.

Policy 12.4: Immediately after extreme rainfall events, high water elevations should be noted and surveyed by the City.

Policy 12.5: The City will develop a history of flooding and water quality problems by noting past events and recording current floods.

Policy 12.6: The City will record changes in water quality, such as increased aquatic vegetation, changing thermal conditions, increased sedimentation, reduced fish numbers, and fish kills.

Policy 12.7: The City will document all items/BMPs provided in the SWPPP and MS4 permit.

VI. ASSESSMENT OF PROBLEMS AND CORRECTIVE ACTIONS

This section assesses the water-related problems in the City, prioritizes the problems and includes actions to adequately solve each identified problem.

The City held a public open house on July 11, 2007 to gather input on water resources-related problems in preparation of the original 2008 plan. A public notice was published in accordance with City policies. Four residents attended the open house. The feedback that was received was primarily associated with the desire to protect the City's natural beauty including wetlands, wildlife habitat and wildlife corridors. The primary concern was that continued and uncontrolled development would adversely impact the current environment. All attendees expressed satisfaction that the SWMP is intended to protect these features.

Throughout the course of completion of the 2008 plan and subsequent flooding events in 2011 and 2014, prior to this 2015 update, City staff compiled a list of nuisance flooding areas either noted by maintenance staff or by resident complaints.

Figure 9 highlights all known nuisance flooding areas.

A. Specific Lakes and Streams with Water Quality Problems

Table 15 in Section IV, page 17 of this report, lists the current (2014) MPCA 303d Impaired Waters in Ramsey. There are also waters downstream of the City of Ramsey, such as Lake Pepin, that are impaired. The process to remedy the impairment includes establishing a Total Maximum Daily Load (TMDL) allocation to each contributor to the problem. A TMDL is a calculation that determines the allowable pollutant load that can be discharged into the impaired water so that the limited load will ensure that the water improves to levels where it is no longer impaired. The typical process is initiated by the MPCA and includes a series of stakeholder meetings to formulate viable solutions and mutually work out a reasonable allocation of acceptable pollutant loading.

Since a TMDL study has not been completed for these waters, the City should identify the priority it places on addressing impaired waters and how the City intends to participate in the development or implementation of TMDL projects. Furthermore, the City should volunteer to participate in the stakeholder process.

Once a TMDL study is completed for the impaired water, the City must include, in this SWMP and its City-wide SWPPP, an implementation strategy including funding mechanisms that will allow the implementation of the TMDL requirements. As MPCA completes its TMDL process for each impaired water, the implementation of the measures to meet the TMDL will immediately become a priority item for the City of Ramsey.

B. Flooding and Storm Water Rate Control Issues

Figure 9 is a map of all flooding areas either noted by staff or associated with a resident complaint compiled between 1985 and 2014.

The lake levels in Lake Itasca are historically variable, and have ranged from elevation 863.24 to elevation 871.9 with an average water level of 867.7. The DNR protects the lake to its Ordinary High Water Level of 871.4. To protect the properties around the lake, an emergency overflow should be established above the DNR protected level of 871.4. The overflow may be in the form of a pipe to the south or southeast, or it may be a new outfall to the Mississippi River.

The storm water modeling performed for the area shows few opportunities for property damage associated with rainfall. Ponding areas having a potential for property damage are shown in red on Figures 10 through 23. The relatively low percentage of potential property damage is presumed to be attributed to the high permeability of the Anoka Sand Plain and proper storm sewer system design.

Because of the pervious nature of the Anoka Sand Plain, the City should be cognizant of the impact that a significant increase in impervious surfacing and mass grading can have on runoff conditions. The addition of significant amounts of impervious surfaces and the reduced permeability associated with the soil compaction in mass grading without a reasonable attempt to restore and duplicate the current infiltration pattern could create significant increases in runoff volumes and downstream flooding.

The City will review and modify its current development ordinances to encourage infiltration and require soil ripping of mass grading to compensate for lost infiltration conditions as well as requiring extended retention ponding to mitigate and compensate for increases in runoff. Innovative solutions to the storm water runoff volume increases associated with the increase in impervious surface will be investigated. Potential solutions include pervious pavements, rain gardens and infiltration basins among others.

Comprehensive storm water runoff modeling of the existing conditions throughout the entire City was completed as part of the 2008 plan. The modeling was updated in 2015 to reflect new development and incorporate the Atlas 14 runoff rates. This modeling will provide a baseline for comparison purposes as new developments change the drainage pattern. With this modeling information, City staff can readily review the cumulative impacts of large developments for effects on baseline conditions across the entire city.

SSA software was used in the comprehensive modeling. This software is based on the industry accepted EPA SWMM process and St. Vennant equations. The model can be used to input actual rainfall events from rain gauges and can model the transport of pollutants through the system. This will be very useful in evaluating the BMP measures to address future TMDLs.

The 2008 plan addressed several previous flooding complaints the City had received over a number of years, beginning in 1980. It was determined in 2008 that several of these concerns were solved by later construction of storm sewer systems as the City developed. The areas that were not solved are shown on the flooding area map.

The City experienced high water levels in 2011 and 2014 caused by high snowfall over the winter and heavy spring rains. Staff logged the complaints received in each year. The lists were presented to the Public Works Committee for review.

The 2011 complaints sorted into three (3) categories, clean existing drainage ways and structures, water ponding outside of existing easements, and water ponding in existing easements. Where water was ponding in existing easements the action was homeowner education on the purpose of drainage and utility easements. The action where existing drainage was and structures needed cleaning was to add the work to the Public Works action list. The action where water was ponding outside of existing easements was a combination of performing a detailed study of each area using Consultant Pool and Staff resources. Cost estimates were generated from the studies and presented to the City Council. Several projects were selected for construction, the remainder were deemed infeasible at that time.

The 2014 complaints were also studied. Staff determined that the majority of these complaints would require additional study, these areas could not be drained without causing high water problems on downstream properties. The City wide storm water model is being used in the review of possible solutions to these problems. The Public Works Committee of the City Council has discussed stormwater ponding concerns several times in 2014 and 2015. Staff is preparing a feasibility study on potential solutions to be brought back to City Council for review.

C. **Impacts of Water Quality and Quantity Management Practices on Recreation Opportunities**

The current City ordinances together with the LRRWMO, County, regional, state and federal rules and laws are designed to protect the existing land and water resources within the City of Ramsey. The City believes that it can allow continued development while maintaining or improving its resources including water quality and recreation opportunities. With the implementation of this plan and the recommended policy and ordinance changes, the developers will be responsible for protecting water quality, mitigating the runoff quantity and ensuring that there will continue to be recreation opportunities in Ramsey. In addition, the City's Storm Water Pollution Prevention Plan is designed to educate the public to better protect the city's water resources, to implement temporary and permanent erosion and sediment controls for new developments, to ensure good housekeeping of the City's municipal operations, and to detect and eliminate illicit discharges.

D. **Impacts of Stormwater Discharges on Water Quality and Fish and Wildlife Resources**

As stated in C above, the current and proposed ordinances and the City's SWPPP are designed to protect the existing land and water resources within the City of Ramsey. This includes measures that are designed to maintain or improve the habitat of the fish and wildlife throughout the area.

E. **Impacts of Soil Erosion on Water Quality and Quantity**

As part of the City-wide SWPPP and MS4 permit, the City established an erosion and sediment control ordinance governing construction practices. The City will also evaluate existing erosion control problem areas that may not be associated with recent construction and formulate mitigation plans to rectify those issues. Given increased regulation of the typical causes of soil erosion and sediment transport, it is anticipated impacts of soil erosion on water quality in the Ramsey area will be greatly diminished.

The SWPPP and MS4 permit also call for the annual inspection of required structural BMPs (structural BMPs are physical devices designed to trap or filter pollutants from runoff or reduce runoff velocities; an example being silt fence). Maintenance is included in the City's annual budget to ensure that structural BMPs continue to work and provide the design storage needed to ensure continued flood mitigation.

F. **General Impact of Land Use Practices**

As stated in Section VI.B, increases in impervious surfacing will require mitigation to reduce the impacts related to change in permeability from the natural Anoka Sand Plain conditions. The preferred mitigation method is to encourage infiltration to duplicate the existing condition. In addition to infiltration, the City will consider low impact

alternatives and oversized regional retention basins to mitigate potential downstream flow changes.

The City also prepared a Wetland Management Plan along with this the 2008 SWMP that includes a function and value assessment of all wetlands in excess of ¼ acre in size. Although the wetland buffer requirements were later rescinded by the City Council, the City gathered a great degree of quantitative data to help study the effects of furtherance of developed areas within the community. The City will continue to use this data as a baseline for analysis as well as to consider potential outcomes of development in close proximity to wetlands Adequacy of Existing Regulatory Controls

The City of Ramsey believes it has adequate policies in place to self-regulate the anticipated growth without sacrificing its abundant water resources. In addition to its ordinances, the existing greater area regulatory controls of the LRRWMO, BWSR, the Metropolitan Council, the DNR, the U.S. Army Corps of Engineers, Anoka County, etc. are more than adequate to properly manage or mitigate adverse impacts on public waters and wetlands.

The City must rely on the regulatory authority of Anoka County, the LRRWMO and the regional, state, and federal plans to monitor and control the runoff entering the City from outside its jurisdiction. The City understands that it will also need to address issues brought to its attention by these outside regulating authorities.

The City is also concerned that the ordinance revisions, various permit fees and charges needed to finance the proposed changes will adversely affect development in Ramsey. To ensure that Ramsey has an equal chance of attracting development, the City must rely on outside agencies and WMOs in the area to regionally enforce similar environmental requirements with comparable financing obligations.

G. **Adequacy of Programs**

The City of Ramsey believes that the BMPs promised in its City-wide SWPPP and MS4 permit are designed to adequately:

1. Limit soil erosion and water quality degradation
2. Maintain the tangible and intrinsic values of natural storage and retention systems
3. Maintain water level control structures

H. **Adequacy of Capital Improvement Programs**

The storm water improvements recommended in the City's 5-year Capital Improvement Program are designed to address and correct problems related to:

1. Runoff Quantity
2. Water Quality Management
3. Fish and Wildlife Habitat and Public Waters and Wetland Management
4. Recreational Opportunities

I. **Future Potential Problems**

The greatest potential for future problems with storm water planning is associated with the ever-growing impervious footprint that is inevitable with growth. As stated earlier, highly pervious nature of the Anoka Sand Plain means that the cumulative effect of development could result in drastically increased runoff volume and flow rates.

The recommended ordinance revisions are designed to:

1. Encourage infiltration and soil ripping of newly graded sites so that developed sites can adequately mimic unimproved site runoff and flow rates.

2. Limit post development runoff rates to the existing condition so that multiple developments do not cause cumulative increases in the downstream condition.

In addition, regional pond modifications are also recommended where plausible because of the economic and runoff management capabilities of larger scale hydrologic systems. By implementing the recommendations in the SWMP, these potential future problems are being anticipated and adequately addressed within the City of Ramsey. As stated earlier, the City must rely on the regulatory authority of Anoka County, the LRRWMO and the regional, state, and federal agencies to monitor and control the runoff entering the city from outside its jurisdiction. The City understands that it will also need to address issues brought to the attention by these outside regulating authorities.

VII. FINANCIAL CONSIDERATIONS

Typically a Capital Improvement Program (CIP) is an itemized program for at least a five-year prospective period. The items and associated costs are subject to at least biennial review. The benefits include setting forth the schedule, timing, and details of specific contemplated capital improvements by year, together with their estimated cost, the need for each improvement, financial sources, and the financial effect that the improvements will have on the local government unit or watershed management organization.

The City recognizes that the detailed modeling exercise of the storm water system for the city laid out many areas of potential full pipes, inadequate flow structures, and potential flooding issues that will need to be constantly re-evaluated as more detailed information is available for the system and as the city grows. As this re-evaluation occurs, the CIP will need to be updated to reflect new projects.

A. 5-year Capital Improvement Program

The current 5-year Capital Improvement Program includes the following:

1. Annual Sediment Pond Cleaning $125,000
2. County Ditch 43 Cleaning $180,000
3. COR Bunker Lake Boulevard (Armstrong Blvd to Ramsey Blvd) $560,000
4. West Mississippi Outlet $680,000
5.
6. Whispering Pines Estates Plat 2 Storm Sewer $330,000
7. Annual Drainage Enhancements $675,000
8. Stormwater Drainage Improvements –Treatment before discharge to River $410,000
9. Storm Sewer South of Bunker Lake Boulevard -COR $250,000
10. Garnet Street Reconstruction $198,000
11. Reconstruction of Andrie Street/ 164th Avenue $1,020,600
12. Reconstruction of Streets -Ford Brook Estates $237,600
13. Alpine Drive Reconstruction $60,700
14. Reconstruction of Streets – Stanhope Terrace and North Forty $587,000
15.

Total Current 5-year Plan Expenditures $5,389,500

The financial impact of implementation of the proposed regulatory controls and programs identified in Section VI is anticipated to include the following:

16. Adopting and Enforcing the SWMP Local Controls and Standards[9] $25,000/year
17. SWPPP Annual Cost and Implementation[10] $100,000/year
18. Current Five Year Capital Improvements $5,389,500

Total 5-year Financial Impact $6,014,500

[9] Estimated cost is based on one half-time employee at salaries (plus benefits) of $50,000 per year.
[10] Estimated cost is based on two fulltime employees at salaries (plus benefits) of $50,000 per year.

Although the cost associated with these recommendations can be financed locally, the City will pursue all opportunities for outside funding. Without outside financing the City will need to finance the adoption of, and enforcement of, the local controls and standards, implementation of the specified programs, and capital improvements recommended in this SWMP using one or more of the following:

1. Increasing the storm water development charges (storm water trunk fees)
2. Increasing the storm water utility fees
3. Increasing the general levy (within levy limits)
4. Creating a storm sewer assessment district
5. Accessing funds from other City projects and funds

The City increased the storm water trunk fees and storm water utility fees in 2015.

Outside funding is greatly desired as the impact of increasing these taxes, fees and charges will increase tax burden against homes and farmsteads, increase the utility burden for all parcels or postpone other necessary improvements currently scheduled in the City's Capital Improvement Plan.

The following are potential sources of outside funding that may be available to assist in the financing of the various storm water related issues:

1. Minnesota Clean Water Legacy funds
2. Clean Water Partnership Funds
3. Clean Water Act, Section 319 funds, administered by the MPCA
4. Minnesota Public Facilities Authority (PFA) grants and low interest loans

There is significant competition for these limited funding sources. If these sources are pursued by the City, it will likely involve innovative treatment technologies in addition to timely requests for funding.

The application deadlines for Section 319 and PFA funds are published annually by the State. The PFA prepares an annual Intended Use Plan for each program that lists the projects eligible to apply for loans. A written request must be submitted by the City to the PFA to place a project on the IUP for consideration. The City routinely monitors the deadlines for these programs.

B. Local Financing Options

Development Charges or Trunk Fees According to City of Ramsey Code section 117-618, anyone creating a new residential lot or a new nonresidential site plan must pay a storm water trunk fee as established by ordinance. Each year the fee is reviewed and approved as part of the City's overall fee ordinance. For residential property, the fee is a flat fee per residential unit. For nonresidential property (commercial / industrial), the trunk fee is calculated on a per acre basis. The monies collected are deposited in the Storm Water Management Fund and are only used to pay for storm drainage financing and improvements. Maintenance of the storm water system is paid for with utility revenue deposited into the Storm Water Utility Fund.

1. Increased Storm Water Utility Fees

According to City of Ramsey Code Section 58-194, the City may impose just and reasonable charges for the use and availability of storm sewer facilities. Rates and charges for the use and availability of the system shall be determined through the use of a Residential Equivalent Factor ("REF"). For the purposes of the Ramsey City Code, one REF is defined as the ratio of the average volume of surface water runoff coming from one acre of land and subjected to a particular use, to the average volume of runoff coming from one acre of land subjected to typical single-family residential use within the City during a standard five-year rainfall event. Rates and charges for the use and availability of the system shall be determined through the use of a Residential Equivalent Unit ("REU"). For the purposes of the Ramsey City Code, one REU is defined as the product of the acreage of a particular parcel multiplied by the REF. The REF shall be based on the relative runoff generated by any land use compared to the expected runoff from a typical half-acre single-family dwelling. This relationship shall be interpreted as a function of the percent of the total lot area that is impervious and shall be applied as determined in City of Ramsey Code.

The City Storm Sewer Utility fee is intended to finance infrastructure maintenance, upgrading, reconstruction and new construction serving previously developed areas. It is not typically used to finance retrofitting the existing system to accommodate new developments. Most cities require the developer to finance the entire new storm sewer system associated with the development. Then, once the new system is accepted and turned over to the City, the municipal maintenance funds (typically storm sewer utility funds) are used to maintain the new system.

2. Increasing the General Levy

   If the City has not yet reached its levy limits, financing could come from increases in the general tax levy across Ramsey. This option is generally not favored because it may duplicate costs for property owners who have either directly or indirectly already financed their own developments. Unless tax expenditures for storm water needs can be uniformly spread to all properties, political opposition should be expected from entities that have already invested in storm water facilities.

3. Creating a Storm Sewer Assessment District or Storm Water Tax District

   If a watershed is well defined and the greater majority of the property owners have a share in the benefit of the proposed storm sewer improvement, the City could form a storm water assessment district. When improvements or repairs are needed within the district, an advertisement hearing process is required similar to that used for assessments in Minnesota Statute 429. Many cities are not choosing this financing option because it can be cumbersome. Cities also find it difficult, on occasion, to legally prove the level of benefit associated with the assessment.

C. **Recommended Local Financing**

1. The cost of existing system retrofitting and maintenance projects should be borne by the Storm Sewer Utility fund as this is the primary focus of these funds.

2. The cost of new improvements in undeveloped land should be borne by the developer.

3. The cost of retrofitting the downstream system to accommodate new developments should be borne by newly established New Development Charges or Trunk Fees.
4. Increasing the general levy for storm sewer related costs is not recommended.
5. Creating a storm sewer assessment district is not recommended.

VIII. IMPLEMENTATION OF PRIORITIES AND PROGRAM

A. Special Waters

According to the MPCA's Special Waters list (January 2004), special waters in the Ramsey area include:

1. The **Mississippi River** is considered part of the Mississippi River Corridor Critical Area (MRCCA) from the western borders of the cities of Ramsey and Dayton to Hastings. The cities of Ramsey and Dayton had previously also been included in the Wild and Scenic Designation until 2012, when these cities received an exemption from the Minnesota Legislature as these areas were also included in the MRCCA.
2. The **Rum River** is considered Scenic/Recreational from Highway 27 bridge in Onamia to Madison and Rice Streets in Anoka.

The City will meet State requirements for development near these waters as identified in the Minnesota Stormwater Manual by designing storm water basins using the sizing criteria described in *Design Calculations for Wet Detention Ponds*, by William Walker Jr. The City will also encourage storm water practices that promote infiltration/filtration and decrease impervious areas (better site design and integrated stormwater management), where practical.

B. City-wide SWPPP and MS4 Permit

The City-wide SWPPP, associated with its MS4 permit, is available on the City's website. The SWPP was updated to reflect the 2013 re-issuance of the MS4 Permit. A copy of the SWPPP is attached in Appendix A.

C. Implementation Schedule

In accordance with Minnesota Rule 8410.0010, the City of Ramsey must provide for the adoption of necessary regulatory controls, storm water design standards, education programs, data collection programs, and maintenance programs. This SWMP must clearly distinguish the City's responsibilities versus the responsibilities of the LRRWMO and Anoka County with respect to implementing each program element.

According to Minnesota Rule 8410, each organization plan must include a schedule for implementation by the organization, joint powers agreement members, and affected local units of government. All plan controls and programs to be implemented by the organization must be in effect within one year of plan adoption. All local plan controls and programs must be developed and in effect within two years of adoption of the last organization plan in the local unit of government.

Since this SWMP is an update to a previously accepted plan, most of the required programs have already been developed and coordinated with Anoka County and the LRRWMO.

D. Capital Improvement Program

This SWMP must include a capital improvement program that identifies specific capital improvements necessary to implement the water resource management goals and policies of the organization. The 5-year Capital Improvement Program is discussed in Section VII of this report.

A Capital Improvement Program, or CIP, already exists and is updated on annually for a projected 5-year period. The CIP includes projects to implement the recommendations in this SWMP.

E. Enforcement

This SWMP must identify the procedure to be followed to enforce violations of the controls of the organization as well as those of the local unit of government.

The City uses a permitting process with a surety requirement for new developments. If the developer fails to follow the conditions of the permit, the City can call on the surety to ensure immediate rectification. The surety must be in the form of a Letter of Credit or Cash Escrow.

The City has adopted the following ordinances:

1. Erosion and Sediment Control Ordinance
2. Illicit Discharge Ordinance
3. Post Construction Storm Water Management Ordinance.

Each of these ordinances will be enforceable locally and will carry fines for failure to adhere to them. In addition, the MPCA can impose significant fines for pollution discharges associated with these ordinance controls as well as any unauthorized pollution discharge.

The City will amend its ordinance to include the enforcement of storm water ordinances as part of City Code Chapter 2, Article VII entitled Administrative Enforcement of Ordinance Violations. The City will have to adopt an ordinance to establish the rates and charges associated with administrative fines for storm water ordinance violations.

F. Administration Process

This SWMP must specify the administrative process and timelines for the submittal, review, and approval of local plans and variances by the organization.

Requirement 1: All communities need to include information on the types of best management practices to be used to improve storm water quality and quantity and the maintenance schedule for the best management practices (BMPs).

Solution 1: *The City's SWPPP, available on the City website, includes the mandatory list of BMPs together with an implementation timeline. All of the BMPs in the SWPPP and designed to improve storm water quality. The City's current development ordinances are designed to regulate storm water quantity in accordance with the LRRWMO requirements. Within a year after the acceptance of this plan, the City will review its ordinances controlling development to include the recommendations of this SWMP, chiefly the recommended runoff volume controls.*

Requirement 2: All communities need to include a Wetland Management Plan or a process and timeline to prepare a plan. The Wetland Management Plan should incorporate a function and value assessment for wetlands.

Pretreatment of storm water prior to discharge is required for discharge into all wetland types.

Solution 2: *The City has completed a MNRAM evaluation of all of wetlands within city limits and greater than ¼ acre in size. The report is available at the Municipal Center. The implementation of the plan was postponed by the*

Requirement 3: The City needs to include funding sources for the various required activities.

Solution 3: *The required funding sources are described in detail in Section VII of this SWMP.*

Requirement 4: The City needs to include activities to be undertaken along with numerical goals, strategies and timelines.

Solution 4: *The City's SWPPP, available on the City website and attached in Appendix B, includes BMPs describing the necessary activities, numerical goals, strategies and timelines.*

Table 18 is an implementation process list of the recommended actions, timing, responsible party, and the cost or funding sources which are presented for the City Council's consideration based upon the data compiled in this report. Actions are listed in order of priority, from highest to lowest.

Table 18

Implementation Process List

Action	Timing	Responsible Party	Cost/Funding Source
Maintain and implement Capital Improvement Program.	On-going, updated on a 5-year period.	City of Ramsey	Storm water area charge and monthly storm water utility fee
A storm water maintenance program enforced to ensure the successful operation of the drainage system.	On-going.	City of Ramsey	Storm water area charge and monthly storm water utility fee
Corrective actions for storm water problem areas.	On-going, as problems come up.	City of Ramsey	Storm water area charge and monthly storm water utility fee
The erosion and sedimentation control criteria for new developments enforced.	On-going, as developments are submitted to the City for approval.	City of Ramsey	Funding by developer's fees and building permits
Low impact development/better site design for new developments encouraged.	On-going, as developments are submitted to the City for approval.	Developer's Engineers, City of Ramsey	City staff funding by developer's fees and building permits. Developers pay for design and construction of developments.
Conceptual regional Ponding areas established as described herein and made a part of the storm water management system.	On-going, as Developments are submitted to the City for approval. Right of first refusal purchasing at time of sale of property.	City of Ramsey	Cost sharing with Anoka County
Standard review procedures established to ensure all development within the City is in compliance with proper erosion control practices.	Currently in place. Update as necessary.	City of Ramsey	Funding by developer's fees and building permits
Detailed hydrologic analysis required during final design of all ponding areas.	Currently in place. Update as necessary.	Developer's Engineers, City of Ramsey	Developers pay for design and construction of developments. City staff funding by developer's fees and building permits.

Final high water levels governing building floor elevations adjacent to ponding areas and floodplains established as development occurs or when drainage facilities are constructed.	On-going.	Developer's Engineers, City of Ramsey	Developers pay for design and construction of developments. City staff funding by developer's fees and building permits.
Overflow routes established and maintained to provide relief during extreme storm conditions, which exceed design conditions.	On-going, as developments are submitted to the City for approval.	City of Ramsey	Developers pay for design and construction of overflow routes. City-conducted maintenance funded by developer's fees and building permits.
An education program for City residents, staff, and development community implemented.	On-going.	City of Ramsey	City of Ramsey, with help from LRRWMO, DNR, University of Minnesota Extension Service, SWCD, NRCS
Amendments to the SWMP adopted and implemented and the SWMP updated.	As warranted by future standards or regulations – by 2015 or earlier if needed.	City of Ramsey	Storm water area charge and monthly storm water utility fee
Regulate construction and land uses along the bluff, to prevent erosion.	On-going, as developments are submitted to the City for approval.	City of Ramsey	Funding by developer's fees and building permits
Encourage landowners to retain any areas of native vegetation, and to plant species native to the area, to protect and improve wildlife habitat and maintain the historic ecological role and appearance of the steeper riverbanks. The existing housing developments along steeper riverbanks have addressed retention of native vegetation in one of two ways: platting of the property in an outlot and deeding that to the City or	On-going, as developments are submitted to the City for approval.	Land Owners, Developers, City of Ramsey	Landowner, City of Ramsey, Future grant opportunities if they arise

through a conservation easement.			
Develop an implementation strategy for TMDLs.	Once TMDLs are formulated.	City of Ramsey, working with LRRWMO	LRRWMO, BWSR, DNR, etc.

IX. AMENDMENT PROCEDURES

This Updated SWMP extends to 2022. Amendments to the plan may be adopted and implemented as warranted by future standards or regulations. The City is aware that the Lower Rum River Watershed Management Organization will be updating its watershed management plan during the effective period of this plan which will trigger the mandatory re-evaluation and potential need for an update of this SWMP within two years from the date the watershed plan is approved by BWSR. The City will initiate any amendments by resolution of the City Council. The citizens of Ramsey, City Staff, the City Council, or any of the review authorities having jurisdiction may submit amendment requests.

The amendment request will be evaluated by City staff and a recommendation will be made to the City Council. If the Council deems the amendment necessary, it will order City staff and/or the City attorney to draft an amendment.

The draft amendment will be brought to the Council for review. If approved, the Council will pass a resolution calling for a hearing on the amendment. The amendment must be forwarded to each organization affected by the amendment. The proposed amendment will be published in the official city newspaper not less than 10 days before the hearing.

The hearing will be held in a public place, typically in the Council chambers at City hall. At the hearing, all interested citizens will be given the opportunity to submit a written statement or voice their opinion on the acceptability of the proposed amendment.

When all have been heard, the City Council will close the hearing and vote their decision on whether to pass a resolution accepting the amendment as written.

According to State Statute 103B.235, Subd. 5, Amendments, to the extent and in the manner required by the LRRWMO, all major amendments to the SWMP shall be submitted to the LRRWMO for review and approval in accordance with the provisions of State Statute 103B.235, subdivisions 3 and 3a for the review of plans. All major plan updates and amendments will be submitted to the Lower Rum River Watershed Management Organization and the Metropolitan Council simultaneously. All minor amendments will have a Public Hearing before the Planning Commission which will then recommend approval by the City Council. The City Council will review the amendments and approve or deny the changes.

X. SUMMARY AND RECOMMENDATIONS

A. Summary

The 2008 plan was prepared by Bolton & Menk, Inc. The technical analysis found within this 2015 update was prepared by Bolton & Menk, Inc. in 2008 and refreshed by City Staff in 2015.

The Ramsey SWMP has a dual purpose: it will serve as a guide for the construction of storm drainage facilities and provide a basis for a consistent approach to the preservation of lakes, wetlands, streams, and the Mississippi and Rum Rivers. The following issues have been incorporated into this plan:

1. Division of the City into major watersheds based on contour maps, grading plans and natural topography
2. Determination of storm water runoff under ultimate land use conditions
3. General layout and sizing of trunk storm sewers and open channels
4. Tributary areas, storage volumes, and high water levels of all existing ponding areas
5. Recommendations for the revision of the current development ordinances
6. Recommendations for standard Operations and Maintenance procedures
7. Recommendations for specific construction site erosion control practices
8. Estimated construction and implementation costs of the SWMP
9. Recommendations for education of City residents, staff, and development community.

The primary function of an urban storm drainage system is to minimize economic loss and inconvenience due to periodic flooding of streets and other low-lying areas. Adequately designed storm drainage facilities provide flood control, minimize hazards and inconvenience associated with flooding, and protect or enhance water quality. The SWMP takes the entire drainage basin with future saturation development into consideration.

Wet water quality ponds upstream or dry regional infiltration basins (where possible) will help control the rate and the volume of storm water runoff. To provide flood protection for adjacent property, the design storm interval for ponding areas with a known outfall is a 100-year storm as compared to a 10-year storm for design of storm sewer piping. For land locked ponds or wetlands, the design storm interval is a back-to-back 100-year storm or the 100-year, 10-day snow melt event, whichever is larger. Any new residential, commercial, industrial and other habitable structures shall be constructed with the following low floor elevation: Elevation of the lowest floor of a structure shall be a minimum of 1 foot above the Emergency Overflow, or 2 feet above the HWL of the nearby pond or waterbody, whichever is higher.

In areas adjacent to designated flood plains as mapped on a Flood Insurance Rate Map, the Regulatory Flood Protection Elevation (RFE) applies. The RFE is defined as the mapped 100-year flood elevation plus 1 foot. However, the LRRWMO requires that the lowest floor elevation be 2 feet above the calculated flood elevation. Therefore, all structures, including accessory structures, must be elevated on fill so that the lowest floor

including basement floor is at or above the Regulatory Flood Protection Elevation or 2 foot above the mapped 100-year flood elevation. The finished fill elevation for structures shall be no lower than the Regulatory Flood Protection Elevation and the fill shall extend at such elevation at least fifteen (15) feet beyond the outside limits of the structure erected thereon.

The area of a pond's HWL plus 1 foot of freeboard shall be contained entirely within an outlot that is owned and maintained by the City.

The numerous natural depressions found throughout Ramsey have been incorporated into the SWMP as ponding areas. Wetlands may be, and are currently being used for stormwater storage for larger rainfall events. They may continue to be used for this purpose – even after upstream development, provided that:

1. There is acceptable Best Management Practice pretreatment of the runoff in accordance with the MPCA NPDES/SDS Construction Permit, Section III.D., Permanent Stormwater Management System.
2. The bounce from the normal water level to the high water level does not exceed two feet.

The effective use of ponding areas enables the installation of outflow sewers with reduced capacities since the design storm duration is effectively increased over the total time required to fill and empty the ponding reservoirs. Storm sewers represent a sizable investment for the community and this investment can be more efficiently utilized by ponding storm water in designated ponding areas and allowing smaller diameter pipes to be used as outfall lines.

Equally as important as flood control and cost considerations, is the use of ponding areas to:

1. Improve water quality;
2. Return storm water to the groundwater table;

For water quality ponds, the storage below the outlet is the most important consideration. The area and depth of the ponds may differ from the values presented here, storage below the outlet must be provided so that the prescribed pollutant loading of the system is not exceeded.

The City will allow Developers to construct storm water ponds to serve a secondary purpose as a development amenity. However, the Developer shall be required to enter into a Development Agreement or Maintenance Agreement that outlines that the City will not take on maintenance obligations beyond basic storm water functions. If constructed as a water feature, the City will not guarantee water levels or water quality above basic storm water requirements.

The wildlife aspects of the ponding areas shall be maximized in design and the proper location of the trail system will allow good access to these areas for wildlife observation.

B. **Model Results**

Even numbered figures from Figure 10 through Figure 22 are maps of critical SSA pond data superimposed on the most recent aerial photo of Ramsey. They are color coded to highlight the 100-year storm conditions as follows:

Green – The pond functions properly and the peak elevation is fully contained within the pond

Yellow – The peak pond elevation is above the emergency overflow spillway

Red – The peak pond elevation may threaten structures

All red and yellow areas will be "ground truthed" to verify the condition depicted. These maps can be used to evaluate regional pond opportunities. In reviewing these maps, one can easily see where the current ponds or depressions are overtaxed for the 100-year event.

Odd numbered figures from Figure 11 through Figure 23 are maps of critical SSA pipe data superimposed on the most recent aerial photo of Ramsey. They are color coded to highlight the 10-year storm conditions as follows:

Orange – The pipe is flowing normally

Red – The pipe is flowing full

The following is a brief discussion of the opportunities and recommendations associated with each watershed:

Figures 10 & 11 – D43 Watershed

This is the Ditch 43 watershed. From Figure 10, it can be seen that this area is fully developed around a significant amount of existing wetlands. This leaves little opportunity to construct regional ponds.

The red areas on Figure 10 indicate ponds that are subject to flooding during the 100-year event. The yellow areas indicate that the emergency overflow is reached during a 100-year event. These ponds should be reviewed relative to the following:

- Should the outfall pipe be replaced with a larger one?
- Can the pond be enlarged?
- Can the overflow spillway be lowered?
- Can rain gardens be incorporated into the upstream watershed?
- Is the upstream watershed larger than allowed by the original design?
- Can some of the upstream watershed be diverted?

The two ponds in the southwestern part of the watershed that are highlighted in red, P26308 and P26310, appear to be infiltration ponds with no outlet pipe. Because our model conservatively assumes no infiltration, the threat of flooding from these ponds may be exaggerated. In comparing this area with the historic flooding map of Figure 8, there have been no reports of flooding in this area.

Pond P25454 appears to need a raised emergency overflow to the west in order to relieve potential flooding. Our model suggests that a 12-inch outfall culvert under Sunwood Drive with an inlet elevation of 866 will eliminate this threat from a 100-yr rainfall event.

Since the D43 watershed is comprised of a significant amount of wetland which acts as satisfactory runoff storage, no other significant designs are necessary with the exception

of the localized flooding associated with the red highlighted ponds. Otherwise, upstream watershed review for infiltration/rain garden opportunities is recommended.

Figures 12 & 13 – D66 Watershed

This is the Ditch 66 watershed. It is nearly identical in nature to the D43 Watershed in build out and wetland storage. Hence, the recommendation is the same: review the highlighted ponds and determine if they need upgrading through either upstream infiltration practices, pond enlargement or increasing the outfall.

From Figure 12, only one pond, P22110 is a potential threat to structures. In reviewing Figure 8, no residential complaints have been made for this area and City Staff has not highlighted this area as a nuisance flooding area. It currently exists as a small natural depression that may have infiltration capacity. Our modeling conservatively assumes that no infiltration occurs and that relief is only provided by storage and the capacity of the outfall pipe. Hence, the potential threat to structures may be exaggerated. If this pond proves to be a problem, the pond storage could be increased or the existing 15" outfall could be increased to a 21" pipe with a lower pipe inlet elevation of 883 to adequately relieve the potential flooding.

The yellow coded ponds in Figure 12 highlight ponds that are immediately adjacent to large wetlands. With the exception of pond P09308, in the northwest part of the watershed, these ponds have emergency overflows directly to these wetlands and there is no concern for public welfare or property damage associated with these ponds. Pond P09308 is another infiltration basin with no historic complaints in the vicinity. Because our model conservatively assumes no infiltration, any threat of flooding from this pond may be exaggerated.

Figures 14 & 15 – EMISS Watershed

This is the Eastern Mississippi watershed. The majority of the northern part of this watershed is adequate in storage and functioning properly. Where there is undeveloped land, the SSA model can be used to recommend appropriate pipe sizing and ponding to ensure that it remains free of flooding.

The southern part is more commercialized and also more prone to flooding. However, there are no historic complaints of flooding in the area (see Figure 9).

If additional flood protection is needed in the southern EMISS watershed, there are some opportunities to correct the ponds that are modeled to be surcharged. From the aerial photograph, it appears that there are a few opportunities for expanding troubled ponds and the creation of additional ponding that may be constructed as backflow basins to relieve the flood prone ponds in the area. Those best opportunities are immediately adjacent to the railroad. These would be best incorporated into future development of this area. Otherwise, retrofitting rain gardens, infiltration basins, and as a last resort, increasing outfall pipes may be considered for nuisance ponds.

Figures 16 & 17 – GOLF Watershed

This watershed is currently functioning well. There is only one pond, P11320, in the watershed that is a potential threat to structures. It appears to be a roadside ditch infiltration basin pond. Again, conservatively ignoring infiltration may exaggerate the flooding potential of this pond. There is no history of complaints of flooding in this area. If flooding becomes a problem, it may only need minor grading to correct its emergency

overflow spillway. Also, upstream watershed review for infiltration/rain garden opportunities may also suffice in correcting the problem.

The remaining yellow ponds appear to be in undeveloped areas and are probably natural depressions that fill and overflow.

For the few upstream areas that are not developed, careful retention, infiltration and outfall design review using the SSA model is the best way to accommodate continued development.

Figures 18 & 19 – MMISS Watershed

This watershed is only partially developed. The existing development is on the downstream end. The ponding areas within the developed part of the watershed are working well. As recommended earlier, infiltration and rain gardens should be incorporated into the upstream development where possible. The recommended ordinance changes should help ensure that this occurs.

Figures 20 & 21 – TROTT Watershed

This watershed is unique in that the majority of the area is currently designed as low impact development. The general nature of the Trott Brook watershed is that it is a linear wetland. The majority of the ponds are functioning well. City staff has noted that one area, near 179th Avenue and Azurite Street is a problem area (Figure 9). This area is also highlighted as a potential threat to structures in Figure 21. Regrading the roadside ditches or constructing a new outfall to relieve this area is recommended to alleviate the problem flooding in this area.

The remaining red highlighted pond and the only yellow highlighted pond in TROTT Watershed are infiltration areas with no historic complaints of flooding in the vicinity. Because our model conservatively assumes no infiltration, any threat of flooding from this pond may be exaggerated. If infiltration is not resolving the problem, the emergency overflow from this area should be regraded to protect the structures in the area.

Figures 22 & 23 – WMISS Watershed

This watershed includes the COR (former Ramsey Town Center) area. However, some ponds are indicated as being a threat. To ensure that this does not become a problem, we recommend using the SSA model to correct these potential problems as future expansion of the COR area occurs. The residential area to the northwest has several ponds that should be reviewed with the same considerations as the Trott and Ditch 43 watersheds.

Pond number P17306, located immediately west of 156th and Nutria, shows as a potential threat to structures and is in an area of property owner complaints. This appears to be a land locked infiltration pond that has very little infiltration capacity. The best solution to this pond is to provide an outfall to the west.

Pond P21210-E, immediately south of 151st Avenue and east of Rhinestone Street, is also shown as flooded. This is also an isolated infiltration with no outlet. The property owners in the vicinity of this pond have filed complaints of nuisance flooding in this area. Solutions for this pond include:

- Expanding the storage and working the pond invert to encourage infiltration
- Regrading to lower the existing emergency overflow channel
- Constructing a new piped outfall to serve the area.

There are two infiltration basins in the mid-eastern part of the watershed (Section 21 near 162nd Avenue and Zirconium Street that have been modeled to be either using the emergency spillway or a potential threat to structures. Although the peak elevation of these ponds may be exaggerated by neglecting infiltration in our model, nuisance flooding has been reported in the vicinity by area residents as shown in Figure 8. To alleviate this problem in Pond P21208, we recommend constructing an outlet culvert outlet under 161st Avenue may adequately address the problem flooding experienced there. The problem in Pond P21210, which is upstream from the residential nuisance flooding area, may be corrected by either expanding the infiltration basin storage or by re-grading the emergency overflow spillway at a lower elevation to alleviate the potential flooding threat.

We recommend that the undeveloped part of the WMISS watershed, lying immediately west of the COR, treated in a similar fashion as the COR. If a separate outfall can be created for this area, it could work in an almost identical fashion. If a separate outfall cannot be obtained, a large regional pond network is recommended. If the ponding alternative is taken, the regional pond network would need to store 100 percent of the runoff at a safe level prior to out letting into the COR system. This would ensure that the COR is not threatened by continued development upstream.

Finally, the Highway 10 corridor is appears to have some pond overflow problems that are only associated with using the ditches as storage. We believe that the best financial and hydrological solution to alleviate these problem areas is to coordinate with MNDOT on any future TH 10 improvements. Any improvements to TH 10 are likely to involve new corridor stormwater management and funding.

General

Figures 28 through 30 are typical SSA output files for a single pipe/pond corridor. These are intended to illustrate the output potential of the model and software. If similar output files were created for every aspect of the entire system, this report would be too cumbersome. The 2008 Plan provided Geographic Information System (GIS) data that allows the City to model virtually any pipe, pond or ditch within Ramsey.

It is extremely important that each area be re-evaluated at the time of final design to confirm the criteria used in this study and to make any changes that a proposed development may dictate. Special consideration must be given to areas that develop differently than shown in the Comprehensive SWMP, especially when a higher runoff coefficient is likely to result from development.

All storm sewer facilities, especially those conveying large quantities of water at high velocities, should be designed with efficient hydraulic characteristics. Special attention should be given during final design to those lines that have extreme slopes and create high hydraulic heads.

The Best Management Practices (BMPs) recommended by the MPCA and adopted by the City shall be followed as development or redevelopment occurs.

C. Recommendations

The following recommendations are presented for the City Council's consideration based upon the data compiled in this report:

1. The SWMP as presented herein will be adopted by the City of Ramsey.

2. The recommended corrections for flood prone areas will be made as described herein and made a part of the storm water management system, where feasible.
3. Standard review procedures will be established, where feasible, to ensure all development within the City is in compliance with proper erosion control practices.
4. Detailed hydrologic analysis will be required, where feasible, during final design of all new developments and ponding areas.
5. Final high water levels governing building elevations adjacent to ponding areas and floodplains will be established as development occurs or when drainage facilities are constructed.
6. Overflow routes will be established and maintained, where feasible, to provide relief during extreme storm conditions, which exceed design conditions.
7. An emergency overflow should be constructed for Lake Itasca to relieve the extreme fluctuation in lake levels of this isolated lake.
8. A storm water maintenance program will be enforced, where feasible, to ensure the successful operation of the drainage system.
9. The erosion and sedimentation control criteria for new developments will be enforced, where feasible.
10. An education program for City residents, staff, and development community will be implemented, where feasible.
11. Amendments to the plan will be adopted and implemented as warranted by future standards or regulations, where feasible.
12. That the plan should be updated in the year 2022 or earlier if needed and feasible.

The existing storm sewer system of the City of Ramsey is not adequate to handle the continued development around the presently developed area. If development continues, the existing system will need major improvement and enlargements to effectively serve the community without excessive flooding. The proposed infiltration and oversized ponding development scenario together with strategically located regional ponds presents one method of accommodating the present growth of Ramsey. However, this report and the proposed scenario is not necessarily the only method of accomplishing the goal of comprehensive storm water management.

Given this, it is imperative that this plan and the SSA model of the City is continually updated on a regular basis and compared to the baseline runoff of the existing conditions model to ensure that any adjustments in area developments continue to be coordinated. In addition, the proposed storm water development charges should be updated annually to ensure that the associated City costs are fully financed. In this manner, the plan can maintain its usefulness as a current document.

Finally, the EPA has initiated the NPDES Phase II requirements whereby cities with populations in excess of 10,000 people are required to apply for a Phase II permit. Some additional cities that are actually under 10,000 in population are also included. The City of Ramsey is a mandatory small MS4 community. One of the requirements of the NPDES permitting process is the existence of a storm water management plan.

As stated earlier, this report is predominantly based on information obtained from available topographic data, field verification of the watershed areas, "ground truthing" of modeled flood prone areas, and discussions with City staff relative to the historical flooding areas. Since the modeled existing system closely matches that described by observation, we feel that this plan has significant benefit as a planning and design tool. However, the quality and accuracy of this report could be further validated with more detailed survey data in the growth areas around the City.

XI. ACRONYMS AND GLOSSARY

A. Acronyms

BMP - Best Management Practices
BWSR - Minnesota Board of Water and Soil Resources
DNR - Minnesota Department of Natural Resources
EOF - Emergency Overflow
EPA - United States Environmental Protection Agency
EPB - Environmental Policy Board
EQB - Minnesota Environmental Quality Board
FEMA - Federal Emergency Management Agency
FIRM - Flood Insurance Rate Map
GIS - Geographic Information System
GPS - Geographic Positioning System
HWL - High Water Level, typically associated with the 100 year rainfall event
IDF - **I**ntensity-Duration-Frequency (for precipitation)
LID - Low Impact Development
LRRWMO - Lower Rum River Watershed Management Organization
LUST - Leaking Underground Storage Tank
MNDOT - Minnesota Department of Transportation
MNRAM - Minnesota Routine Assessment Method
MPCA - Minnesota Pollution Control Agency
MS4 - Municipal Separate Storm Sewer System
MSWMP - Metropolitan Surface Water Management Program
MUSA - Metropolitan Urban Services Area
NOI - Notice of Intent (for coverage under the NPDES Permit Program)
NPDES - National Pollutant Discharge Elimination System
NPDES/SDS - The General Permit Authorization to Discharge Storm Water Associated with Construction Activity under the National Pollutant Discharge Elimination System/State Disposal System Permit Program. Administered by the MPCA
NURP - Nationwide Urban Runoff Program
NWL - Normal Water Level or Low Outlet Elevation
SWCD - Soil and Water Conservation District
SWMP - Surface Water Management Plan
SWPPP - Storm Water Pollution Prevention Program
TP - Total Phosphorus
TEP - Technical Evaluation Panel, typically needed for WCA approval of wetland impacts
TSS - Total Suspended Solids
USEPA - United States Environmental Protection Agency
UST - Underground Storage Tank
WCA - The Minnesota Wetland Conservation Act and its subsequent Minnesota Rules 6115 and 8420.
WD - Watershed District
WMO - Watershed Management Organization

B. **Glossary**

100-Year Flood: The flood reaching water levels or flow rates with a one-percent (1%) chance of occurring in any given year. On the average, a 100-year flood is statistically probable to occur only once in a 100-year period. A 100-year flood is synonymous with Base Flood, Regional or 1% Chance Flood.

100-Year Storm Event: The rainfall event having a total precipitation over a 24-hour period with a one-percent (1%) chance of occurring in any given year. On the average, a 100-year storm event is statistically probable to occur only once in a 100-year period. NOAA Atlas 14: Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin (2013). NOAA Atlas 14, Volume 8, Version 2, *Precipitation-Frequency Atlas of the United States, Midwestern States.* NOAA, National Weather Service, Silver Spring, MD.**100-Year, 10-Day Snowmelt Event:** The storm event having a total precipitation over a 10-day period with a one-percent (1%) chance of occurring in any given year. On the average, a 100-year snowmelt event is statistically probable to occur only once in a 100-year period. The value for the Ramsey area is taken from the SCS National Engineering Handbook, which shows the 100-year, 10-day snowmelt event is 7.3 inches over 10 days.

Agricultural Land: Any land designated specifically for agricultural production. This may include row crops, pasture, hay land, orchards, or land used for horticultural purposes.

Anaerobic: Conditions either in water or soil where there is a lack of oxygen.

Army Corps of Engineers (COE or USCOE): The United States Army Corps of Engineers is a regulatory agency involved in design, permitting and construction projects related to or impacting navigable waters of the United States including lakes, waterways and wetlands.

Aquatic Bench: A 10- to 15-foot bench around the inside perimeter of a permanent pool that ranges from zero depth at the shore to 1-foot depth no less than 10-feet from the shore. Normally vegetated with emergent plants, the bench augments pollutant removal, provides habitat, conceals trash and water level drops, and enhances safety.

Best Management Practice (BMP): An action, procedure, or structural improvement designed to improve water quality. BMPs include schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the State. BMPs also include treatment practices such as ponds, rain gardens, vegetated buffers and vegetated swales, treatment requirements, operating procedures, and practices to control runoff, spillage or leaks, or drainage from raw material storage.

Buffer: A vegetated area immediately adjacent to a wetland that is not mowed and/or managed. Buffers are ideally dominated by native vegetation and add to the ecological health of the wetland by adding habitat and assisting and filtering pollutants from surface water runoff.

Buffer Strip: An area of vegetated ground cover abutting a water body that is intended to remove sediment and other pollutants from runoff.

BWSR: Board of Water and Soil Resources. This is the lead regulatory agency that oversees Minnesota Statue 103B.205 to 103B.255, Minnesota Rule 8410 and the Minnesota Wetland Conservation Act.

Circular 39: A wetland classification system developed by United States Fish and Wildlife Service in 1956 that categorizes wetlands into eight types. This is the same classification system generally accepted by the State of Minnesota for wetland classification.

Comprehensive Plan: As defined in Minnesota Statutes 394.21, a Comprehensive Plan defines a City's the policies, statements, goals and interrelated plans for private and public land and water use, transportation and community facilities to assist in guiding future development and growth.

Cowardin Classification: A wetland classification system developed by the United States Fish and Wildlife Service in 1979. This system defines wetlands by a tiered system and is more detailed than the Circular 39 method. The Cowardin System is the classification System used in the National Wetlands Inventory.

Design Storm: A rainfall event of specified size and return frequency that is used to calculate the runoff volume and peak discharge rate to a BMP. In Ramsey, a 10-year design storm is 4.1-inches in 24-hours and a 100-year storm is 5.9-inches in 24-hours. If designing piped storm sewer, a 10-year design storm may also refer to an IDF curve used in the Rational Method of storm sewer design.

Detention: The temporary storage of runoff from rainfall and snowmelt events to control peak discharge rates and provide an opportunity for treatment to occur. Detention storage is typically designed in basins.

Development: The construction, installation or alteration of any structure, the extraction, clearing or other alteration of terrestrial or aquatic vegetation, land or the course, current or cross section of any water body or water course or division of land into two (2) or more parcels. See also re-development, new development and existing development.

Drawdown: The gradual reduction in water level typically due to the combined effect of infiltration and evaporation, but may be the result of human interference.

Draining: The removal of surface water or ground water.

Drop Structure: Placement of logs with a weir notch across a stream channel. Water flowing through the weir creates a plunge pool downstream of the structure and creates fish habitat.

Easement: A grant of one or more property rights by a property owner for use by the public, a corporation, or another person or entity.

Emergency Overflow (EOF): A hydraulic channel, swale, weir, etc. that provides an outlet from a pond or flooded area at an elevation below the point where property damage can occur.

End of Pipe Control: Water quality control technologies suited for the control of existing urban storm water at the point of storm sewer discharge to a receiving water. Due to typical space constraints, these technologies are usually designed to provide water **quality control rather than quantity control.**

Erosion: The wearing away of land surface and soil by the action of natural elements (wind and/or water).

Eutrophication: Process by which overabundance of nutrients in a waterbody lead to accelerated productivity and general decrease in water clarity and quality.

Exfiltration: The downward movement of runoff through the surface and into the subsoil.

Existing Development: A property or parcel of land that has previously been subject to development and no major changes are anticipated to the property in the near future.

Exotic Species or Invasive Species: Non-native plants or wild animals that can naturalize, have high propagation potential, are highly competitive for limiting factors, and cause displacement of, or otherwise threaten, native plants or native animals in their natural communities.

Extended Detention: A storm water design feature that provides for the gradual release of a volume of water (typically 0.25 to 1.0 inches per impervious acre) over a 12 to 48 hour time period. With proper design, the extended detention period allows for an increased settling of pollutants, and can protect channels from frequent flooding or scour.

Extended Detention (ED) Ponds: A conventional ED pond temporarily detains a portion of storm water runoff for a period of 12 to 48 hours after a storm using a fixed orifice. Such extended detention allows urban pollutants to settle out. ED ponds can be designed to be "dry" between storm events and thus do not have any permanent standing water or "wet" with a permanent pool of water. An enhanced ED pond is designed to prevent clogging and resuspension and provides greater flexibility in achieving target detention times. It may be equipped with plunge pools near the inlet, a micropool at the outlet, and utilize an adjustable reverse-sloped pipe at the ED control device. See also "wet pond" definition for diagram.

Extended Detention Wetland: A storm water wetland design alternative in which the total treatment volume is equally split between a shallow marsh and temporary detention of runoff above the marsh. After a storm, the normal pool of the shallow marsh may rise by up to two feet. The extra runoff is stored for up to 24 hours to allow pollutants to settle before being released downstream.

Finished Floor Elevation: The lowest elevation of the first floor or basement in a residential building or other structure that will or may be inhabited by a person or persons.

Filtration Basin: A treatment area designed to treat storm water by a process that physically removes particles from the water.

Flood: A temporary rise in stream flow or stage that results in inundation of the areas adjacent to the channel or water body.

Flood Frequency: The statistically determined average time period between events where a specific flood stage or discharge may be equaled or exceeded.

Flood Fringe: That portion of the 100-year floodplain outside of the floodway.

Flood Obstruction: Any dam, wharf, embankment, levee, dike, pile, abutment, projection, excavation, channel rectification, culvert, building, wire, fence, stockpile, refuse, fill, structure or matter in, along, across or projecting into any channel, watercourse or regulatory flood hazard area that may impede, retard or change the direction of the flow of water, either in itself or by catching or collecting debris carried by such water that may cause the flood level to rise and damage property or threaten life.

Floodplain: Floodplains are lowland areas adjoining lakes, wetlands, and rivers that are susceptible to inundation of water during a flood. For regulatory purposes, the floodplain is the area covered by the 100-year flood and it is usually divided into districts called the floodway and flood fringe. Areas where floodway and flood fringe have not been determined are called approximate study areas or general floodplain.

Floodplain (General) Area: The general floodplain area is determined using the best available data, in lieu of performing a detailed engineering study. These data may be from soils mapping, experienced high water profiles, aerial photographs of previous floods, or other appropriate sources. There are no associated published 100-year flood elevations with general floodplain delineations, unlike detailed study areas. General floodplain area is synonymous with approximate study area and unnumbered A-Zone.

Flood Proofing: A combination of structural provisions, changes or adjustments to properties and structures subject to flooding primarily for the reduction or elimination of flood damages to properties, water and sanitary facilities, structures and contents of buildings in a flood hazard area in accordance with the Minnesota State Building Code.

Floodway: The floodway is the channel of a river or other watercourse and the adjacent land areas which must remain open in order to discharge the 100-year flood.

Forebay: An extra storage area provided near an inlet of a pond or BMP to trap incoming sediments, reducing the amount that accumulates in a pond or BMP.

Freeboard: A factor of safety usually expressed in feet above a certain flood level. Freeboard compensates for the many unknown factors (e.g., waves, ice, debris, etc.) that may increase flood levels beyond the calculated level.

Forbs: Vegetation that does not consist of trees, grass or shrubs. Forbs are typically associated with flowering plants

Geographic Information System (GIS): Computer databases of georeferenced information on the cities various resources.

Global Positioning System (GPS): Network of satellites used to map and identify locations on the earth.

Hydric Soil: Soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soil is one of the three criteria that define wetlands

Hydrophytic Vegetation: Macrophytic plant life growing in water, soil, or a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hypereutropic: A very nutrient-rich lake characterized by frequent and severe nuisance algae blooms and low transparency.

Intensity-Duration-Frequency (IDF) Curve: A graphical representation of the rainfall intensity versus time of concentration for an area. The IDF curve is typically used in the Rational Method of storm sewer design to determine design rainfall intensity in inches per hour. The following IDF curve is taken from the Minnesota Department of Transportation Drainage Manual and applies is used in the rational method of storm sewer design for the Ramsey Area.

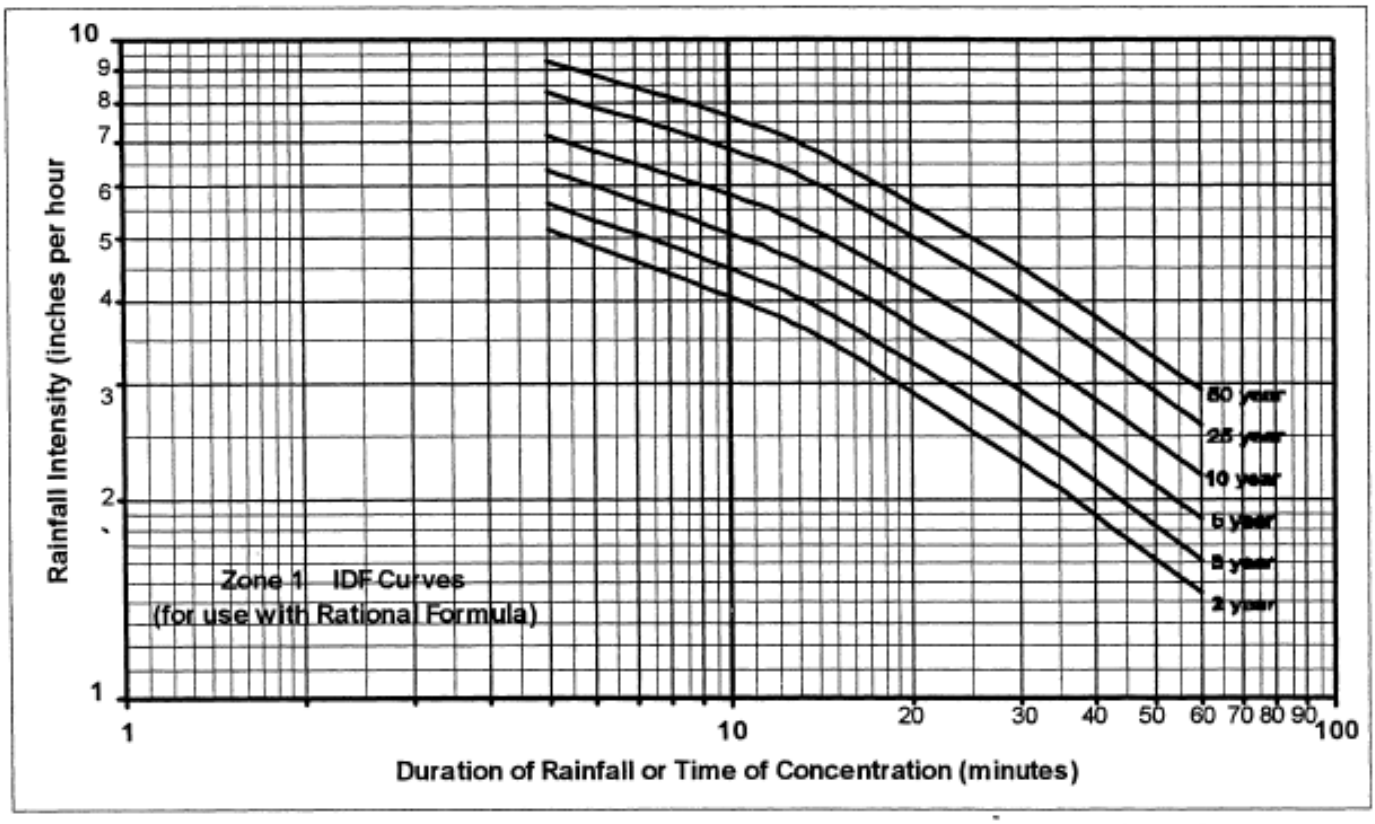


Figure 3.4 Zone 1 Southern Minnesota Rainfall Intensity - Duration - Frequency (IDF) Curves

Impervious Surface: The portion of the buildable parcel which has a covering which does not permit water to percolate into the natural soil. Impervious surface shall include, but not be limited to, buildings, all driveways and parking areas (whether paved or not), sidewalks, patios, swimming pools, tennis and basketball courts, covered decks, porches, and other structures. Open, uncovered decks are not considered impervious for the purposes of this ordinance. The use of patio blocks, paver bricks or class 5 gravel material are considered impervious surfaces as a majority of water runs-off the surface rather than being absorbed into natural soils underneath. Some exceptions to these conditions may include paver blocks or pavement systems engineered to be permeable with the underlying soils suitable for infiltration.

Infiltration Basin: An impoundment where incoming storm water runoff is stored until it gradually infiltrates into and through the soil of the basin floor.

Infiltration Trench: A conventional infiltration trench is a shallow, excavated trench that has been backfilled with stone to create an underground reservoir. Storm water runoff diverted into the trench gradually exfiltrates from the bottom of the trench into the subsoil and eventually into the water table. An enhanced infiltration trench has an extensive pretreatment system to remove sediment and oil. It requires an on-site geotechnical investigation to determine appropriate design and location.

Infrastructure: Public facilities and services, including transportation, storm water pipes, structures and ponds, water and sewer pipes and structures, telecommunications, recycling and solid waste disposal, parks and other public spaces, schools, police and fire protection, and health and welfare services.

Integrated Management Practice (IMP): A range of small-scale storm water controls or practices distributed throughout a site and intended to maintain flow patterns, filter pollutants and/or re-create or maintain existing site hydrology.

Invasive Species or Exotic Species: Non-native plants or wild animals that can naturalize, have high propagation potential, are highly competitive for limiting factors, and cause displacement of, or otherwise threaten, native plants or native animals in their natural communities.

Landlocked High Water Level or Landlocked HWL: The peak water level or high water level in a land locked basin. The HWL is the highest peak ponding elevation generated by the back-to-back 100-year SCS 24-hour rainfall events, the 10-inch SCS 24-hour rainfall event or the 100-year, 10-day snowmelt snow melt event.

Local Government Unit (LGU): Agency that has the primary responsibility of administering the Wetland Conservation Act. The City of Ramsey acts as LGU for all wetlands within the City limits and shares responsibility for basins that border adjacent municipalities.

Lowest Floor: The lowest floor of a structure, including basement.

Low Impact Development (LID): An approach to storm water management intended to protect water resources, reduce storm sewer infrastructure costs and provide a more attractive storm water management system. LID practices include infiltration systems, bioretention areas, rain barrels, green roofs, porous pavements and a long list of additional innovative storm water treatment practices.

Mesotrophic: Describes a lake of moderate photosynthetic productivity.

MNRAM: The Minnesota Routine Assessment Methodology as referenced by Minnesota Rules 8420. MNRAM is the primary tool used to assess wetland functions and values on a qualitative basis. MNRAM evaluates wetlands based on vegetation, wildlife habitat, water quality, flood and storm water attenuation, recreational opportunities, aesthetics, fishery habitat, groundwater interactions, and commercial use. The result of a MNRAM evaluation is a ranking of the wetland quality that can be used to monitor the wetland

changes over time and to set appropriate protection needs and techniques. The version referenced in this plan is Version 3.0.

Monotypic: Used to describe vegetation communities in which only one dominant species is present. Most often used to describe areas that are entirely dominated by reed canary grass or cattails.

Navigable Waters: Waters defined by the United States, 33 Code of Federal Regulations Section 329.4 as those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. The U.S. Army Corps of Engineers has Federal Jurisdiction over Navigable Waters.

New Development: Development of a property or portion thereof that is currently undeveloped property.

NURP: Nationwide Urban Runoff Program, a study by the U.S. Environmental Protection Agency. A key component of this program was to assess the effectiveness of urban runoff detention/retention basins (e.g., ponds) in removing pollutants from storm water runoff.

Off-Line BMP: A water quality facility designed to treat a portion of storm water (usually 0.5 to 1.0 inches per impervious acre) which has been diverted from a stream or storm drain.

Off-Line Treatment: A BMP system that is located outside of the stream channel or drainage path. A flow diverter is used to divert runoff from the channel and into the BMP for subsequent treatment.

Ordinary High Water Level (OHWL or OHW): The Minnesota DNR jurisdictional boundary of public waters and wetlands that is depicted by an elevation delineating the highest water level which has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly that point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial. For watercourses, the ordinary high water level is the elevation of the top of the bank of the channel. For reservoirs and flowage, the ordinary high water level is the operating elevation of the normal summer pool. In Ramsey all of the lakes have an OHW established. For streams and waterways, the OHW is considered the top of bank. Areas below the OHW are under the jurisdiction of the Minnesota Department of Natural Resources and are not regulated by the Wetland Conservation Act.

Permanent Pool: A 3- to 10-foot deep pool in a storm water pond system that provides removal of urban pollutants through settling and biological uptake (also referred to as a wet pond).

Porous Pavement: An alternative to conventional pavement whereby runoff is diverted through a porous asphalt or concrete layer and into an underground stone reservoir. The stored runoff then gradually infiltrates into the subsoil.

Protected Water: Any water or wetland designated by the Minnesota Department of Natural Resources and identified by statute on the Protected Waters Inventory.

Public Waters: Those waters of the state identified as public waters or wetlands under Minnesota Statutes, Section 103G.005.

Rational Method: A method of estimating the peak runoff from a watershed that is based on the formula Q = CIA. Where:

Q = peak flow rate in cubic feet per second
C = a runoff coefficient based on the percentage of impervious surface, type of vegetative cover, and soil type
I = rainfall intensity in inches per hour as determined from an area IDF curve
A = watershed area in acres

Reach: A hydraulic engineering term to describe a longitudinal segment of a stream or river influenced by the natural or man-made obstruction. In an urban area, the segment of a stream or river between two consecutive bridge crossings or between two reservoirs would most typically constitute a reach.

Redevelopment: Any development including but not limited to rebuilding, renovation, revision, remodeling, reconstruction or redesign of or at an existing development.

Regional Flood: A flood which is representative of large floods known to have occurred generally in Minnesota and reasonably characteristics of what can be expected to occur on an average frequency in the magnitude of the 100-year recurrence interval. A regional flood is synonymous with the term "base flood" used in the Flood Insurance Study.

Regulatory Flood Protection Elevation: A point not less than one-foot above the water surface profile associated with the 100-year flood as determined by the use of the 100-year flood profile and surrounding technical data in the Flood Insurance Study plus any increase in flood heights attributable to encroachments on the floodplain. It is the minimum elevation the DNR requires Cities to regulate by ordinance.

Retention: The permanent storage of runoff from rainfall and snowmelt events with volume reduction coming from infiltration, evaporation or emergency release.

Riprap: A combination of large stone, cobbles and boulders used as an erosion control BMP. Riprap is typically used to line channels, stabilize banks, reduce runoff velocities, or filter out sediment.

Runoff (Storm Water): The overland and near surface flow from rainfall and snowmelt.

Runoff Coefficient: A measure of the rate of runoff that is statistically generated from a parcel of land that is based on the land use, percent of impervious surfacing, soil type and vegetative cover. The higher the coefficient, the higher the amount of runoff anticipated from the parcel. Rational method runoff coefficients range from 0.2 for meadow lands to 0.95 for paved surfaces.

Runoff Conveyance: Methods for safely conveying runoff to a BMP to minimize disruption of the stream network, and promote infiltration or filtering of the runoff.

Runoff Pretreatment: Techniques to capture or trap coarse sediments before they enter a BMP to preserve storage volumes or prevent clogging within the BMP. Examples include forebays and micropools for pond BMPs, and plunge pools, grass filter strips and filter fabric for infiltration BMPs.

Sand Filter: A technique for treating storm water, whereby the first flush of runoff is diverted into a self-contained bed of sand. The runoff is then strained through the sand, collected in underground pipes and returned back to the stream or channel.

Sediment Forebay: A storm water design feature that employs the use of a small settling basin to settle out incoming sediments before they are delivered to a storm water BMP. Often used full in tandem with infiltration devices, wet ponds or marshes.

Sequencing: The process used by the Local Government Unit to evaluate the necessity of an activity relative to its impact on a wetland. The party proposing the impact must demonstrate that the activity proposed complies with the following principles in descending order of priority.

1. Avoids direct or indirect impacts to the wetlands that may diminish or destroy them;
2. Minimizes the impact to the wetland by limiting the degree or magnitude of the wetland activity and its implementation;
3. Rectifies the impacts by repairing, rehabilitating, or restoring the affected wetland;
4. Reduces or eliminates the impact to the wetland over time by preservation and maintenance operations; and,
5. Replaces unavoidable wetland impacts to the wetland by restoring or, if wetland restoration opportunities are not reasonably available, creating substitute wetland areas having equal or greater public value as provided for under the Wetland Conservation Act.

Shoreland: Land located within the following distances from public waters:

1. One thousand feet from the ordinary high water level of a lake, pond, or flowage
2. Three hundred feet from a river or stream, or the landward extent of a floodplain designated by ordinance on a river or stream, whichever is greater.

The limits of shoreland may be reduced whenever the waters involved are bounded by topographic divides which extend landward from the waters for lesser distances and when approved by the Commissioner of the DNR.

Short Circuiting: The passage of runoff through a BMP in less than the theoretical or design treatment time. For example, a properly designed treatment pond will have the inlet and outlet pipes located as far apart (along the water flow path) as possible. A short circuiting pond would have the inlet very close to the outlet and the water coming into the pond would leave the pond much sooner than if it were able to travel through the entire pond.

Storm Water Treatment: The use of accepted BMPs to treat runoff including **d**etention, retention, filtering or infiltration of a given volume of storm water to remove pollutants.

Stream Buffer: A variable width strip of vegetated land adjacent to a stream that is preserved from a disturbance and/or mowing to protect water quality and aquatic and terrestrial habitats. See also buffer strip.

Structure: Anything manufactured, built, constructed, erected, or a portion thereof which is normally attached to or positioned on land, whether temporary or permanent in character, including but not limited to buildings, fences, sheds, advertising signs, dog kennels, hard surface parking areas, boardwalks, playground equipment, concrete slabs.

Shoreland Wetland Protection Zone: The land located within 1,000 feet from the Ordinary High Water Elevation of a Protected Water, 500 feet from the Mississippi or Rum Rivers or the landward extent of the designated floodplain, and 300 feet from any stream designated in the shoreline management ordinance.

Storm Water: (See Runoff)

Storm Water Treatment Pond: Any waterbody that has been specifically created to remove sediment and nutrients and "treat" surface water runoff. Storm water ponds that were created from existing wetland are still regulated as jurisdictional wetlands. Storm water ponds created from upland areas are not wetland and are exempt from regulatory jurisdiction.

Subwatershed: A subdivision based on hydrology corresponding to a smaller drainage area within a larger watershed.

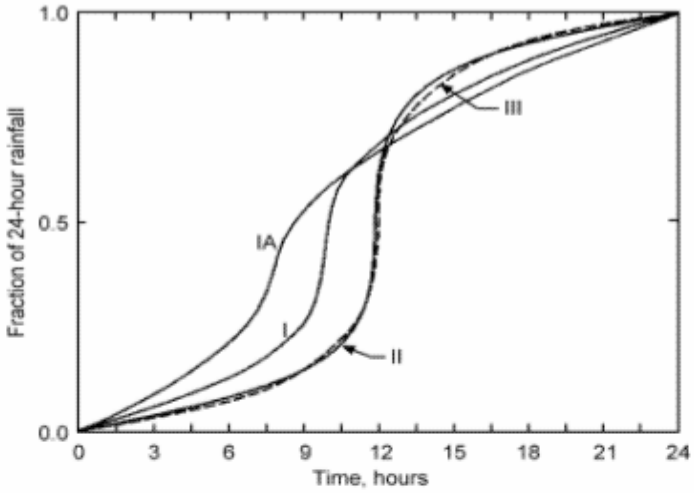
Technical Evaluation Panel (TEP): A panel of technical professionals from the Board of Water and Soil resources, the Anoka County SWCD, the LRRWMO and the LGU (City of Ramsey) at a minimum. This panel may also be expanded to include a Minnesota Department of Natural Resources representative, the U.S. Army Corps of Engineers and interested citizens requesting to participate in the wetland decision making process. Invitations to a TEP meeting are typically sent to all parties listed. The DNR, COE and interested citizens (if any) may elect not to attend. The TEP provides decision making support for the LGU for many wetland and regulatory issues.

Ten-Day Snow Melt Runoff with Type "C" Distribution (100-Year/10-day snow melt runoff): A modeled runoff event that represents snowmelt conditions over a 10-day period for a return period snow depth of 100 years. The runoff event is simulated for a curve number (CN) of 100 which represents frozen soil conditions or where all surfaces are considered impervious. For some Ramsey the ten-day runoff event is critical event for identifying the high water level of the basin or water body because the Anoka Sand Plain typically reduces runoff under unfrozen conditions. The Type C distribution is similar in concept to the Type I and II distributions, and for this event, establishes the time distribution of runoff volume over the ten-day period.

Treatment Volume (Vt): The volume of storm water runoff that is treated within a BMP or IMP storm water treatment facility. Typically the volume is expressed in terms of inches of runoff per impervious acre.

Type I, IA, II and III Storm Distributions - NRCS: These storm types represent the time distribution of a 24-hour rainfall event for areas throughout the United States. The total storm depth is distributed according to the diagram in subpart A. Type II storms are more "flashy" (i.e., convective/thunderstorms) than a Type I or IA storm. Subpart B illustrates that all of Minnesota is within the Type II rainfall distribution area.

A. SCS 24-hour rainfall distributions (SCS, 1986):



B. Approximate geographic boundaries for SCS rainfall distributions (SCS, 1986):

Underdrain: Typically perforated plastic pipes installed on the bottom of a filtration of infiltration BMP, or sand filter. The under drain is used to collect and remove treated storm water that exceeds the water holding and/or infiltration capacity of the soil.

Upland: General term to describe any area that is not a wetland.

Vegetated Filter Strip: A vegetated section of land designed to accept runoff as overland sheet flow from upstream development. It may adopt any natural vegetated form, from grassy meadow to small forest. The dense vegetative cover facilitates pollutant removal. Vegetated filter strips cannot treat high velocity flows; therefore, they have generally been recommended for use in agriculture and low-density development. A filter strip can also be an enhanced natural buffer, whereby the removal capability of the natural buffer is improved through engineering and maintenance activities such as land grading or the installation of a level spreader. A filter strip differs from a grassed

swale in that a swale is a concave vegetated conveyance system, whereas a filter strip has a fairly level surface.

Watershed: A topographically defined area within which all runoff water drains to a point.

Water Quality Volume: A design volume of water as defined by the MPCA that is required to be treated from a new development site. The MPCA defines the water quality volume as 0.5-inches of runoff from all new impervious surfaces associated with the development in the watershed.

Watershed-to-Lake Ratio: The relative surface area of the contributing watershed to the surface area of the lake or water body. In terms of water quality, generally the smaller the watershed-to-lake ratio, the better the quality of the lake. For example a lake with a ratio of 4 to 1 means that the watershed is four times the size of the lake (i.e., 200 acres contributing to a 50 acre lake).

Wetland: Transitional land between terrestrial and aquatic systems where the water table is at or near the surface or the land is covered by shallow water. The jurisdictionally accepted definition of a wetland includes the following three characteristics:

1. Have a predominance of hydric soil
2. Be inundated or saturated within 1-foot of the surface for at least 5 percent of the growing season. The inundation refers to a single continuous episode.
3. Support a prevalence of hydrophytic vegetation typically adapted for life in saturated soils.

Wetland Conservation Act (WCA): In 1991 Minnesota adopted the initial Wetland Conservation Act (Minnesota Laws Chapter 354) to protect the states wetland resources. This act has been amended and updated periodically, typically under Minnesota Rule 8420, and is used by reference to the current program, as well as any future amendments.

Wetland Delineation: The process and procedure by which an area is determined a wetland or non-wetland including a determination of the wetland boundary based on the point where the non-wetland areas shift to wetlands or aquatic habitats.

Wetland Mitigation: Wetlands created to replace wetland areas destroyed or impacted by land disturbances.

Wet Pond: A conventional wet pond has a permanent pool of water for treating incoming storm water runoff and a live storage component for flood storage and additional water quality treatment detention.

Tables

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P23202	880.0	L23240	873.2	CIRCULAR	18	881.9	11
P23218	882.0		0.0		0	876.8	1
P23310	874.0	L23308	870.0	CIRCULAR	15	871.8	9
P23320	866.5	OC23318	863.5	RECT_OPEN		863.9	55
P23400	866.0	L23320	864.0	CIRCULAR	24	866.4	16
P23402	872.5	L23400	864.5	CIRCULAR	42	868.0	49
P23404	874.0	L23402	866.0	CIRCULAR	24	869.3	13
P23406	874.0	L23404	868.0	CIRCULAR	18	869.8	8
P24212	861.0	L24TH47-1	858.9	ARCH	18.25	860.8	8
P24310	880.0	L24308	872.0	CIRCULAR	15	879.1	8
P24322	861.0	L24213	858.5	CIRCULAR	12	862.1	6
P24324	865.0	L24321	860.0	CIRCULAR	12	863.5	5
P24324A	867.0	ZC24324A	865.5	RECT_OPEN		866.3	5
P24324B	866.0	ZC24324B	865.5	RECT_OPEN		866.2	4
P24326	864.0	L24324	862.0	CIRCULAR	15	866.3	12
P24330	864.0	OC24213	863.5	RECT_OPEN		863.8	18
P24350	870.0	L24348	864.0	CIRCULAR	12	868.8	8
P24354	866.0	OC24327	865.0	RECT_OPEN		866.3	51
P24355	868.0		0.0		0	866.3	25
P24366	863.0	L24TH47	860.1	CIRCULAR	15	861.3	38
P24368	864.0	L24366	860.2	CIRCULAR	18	862.1	10
P24374	864.0	L24TH47-4	858.2	ARCH	18.25	863.7	30
P24389	867.4		0.0		0	861.0	0
P24391	860.5		0.0		0	862.1	4
P24392	868.0	L24387	864.0	CIRCULAR	12	866.2	5
P25204	858.0	L25202	854.0	CIRCULAR	24	855.6	12
P25216	850.0	L25214	847.8	CIRCULAR	48	850.8	107
P25304	856.0	L25302	852.0	CIRCULAR	15	856.9	18
P25315	862.3	L26215	859.4	CIRCULAR	12	861.8	17
P25317	867.0	L25319	861.9	CIRCULAR	12	866.2	6
P25319	872.5	L25321	866.0	CIRCULAR	15	866.9	3
P25321	879.5	L25329	875.6	CIRCULAR	15	877.8	3
P25328	858.0	C25326	852.8	RECT_OPEN		857.4	27
P25400	868.0	L25400	866.0	CIRCULAR	15	869.4	5
P25402	876.0	L25402	870.0	CIRCULAR	18	877.3	15
P25424	866.0	L25420	862.0	CIRCULAR	12	866.2	6
P25426	863.0	L25425	863.0	CIRCULAR	15	859.2	6
P25442	880.0	L25439	878.0	CIRCULAR	12	880.1	5
P25454	868.0	D43-P559	866.0	CIRCULAR	12	868.5	19
P25456	868.0	L25447	863.0	CIRCULAR	12	866.9	5
P25458	860.0	C25456	860.0	RECT_OPEN		860.0	33
P25484	872.0	L25482	870.0	CIRCULAR	12	872.0	5

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P25488	880.2	L25488	873.0	CIRCULAR	18	881.9	2
P25490	880.0		0.0		0	881.9	0
P25492	879.3		0.0		0	885.4	0
P26112	870.0	L26110	866.0	CIRCULAR	12	869.3	5
P26118	866.0	L26117	860.0	CIRCULAR	24	862.7	16
P26136	874.0	L26135	871.0	CIRCULAR	15	871.6	6
P26144	868.0	L26442	863.0	CIRCULAR	15	864.3	3
P26158	864.0	L26154	860.0	CIRCULAR	18	862.9	8
P26168	864.0		0.0		0	863.4	0
P26176	866.0	L25418	862.4	CIRCULAR	15	867.9	7
P26190	872.0	L26187	868.0	CIRCULAR	12	870.4	4
P26200	860.0	C25329	856.0	RECT_OPEN		857.5	24
P26204	862.0	L26200	858.2	CIRCULAR	15	861.6	9
P26206	864.0	L26209	858.4	CIRCULAR	30	863.8	30
P26226	866.0	L26415	865.2	CIRCULAR	15	864.1	0
P26302	862.0		0.0		0	856.0	23
P26304	874.0	L26323	868.0	CIRCULAR	18	874.2	10
P26306	876.0	L26326	871.0	CIRCULAR	15	873.5	5
P26308	872.0	C26313	871.5	RECT_OPEN		876.5	8
P26310	874.0		0.0		0	876.5	6
P26312	860.0	L28313	852.5	CIRCULAR	18	855.4	4
P26400	865.0		0.0		0	860.9	0
P26402							
864	864.0		0.0	0	0	864.1	0
P26420	865.0	L26418	861.0	CIRCULAR	15	863.5	7
P26424	866.0	L26423	860.0	CIRCULAR	24	861.5	11
P26428	865.0		0.0		0	864.1	7
P26458	872.0	L26456	868.9	CIRCULAR	15	869.9	5
P28313	858.0	L28315	850.0	CIRCULAR	18	854.3	4
P36400	855.0	L25236	850.8	CIRCULAR	36	853.3	34

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P09308	878.0	C16406	875.0	RECT_OPEN		875.3	12
P11338	874.0	ZC14436	872.0	RECT_OPEN		872.8	39
P11340	878.0	ZC11338	874.0	RECT_OPEN		874.4	29
P13314	872.0	ZC13312	871.0	RECT_OPEN		871.2	23
P13408	864.0	L13406	850.8	CIRCULAR	36	862.6	139
P14104	866.0	L14102	861.5	CIRCULAR	12	867.6	8
P14118	866.0	L14116	862.0	CIRCULAR	18	863.9	11
P14122	866.0	L14120	858.0	CIRCULAR	12	868.4	11
P14124	878.0	L14132	870.0	RECT_CLOSE	48	870.3	8
P14126	870.0	L14127	866.0	CIRCULAR	12	868.0	3
P14140	874.0	L14137	868.9	CIRCULAR	12	872.5	5
P14148	872.0	ZC14455	871.0	RECT_OPEN		870.3	0
P14156	874.0	ZC14156	865.5	RECT_OPEN		867.6	20
P14166	874.0		0.0			873.2	0
P14202	888.0	C23157	868.0	RECT_OPEN		869.3	98
P14218	864.0	ZC14215	861.0	RECT_OPEN		863.3	56
P14220	870.0	L14218	853.6	CIRCULAR	48	864.4	107
P14228	866.5	ZC14223	864.5	RECT_OPEN		865.1	49
P14230	872.0	ZC14228	871.7	RECT_OPEN		870.7	0
P14240	888.0	L14238	882.0	CIRCULAR	21	884.3	7
P14246	888.0	L14237	884.0	CIRCULAR	12	884.8	6
P14260	865.0	L14258	861.0	CIRCULAR	12	865.3	12
P14268	868.0	L14263	865.0	CIRCULAR	12	867.7	5
P14270	881.0	Link-12	878.0	CIRCULAR	15	879.5	5
P14334	870.0		0.0		0	869.3	0
P14432	870.0	L14430	861.4	CIRCULAR	36	867.0	112
P14436	874.0	L14434	870.0	CIRCULAR	15	872.3	10
P14438	874.0	L14438	871.0	CIRCULAR	15	873.1	14
P14440	872.0	ZC14422	871.0	RECT_OPEN		871.1	1
P14442	872.0	ZC14423	871.0	RECT_OPEN		871.5	21
P14446	872.0	ZC14456	870.5	RECT_OPEN		872.3	10
P14449	875.0	L14440	871.9	CIRCULAR	18	873.1	10
P14450	870.0	ZC14453	869.0	RECT_OPEN		869.2	6
P15102	876.0	C15334	875.2	RECT_OPEN		875.6	35
P15236	878.0	L15234	863.6	CIRCULAR	36	867.3	32
P15240	871.5	L15238	865.0	CIRCULAR	36	868.4	30
P15244	872.0	C15243	870.0	RECT_OPEN		870.5	88
P15246	872.0	C22145	872.0	RECT_OPEN		872.0	1
P15248	878.0	C15250	877.0	RECT_OPEN		873.5	0
P15250	874.0	C15246	873.2	RECT_OPEN		873.3	1
P15252	877.0	C15248	877.0	RECT_OPEN		875.8	0
P15350	874.0	L15348	867.5	CIRCULAR	36	871.0	80

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P15352	872.0	L15347	867.7	CIRCULAR	18	871.7	17
P15402	876.0		0.0		0	873.6	0
P16104	872.0	L16102	868.0	CIRCULAR	12	873.1	6
P16114	878.0	L16138	868.1	CIRCULAR	12	878.3	7
P16128	872.0	C16201	871.0	RECT_OPEN		870.5	0
P16140	873.0	L16254a	869.0	CIRCULAR	18	872.0	24
P16252	872.0	C15350	870.5	IRREGULAR		871.1	176
P16402	874.0	C16200	871.0	RECT_OPEN		872.0	44
P16404	874.0	L16402	872.0	CIRCULAR	15	873.3	5
P16406	874.0	L16404	871.0	CIRCULAR	15	873.5	9
P19E304	848.0	L19302	845.0	CIRCULAR	21	854.5	14
P22110	886.0	L22208	885.0	CIRCULAR	15	886.7	5
P22150	876.0	ZC23447	875.8	RECT_OPEN		875.9	4
P22208	886.0	L22206	881.4	CIRCULAR	15	884.6	6
P22216	874.0		0.0		0	873.1	0
P22220	876.0	L22218	872.0	CIRCULAR	15	876.5	8
P22402	872.0		0.0		0	871.1	7
P22404	872.0	L22402	868.5	CIRCULAR	15	871.0	12
P22406	874.0	L22404	868.4	CIRCULAR	15	871.0	4
P22408	872.0	ZC22408	867.7	TRAPEZOIDA		871.3	16
P22410	874.0	L22408	871.0	CIRCULAR	18	874.5	37
P22454	872.0	ZC22408A	866.5	TRAPEZOIDA		871.3	43
P23102	870.0	L23101	865.8	CIRCULAR	12	877.2	18
P23118	870.0	L24412	866.0	CIRCULAR	15	869.4	11
P23158	868.0	P23158	864.0	CIRCULAR	18	865.7	1
P23160	868.0	L23159	862.5	CIRCULAR	15	866.2	5
P23186	867.2	L23185	864.3	CIRCULAR	15	866.2	10
P23302	872.0		0.0		0	867.8	4
P23312	869.0		0.0		0	867.3	0
P23416	872.0	L23408	866.2	CIRCULAR	18	871.1	12
P23438	868.0	C23158	866.0	RECT_OPEN		867.1	37
P23444	872.0	C15241	868.9	RECT_OPEN		869.2	5
P23446	872.0	L23444	871.0	CIRCULAR	18	872.4	39
P24114	870.0	L24112	858.7	CIRCULAR	21	867.4	11
P24118	868.3	L24116	864.2	CIRCULAR	15	868.5	8
P24126	880.0	L24124	878.0	CIRCULAR	21	879.0	13
P24148	874.0	L24146	864.5	CIRCULAR	15	871.9	20
P24222	890.0	L24150	883.1	CIRCULAR	15	887.2	7
P24230	888.0	L24228	884.0	CIRCULAR	12	887.8	8
P24244	890.0	L24242	886.0	CIRCULAR	15	889.4	5
P24402	868.0	L24451	861.0	CIRCULAR	15	865.7	4
P24406	868.0	L24404	862.3	CIRCULAR	15	866.1	6

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P24426	868.0	L24425	864.2	CIRCULAR	15	866.3	7
P24440	868.0	L24138	857.4	CIRCULAR	15	865.9	6
P24450	866.0	L24448	862.0	CIRCULAR	18	865.4	12
P24452	872.0	L24449	870.0	CIRCULAR	18	872.2	14
P24454	872.0	C24450	871.2	RECT_OPEN		871.3	4

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P22302	870.0	L27116	864.5	CIRCULAR	12	866.4	2
P22304	870.0	L22302	866.0	CIRCULAR	15	866.7	4
P22306	888.0	C22304	887.6	RECT_OPEN		886.5	0
P27102	868.0	L27119	864.5	CIRCULAR	18	862.5	0
P27104	870.0	C27104	870.5	RECT_OPEN		869.5	0
P27106	872.0	C27108	871.2	RECT_OPEN		868.6	0
P27108	872.0		0.0			864.9	0
P27110	872.0	C27109	870.4	RECT_OPEN		867.0	0
P27112	872.0	C27107	870.0	RECT_OPEN		869.2	0
P27114	872.0	C27106	870.6	RECT_OPEN		869.8	0
P27116	870.0	C27411	870.3	RECT_OPEN		866.4	2
P27118	866.0		0.0		0	862.5	0
P27202	866.0	L27232	857.6	CIRCULAR	36	865.5	43
P27234	866.0	L27229	861.6	CIRCULAR	15	863.7	38
P27268	868.0	C27269	864.5	RECT_OPEN		864.8	7
P27270	866.0		0.0		0	862.6	0
P27276	880.0	C27270				873.8	0
P27302	867.0	L27344	858.2	CIRCULAR	15	866.0	12
P27316	866.0	L27301	865.0	CIRCULAR	24	865.5	2
P27330	866.0	L27328	858.0	CIRCULAR	18	865.4	8
P27338	862.0	C34176	862.0	RECT_OPEN		862.3	8
P27346	865.0	L27404	862.0	CIRCULAR	18	863.9	10
P27402	868.0	L27118	862.5	CIRCULAR	24	861.8	0
P27404	868.0	C27402	868.2	RECT_OPEN		867.4	0
P27406	868.0	C27403	868.2	RECT_OPEN		868.4	3
P27408	870.0		0.0		0	865.4	0
P27416	872.0	L27414	868.0	CIRCULAR	15	871.0	7
P27434	880.0	L27432	876.0	CIRCULAR	12	878.0	5
P27446	870.0	L27401	863.8	CIRCULAR	12	869.1	6
P27456	872.0		0.0		0	870.6	0
P34106	859.0	L34104	857.4	CIRCULAR	24	859.0	22
P34137	864.0	L34137	854.0	CIRCULAR	15	859.1	10
P34148	860.0	L34149	853.8	CIRCULAR	24	857.9	11
P34150	862.0	L34152	854.5	CIRCULAR	30	861.2	29
P34164	866.0		0.0		0	864.7	0
P34166	868.0		0.0		0	868.1	0
P34168	860.0		0.0		0	861.9	0
P34170	862.0	L34139	858.5	CIRCULAR	15	862.2	14
P34172	868.0		0.0		0	869.0	0
P34174	863.5	L27274	860.8	CIRCULAR	15	863.4	14
P34402	861.0	L34405	855.7	ARCH	36	860.7	8
P34408	860.0	C34106	858.5	RECT_OPEN		859.0	13

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P34410	862.0	C34408	862.0	RECT_OPEN		862.1	15
P34412	864.0	C34410	864.0	RECT_OPEN		864.1	8
P34414	862.0		0.0			860.5	0
P34416	862.0	C34414	862.0	RECT_OPEN		860.6	0
P35402	856.0	L35317	848.5	CIRCULAR	18	852.5	11
P35407	860.0	L35407	851.0	CIRCULAR	36	858.2	10
P35420	862.0	L35420	858.0	CIRCULAR	42	860.2	39
P35422	862.0	P35418	856.2	CIRCULAR	42	860.3	9
P35424	860.0		0.0		0	861.3	59
P35438	862.0	L35436	858.0	CIRCULAR	12	861.9	6
P35446	866.0		0.0		0	866.7	3
P35464	868.0	L35462	861.5	CIRCULAR	12	866.7	6
P35474	868.0	L35432	866.8	CIRCULAR	15	867.1	28
P35476	882.0		0.0		0	881.4	0
P35478	866.0		0.0		0	864.4	0
P35480	866.0		0.0		0	865.9	0

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P10242	884.0	C11340	883.0	RECT_OPEN		883.0	1
P10244	884.0	C10242	883.5	RECT_OPEN		883.6	0
P10246	878.0		0.0			875.1	0
P10248	878.0	C10246	876.3	RECT_OPEN		876.3	1
P10254	884.0	C10243	886.9	RECT_OPEN		882.4	0
P11104	884.0		0.0			885.7	0
P11106	882.0	C11105	880.6	RECT_OPEN		880.8	14
P11108	888.0	C11106	886.3	RECT_OPEN		878.4	0
P11110	884.0	C11107	882.9	RECT_OPEN		876.0	0
P11112	880.0	C11210	880.7	PARABOLIC		881.1	16
P11114	878.0	C11113	878.0	RECT_OPEN		878.1	10
P11116	882.0	L11118	877.7	CIRCULAR	18	879.4	2
P11118	878.0	L11120	873.0	CIRCULAR	18	874.1	9
P11202	874.0	L11211	868.0	CIRCULAR	12	870.6	3
P11206	876.0	L11204	871.5	CIRCULAR	24	872.9	11
P11208	878.0	C11205	875.9	PARABOLIC		873.9	0
P11210	878.0	C11208	877.4	PARABOLIC		877.6	1
P11212	878.0	C11215	875.5	TRAPEZOIDA		876.8	11
P11213	872.5	C11202	870.0	TRAPEZOIDA		870.7	8
P11306	886.0	C11104	885.1	RECT_OPEN		885.7	24
P11308	880.0	C11406	878.8	RECT_OPEN		875.6	0
P11310	881.0	C11308	880.1	RECT_OPEN		880.3	7
P11312	881.0	C11310	880.5	RECT_OPEN		880.7	12
P11314	881.0		0.0			880.7	1
P11316	876.0	C11407	872.1	CIRCULAR	18	872.9	8
P11318	878.0	C11316	877.5	RECT_OPEN		877.6	5
P11320	878.0	C11206	876.1	RECT_OPEN		876.5	40
P11338	874.0	C14436	872.0	RECT_OPEN		872.5	43
P11340	878.0	L11338	874.0	CIRCULAR	18	875.0	13
P11402	874.0		0.0		0	872.8	0
P11404	874.0	C11402	872.7	RECT_OPEN		873.0	44
P11406	878.0	C11404	877.5	RECT_OPEN		873.0	0
P11408	874.0	C11403	872.4	RECT_OPEN		873.5	73
P11410	882.0	C11408	880.5	RECT_OPEN		880.6	45
P12302	860.0	C12300	856.0	RECT_OPEN		856.7	45
P12304	862.0	C12302	860.0	RECT_OPEN		860.6	28
P12306	878.0	C12301	877.1	PARABOLIC		877.1	1
P12312	876.0	C12303	874.0	RECT_OPEN		874.2	30
P12313	860.0	L12306	857.8	CIRCULAR	15	858.1	9
P12314	858.0	C12307	856.0	TRAPEZOIDA		856.8	2
P13402	880.0		0.0			879.0	0
P13404	879.0	C13410	878.6	RECT_OPEN		878.4	0

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P13408	865.0	L13406	863.4	CIRCULAR	12	864.1	7
P13410	868.0	C13408	866.8	RECT_OPEN		866.9	2
P14106	876.0	L14104	874.5	CIRCULAR	12	876.7	6
P14108	881.0	C14106	880.2	RECT_OPEN		880.3	16
P14401	877.5	L14435	871.5	CIRCULAR	15.72	876.8	9
P14402	896.0		0.0		0	894.1	0
P14436	874.0	L14434	870.0	CIRCULAR	15	872.5	7
P15150	888.0	C10248	887.3	RECT_OPEN		884.3	0
P15152	888.0	C15150	888.7	RECT_OPEN		882.1	0

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P34304	848.0	P34304	842.0	CIRCULAR	24	848.9	36
P34311	854.0	P34311	850.0	CIRCULAR	15	853.5	5
P34316	856.0	P34316	852.0	CIRCULAR	15	855.7	7
P34418	856.0	P34418	850.1	CIRCULAR	24	859.8	29
P34434	856.0	P34434	853.0	CIRCULAR	15	859.3	7
P34451	854.0	P34451	849.1	CIRCULAR	18	853.6	10
P34452	854.0	P34452	849.3	CIRCULAR	18	853.6	5
P34460	858.0	P34460	853.2	CIRCULAR	27	856.3	11

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P01108	864.0	C01200	863.7	RECT_OPEN		863.4	0
P01304	858.0	C01301	856.5	RECT_OPEN		858.2	95
P01306	870.0	C01304	867.3	RECT_OPEN		867.5	19
P01307	864.0	C01303	862.7	RECT_OPEN		862.7	1
P01308	874.0	L01306	870.0	FILLED_CIR	18	871.8	7
P01314	870.0	C01305	869.0	RECT_OPEN		869.2	33
P01410	872.0	C01108	870.5	RECT_OPEN		870.8	40
P02110	890.0	C02208	888.9	RECT_OPEN		889.1	26
P02112	890.0	C02211	889.6	RECT_OPEN		889.9	9
P02114	900.0	C02112	899.5	RECT_OPEN		893.9	0
P02116	902.0	C02114	900.0	RECT_OPEN		900.0	0
P02206	868.0	C02204	858.0	IRREGULAR		861.9	475
P02208	864.0	C02205	863.8	RECT_OPEN		864.1	40
P02212	886.0	C01311	885.1	RECT_OPEN		885.1	2
P02310	872.0	C02209	871.0	RECT_OPEN		871.3	34
P02412	892.0	C02410	888.3	RECT_OPEN		888.6	39
P03212	874.0	C02310	873.5	RECT_OPEN		873.8	36
P03314	886.0	L03312	882.0	CIRCULAR	18	884.8	15
P03316	888.0	C03314	886.9	RECT_OPEN		888.7	38
P03330	886.0	C03315	884.9	RECT_OPEN		885.0	3
P03418	890.0	C03316	889.0	RECT_OPEN		889.5	37
P03432	892.0	L03419	889.0	CIRCULAR	18	889.5	3
P04220	896.0	C03418	892.0	RECT_OPEN		893.3	41
P05338	892.0	L05336	886.0	CIRCULAR	42	888.2	96
P05340	894.0	L05338	890.0	CIRCULAR	42	892.4	93
P05344	906.0	C08135	904.5	RECT_OPEN		906.0	112
P05346	908.0	C05344	905.6	RECT_OPEN		906.7	107
P05444	894.0	C05443	892.0	RECT_OPEN		892.0	1
P06148	900.0	C06146	899.5	RECT_OPEN		900.2	25
P06302	896.0		0.0		0	896.4	0
P06404	891.0	L04402	887.0	CIRCULAR	18	889.7	13
P06410	898.0	L06408	890.0	CIRCULAR	18	892.5	12
P06414	906.0	L06412	902.0	CIRCULAR	18	903.0	13
P06418	904.0	L06416	901.0	CIRCULAR	18	902.0	14
P06424	912.0	L06422	910.0	CIRCULAR	18	910.8	7
P07102	892.0	L07414	889.0	CIRCULAR	15	893.3	18
P07104	892.0	C07102	892.8	RECT_OPEN		893.3	16
P07106	892.0	L07107	889.2	CIRCULAR	24	894.1	20
P07107	892.0	L07102	889.0	CIRCULAR	24	893.6	13
P07112	892.0	L08410	890.0	ARCH	27.6	891.6	17
P07114	890.0	C08411	889.9	RECT_OPEN		890.4	24
P07116	894.0		0.0		0	892.0	0

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P07204	890.0	L07202	885.0	CIRCULAR	18	888.3	13
P07206	902.0	L07204	898.0	CIRCULAR	18	903.9	23
P07210	878.0	C07203	877.0	RECT_OPEN		877.1	4
P07340	880.0	C07338	879.0	IRREGULAR		880.0	8
P07414	892.0	C07112	893.0	RECT_OPEN		893.2	17
P08130	878.0	C08228	873.0	RECT_OPEN		875.5	468
P08134	884.0	C08132	880.0	RECT_OPEN		881.2	335
P08304	888.0	L08302	886.0	CIRCULAR	18	887.5	15
P08330	878.0	L08328	868.0	ARCH	60	871.4	197
P08406	888.0	C08304	887.0	RECT_OPEN		887.5	24
P08408	886.0		0.0			889.4	11
P08410	890.0	C08408	889.8	RECT_OPEN		890.0	29
P08412	890.0	C08409	889.5	RECT_OPEN		889.8	23
P08414	896.0	C08412	895.2	RECT_OPEN		895.5	36
P08416	886.0	L08408	882.2	CIRCULAR	15	887.8	11
P08418	896.0	L08407	891.7	CIRCULAR	18	892.6	14
P08420	900.0	L08418	893.5	CIRCULAR	15	897.7	11
P08430	880.0	C08229	879.0	RECT_OPEN		879.5	26
P08434	903.0	C08133	903.0	RECT_OPEN		901.7	0
P08436	904.0	C08434	904.0	RECT_OPEN		904.2	18
P09118	890.0	C09215	889.0	RECT_OPEN		889.0	3
P09120	902.0	C09118	899.0	RECT_OPEN		899.1	12
P09122	892.0	C09221	890.5	RECT_OPEN		890.6	12
P09124	900.0	C09122	898.2	RECT_OPEN		898.3	9
P09222	874.0	C09220	872.3	RECT_OPEN		872.4	2
P09320	872.0	L09218	864.0	ARCH	60	868.6	225
P09330	876.0	C09323	873.5	RECT_OPEN		873.7	10
P09422	890.0	C04220	899.3	RECT_OPEN		890.7	0
P09424	898.0	C09422	896.6	RECT_OPEN		893.3	0
P09426	896.0	L09324	893.0	CIRCULAR	15	893.6	3
P09428	894.0	L09326	892.0	CIRCULAR	15	893.0	2
P09432	892.0	L09330	886.5	CIRCULAR	15	889.7	7
P09434	890.0	L09123	889.0	CIRCULAR	15	886.8	1
P10114	890.0	L10112	886.0	HORIZ_ELLI	18	887.3	14
P10116	890.0	C10114	888.8	RECT_OPEN		889.0	5
P10118	890.0	C10116	889.1	RECT_OPEN		889.5	17
P10120	890.0	C10118	888.5	RECT_OPEN		889.5	4
P10122	890.0	L10122	888.0	CIRCULAR	15	889.0	5
P10214	890.0	C10413	889.8	RECT_OPEN		890.3	11
P10216	888.0	C10415	887.6	RECT_OPEN		886.0	0
P10412	867.0	L10110	863.0	ARCH	84	866.6	239
P10416	884.0	C10417	883.1	RECT_OPEN		883.3	42

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P10418	888.0	C10419	886.0	RECT_OPEN		886.4	30
P15424	876.0	C09222	875.3	RECT_OPEN		875.0	0
P15426	876.0	C15424	874.6	RECT_OPEN		875.0	12
P16424	892.0	C09325	890.4	RECT_OPEN		889.2	0
P17106	878.0	C17404	876.2	RECT_OPEN		875.6	0
P17108	898.0	C17106	897.2	RECT_OPEN		894.9	0
P17110	892.0	C17107	889.5	RECT_OPEN		889.8	52
P17124	886.0	C09321	885.0	RECT_OPEN		885.1	7
P17126	894.0	C08223	892.5	RECT_OPEN		892.6	12
P17402	880.0	C08329	878.2	RECT_OPEN		874.5	0
P17404	876.0	C17402	875.3	RECT_OPEN		875.4	1
P17407	880.0	L17405	878.0	CIRCULAR	15	874.9	0
P17409	874.0	C07233	873.0	RECT_OPEN		873.2	7
P17410	880.0	C17408	879.3	RECT_OPEN		878.9	0

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
1P	867.0	Link-40	858.5	CIRCULAR	18	869.6	128
2P	870.0	2 Pipe	864.0	CIRCULAR	21	869.7	107
3P	872.0	3 pipe	869.0	CIRCULAR	18	871.4	36
9P	869.0	9 outlet	867.2	CIRCULAR	15	869.0	3
P16300	900.0		0.0		0	900.6	0
P16302	900.0		0.0		0	900.9	0
P17200	888.0	C17307	888.0	RECT_OPEN		887.4	0
P17202	884.0		0.0			880.0	0
P17204	884.0	C17302	883.5	RECT_OPEN		883.6	4
P17300	872.0	C19105	872.0	RECT_OPEN		872.1	54
P17302	874.0	C17301	872.0	RECT_OPEN		872.2	69
P17304	874.0	C17300	872.0	RECT_OPEN		871.8	1
P17306	874.0		0.0		0	875.5	0
P17400	874.0	L17400	870.5	CIRCULAR	15	873.5	10
P17406	876.0	L174111	873.1	CIRCULAR	15	874.0	3
P17408	876.0	C17305	872.0	RECT_OPEN		872.5	26
P18100	876.0	C18102	883.6	RECT_OPEN		875.6	0
P18102	876.0		0.0			875.5	0
P18104	874.0	C18100	873.7	RECT_OPEN		875.6	25
P18106	874.0		0.0			873.0	0
P18108	874.0	C18106	874.0	RECT_OPEN		874.1	4
P18110	874.0	C18108	874.0	RECT_OPEN		873.8	1
P18112	874.0	C18107	874.0	RECT_OPEN		873.2	0
P18200	884.0		0.0			874.1	0
P18202	872.0	C19107	870.0	RECT_OPEN		871.9	74
P18300	886.0		0.0			868.9	185
P18334	885.0	C18332	881.0	RECT_OPEN		883.0	13
P18336	882.0		0.0			884.0	0
P18338	884.0		0.0			883.4	0
P18400	886.0	C18406	883.5	RECT_OPEN		884.0	60
P18402	894.0	C18400	886.0	RECT_OPEN		886.4	41
P18404	886.0	C18407	885.3	RECT_OPEN		885.8	61
P18406	884.0		0.0			880.3	0
P18408	882.0		0.0			881.6	0
P18410	878.0		0.0			875.1	0
P19100	874.0		0.0			871.9	0
P19102	888.0	C19109	886.0	RECT_OPEN		886.2	9
P19200	870.0	C20308	870.0	RECT_OPEN		869.4	0
P19202	872.0	C19101	875.0	RECT_OPEN		872.1	0
P19206	868.0	C19300	868.0	RECT_OPEN		868.2	71
P19304	858.0	C19302	856.0	RECT_OPEN		856.1	25
P19306	858.0	C19304	858.0	RECT_OPEN		858.2	12

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P19400	888.0	L19400	885.0	RECT_OPEN		886.7	59
P19402	884.0		0.0			886.0	0
P19404	882.0		0.0			879.8	0
P19406	882.0	C19404	880.6	RECT_OPEN		881.0	20
P19408	881.0		0.0			881.0	0
P19410	888.0	L19410	885.0	RECT_OPEN		886.5	42
P20100	880.0		0.0			875.1	0
P20102	880.0	C20100	880.0	RECT_OPEN		877.3	0
P20104	880.0		0.0			880.0	0
P20106	882.0	C20104	882.0	RECT_OPEN		882.1	8
P20200	874.0	C29107	874.0	RECT_OPEN		874.1	7
P20300	870.0		0.0			871.5	0
P20302	880.0	C29105	878.0	RECT_OPEN		878.5	31
P20304	868.0	C29104	868.0	RECT_OPEN		868.2	15
P20306	870.0	C20304	871.5	RECT_OPEN		871.0	0
P20308	868.0	C20305	868.0	RECT_OPEN		868.2	6
P20400	872.0	L20306	870.0	CIRCULAR	24	871.0	2
P20402	884.0	C20400	884.0	RECT_OPEN		884.1	5
P20404	878.0	C19103	878.0	RECT_OPEN		871.9	0
P21202-E	870.0	L28136-E	867.0	CIRCULAR	18	869.9	7
P21204-E	870.0	L21202-E	866.5	CIRCULAR	15	870.0	4
P21206-E	870.0	L21204-E	867.0	CIRCULAR	15	870.3	6
P21208-E	870.0	ZC21206-E	869.0	RECT_OPEN		870.3	25
P21210-E	872.0	ZC21208-E	871.4	RECT_OPEN		872.3	28
P21300	876.0	C21405	876.0	RECT_OPEN		876.0	0
P21400	876.0		0.0			868.8	0
P21402	882.0	L21400	876.0	CIRCULAR	24	877.9	24
P21404	881.9	C21401	881.1	RECT_OPEN		881.6	78
P21406	886.0	C21403	885.2	RECT_OPEN		885.6	44
P27306	862.0	L27301	862.0	CIRCULAR	18	863.5	3
P28102	867.0	L28100	860.0	ARCH	44.64	866.2	102
P28104	867.0	L28118	859.0	CIRCULAR	15	866.2	63
P28104-E	870.0	L28102-E	862.5	CIRCULAR	24	865.8	14
P28106-E	868.0	L28104-E	864.0	CIRCULAR	18	867.5	17
P28124	871.5	L28122	865.3	CIRCULAR	18	869.4	12
P28136-E	870.0	L28134-E	867.0	CIRCULAR	15	869.7	6
P28143-E	870.0	L28154-E	861.5	CIRCULAR	18	868.4	13
P28200	870.0		0.0		0	868.0	0
P28220	868.1	L28218	856.0	RECT_CLOSE	36	863.6	227
P28228	864.0	L28219	855.8	ARCH	72	863.4	110
P28242	864.6	L28240	858.5	CIRCULAR	42	865.3	29
P28244	864.9	L28237	859.5	ARCH	31.32	865.2	43

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P28248	864.0	L28246	858.8	CIRCULAR	33	865.7	22
P28258	862.0		0.0		0	862.2	0
P28304	864.0	L28302	850.8	CIRCULAR	42	861.3	80
P28310	865.0	L28201	853.0	CIRCULAR	48	863.0	139
P28320	866.1	L28318	859.2	CIRCULAR	48	865.6	62
P28326	865.4	L28244	860.4	ARCH	31.32	865.9	35
P28332	872.0		0.0		0	874.2	0
P28334	870.0	L28301	847.0	CIRCULAR	30	860.3	62
P28336	867.0	PipeÂ 16	858.5	CIRCULAR	15	864.6	9
P28342	865.0	PipeÂ 40	860.0	CIRCULAR	18	862.7	6
P28353	872.0		0.0		0	871.8	5
P28401	881.0		0.0		0	881.3	7
P28402	879.0		0.0		0	877.4	11
P28403	872.0	L28422	866.0	CIRCULAR	27	867.4	6
P28404	872.2	L28424	869.2	CIRCULAR	21	871.7	8
P28405	871.5	L28425	868.2	CIRCULAR	24	870.9	11
P28406	870.9	L28427	867.3	CIRCULAR	24	870.2	14
P28407	870.0	L28428	866.5	CIRCULAR	24	869.1	17
P28408	871.0	L28406	854.0	RECT_CLOSE	24	865.4	130
P28409	871.7	L28440	869.2	CIRCULAR	18	870.4	4
P28410	870.0	L28439	868.1	CIRCULAR	18	870.0	7
P28411	869.8	L28441	867.2	CIRCULAR	18	869.8	6
P28412	868.0	L28410	862.0	CIRCULAR	48	865.4	33
P28413	869.5	L28442	866.4	CIRCULAR	18	869.1	4
P28414	868.0	C28412	862.0	TRAPEZOIDA		865.4	32
P28415	868.9	Link-30	865.2	CIRCULAR	21	868.6	8
P28416	867.0	L28414	862.7	CIRCULAR	30	868.2	86
P28417	868.5	Link-31	864.4	CIRCULAR	24	868.3	4
P28418	868.0	C28416	862.7	IRREGULAR		868.2	17
P28420	868.0	L28449	865.0	CIRCULAR	15	863.9	2
P28440	865.5		0.0		0	865.1	14
P28441	868.0	LROut	865.7	TRAPEZOIDA		861.3	0
P28472	866.1	L28470	860.6	CIRCULAR	33	866.4	27
P28474	866.9	L28472	860.8	CIRCULAR	33	867.2	30
P28486	869.2	L28484	863.1	CIRCULAR	27	869.3	19
P28492	870.0	L28490	857.7	CIRCULAR	36	868.9	42
P29100	872.0	C29207	871.5	RECT_OPEN		870.9	10
P29102	874.0	L29100	868.5	CIRCULAR	18	870.1	5
P29104	869.0	L28416	864.0	CIRCULAR	24	867.9	23
P29202	856.0	C29200	854.0	RECT_OPEN		854.7	82
P29204	864.0	C29205	863.5	RECT_OPEN		863.8	12
P29304	858.0	C29203	857.5	RECT_OPEN		860.1	18

Pond ID	Ground Elev	DS Link	Outlet Invert Elevation (ft)	Outlet Shape	Outlet Size	100 Year Peak Elev (ft)	Peak Outflow (cfs)
P29400	870.0	C29304	869.5	RECT_OPEN		870.3	58
P29402	878.0	C29400	877.0	RECT_OPEN		877.4	41
P29404	878.0		0.0			880.6	0
P33402	862.0	C33400	861.5	RECT_OPEN		856.6	0
P34400	862.0	L27308	862.0	ARCH	18	864.2	16
P34402	862.0	C34400	862.0	RECT_OPEN		864.6	15
P34404	862.0	C34402	862.0	RECT_OPEN		864.6	19
P34406	862.0	C34404	862.0	RECT_OPEN		864.6	5
P-6	876.0	Link-35	866.0	CIRCULAR	36	874.5	244

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
D43-P559	P25454	P24366	100.00	4.00	CIRCULAR	12	12	7	867.5	860.6	7	No
L23138	CB23240	CB23238	19.83	0.35	CIRCULAR	18	18	6	880.2	879.9	9	Yes
L23200	CB23200	P23320	304.00	3.49	CIRCULAR	15	15	12	876.3	863.7	7	No
L23202	CB23204	P23202	50.00	0.60	CIRCULAR	24	24	18	880.6	880.6	14	Yes
L23203	CB23244	P23202	48.00	0.96	CIRCULAR	18	18	10	880.8	880.6	10	Yes
L23204	CB23206	CB23204	155.04	2.68	CIRCULAR	18	18	17	885.3	880.6	15	Yes
L23206	CB23208	CB23206	204.40	1.78	CIRCULAR	12	12	5	887.1	885.3	2	Yes
L23207	CB23212	CB23206	200.86	2.09	CIRCULAR	12	12	5	887.2	885.3	4	Yes
L23208	CB23110	CB23208	164.70	0.84	CIRCULAR	12	12	3	885.3	887.1	2	No
L23213	CB23214	CB23206	209.07	0.82	CIRCULAR	12	12	3	887.6	885.3	5	Yes
L23214	CB23216	CB23214	290.15	0.70	CIRCULAR	12	12	3	887.3	887.6	3	Yes
L23218	CB23220	P23218	161.77	3.14	CIRCULAR	12	12	6	881.0	874.3	8	Yes
L23219	CB23228	CB23220	230.80	0.36	CIRCULAR	12	12	2	876.7	881.0	5	No
L23220	CB23222	CB23220	334.25	0.54	CIRCULAR	12	12	3	887.0	881.0	6	Yes
L23221	CB23226	CB23220	110.70	0.53	CIRCULAR	12	12	3	882.5	881.0	4	Yes
L23222	CB23224	CB23222	164.49	2.53	CIRCULAR	12	12	6	889.2	887.0	4	Yes
L23232	CB23234	CB23232	221.08	0.27	CIRCULAR	18	18	5	878.2	873.9	8	No
L23234	CB23236	CB23234	42.31	0.21	CIRCULAR	18	18	5	878.6	878.2	8	Yes
L23236	CB23238	CB23236	213.89	0.25	CIRCULAR	18	18	5	879.9	878.6	8	Yes
L23240	P23202	CB23240	30.00	0.33	CIRCULAR	18	18	6	880.6	880.2	14	Yes
L23244	CB23246	CB23244	207.72	0.71	CIRCULAR	18	18	9	885.9	880.8	10	Yes
L23246	CB23248	CB23246	231.66	2.58	CIRCULAR	15	15	10	884.0	885.9	5	No
L23301	CB23302	J23316	116.00	2.10	CIRCULAR	27	27	45	868.0	862.4	26	No
L23302	CB23304	CB23302	55.85	1.00	CIRCULAR	21	21	16	869.9	868.0	23	Yes
L23304	CB23306	CB23304	139.87	0.99	CIRCULAR	18	18	10	872.2	869.9	12	Yes
L23306	CB23308	CB23306	203.63	0.78	CIRCULAR	15	15	6	877.0	872.2	10	Yes
L23308	P23310	CB23308	232.32	0.87	CIRCULAR	15	15	6	870.5	877.0	3	No
L23311	CB23312	J23316	114.00	4.52	CIRCULAR	15	15	14	868.0	862.4	3	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L23313	CB23314	P23320	180.00	0.71	CIRCULAR	15	15	5	869.0	863.7	3	No
L23320	P23400	P23320	140.00	0.14	CIRCULAR	24	24	9	865.4	863.7	7	No
L23321	CB23230	P23320	160.00	1.88	CIRCULAR	18	18	14	870.1	863.7	14	No
L23400	P23402	P23400	310.00	0.16	CIRCULAR	42	42	35	866.7	865.4	24	No
L23402	P23404	P23402	630.00	0.24	CIRCULAR	24	24	11	867.5	866.7	9	No
L23404	P23406	P23404	190.00	1.05	CIRCULAR	18	18	11	868.8	867.5	6	No
L24112	CB24314	CB24312	168.09	0.32	CIRCULAR	12	12	2	877.0	875.7	0	No
L24212	CB24214	P24212	196.00	0.09	CIRCULAR	18	18	3	862.2	859.6	13	Yes
L24213	P24322	P24212	48.00	0.54	CIRCULAR	12	12	3	860.3	859.6	4	Yes
L24214	CB24216	CB24214	227.10	0.11	CIRCULAR	18	18	4	862.2	862.2	3	Yes
L24216	CB24218	CB24216	138.13	0.10	CIRCULAR	18	18	3	862.1	862.2	3	Yes
L24218	CB24218	CB25104	177.74	1.16	CIRCULAR	18	18	11	862.1	859.5	13	Yes
L24219	CB24220	CB24218	162.72	0.92	CIRCULAR	12	12	3	868.1	862.1	6	No
L24266	CB24302	P24366	570.00	1.40	CIRCULAR	27	27	32	870.6	860.6	4	No
L24302	CB24304	CB24302	365.76	0.23	CIRCULAR	15	15	3	873.1	870.6	4	No
L24304	CB24306	CB24304	248.53	0.17	CIRCULAR	15	15	3	874.3	873.1	4	Yes
L24306	CB24308	CB24306	218.54	0.17	CIRCULAR	15	15	3	875.4	874.3	4	Yes
L24308	P24310	CB24308	77.00	0.48	CIRCULAR	15	15	4	875.7	875.4	4	Yes
L24310	CB24312	P24310	40.00	0.50	CIRCULAR	24	24	16	875.7	875.7	19	Yes
L24312	CB24314	CB24312	168.04	0.30	CIRCULAR	24	24	12	877.0	875.7	19	Yes
L24314	CB24316	CB24314	461.23	0.61	CIRCULAR	18	18	8	880.8	877.0	10	Yes
L24316	CB24318	CB24316	345.34	0.82	CIRCULAR	15	15	6	881.8	880.8	5	Yes
L24321	P24324	P24322	48.00	0.35	CIRCULAR	12	12	2	861.4	860.3	4	No
L24323	CB24330	P24322	20.00	0.35	CIRCULAR	15	15	4	860.3	860.3	8	Yes
L24324	P24326	P24324	610.00	0.49	CIRCULAR	15	15	5	863.0	861.4	4	No
L24326	CB25128	P24326	154.00	1.30	CIRCULAR	15	15	7	865.4	863.0	5	No
L24331	CB24332	P24330	133.00	0.45	CIRCULAR	24	24	15	863.6	863.6	15	Yes
L24332	CB24334	CB24332	125.88	0.47	CIRCULAR	24	24	15	863.6	863.6	12	Yes

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L24333	CB24342	CB24332	76.09	1.25	CIRCULAR	24	24	25	863.6	863.6	12	No
L24334	CB24336	CB24334	65.55	0.24	CIRCULAR	18	18	5	863.9	863.6	9	Yes
L24336	CB24338	CB24336	113.46	1.60	CIRCULAR	15	15	8	864.5	863.9	5	No
L24338	CB24340	CB24338	68.00	7.51	CIRCULAR	15	15	15	869.1	864.5	3	No
L24344	CB24346	CB24344	261.34	0.23	CIRCULAR	24	24	11	864.9	863.6	7	No
L24346	CB24348	CB24346	196.90	0.23	CIRCULAR	24	24	11	865.1	864.9	6	No
L24348	P24350	CB24348	36.00	0.19	CIRCULAR	12	12	2	866.7	865.1	6	Yes
L24350	CB24352	P24350	171.00	7.60	CIRCULAR	12	12	10	878.5	866.7	4	No
L24354	CB24356	P24354	36.00	1.39	CIRCULAR	24	24	27	867.1	865.1	28	No
L24356	CB24358	CB24356	194.91	1.80	CIRCULAR	24	24	30	870.6	867.1	28	Yes
L24357	CB24364	CB24358	163.15	0.61	CIRCULAR	12	12	3	872.7	870.6	4	Yes
L24358	CB24360	CB24358	428.23	3.74	CIRCULAR	24	24	38	885.0	870.6	18	No
L24359	CB24362	CB24358	36.32	3.30	CIRCULAR	12	12	6	881.0	870.6	7	Yes
L24366	P24368	P24366	100.00	0.20	CIRCULAR	18	18	4	861.2	860.6	3	No
L24368	CB24370	P24368	65.00	0.31	CIRCULAR	15	15	4	866.3	861.2	12	Yes
L24369	CB24374	P24368	52.00	0.96	CIRCULAR	15	15	6	862.4	861.2	5	No
L24370	CB24372	CB24370	247.55	1.94	CIRCULAR	15	15	9	871.1	866.3	9	Yes
L24374	CB24392	P24374	67.00	0.60	CIRCULAR	15	15	5	864.3	862.1	8	No
L24375	CB24376	P24374	135.00	0.19	CIRCULAR	21	21	7	864.9	862.1	14	No
L24376	CB25478	CB24376	427.93	0.68	CIRCULAR	21	21	13	868.3	864.9	14	Yes
L24387	P24392	CB24388	27.82	3.63	CIRCULAR	12	12	7	865.0	864.9	4	No
L24388	CB24388	CB24376	209.48	0.35	CIRCULAR	15	15	4	864.9	864.9	2	Yes
L24389	CB24390	CB24388	213.97	0.24	CIRCULAR	15	15	3	860.4	864.9	3	No
L24390	J24390	P24391	73.71	4.07	CIRCULAR	18	18	18	861.2	861.2	1	No
L24391	J24391	P24389	16.00	4.63	CIRCULAR	18	18	20	869.9	860.8	12	No
L24392	J24392	J24391	148.00	0.50	CIRCULAR	18	18	6	873.3	869.9	12	Yes
L24393	J24393	J24392	337.00	0.50	CIRCULAR	18	18	6	875.4	873.3	7	Yes
L24394	J24394	J24393	289.00	0.61	CIRCULAR	18	18	7	875.7	875.4	7	Yes

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L24395	J24395	J24394	96.01	1.84	CIRCULAR	15	15	8	871.8	875.7	10	Yes
L24396	CB23228	J24395	248.00	3.40	CIRCULAR	15	15	10	876.7	871.8	6	No
L24TH47	P24366	P24212	129.00	0.50	CIRCULAR	15	15	5	860.6	859.6	1	No
L24TH47-1	P24212	J24tH47-1	40.00	0.12	Arch	11	18	2	859.6	860.1	4	No
L24TH47-2	J24tH47-1	J24TH47-2	197.00	0.14	Arch	11	18	2	860.1	861.5	4	Yes
L24TH47-3	J24TH47-2	P24374	72.00	0.18	Arch	11	18	2	861.5	862.1	4	Yes
L24TH47-4	P24374	J24TH47-3	153.86	0.08	Arch	11	18	1	862.1	861.3	3	Yes
L24TH47-5	J24TH47-3	J24TH47-4	192.00	0.15	Arch	11	18	2	861.3	860.5	3	Yes
L24TH47-6	J24TH47-4	D43-CB444	270.00	0.15	Arch	11	18	2	860.5	860.4	3	Yes
L24TH47-7	D43-CB444	CB24390	30.00	0.27	Arch	11	18	3	860.4	860.4	3	Yes
L25100	CB25102	O-25-1-02	292.23	3.10	CIRCULAR	30	30	72	854.3	845.0	53	No
L25102	CB25104	CB25102	420.00	0.54	CIRCULAR	30	30	30	859.5	854.3	37	No
L25104	CB25106	CB25104	360.02	0.47	CIRCULAR	27	27	21	860.3	859.5	14	Yes
L25105	CB25108	CB25104	219.32	0.23	CIRCULAR	18	18	4	867.6	859.5	13	No
L25106	CB25110	CB25106	186.34	9.03	CIRCULAR	15	15	19	876.5	860.3	7	No
L25108	CB24390	CB25106	375.86	0.13	CIRCULAR	27	27	11	860.4	860.3	6	Yes
L25114	CB25116	CB25114	349.60	0.21	CIRCULAR	18	18	5	864.0	861.5	9	Yes
L25116	CB25118	CB25116	105.68	0.47	CIRCULAR	12	12	2	862.9	864.0	6	Yes
L25118	CB25420	CB25118	218.94	2.28	CIRCULAR	12	12	5	863.6	862.9	3	Yes
L25120	CB25122	O-25-1-01	215.00	7.44	CIRCULAR	18	18	29	866.7	851.9	13	No
L25200	CB25202	O-25-2-05	163.41	0.31	CIRCULAR	24	24	13	854.6	853.9	7	No
L25202	P25204	CB25202	115.84	0.43	CIRCULAR	24	24	15	854.9	854.6	6	No
L25204	CB25114	P25204	220.00	0.34	CIRCULAR	18	18	6	861.5	854.9	9	No
L25206	CB25208	O-25-2-04	214.21	0.23	CIRCULAR	18	18	5	853.5	850.7	10	No
L25210	CB25212	O-25-2-03	220.00	2.93	CIRCULAR	18	18	18	852.1	849.0	10	Yes
L25214	P25216	O-25-2-01a	140.00	0.21	CIRCULAR	48	48	66	850.1	849.3	38	No
L25216	CB25218	P25216	130.00	0.37	CIRCULAR	48	48	87	850.3	850.1	47	No
L25218	CB25220	CB25218	274.00	0.19	CIRCULAR	42	42	44	851.5	850.3	42	No

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L25220	CB25222	CB25220	133.11	0.44	CIRCULAR	30	30	27	852.5	851.5	27	No
L25221	CB25232	CB25220	555.34	0.61	CIRCULAR	15	15	5	857.9	851.5	7	Yes
L25222	CB25224	CB25222	575.08	0.39	CIRCULAR	30	30	26	854.2	852.5	21	No
L25224	CB25226	CB25224	59.08	0.41	CIRCULAR	27	27	20	854.7	854.2	18	No
L25225	CB25236	CB25220	349.00	0.10	CIRCULAR	36	36	21	851.6	851.5	20	No
L25226	CB25228	CB25226	296.51	0.42	CIRCULAR	24	24	15	855.2	854.7	10	No
L25228	CB25230	CB25228	133.48	0.78	CIRCULAR	12	12	3	858.4	855.2	5	Yes
L25232	CB36136	CB25232	208.57	0.48	CIRCULAR	12	12	2	859.2	857.9	5	Yes
L25233	CB25234	CB25232	76.26	3.93	CIRCULAR	12	12	7	858.7	857.9	4	Yes
L25236	P36400	CB25236A	236.00	0.33	CIRCULAR	36	36	39	852.4	851.6	20	No
L25236A	CB25236A	CB25236	90.00	0.71	CIRCULAR	36	36	56	851.6	851.6	20	No
L25301	CB25302	P36400	40.00	0.18	CIRCULAR	15	15	3	855.3	852.4	13	Yes
L25302	P25304	CB25302	89.63	0.30	CIRCULAR	15	15	4	855.1	855.3	8	Yes
L25303	FES25301	CB25340	217.12	1.65	CIRCULAR	15	15	8	867.8	864.4	8	Yes
L25306	CB25306	P25304	140.00	0.17	CIRCULAR	24	24	9	855.2	855.1	17	Yes
L25307	CB25308	P36400	172.00	0.10	CIRCULAR	36	36	21	853.6	852.4	41	No
L25308	CB25310	CB25308	280.08	0.10	CIRCULAR	36	36	21	854.2	853.6	29	Yes
L25310	CB25312	CB25310	314.81	0.10	CIRCULAR	36	36	21	855.5	854.2	23	Yes
L25312	CB25314	CB25312	289.61	0.09	CIRCULAR	24	24	7	854.7	855.5	7	Yes
L25313	CB25316	CB25312	170.00	0.29	CIRCULAR	30	30	22	854.9	855.5	16	Yes
L25316	CB25318	CB25316	154.03	0.14	CIRCULAR	27	27	12	855.1	854.9	15	Yes
L25317	CB36418	CB25312	129.05	0.42	CIRCULAR	12	12	2	856.5	855.5	3	Yes
L25318	CB25320	CB25318	145.08	0.05	CIRCULAR	27	27	7	855.1	855.1	15	Yes
L25319	P25317	P26200	164.00	1.15	CIRCULAR	12	12	4	864.0	856.7	4	No
L25320	CB25322	CB25320	112.54	0.08	CIRCULAR	27	27	9	855.1	855.1	14	Yes
L25321	P25319	CB25331	10.00	2.00	CIRCULAR	15	15	9	866.9	862.5	3	No
L25322	CB25324	CB25322	184.35	0.20	CIRCULAR	27	27	14	855.0	855.1	14	Yes
L25323	CB25323	CB25325	421.45	0.88	CIRCULAR	18	18	10	870.4	867.5	1	No

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L25324	CB25326	CB25324	93.53	0.10	CIRCULAR	27	27	10	855.3	855.0	14	Yes
L25325	CB25325	CB25328	493.16	0.50	CIRCULAR	24	24	16	867.5	865.5	9	No
L25327	CB25327	CB25325	203.11	1.88	CIRCULAR	15	15	9	872.2	867.5	9	No
L25328	CB25330	P25328	112.00	0.18	CIRCULAR	18	18	4	860.0	855.3	21	Yes
L25329	P25321	CB25329	283.09	-0.16	CIRCULAR	15	15	3	876.6	876.3	1	No
L25330	CB25332	CB25330	228.73	0.44	CIRCULAR	18	18	7	860.1	860.0	10	Yes
L25331	CB25329	CB25360	53.35	1.48	CIRCULAR	18	18	13	876.3	875.8	1	No
L25332	CB25335	CB25332	466.28	0.21	CIRCULAR	18	18	5	861.0	860.1	8	Yes
L25334	CB25336	CB25335	400.04	0.20	CIRCULAR	15	15	3	861.2	861.0	5	Yes
L25336	CB25338	CB25336	99.80	0.20	CIRCULAR	15	15	3	861.2	861.2	5	Yes
L25339	CB25331	P25328	72.05	0.28	CIRCULAR	15	15	3	862.5	855.3	12	Yes
L25340	CB25340	CB25341	99.97	0.17	CIRCULAR	18	18	4	864.4	863.5	8	No
L25341	CB25341	CB25342	170.25	0.64	CIRCULAR	18	18	8	863.5	861.0	8	No
L25342	CB25342	CB25344	186.28	0.27	CIRCULAR	30	30	21	861.0	865.8	13	Yes
L25344	CB25344	P25315	179.99	0.22	CIRCULAR	30	30	19	865.8	861.0	17	Yes
L25346	CB25346	CB25348	57.18	0.38	CIRCULAR	15	15	4	886.2	885.3	6	Yes
L25348	CB25348	CB25350	140.92	0.30	CIRCULAR	15	15	4	885.3	878.8	6	No
L25350	CB25350	P25321	198.40	0.25	CIRCULAR	15	15	3	878.8	876.6	6	No
L25352	CB25352	CB25354	65.35	0.58	CIRCULAR	12	12	3	876.6	876.6	0	No
L25354	CB25354	P25321	177.99	0.29	CIRCULAR	18	18	6	876.6	876.6	0	No
L25356	CB25356	CB25358	38.14	1.18	CIRCULAR	12	12	4	875.8	875.8	0	No
L25358	CB25358	CB25360	158.78	1.37	CIRCULAR	18	18	12	875.8	875.8	0	No
L25360	CB25360	CB25323	209.09	-0.21	CIRCULAR	18	18	5	875.8	870.4	1	No
L25362	FES25362	CB25364	150.25	3.37	CIRCULAR	15	15	12	872.1	867.0	0	No
L25364	CB25364	CB25342	160.13	3.73	CIRCULAR	15	15	12	867.0	861.0	0	No
L25366	CB25366	CB25368	145.00	1.12	CIRCULAR	12	12	4	878.8	876.8	3	No
L25368	CB25368	CB25370	101.00	3.18	CIRCULAR	12	12	6	876.8	867.2	3	No
L25370	CB25370	P25319	295.12	0.78	CIRCULAR	18	18	9	867.2	866.9	3	No

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L25372	CB25372	CB25370	53.00	0.32	CIRCULAR	12	12	2	867.2	867.2	0	No
L25374	CB25374	P25319	53.00	0.81	CIRCULAR	12	12	3	866.9	866.9	0	No
L25376	CB25376	P25319	49.00	0.59	CIRCULAR	18	18	8	866.9	866.9	0	No
L25400	P25400	P24366	1295.66	0.39	CIRCULAR	15	15	4	866.8	860.6	2	No
L25402	P25402	CB25442	193.44	1.66	CIRCULAR	18	18	14	873.2	870.8	12	Yes
L25404	CB25404	P24366	143.00	0.35	CIRCULAR	15	15	4	863.4	860.6	6	No
L25405	CB25406	P24366	142.00	0.14	CIRCULAR	21	21	6	865.1	860.6	19	No
L25406	CB25408	CB25406	191.02	0.19	CIRCULAR	21	21	7	866.8	865.1	16	Yes
L25408	CB25410	CB25408	131.76	0.45	CIRCULAR	21	21	11	867.2	866.8	12	Yes
L25410	CB25412	CB25410	444.78	2.21	CIRCULAR	15	15	10	876.1	867.2	9	Yes
L25413	CB25414	P24366	120.00	0.42	CIRCULAR	18	18	7	864.0	860.6	8	No
L25414	CB25416	CB25414	256.00	0.23	CIRCULAR	18	18	5	864.5	864.0	6	Yes
L25416	CB25418	CB25416	179.01	0.61	CIRCULAR	15	15	5	863.9	864.5	5	Yes
L25418	P26176	CB25418	120.00	0.18	CIRCULAR	15	15	3	864.7	863.9	5	Yes
L25420	P25424	CB25420	27.10	3.69	CIRCULAR	12	12	7	863.6	863.6	2	Yes
L25424	CB25422	P25424	63.00	3.97	CIRCULAR	15	15	13	866.9	863.6	2	No
L25425	P25426	P25424	237.73	0.21	CIRCULAR	15	15	3	857.3	863.6	1	No
L25432	CB25434	CB25432	95.62	0.52	CIRCULAR	18	18	8	881.2	880.6	0	No
L25436	CB25438	CB25436	414.27	1.45	CIRCULAR	15	15	8	880.1	879.9	6	Yes
L25438	CB25440	CB25438	42.73	0.47	CIRCULAR	15	15	4	880.2	880.1	5	Yes
L25439	P25442	CB25438	157.24	1.27	CIRCULAR	12	12	4	879.1	880.1	4	Yes
L25444	P25454	CB25444	180.08	0.28	CIRCULAR	18	18	6	867.5	865.8	7	No
L25445	CB25447	CB25444	223.34	1.00	CIRCULAR	15	15	6	871.2	865.8	7	No
L254454	CB25442	P25454	146.97	1.22	CIRCULAR	18	18	12	870.8	867.5	13	Yes
L25446	CB25444	CB25446	72.39	5.37	CIRCULAR	21	21	37	865.8	864.5	14	No
L25447	P25456	CB25446	58.38	3.24	CIRCULAR	12	12	6	865.1	864.5	5	Yes
L25448	CB25446	CB25448	66.72	0.91	CIRCULAR	24	24	22	864.5	863.9	17	Yes
L25450	CB25448	CB25450	215.21	0.23	CIRCULAR	24	24	11	863.9	862.4	18	Yes

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L25452	CB25450	CB25452	222.88	0.36	CIRCULAR	24	24	14	862.4	860.8	18	No
L25454	CB25452	P25458	115.80	0.43	CIRCULAR	24	24	15	860.8	860.0	20	Yes
L25468	CB25466	CB25468	47.11	1.13	CIRCULAR	12	12	4	875.7	875.7	2	Yes
L25469	CB25466	CB25468	47.30	1.12	CIRCULAR	12	12	4	875.7	875.7	2	Yes
L25478	CB25486	CB25478	57.35	0.51	CIRCULAR	15	15	5	868.8	868.3	7	Yes
L25479	CB25480	CB25478	137.75	2.06	CIRCULAR	15	15	9	870.9	868.3	9	Yes
L25480	CB25482	CB25480	336.30	0.15	CIRCULAR	15	15	2	871.4	870.9	4	Yes
L25482	P25484	CB25482	98.15	1.53	CIRCULAR	12	12	4	871.0	871.4	3	No
L25488	P25488	P25490	210.00	0.00	CIRCULAR	18	18	0	876.3	876.3	1	Yes
L26102	CB26104	CB26102	71.73	0.78	CIRCULAR	15	15	6	867.6	867.3	5	Yes
L26104	CB26106	CB26104	108.03	0.78	CIRCULAR	12	12	3	867.6	867.6	3	Yes
L26106	CB26110	CB26106	173.29	0.78	CIRCULAR	12	12	3	867.7	867.6	3	Yes
L26110	P26112	CB26110	25.76	0.70	CIRCULAR	12	12	3	867.7	867.7	2	Yes
L26113	CB26114	J26186	85.00	2.35	CIRCULAR	12	12	5	863.6	860.9	5	No
L26115	CB26116	J26184	75.00	0.37	CIRCULAR	15	15	4	863.3	860.8	8	No
L26117	P26118	J26186	125.00	0.16	CIRCULAR	24	24	9	861.5	860.9	9	No
L26118	CB26122	P26118	52.00	0.38	CIRCULAR	24	24	14	862.7	861.5	13	No
L26119	CB26120	P26118	45.00	1.11	CIRCULAR	15	15	7	865.0	861.5	7	No
L26123	CB26124	CB26122	81.07	0.74	CIRCULAR	15	15	6	865.4	862.7	2	No
L26124	CB26126	CB26122	397.31	0.80	CIRCULAR	18	18	9	865.8	862.7	9	Yes
L26126	CB26456	CB26126	646.00	0.63	CIRCULAR	18	18	8	869.2	865.8	6	No
L26127	CB26128	J26180	130.00	1.21	CIRCULAR	27	27	34	862.0	860.0	15	No
L26128	CB26134	CB26128	97.50	1.38	CIRCULAR	18	18	12	862.8	862.0	5	No
L26129	CB26130	CB26128	317.70	1.98	CIRCULAR	15	15	9	867.7	862.0	5	No
L26130	CB26132	CB26130	204.02	1.87	CIRCULAR	12	12	5	871.5	867.7	3	No
L26134	CB26138	CB26134	176.50	1.04	CIRCULAR	18	18	11	864.6	862.8	4	No
L26135	P26136	CB26134	235.90	3.76	CIRCULAR	15	15	13	871.3	862.8	2	No
L26138	CB26142	CB26138	199.09	0.86	CIRCULAR	15	15	6	865.7	864.6	0	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L26139	CB26140	CB26138	62.22	1.19	CIRCULAR	12	12	4	872.3	864.6	4	No
L26145	CB26146	J26180	138.00	1.30	CIRCULAR	24	24	26	864.2	860.0	17	No
L26146	CB26148	CB26146	307.50	0.47	CIRCULAR	21	21	11	866.4	864.2	13	No
L26148	CB26186	CB26148	664.02	0.47	CIRCULAR	21	21	11	868.6	866.4	9	No
L26149	CB26150	J26182	73.00	5.89	CIRCULAR	12	12	9	864.3	860.4	4	No
L26151	CB26152	J26182	92.00	3.59	CIRCULAR	15	15	12	863.5	860.4	6	No
L26153	CB26156	CB26154	83.15	0.36	CIRCULAR	18	18	6	860.9	860.6	5	No
L26154	P26158	CB26156	118.00	0.42	CIRCULAR	18	18	7	861.2	860.9	5	No
L26156	CB26162	CB26160	167.01	0.34	CIRCULAR	15	15	4	866.1	864.3	8	Yes
L26158	CB26160	P26158	51.00	0.33	CIRCULAR	15	15	4	864.3	861.2	11	Yes
L26159	CB26166	P26158	156.00	5.45	CIRCULAR	15	15	15	875.7	861.2	16	Yes
L26162	CB26164	CB26162	76.83	0.35	CIRCULAR	12	12	2	866.1	866.1	4	Yes
L26166	CB25468	CB26166	235.65	0.70	CIRCULAR	15	15	5	875.7	875.7	8	Yes
L26167	CB25472	CB26166	196.25	1.83	CIRCULAR	12	12	5	873.4	875.7	3	No
L26168	CB26170	P26168	141.00	0.71	CIRCULAR	15	15	5	865.6	861.5	11	No
L26169	CB25430	P26168	114.00	0.88	CIRCULAR	18	18	10	869.3	861.5	1	No
L26170	CB26172	CB26170	221.03	1.81	CIRCULAR	15	15	9	869.0	865.6	8	Yes
L26171	CB26174	CB26170	68.67	1.46	CIRCULAR	12	12	4	866.1	865.6	5	Yes
L26172	CB25436	CB26172	414.30	1.21	CIRCULAR	15	15	7	879.9	869.0	10	Yes
L26176	CB26178	P26176	343.00	0.76	CIRCULAR	15	15	6	867.9	864.7	4	No
L26178	CB23280	CB26178	237.00	0.16	CIRCULAR	15	15	3	869.1	867.9	4	No
L26187	P26190	CB26186	109.70	0.59	CIRCULAR	12	12	3	869.0	868.6	3	Yes
L26200	P26204	P26200	170.00	0.41	CIRCULAR	15	15	4	860.0	856.7	6	No
L26201	CB26102	J26188	320.00	0.18	CIRCULAR	15	15	3	867.3	861.1	7	No
L26203	CB26154	P26204	180.00	0.11	CIRCULAR	18	18	4	860.6	860.0	5	No
L26206	CB26206	P26204	150.00	2.47	CIRCULAR	15	15	10	865.8	860.0	13	Yes
L26207	CB26208	P26204	100.00	0.27	CIRCULAR	30	30	21	860.0	860.0	28	Yes
L26208	CB26210	CB26208	68.80	0.29	CIRCULAR	15	15	3	862.6	860.0	9	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L26209	P26206	CB26208	635.00	0.26	CIRCULAR	30	30	21	861.2	860.0	23	No
L26211	CB26212	P26204	115.00	2.17	CIRCULAR	30	30	60	861.8	860.0	22	No
L26212	CB26214	CB26212	71.93	1.39	CIRCULAR	27	27	37	863.1	861.8	18	No
L26214	CB26216	CB26214	90.91	0.77	CIRCULAR	24	24	20	863.7	863.1	12	No
L26215	P25315	P26204	52.00	0.54	CIRCULAR	12	12	3	861.0	860.0	4	No
L26216	CB26218	CB26216	73.09	0.82	CIRCULAR	21	21	14	864.2	863.7	10	No
L26218	CB26220	CB26218	85.90	1.98	CIRCULAR	15	15	9	866.1	864.2	8	Yes
L26220	CB26222	CB26220	193.09	0.26	CIRCULAR	12	12	2	869.0	866.1	5	Yes
L26302	CB26304	CB26302	66.94	0.25	CIRCULAR	18	18	5	863.8	863.7	11	Yes
L26303	CB26316	CB26302	672.41	0.52	CIRCULAR	24	24	16	868.2	863.7	15	Yes
L26304	CB26308	CB26304	334.10	2.28	CIRCULAR	18	18	16	871.4	863.8	15	Yes
L26307	CB26302	P26206	210.00	0.09	CIRCULAR	30	30	12	863.7	861.2	41	No
L26309	CB26314	CB26308	292.78	1.19	CIRCULAR	15	15	7	876.8	871.4	8	Yes
L26310	CB26312	CB26310	698.89	0.86	CIRCULAR	15	15	6	881.9	876.1	6	Yes
L26311	CB26328	P26308	120.00	0.40	CIRCULAR	24	24	14	874.9	874.1	26	Yes
L26315	CB26336	P26310	120.50	2.00	CIRCULAR	15	15	9	874.1	874.1	8	Yes
L26316	CB26318	CB26316	208.59	0.36	CIRCULAR	24	24	14	869.5	868.2	16	Yes
L26317	CB26338	P26310	188.00	4.52	CIRCULAR	30	30	87	877.6	874.1	35	No
L26318	CB26320	CB26318	190.70	1.30	CIRCULAR	21	21	18	870.1	869.5	16	Yes
L26320	CB26322	CB26320	138.21	0.12	CIRCULAR	18	18	4	871.1	870.1	12	Yes
L26321	CB26326	CB26320	346.62	0.78	CIRCULAR	15	15	6	870.2	870.1	4	No
L26322	CB26324	CB26322	301.46	1.86	CIRCULAR	15	15	9	876.2	871.1	8	Yes
L26323	P26304	CB26322	132.89	1.14	CIRCULAR	18	18	11	871.4	871.1	10	Yes
L26325	CB26348	P26312	22.00	0.23	CIRCULAR	18	18	5	856.2	854.8	13	No
L26326	P26306	MH28328	300.00	0.10	CIRCULAR	15	15	2	872.7	871.6	4	No
L26327	CB26344	P26312	30.00	0.67	CIRCULAR	21	21	13	858.0	854.8	17	No
L26328	CB28329	P26306	224.00	0.21	CIRCULAR	15	15	3	873.8	872.7	6	Yes
L26329	CB26330	CB26328	250.00	0.35	CIRCULAR	18	18	6	875.5	874.9	7	Yes

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L26330	CB26332	CB26330	297.42	0.31	CIRCULAR	18	18	6	876.5	875.5	7	Yes
L26331	CB26224	P26312	80.00	0.25	CIRCULAR	12	12	2	860.5	854.8	7	Yes
L26332	CB26334	CB26332	400.00	0.41	CIRCULAR	15	15	4	879.1	876.5	5	Yes
L26333	CB26354	P26312	165.00	0.91	CIRCULAR	15	15	6	868.0	854.8	9	No
L26338	CB26340	CB26338	459.35	0.11	CIRCULAR	24	24	7	881.8	877.6	18	No
L26341	CB28330	CB26328	30.00	1.20	CIRCULAR	15	15	7	874.2	874.9	6	Yes
L26344	CB26346	CB26344	142.48	4.74	CIRCULAR	15	15	14	865.8	858.0	16	Yes
L26345	CB26344	P26302	17.00	-1.18	CIRCULAR	24	24	2	858.0	856.0	23	Yes
L26348	CB26350	CB26348	87.98	6.50	CIRCULAR	15	15	16	865.6	856.2	13	No
L26350	CB26352	CB26350	54.36	2.72	CIRCULAR	15	15	11	866.7	865.6	6	Yes
L26402	CB26404	P26402	186.00	0.39	CIRCULAR	18	18	7	867.2	864.8	9	No
L26403	CB26412	P26402	28.00	2.14	CIRCULAR	15	15	8	865.9	864.8	6	No
L26404	CB26406	CB26404	127.71	0.98	CIRCULAR	18	18	10	867.3	867.2	4	No
L26406	CB26408	CB26406	221.12	0.92	CIRCULAR	15	15	6	868.9	867.3	4	No
L26408	CB26310	CB26308	265.14	1.44	CIRCULAR	15	15	8	876.1	871.4	8	Yes
L26409	CB26410	CB26408	156.28	0.47	CIRCULAR	15	15	4	870.0	868.9	4	No
L26413	CB26414	P26400	48.00	0.75	CIRCULAR	18	18	9	862.9	860.0	15	No
L26414	CB26416	CB26414	270.63	0.15	CIRCULAR	18	18	4	863.7	862.9	6	Yes
L26415	P26226	CB26414	120.00	4.20	CIRCULAR	15	15	13	862.0	862.9	0	No
L26416	CB26418	CB26416	88.01	0.27	CIRCULAR	18	18	5	864.0	863.7	6	Yes
L26418	P26420	CB26418	202.07	0.08	CIRCULAR	15	15	2	862.1	864.0	3	No
L26422	CB26422	CB26414	214.72	0.24	CIRCULAR	15	15	3	864.7	862.9	7	Yes
L26423	P26424	P26400	150.00	0.33	CIRCULAR	24	24	13	860.7	860.0	3	No
L26426	P26226	P26428	33.00	1.21	CIRCULAR	12	12	4	862.0	862.0	4	Yes
L26428	CB26430	P26428	80.00	0.21	CIRCULAR	36	36	31	862.0	862.0	12	No
L26430	CB26432	CB26430	68.14	0.76	CIRCULAR	15	15	6	869.4	862.0	1	No
L26431	CB26434	CB26430	138.90	0.22	CIRCULAR	36	36	31	862.0	862.0	9	No
L26434	CB26436	CB26434	294.96	0.19	CIRCULAR	33	33	23	862.2	862.0	7	No

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L26436	CB26438	CB26436	113.74	0.21	CIRCULAR	27	27	14	862.4	862.2	6	No
L26438	CB26440	CB26438	227.48	0.20	CIRCULAR	21	21	7	862.6	862.4	2	No
L26440	CB26442	CB26440	232.65	0.35	CIRCULAR	15	15	4	863.0	862.6	1	No
L26442	P26144	CB26442	306.76	0.15	CIRCULAR	15	15	2	863.6	863.0	1	No
L26445	CB26446	P26428	81.00	1.00	CIRCULAR	15	15	6	862.0	862.0	6	No
L26446	CB26448	CB26446	90.70	3.12	CIRCULAR	15	15	11	864.3	862.0	6	No
L26448	CB26450	CB26448	149.29	0.35	CIRCULAR	15	15	4	865.4	864.3	4	No
L26450	CB26452	CB26450	135.32	0.35	CIRCULAR	15	15	4	865.6	865.4	2	No
L26452	CB26454	CB26452	224.07	0.33	CIRCULAR	15	15	4	865.8	865.6	1	No
L26456	P26458	CB26456	69.80	0.90	CIRCULAR	15	15	6	869.2	869.2	1	No
L26458	CB26460	P26458	125.00	0.58	CIRCULAR	15	15	5	869.2	869.2	8	Yes
L26460	CB26462	CB26460	68.88	0.38	CIRCULAR	15	15	3	869.2	869.2	8	Yes
L26462	CB26464	CB26462	114.15	0.25	CIRCULAR	15	15	3	870.1	869.2	7	Yes
L26463	CB26263	CB26462	94.18	7.78	CIRCULAR	12	12	10	872.0	869.2	2	No
L26464	CB26466	CB26464	163.76	0.52	CIRCULAR	15	15	5	871.1	870.1	5	Yes
L26466	CB26468	CB26466	50.57	0.85	CIRCULAR	15	15	6	871.2	871.1	3	Yes
L26467	CB26476	CB26466	62.62	0.70	CIRCULAR	18	18	9	871.2	871.1	4	Yes
L26468	CB26470	CB26468	143.74	0.49	CIRCULAR	15	15	5	871.2	871.2	2	Yes
L26470	CB26472	CB26470	236.36	0.50	CIRCULAR	15	15	5	871.4	871.2	3	Yes
L26472	CB26474	CB26472	103.95	5.37	CIRCULAR	15	15	15	873.8	871.4	3	No
L26476	CB26478	CB26476	101.05	0.76	CIRCULAR	15	15	6	871.2	871.2	3	Yes
L26478	CB26480	CB26478	146.10	0.17	CIRCULAR	15	15	3	871.2	871.2	3	Yes
L26480	CB26482	CB26480	110.88	4.88	CIRCULAR	12	12	8	872.9	871.2	4	No
L26482	CB26484	CB26482	107.55	0.60	CIRCULAR	12	12	3	873.8	872.9	2	No
L26486	CB26188	CB26186	70.92	0.47	CIRCULAR	15	15	4	868.8	868.6	4	No
L28312	CB28330	CB28329	10.00	0.40	CIRCULAR	15	15	4	874.2	873.8	6	Yes
L28313	P26312	P28313	140.00	-1.09	CIRCULAR	18	18	9	854.8	853.9	2	No
L28315	P28313	J28317	35.00	0.00	CIRCULAR	18	18	1	853.9	853.9	4	Yes

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L28317	J28317	O28301	40.00	1.33	CIRCULAR	24	24	26	853.9	853.0	1	No
L28328	MH28328	MH28329	23.00	0.74	CIRCULAR	15	15	6	871.6	871.4	4	No
L28329	MH28329	CB26326	137.00	0.51	CIRCULAR	15	15	5	871.4	870.2	4	No
L36400	CB36406	P36400	240.00	0.42	CIRCULAR	24	24	15	855.2	852.4	21	No
L36401	CB36402	P36400	184.00	0.27	CIRCULAR	18	18	5	853.3	852.4	7	No
L36402	CB36404	CB36402	132.52	0.38	CIRCULAR	12	12	2	854.4	853.3	3	Yes
L36406	CB36408	CB36406	333.90	0.46	CIRCULAR	15	15	4	855.9	855.2	5	Yes
L36407	CB36414	CB36406	116.23	0.50	CIRCULAR	18	18	7	856.2	855.2	11	Yes
L36408	CB36410	CB36408	98.14	0.46	CIRCULAR	15	15	4	857.1	855.9	1	Yes
L36409	CB36412	CB36408	111.18	0.40	CIRCULAR	15	15	4	857.5	855.9	4	Yes
L36414	CB36416	CB36414	174.66	0.50	CIRCULAR	15	15	5	856.5	856.2	3	Yes
Link-28	CB25328	P25317	198.62	0.20	CIRCULAR	24	24	10	865.5	864.0	9	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L13202	CB13204	J144278	177.65	3.34	CIRCULAR	18	18	19	864.0	856.9	19	YES
L13203	J144278	O-13-2-01	144.46	3.39	CIRCULAR	18	18	19	856.9	857.6	18	YES
L13204	CB13206	CB13204 A	107.3	0.4	CIRCULAR	21	21	10	865.4	864.5	13	YES
L13204 A	CB13204 A	CB13204	55.47	0.7	CIRCULAR	21	21	13	864.5	864.0	13	YES
L13206	CB13208	CB13206	394.22	0.36	CIRCULAR	21	21	9	865.6	865.4	11	YES
L13208	CB13210	CB13208	138	0.11	CIRCULAR	21	21	5	864.5	865.6	19	YES
L13209	CB13312	CB13208	158.18	5.37	CIRCULAR	12	12	8	872.7	865.6	9	YES
L13210	CB24112	CB13210	259	0.15	CIRCULAR	21	21	6	864.6	864.5	8	YES
L13402	J13404	J13402	67.47	0.13	CIRCULAR	48	48	31	857.8	856.1	110	YES
L13406	P13408	J13406	64.21	0.16	CIRCULAR	36	36	31	859.4	857.9	104	YES
L14102	P14104	CB14102	32	-6.25	CIRCULAR	12	12	9	866.3	866.0	3	YES
L14104	CB14106	P14104	99	0.32	CIRCULAR	21	21	9	866.4	866.3	11	YES
L14106	CB14108	CB14106	154.29	0.4	CIRCULAR	18	18	7	868.0	866.4	9	YES
L14108	CB14110	CB14108	181.64	0.3	CIRCULAR	18	18	6	868.0	868.0	8	YES
L14110	CB14112	CB14110	131.54	6.13	CIRCULAR	15	15	16	873.5	868.0	4	NO
L14111	CB14114	CB14110	216.58	0.48	CIRCULAR	12	12	2	869.0	868.0	2	YES
L14112	CB14214	CB14212	464.48	0.11	CIRCULAR	18	18	3	887.0	885.6	7	YES
L14116	P14118	CB14116	91.84	0.54	CIRCULAR	18	18	8	863.1	862.2	7	NO
L14118	CB14120	P14118	24	2.08	CIRCULAR	12	12	5	864.5	863.1	6	NO
L14120	P14122	CB14120	25	-20	CIRCULAR	12	12	16	865.6	864.5	6	YES
L14121	CB14134	P14122	149	0.68	CIRCULAR	21	21	13	865.6	865.6	11	NO
L14122	CB14124	P14122	149	0.3	CIRCULAR	24	24	12	865.6	865.6	15	YES
L14123	CB14132	CB14124	186.87	0.49	CIRCULAR	15	15	5	865.9	865.6	3	YES
L14124	CB14126	CB14124	136.24	0.34	CIRCULAR	21	21	9	866.6	865.6	10	YES
L14126	CB14128	CB14126	143.75	0.24	CIRCULAR	18	18	5	867.3	866.6	7	YES
L14127	P14126	P14118	503.35	0.16	CIRCULAR	12	12	1	866.9	863.1	1	NO
L14128	CB14130	CB14128	411.79	0.45	CIRCULAR	15	15	4	869.1	867.3	5	YES
L14132	P14124	J14132	389.16	1.54	Rectangular	48	48	227	870.2	861.1	3	NO

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L14134	CB14136	CB14134	288.03	1.39	CIRCULAR	18	18	12	868.9	865.6	8	NO
L14135	CB14142	CB14134	127.76	3.24	CIRCULAR	15	15	12	868.6	865.6	3	NO
L14136	CB14138	CB14136	25.16	1.79	CIRCULAR	15	15	9	869.0	868.9	2	NO
L14137	P14140	CB14136	212.98	0.42	CIRCULAR	12	12	2	869.4	868.9	1	NO
L14202	CB14204	P14202	180	1.67	CIRCULAR	36	36	86	873.2	868.7	63	NO
L14204	CB14206	CB14204	216.41	1.39	CIRCULAR	36	36	79	876.0	873.2	52	NO
L14205	CB14242	CB14204	41.31	1.21	CIRCULAR	15	15	7	874.2	873.2	8	YES
L14206	CB14208	CB14206	184.31	0.43	CIRCULAR	36	36	44	877.4	876.0	46	NO
L14207	CB14230	CB14206	198.09	3.03	CIRCULAR	12	12	6	883.0	876.0	6	YES
L14208	CB14210	CB14208	64.52	1.86	CIRCULAR	24	24	31	878.4	877.4	22	YES
L14209	CB14216	CB14208	62.32	1.93	CIRCULAR	30	30	57	877.6	877.4	23	NO
L14210	CB14212	CB14210	709.04	0.78	CIRCULAR	21	21	14	885.6	878.4	16	YES
L14216	CB14258	J14216	20	51.3	CIRCULAR	12	12	26	863.4	859.7	4	NO
L14217	CB14232	CB14216	558.68	0.21	CIRCULAR	30	30	19	879.2	877.6	17	NO
L14218	P14220	J14218	79.04	0.14	CIRCULAR	48	48	46	860.1	859.7	63	YES
L14219	CB14102	P14218	368	0.27	CIRCULAR	12	12	2	866.0	861.4	3	NO
L14224	J14226	J14224	75.71	0.15	CIRCULAR	36	36	22	861.0	860.2	49	YES
L14232	CB14234	CB14232	182.64	0.33	CIRCULAR	21	21	9	879.8	879.2	9	YES
L14233	CB14238	CB14232	442.17	0.97	CIRCULAR	21	21	16	882.3	879.2	7	NO
L14234	CB14236	CB14234	44.1	0.45	CIRCULAR	15	15	4	880.3	879.8	6	YES
L14236	CB14248	CB14236	117.98	0.42	CIRCULAR	12	12	2	882.1	880.3	4	YES
L14237	P14246	CB14236	147.51	4.07	CIRCULAR	12	12	7	884.4	880.3	2	NO
L14238	P14240	CB14238	147.06	0.34	CIRCULAR	21	21	9	882.8	882.3	4	NO
L14242	CB14244	CB14242	143.49	2.44	CIRCULAR	12	12	6	878.4	874.2	6	YES
L14254	CB14256	CB14254	78.82	0.38	CIRCULAR	15	15	4	879.9	877.9	8	NO
L14258	P14260	CB14258	20	-10	CIRCULAR	12	12	11	864.1	863.4	4	NO
L14260	CB14262	P14260	334.13	0.38	CIRCULAR	18	18	6	869.1	864.1	8	NO
L14262	CB14264	CB14262	366.88	0.54	CIRCULAR	15	15	5	867.2	869.1	4	NO

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L14263	P14268	CB14262	184	0.42	CIRCULAR	12	12	2	866.4	869.1	3	YES
L14264	CB14266	CB14264	192.35	0.32	CIRCULAR	15	15	4	868.0	867.2	4	NO
L14430	P14432	J14430	83.02	0.13	CIRCULAR	36	36	21	863.7	862.5	45	NO
L14434	P14436	J14434	623.82	0.03	CIRCULAR	15	15	1	871.4	869.9	1	NO
L14438	P14438	P14436	30	3.33	CIRCULAR	15	15	12	872.0	871.4	9	NO
L14440	P14449	J14442	715	0.97	CIRCULAR	18	18	10	872.4	861.6	2	NO
L15234	P15236	J15234	157.83	0.19	CIRCULAR	36	36	29	866.9	866.7	18	YES
L15238	P15240	J15238	108.17	0.65	CIRCULAR	36	36	47	867.8	867.7	20	NO
L15347	P15352	J15352A	113.73	0.69	CIRCULAR	18	18	8	870.0	869.2	11	YES
L15348	P15350	J15348	178.72	0.04	CIRCULAR	36	36	14	869.8	869.3	26	NO
L15402	J15404	P15402	1090	0.37	CIRCULAR	18	18	6	884.6	872.0	2	NO
L16102	P16104	CB16102	28	0.36	CIRCULAR	12	12	2	871.9	871.7	5	YES
L16104	CB16106	P16104	172	0.23	CIRCULAR	18	18	5	874.9	871.9	9	YES
L16106	CB16108	CB16106	358.52	0.66	CIRCULAR	15	15	5	875.7	874.9	6	YES
L16107	CB16110	CB16106	157.42	0.26	CIRCULAR	15	15	3	873.6	874.9	3	YES
L16114	CB16117	P16114	195.62	0.42	CIRCULAR	33	33	34	876.2	874.7	16	NO
L16115	CB16134	P16114	57.69	0.38	CIRCULAR	12	12	2	874.7	874.7	5	YES
L16116	CB16118	CB16116	103.2	0.69	CIRCULAR	24	24	19	880.6	880.4	8	YES
L16117	CB16117	CB16116	175.89	1.18	CIRCULAR	15	15	7	876.2	880.4	10	YES
L16118	CB16120	CB16118	151.27	0.62	CIRCULAR	27	27	24	880.7	880.6	7	YES
L16119	CB16132	CB16118	251.79	0.26	CIRCULAR	15	15	3	881.0	880.6	2	YES
L16120	CB16122	CB16120	123.14	0.25	CIRCULAR	18	18	5	880.9	880.7	5	YES
L16122	CB16124	CB16122	407.52	0.64	CIRCULAR	15	15	5	882.5	880.9	4	YES
L16123	CB16126	CB16122	55.11	0.45	CIRCULAR	12	12	2	881.0	880.9	2	YES
L16127	CB16102	P16128	255	0.78	CIRCULAR	12	12	3	871.7	869.8	2	NO
L16128	CB16130	CB16117	332.14	1.83	CIRCULAR	12	12	5	886.0	876.2	4	NO
L16129	CB16138	P16128	255	0.24	CIRCULAR	12	12	2	873.7	869.8	4	NO
L16134	CB16136	CB16134	118.4	5.07	CIRCULAR	15	15	15	883.5	874.7	5	NO

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L16138	P16114	CB16138	64	0.16	CIRCULAR	12	12	1	874.7	873.7	4	YES
L16254a	P16140	J16254	72	-2.08	CIRCULAR	18	18	15	871.4	870.9	3	NO
L16255	P16140	J16254	72	-0.14	CIRCULAR	18	18	8	871.4	870.9	5	NO
L16402	P16404	P16402	110	0.45	CIRCULAR	15	15	4	872.6	871.5	2	NO
L16404	P16406	P16404	115	-0.87	CIRCULAR	15	15	5	872.7	872.6	2	NO
L19300	CB19302	O-19E-3-01	101.19	0.99	CIRCULAR	12	12	4	854.5	854.5	9	YES
L19302	P19E304	CB19302	50	2	CIRCULAR	21	21	22	854.5	854.5	21	YES
L19304	CB19306	P19E304	619.81	6.7	CIRCULAR	18	18	27	888.3	854.5	16	NO
L19306	CB19308	CB19306	123.51	0.4	CIRCULAR	18	18	7	889.4	888.3	9	NO
L22146	J22148	J22146	111.28	0.45	CIRCULAR	24	24	15	884.6	882.7	17	NO
L22204	CB22206	CB22204	468.08	0.75	CIRCULAR	15	15	6	882.0	877.9	6	NO
L22206	P22208	CB22206	145.84	0.53	CIRCULAR	15	15	5	883.0	882.0	5	YES
L22208	P22110	P22208	484	0.72	CIRCULAR	15	15	5	886.0	883.0	5	NO
L22216	CB22218	P22216	240	0.63	CIRCULAR	15	15	5	876.0	870.3	9	NO
L22218	P22220	CB22218	430	0.12	CIRCULAR	15	15	2	874.7	876.0	5	YES
L22220	J22222	P22220	145	0.32	CIRCULAR	15	15	4	875.0	874.7	5	NO
L22402	P22404	J22404A	108.91	0.33	CIRCULAR	15	15	4	869.8	869.8	4	YES
L22404	P22406	J122406A	124.72	0.26	CIRCULAR	15	15	3	869.8	869.8	3	YES
L22406	J22408A	P22408	96.96	0.55	CIRCULAR	15	15	5	869.8	869.8	4	YES
L22408	P22410	P22402	160	1.25	CIRCULAR	18	18	12	873.6	869.8	14	NO
L23101	P23102	P23158	55	0.55	CIRCULAR	12	12	3	872.6	865.3	10	YES
L23102	CB23104	P23102	104.77	1.34	CIRCULAR	30	30	47	872.8	872.6	37	YES
L23103	CB23106	CB23104	47.85	1.5	CIRCULAR	12	12	4	872.8	872.8	7	YES
L23104	CB23108	CB23104	245.93	1.5	CIRCULAR	27	27	38	874.4	872.8	32	YES
L23108	CB23112	CB23108	314.43	1.5	CIRCULAR	24	24	28	879.4	874.4	27	YES
L23109	CB23136	CB23108	207.37	2.47	CIRCULAR	15	15	10	876.9	874.4	7	NO
L23110	CB24412	CB23110	123.08	0.45	CIRCULAR	15	15	4	868.0	868.0	5	YES
L23112	CB23114	CB23112	115.59	1.5	CIRCULAR	21	21	19	881.4	879.4	20	YES

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L23114	CB23116	CB23114	147.64	1.49	CIRCULAR	18	18	13	883.5	881.4	17	YES
L23116	CB23118	CB23116	225.26	1.5	CIRCULAR	18	18	13	887.2	883.5	13	YES
L23117	CB24420	P23118	94	0.2	CIRCULAR	21	21	7	869.2	867.5	18	NO
L23118	CB23128	CB23118	207.78	1.49	CIRCULAR	15	15	8	888.2	887.2	7	YES
L23119	CB23120	CB23118	47.96	1.5	CIRCULAR	15	15	8	888.4	887.2	9	YES
L23120	CB23122	CB24420	154.67	0.2	CIRCULAR	21	21	7	871.6	869.2	18	YES
L23122	CB23124	CB23122	250.45	0.2	CIRCULAR	18	18	5	871.9	871.6	8	YES
L23129	CB23130	P23158	140	1.25	CIRCULAR	18	18	12	869.8	865.3	9	NO
L23130	CB23132	CB23130	48.84	0.31	CIRCULAR	18	18	6	870.2	869.8	8	NO
L23132	CB23134	CB23132	203.67	0.54	CIRCULAR	15	15	5	870.8	870.2	4	NO
L23138	CB23140	CB23138	171.5	0.99	CIRCULAR	15	15	6	872.5	868.5	7	YES
L23142	CB23144	CB23142	75.51	1.8	CIRCULAR	12	12	5	870.4	866.4	7	NO
L23144	CB23146	CB23144	345.73	1.82	CIRCULAR	15	15	9	873.9	870.4	5	NO
L23159	P23160	P23158	90	-1.11	CIRCULAR	15	15	6	865.3	865.3	3	YES
L23160	CB23162	P23160	130.62	0.38	CIRCULAR	18	18	7	867.1	865.3	13	NO
L23161	CB23168	CB23162	57.62	3.47	CIRCULAR	12	12	7	868.2	867.1	5	YES
L23162	CB23164	CB23162	103.54	0.97	CIRCULAR	15	15	6	869.3	867.1	9	YES
L23164	CB23166	CB23164	174.29	0.57	CIRCULAR	15	15	5	870.1	869.3	6	YES
L23169	CB23170	P23158	77	0.3	CIRCULAR	24	24	12	867.9	865.3	14	NO
L23170	CB23172	CB23170	113.96	0.3	CIRCULAR	24	24	12	868.5	867.9	14	NO
L23172	CB23174	CB23172	121.13	0.3	CIRCULAR	24	24	12	868.8	868.5	10	NO
L23173	CB23184	CB23172	96.08	0.3	CIRCULAR	12	12	2	869.4	868.5	3	YES
L23174	CB23176	CB23174	53.2	0.3	CIRCULAR	21	21	9	868.8	868.8	5	YES
L23176	CB23178	CB23176	80.98	0.3	CIRCULAR	21	21	9	868.9	868.8	4	NO
L23178	CB23180	CB23178	132.97	0.3	CIRCULAR	15	15	4	869.5	868.9	4	YES
L23180	CB23182	CB23180	64.98	0.31	CIRCULAR	12	12	2	869.9	869.5	3	YES
L23185	P23186	P23158	10	0.8	CIRCULAR	15	15	6	865.3	865.3	5	NO
L23186	CB23188	P23186	181	3.87	CIRCULAR	18	18	21	871.8	865.3	11	NO

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L23302	CB22204	P23302	165	4.3	CIRCULAR	15	15	13	877.9	865.9	10	NO
L23312	CB23314	P23312	130	0.22	CIRCULAR	18	18	5	865.9	865.9	5	NO
L23314	CB23314	P23302	60	1.58	CIRCULAR	15	15	8	865.9	865.9	7	YES
L23402	CB23404	CB23402	215.66	2.56	CIRCULAR	15	15	10	876.2	868.8	4	NO
L23403	CB23402	P23444	52	0.79	CIRCULAR	15	15	6	868.8	867.1	10	NO
L23404	CB23406	CB23404	63.3	1.42	CIRCULAR	15	15	8	877.0	876.2	2	NO
L23407	CB23408	P23444	197	0.15	CIRCULAR	18	18	4	868.8	867.1	8	NO
L23408	P23416	CB23408	48.31	-0.06	CIRCULAR	18	18	3	869.3	868.8	11	YES
L23410	CB23412	CB23410	111.09	1.04	CIRCULAR	18	18	11	874.3	872.9	6	NO
L23412	CB23414	CB23412	83.34	1.32	CIRCULAR	15	15	7	875.0	874.3	3	NO
L23416	CB23410	P23416	55.82	7.67	CIRCULAR	18	18	29	872.9	869.3	7	NO
L23417	CB23418	P23416	107	3.52	CIRCULAR	18	18	20	872.4	869.3	7	NO
L23418	CB23420	CB23418	213.98	0.34	CIRCULAR	15	15	4	873.7	872.4	4	NO
L23444	P23446	P23444	110	1.82	CIRCULAR	18	18	14	872.1	867.1	11	NO
L24111	J24113	CB24112	70	0.2	CIRCULAR	21	21	7	864.6	864.6	11	YES
L24112	P24114	J24113	80.47	-1.34	CIRCULAR	21	21	18	864.6	864.6	11	YES
L24113	CB24115	P24114	135	0.37	CIRCULAR	12	12	2	881.6	864.6	9	YES
L24114	CB24116	P24114	247	0.12	CIRCULAR	18	18	4	872.3	864.6	5	YES
L24116	P24118	CB24116	778	0.29	CIRCULAR	15	15	3	865.4	872.3	3	NO
L24118	CB24120	P24118	192	1.29	CIRCULAR	24	24	26	868.6	865.4	23	NO
L24119	CB24164	P24118	230	3.19	CIRCULAR	36	36	119	866.3	865.4	25	NO
L24120	CB24122	CB24120	220.75	2.42	CIRCULAR	21	21	25	873.3	868.6	12	NO
L24121	CB24128	CB24120	170	0.71	CIRCULAR	21	21	13	869.7	868.6	8	NO
L24122	CB24124	CB24122	145.6	0.37	CIRCULAR	21	21	10	874.1	873.3	8	NO
L24124	P24126	CB24124	223.44	2.27	CIRCULAR	21	21	24	878.6	874.1	5	NO
L24128	CB24130	CB24128	178	0.38	CIRCULAR	21	21	10	869.9	869.7	4	NO
L24130	CB24252	CB24130	331.49	2.91	CIRCULAR	15	15	11	879.6	869.9	4	NO
L24135	CB24136	CB24116	311	0.12	CIRCULAR	15	15	2	864.3	872.3	3	YES

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L24136	CB24138	CB24136	541	0.07	CIRCULAR	15	15	2	863.8	864.3	3	YES
L24137	CB24152	CB24136	220	2.32	CIRCULAR	15	15	10	873.0	864.3	3	NO
L24138	P24440	CB24138	50	-3.68	CIRCULAR	15	15	12	863.8	863.8	3	YES
L24140	CB24142	P24440	392.47	1.03	CIRCULAR	21	21	16	865.7	863.8	15	YES
L24142	CB24144	CB24142	203.48	0.49	CIRCULAR	18	18	7	867.8	865.7	11	YES
L24143	CB24150	CB24142	47.34	4.33	CIRCULAR	12	12	7	865.2	865.7	4	YES
L24144	CB24146	CB24144	102.3	0.27	CIRCULAR	18	18	6	867.7	867.8	5	YES
L24146	P24148	CB24146	482.84	0.37	CIRCULAR	15	15	4	868.2	867.7	4	YES
L24148	CB24154	P24148	189.27	0.77	CIRCULAR	30	30	36	868.3	868.2	15	YES
L24149	P24118	P24148	150	0.33	CIRCULAR	18	18	6	865.4	868.2	8	NO
L24150	P24222	CB24250	127	1.09	CIRCULAR	15	15	7	885.0	885.4	5	YES
L24152	CB24250	CB24252	917	0.28	CIRCULAR	15	15	3	885.4	879.6	4	NO
L24154	CB24156	CB24154	132.36	1.46	CIRCULAR	27	27	37	868.4	868.3	14	NO
L24156	CB24158	CB24156	220.97	1.05	CIRCULAR	21	21	16	870.8	868.4	10	NO
L24158	CB24160	CB24158	177.61	2.63	CIRCULAR	18	18	17	874.9	870.8	5	NO
L24159	CB24162	CB24158	223.7	0.59	CIRCULAR	15	15	5	871.8	870.8	3	NO
L24164	CB24172	CB24164	117.66	4.31	CIRCULAR	18	18	22	870.9	866.3	6	NO
L24165	CB24166	CB24164	384.44	0.18	CIRCULAR	33	33	23	867.6	866.3	14	NO
L24166	CB24168	CB24166	362.68	4.4	CIRCULAR	30	30	86	882.5	867.6	7	NO
L24167	CB24170	CB24166	46.52	12.75	CIRCULAR	18	18	38	879.9	867.6	6	NO
L24172	CB24174	CB24172	169.36	0.89	CIRCULAR	15	15	6	872.6	870.9	3	NO
L24175	CB24176	P24118	175	0.57	CIRCULAR	27	27	23	865.8	865.4	25	NO
L24176	CB24178	CB24176	35.75	0.28	CIRCULAR	24	24	12	866.3	865.8	22	YES
L24178	CB24180	CB24178	227.07	0.22	CIRCULAR	18	18	5	870.1	866.3	14	YES
L24180	CB24182	CB24180	108.04	8.33	CIRCULAR	15	15	19	876.0	870.1	14	YES
L24182	CB24184	CB24182	322.72	2.17	CIRCULAR	15	15	10	880.5	876.0	3	NO
L24183	CB24186	CB24182	189.5	0.26	CIRCULAR	12	12	2	877.2	876.0	5	YES
L24185	CB24188	P24118	400	1.36	CIRCULAR	15	15	8	871.8	865.4	8	NO

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L24186	CB24190	CB24188	154.69	3.38	CIRCULAR	12	12	7	879.3	871.8	8	YES
L24189	CB24194	P24118	231.55	1.51	CIRCULAR	15	15	8	868.7	865.4	5	NO
L24221	CB24238	P24222	150	3	CIRCULAR	18	18	18	887.2	885.0	18	YES
L24222	CB24224	P24222	140	0.26	CIRCULAR	15	15	3	885.1	885.0	7	YES
L24224	CB24226	CB24224	564.98	0.2	CIRCULAR	15	15	3	889.2	885.1	6	YES
L24226	CB24228	CB24226	63.11	0.13	CIRCULAR	15	15	2	889.1	889.2	3	YES
L24228	P24230	CB24228	198.62	0.35	CIRCULAR	12	12	2	886.8	889.1	4	YES
L24230	CB24232	P24230	40	0.25	CIRCULAR	15	15	3	886.5	886.8	5	YES
L24231	CB24234	CB24232	162.95	0.09	CIRCULAR	15	15	2	886.5	886.5	4	NO
L24232	CB24236	CB24232	994.12	0.1	CIRCULAR	15	15	2	889.3	886.5	4	YES
L24234	CB24234	O-24-2-01	143.71	21.57	CIRCULAR	12	12	17	886.5	854.5	15	YES
L24238	CB24240	CB24238	223.33	0.22	CIRCULAR	15	15	3	891.5	887.2	10	YES
L24241	CB24242	P24222	132	0.38	CIRCULAR	15	15	4	886.8	885.0	8	YES
L24242	P24244	CB24242	232.02	0.86	CIRCULAR	15	15	6	887.6	886.8	5	YES
L24245	CB24246	P24222	313	0.26	CIRCULAR	18	18	5	889.2	885.0	8	NO
L24246	CB24248	CB24246	123.85	0.16	CIRCULAR	18	18	4	891.0	889.2	7	YES
L24402	CB24104	P24402	240	0.17	CIRCULAR	15	15	3	864.0	863.1	5	YES
L24403	CB23150	P24402	110	1.82	CIRCULAR	18	18	14	870.1	863.1	12	NO
L24404	P24406	CB24104	90	0.44	CIRCULAR	15	15	4	864.5	864.0	5	YES
L24405	CB23138	P24406	98	0.82	CIRCULAR	15	15	6	868.5	864.5	7	NO
L24406	CB24408	P24406	22	2	CIRCULAR	15	15	9	865.9	864.5	16	YES
L24407	CB23142	P24406	86	1.8	CIRCULAR	24	24	30	866.4	864.5	10	NO
L24408	CB24428	CB24408	147.52	2.7	CIRCULAR	21	21	26	867.7	865.9	15	NO
L24409	CB23110	CB24408	298.32	0.69	CIRCULAR	15	15	5	868.0	865.9	6	YES
L24412	P23118	CB24412	51	1.86	CIRCULAR	15	15	9	867.5	868.0	8	YES
L24413	CB24414	CB24412	230.88	1.98	CIRCULAR	15	15	9	872.3	868.0	8	YES
L24414	CB24416	CB24414	167.29	0.54	CIRCULAR	12	12	3	873.6	872.3	3	YES
L24425	P24426	CB24408	186	0.04	CIRCULAR	15	15	1	864.0	865.9	4	NO

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L24428	CB24430	CB24428	219.66	1.63	CIRCULAR	18	18	13	870.9	867.7	8	NO
L24430	CB24432	CB24430	271.51	0.61	CIRCULAR	18	18	8	872.9	870.9	8	NO
L24432	CB24434	CB24432	173.89	0.88	CIRCULAR	15	15	6	875.0	872.9	7	YES
L24434	CB24436	CB24434	163.1	0.44	CIRCULAR	15	15	4	875.8	875.0	3	YES
L24440	CB24442	P24440	40	6.88	CIRCULAR	24	24	59	863.8	863.8	34	YES
L24442	J24444	CB24442	265.78	0.13	CIRCULAR	18	18	4	865.9	863.8	13	YES
L24444	J24446	J24444	798.9	0.13	CIRCULAR	18	18	4	866.5	865.9	3	YES
L24446	J24448	J24446	400.9	0.12	CIRCULAR	18	18	4	864.6	866.5	7	YES
L24448	P24450	J24448	70	0.17	CIRCULAR	18	18	4	863.0	864.6	12	NO
L24449	P24452	P24450	110	0.91	CIRCULAR	18	18	10	871.5	863.0	10	NO
L24451	P24402	P24450	146	-0.34	CIRCULAR	15	15	4	863.1	863.0	2	YES
L24453	P23158	P24402	205	0.3	CIRCULAR	18	18	6	865.3	863.1	1	NO
L25250	CB23152	CB23150	38.26	7.84	CIRCULAR	18	18	25	872.7	870.1	10	NO
Link-12	P14270	P14220	300	0.45	CIRCULAR	15	15	4	878.8	860.1	3	NO
ZC15352	J22454	J22454A	93.96	0.28	CIRCULAR	15	15	3	870.0	872.0	5	YES
ZC24414A	CB24416	CB24414	140.12	0.65	CIRCULAR	15	15	5	873.6	872.3	5	YES

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
C27270	P27276	P27270	90	2	CIRCULAR	18	18	13	873.8	862.6	0	No
L22302	P22304	P22302	85	1.76	CIRCULAR	15	15	5	866.7	866.4	3	No
L27116	P22302	P27116	75	0.4	CIRCULAR	12	12	1	866.4	866.4	2	Yes
L27118	P27402	P27118	150	0.13	CIRCULAR	24	24	7	861.8	862.5	0	No
L27119	P27102	P27118	150	0.33	CIRCULAR	18	18	6	862.5	862.5	0	No
L27168	CB27170	CB27168	205	0.15	CIRCULAR	15	15	2	867.7	867.4	0	No
L27202	CB27204	P27202	246.08	0.57	CIRCULAR	27	27	23	866.3	865.5	25	Yes
L27203	CB27216	P27202	253	0.09	CIRCULAR	36	36	20	866.1	865.5	43	Yes
L27204	CB27206	CB27204	249.76	0.2	CIRCULAR	27	27	14	869.3	866.3	25	Yes
L27206	CB27208	CB27206	358.38	0.2	CIRCULAR	27	27	14	869.8	869.3	25	Yes
L27207	CB27214	CB27208	355.78	0.2	CIRCULAR	24	24	10	870.6	869.8	12	Yes
L27208	CB27210	CB27208	274.29	0.3	CIRCULAR	24	24	12	870.4	869.8	15	Yes
L27210	CB27212	CB27210	249.7	0.3	CIRCULAR	15	15	4	870.1	870.4	6	Yes
L27216	CB27218	CB27216	411.98	1.28	CIRCULAR	21	21	18	867.1	866.1	12	Yes
L27217	CB27220	CB27216	432.3	0.13	CIRCULAR	30	30	15	866.3	866.1	21	Yes
L27220	CB27222	CB27220	56.19	1.25	CIRCULAR	18	18	12	867.6	866.3	16	Yes
L27221	CB27322	CB27220	90.48	0.13	CIRCULAR	18	18	4	866.3	866.3	9	Yes
L27222	CB27224	CB27222	239.52	2.3	CIRCULAR	15	15	10	869.6	867.6	6	Yes
L27226	CB27228	CB27226	242.8	0.1	CIRCULAR	36	36	21	863.2	862.6	47	Yes
L27228	CB27230	CB27228	92.2	0.1	CIRCULAR	36	36	21	863.7	863.2	39	Yes
L27229	P27234	CB27228	30	0.27	CIRCULAR	15	15	3	863.7	863.2	9	Yes
L27230	CB27232	CB27230	203	0.06	CIRCULAR	36	36	17	864.6	863.7	39	Yes
L27232	P27202	CB27233	24	-1.46	CIRCULAR	36	36	81	865.5	865.1	41	Yes
L27234	CB27236	P27234	60	0.42	CIRCULAR	36	36	43	863.9	863.7	38	Yes
L27236	CB27238	CB27236	261.17	0.51	CIRCULAR	36	36	47	864.5	863.9	30	Yes
L27238	CB27240	CB27241	53.52	0.3	CIRCULAR	30	30	22	865.7	865.1	29	Yes
L27238A	CB27241	CB27238	276.59	0.54	CIRCULAR	33	33	39	865.1	864.5	24	Yes
L27240	CB27242	CB27240	261.17	0.2	CIRCULAR	30	30	18	865.7	865.7	5	Yes

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L27242	CB27244	CB27242	184.51	0.26	CIRCULAR	24	24	12	865.8	865.7	4	Yes
L27243	CB27246	CB27244	68.2	0.22	CIRCULAR	18	18	5	865.9	865.8	4	Yes
L27244	CB27274	CB27244	38	0.71	CIRCULAR	21	21	13	864.9	865.8	18	Yes
L27248	CB27250	CB27248	107	0.21	CIRCULAR	15	15	3	858.2	858.0	0	No
L27250	CB27252	CB27250	247	0.18	CIRCULAR	15	15	3	858.7	858.2	0	No
L27252	CB27254	CB27252	291	0.15	CIRCULAR	15	15	3	859.1	858.7	0	No
L27254	CB27256	CB27254	250	1.84	CIRCULAR	15	15	9	863.7	859.1	0	No
L27256	CB27258	CB27256	400.78	0.21	CIRCULAR	15	15	3	864.5	863.7	0	No
L27258	CB27260	CB27258	394	0.12	CIRCULAR	15	15	2	865.0	864.5	0	No
L27260	CB27262	CB27260	387	0.1	CIRCULAR	15	15	2	865.4	865.0	0	No
L27262	CB27264	CB27262	400	0.21	CIRCULAR	15	15	3	866.3	865.4	0	No
L27264	CB27266	CB27264	403	0.12	CIRCULAR	15	15	2	866.8	866.3	0	No
L27266	CB27168	CB27266	403	0.15	CIRCULAR	15	15	2	867.4	866.8	0	No
L27272	CB27226	MH27235	136	0.16	CIRCULAR	42	42	40	862.6	862.6	47	Yes
L27274	P34174	CB27274	14	0.71	CIRCULAR	15	15	5	863.4	864.9	17	Yes
L27276	MH27235	P27270	40	0.55	CIRCULAR	42	42	75	862.6	862.6	47	Yes
L27301	P27316	P27302	120	0.67	CIRCULAR	24	24	18	865.5	866.0	5	No
L27302	CB27304	P27302	202.82	0.2	CIRCULAR	24	24	10	866.5	866.0	17	Yes
L27303	CB27310	P27302	156.58	0.32	CIRCULAR	18	18	6	866.2	866.0	17	Yes
L27304	CB27306	CB27304	412.06	0.1	CIRCULAR	24	24	7	866.5	866.5	13	Yes
L27306	CB27308	CB27306	333.84	0.1	CIRCULAR	24	24	7	866.6	866.5	11	Yes
L27310	CB27312	CB27310	502.07	0.22	CIRCULAR	18	18	5	866.6	866.2	7	Yes
L27312	CB27314	CB27312	131.05	0.31	CIRCULAR	15	15	4	866.6	866.6	2	Yes
L27322	CB27324	CB27322	273.79	0.13	CIRCULAR	18	18	4	866.7	866.3	7	Yes
L27324	CB27326	CB27324	220.51	0.13	CIRCULAR	18	18	4	865.5	866.7	10	Yes
L27326	CB27328	CB27326	268.85	0.54	CIRCULAR	18	18	8	865.4	865.5	10	Yes
L27328	P27330	CB27328	20	0	CIRCULAR	18	18	1	865.4	865.4	10	Yes
L27330	CB27332	P27330	128	0.31	CIRCULAR	30	30	23	865.4	865.4	24	Yes

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L27332	CB27334	CB27332	353.86	0.23	CIRCULAR	27	27	15	865.4	865.4	18	Yes
L27334	CB27336	CB27334	397.22	0.2	CIRCULAR	18	18	5	865.6	865.4	8	Yes
L27338	CB27340	P27338	136	0.2	CIRCULAR	21	21	7	862.5	862.3	9	Yes
L27340	CB27342	CB27340	396.9	0.2	CIRCULAR	21	21	7	863.1	862.5	9	Yes
L27342	CB27344	CB27342	388.64	0.17	CIRCULAR	21	21	7	863.8	863.1	9	Yes
L27344	P27302	CB27344	143.35	0	CIRCULAR	15	15	0	866.0	863.8	9	Yes
L27346	CB27348	P27346	70	0.71	CIRCULAR	30	30	35	864.4	863.9	31	No
L27347	CB27352	P27346	108	0.37	CIRCULAR	21	21	10	864.0	863.9	14	Yes
L27348	CB27350	CB27348	660.47	0.08	CIRCULAR	24	24	6	866.6	864.4	13	Yes
L27352	CB27354	CB27352	233.15	0.09	CIRCULAR	21	21	5	864.6	864.0	8	Yes
L27401	P27446	CB27447	81.71	-1.6	CIRCULAR	12	12	5	869.1	867.3	5	Yes
L27402	CB27447	P27102	96	0.72	CIRCULAR	12	12	3	867.3	862.5	5	No
L27404	P27346	P27402	100	0.5	CIRCULAR	18	18	7	863.9	861.8	10	No
L27407	CB27444	P27408	204	1.96	CIRCULAR	15	15	9	872.7	865.4	5	No
L27408	CB27410	P27408	174	0.34	CIRCULAR	21	21	9	868.1	865.4	10	No
L27409	CB27438	P27408	856.87	0.18	CIRCULAR	24	24	9	872.0	865.4	13	No
L27410	CB27412	CB27410	55.74	0.36	CIRCULAR	18	18	6	868.8	868.1	9	Yes
L27412	CB27414	CB27412	257.7	0.35	CIRCULAR	18	18	6	870.2	868.8	8	Yes
L27414	P27416	CB27414	55	0.55	CIRCULAR	15	15	5	871.0	870.2	7	Yes
L27415	CB27436	CB27414	184.49	0.6	CIRCULAR	18	18	8	870.2	870.2	3	No
L27416	CB27418	P27416	164	0.37	CIRCULAR	21	21	10	873.8	871.0	16	No
L27417	CB27426	P27416	148	0.54	CIRCULAR	21	21	12	871.1	871.0	13	Yes
L27418	CB27420	CB27418	209.66	0.29	CIRCULAR	21	21	8	874.7	873.8	11	Yes
L27420	CB27422	CB27420	94.92	0.32	CIRCULAR	18	18	6	875.7	874.7	9	Yes
L27422	CB27424	CB27422	167.88	0.3	CIRCULAR	15	15	4	878.0	875.7	7	Yes
L27426	CB27428	CB27426	35.71	0.56	CIRCULAR	18	18	8	871.3	871.1	11	Yes
L27428	CB27430	CB27428	63.59	0.79	CIRCULAR	15	15	6	872.9	871.3	9	Yes
L27430	CB27432	CB27430	407.35	1.35	CIRCULAR	12	12	4	880.0	872.9	4	Yes

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L27432	P27434	CB27432	158.66	0.63	CIRCULAR	12	12	3	878.0	880.0	4	Yes
L27438	CB27440	CB27438	247.67	0.81	CIRCULAR	18	18	9	874.0	872.0	12	Yes
L27440	CB27442	CB27440	220.83	0.91	CIRCULAR	15	15	6	876.1	874.0	8	Yes
L27446	CB27448	P27446	48	2.06	CIRCULAR	15	15	9	869.2	869.1	6	Yes
L27447	CB27454	P27446	160	1.08	CIRCULAR	12	12	4	869.5	869.1	2	Yes
L27448	CB27450	CB27448	144	1.14	CIRCULAR	15	15	7	870.1	869.2	7	Yes
L27450	CB27452	CB27450	124	1.05	CIRCULAR	15	15	7	870.8	870.1	4	No
L34104	P34106	CB34104	254.91	1.45	CIRCULAR	24	24	27	859.0	854.0	22	No
L34118	CB34120	CB35318	152.36	0.47	CIRCULAR	42	42	69	852.7	851.7	61	No
L34120	CB34122	CB34120	105.12	0.47	CIRCULAR	42	42	69	853.5	852.7	61	No
L34121	CB34152	CB34130	710	0.2	CIRCULAR	30	30	18	860.7	856.9	29	Yes
L34122	CB34124	CB34122	145.85	0.71	CIRCULAR	42	42	85	854.3	853.5	61	No
L34124	CB34126	CB34124	31	0.13	CIRCULAR	42	42	36	854.8	854.3	61	No
L34128	CB34130	CB34128	194	0.14	CIRCULAR	42	42	38	856.9	856.5	39	Yes
L34130	CB34132	CB34130	80	0.18	CIRCULAR	42	42	42	856.9	856.9	9	Yes
L34132	CB34134	CB34132	44	0.73	CIRCULAR	21	21	14	857.1	856.9	9	Yes
L34134	CB34136	CB34134	233	0.15	CIRCULAR	21	21	6	858.0	857.1	9	Yes
L34136	CB34138	CB34136	304	0.16	CIRCULAR	21	21	6	858.0	858.0	2	Yes
L34137	P34137	CB34136	41.71	-1.03	CIRCULAR	15	15	7	859.1	858.0	10	Yes
L34138	CB34140	CB34138	321.89	0.14	CIRCULAR	21	21	6	858.0	858.0	2	Yes
L34139	P34170	CB34182	200	0.08	CIRCULAR	15	15	2	862.2	861.3	6	Yes
L34140	CB34142	CB34140	324	0.21	CIRCULAR	21	21	7	858.0	858.0	2	Yes
L34142	CB34144	CB34142	404	0.13	CIRCULAR	18	18	4	858.0	858.0	1	No
L34144	CB34146	CB34144	396	0.17	CIRCULAR	18	18	4	858.0	858.0	1	No
L34146	CB27248	CB34146	386	0.19	CIRCULAR	18	18	5	858.0	858.0	0	No
L34149	P34148	CB34128	522	0.38	CIRCULAR	24	24	14	857.9	856.5	11	Yes
L34150	CB34154	P34150	141	0.23	CIRCULAR	36	36	32	861.3	861.2	39	Yes
L34152	P34150	CB34152	46	0.2	CIRCULAR	30	30	18	861.2	860.7	29	Yes

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L34154	CB34156	CB34154	270	0.05	CIRCULAR	36	36	15	861.8	861.3	40	Yes
L34156	CB34158	CB34156A	20.21	-0.54	CIRCULAR	36	36	49	862.2	862.0	41	Yes
L34156B	CB34156A	CB34156	18	0.61	CIRCULAR	36	36	52	862.0	861.8	41	Yes
L34158	CB34160	CB34158	344	0.09	CIRCULAR	36	36	20	863.1	862.2	37	Yes
L34160	CB34162	CB34160	311	0.13	CIRCULAR	36	36	24	863.8	863.1	35	Yes
L34174	CB34176	CB34178	300	0.1	Arch	15.48	26.04	3	862.0	861.4	9	Yes
L34178	CB34178	CB34180	350	0.1	Arch	15.48	26.04	3	861.4	864.3	10	Yes
L34180	CB34180	CB34162	352	0.1	CIRCULAR	36	36	18	864.3	863.8	25	Yes
L34182	CB34182	P34150	80	0.54	CIRCULAR	15	15	5	861.3	861.2	6	Yes
L34405	P34402	MH34404	44	-2.66	Arch	15.48	26.04	18	860.7	860.5	9	Yes
L34406	CB34406	P34402	47	0.06	CIRCULAR	24	24	6	860.7	860.7	8	Yes
L34412	CB34408	CB34406	188	0.16	CIRCULAR	24	24	9	860.8	860.7	8	Yes
L34416	CB34410	CB34408	247	0.09	CIRCULAR	24	24	7	861.0	860.8	8	Yes
L35126	CB34128	CB34126	417	0.14	CIRCULAR	42	42	37	856.5	854.8	61	Yes
L35300	CB35302	O35301	209.03	1.91	CIRCULAR	27	27	43	851.8	842.1	64	Yes
L35302	CB35304	CB35302	385.37	1.04	CIRCULAR	27	27	32	857.6	851.8	43	Yes
L35304	CB35306	CB35304	426.8	0.94	CIRCULAR	24	24	22	857.6	857.6	27	Yes
L35310	CB35312	O34204	269.57	0.48	CIRCULAR	48	48	99	849.7	847.9	92	No
L35312	CB35314	CB35312	73.86	0.47	CIRCULAR	48	48	99	850.5	849.7	92	No
L35314	CB35316	CB35314	86.54	0.46	CIRCULAR	48	48	98	851.0	850.5	75	No
L35316	CB35318	CB35316	431.98	0.47	CIRCULAR	48	48	98	851.7	851.0	66	No
L35317	P35402	CB35316	126.17	1.16	CIRCULAR	18	18	11	852.5	851.0	11	Yes
L35400	J34101	O34203	32	1.84	CIRCULAR	21	21	22	843.9	842.5	45	Yes
L35401	CB34102	J34101	470	1.1	CIRCULAR	21	21	21	855.0	843.9	23	Yes
L35402	CB35403	CB35404	430	0.1	CIRCULAR	36	36	21	857.1	857.6	24	Yes
L35403	MH34404	CB34176	150	0.12	Arch	15.48	26.04	4	860.5	862.0	9	Yes
L35404	CB35404	CB35406	225	0.1	CIRCULAR	36	36	23	857.6	858.1	24	Yes
L35406	CB35406	CB35407	110	0.14	CIRCULAR	36	36	25	858.1	858.2	24	Yes

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L35407	P35407	CB35407	40	-1.32	CIRCULAR	36	36	77	858.2	858.2	69	Yes
L35408	CB35408	CB35410	205	0.13	CIRCULAR	42	42	36	859.3	859.7	42	Yes
L35410	CB35410	P35420	296.71	0.27	CIRCULAR	42	42	52	859.7	860.2	39	Yes
L35411	CB35412	CB35410	109.33	0.91	CIRCULAR	42	42	96	859.7	859.7	11	Yes
L35414	CB35416	CB35414	355.99	0.27	CIRCULAR	48	48	75	860.8	860.3	53	Yes
L35416	CB35418	CB35416	349.36	0.27	CIRCULAR	48	48	75	861.6	860.8	38	Yes
L35419	CB35440	P35420	735.61	0.48	CIRCULAR	30	30	28	862.0	860.2	30	Yes
L35420	P35420	P35424	133	0.38	CIRCULAR	42	42	62	860.2	861.3	59	No
L35421	CB35414	P35420	148.95	0.34	CIRCULAR	48	48	83	860.3	860.2	53	Yes
L35422	SB35409	SB35411	220	0.27	CIRCULAR	36	36	38	858.5	859.2	44	Yes
L35423	CB35407	SB35409	202	0.21	CIRCULAR	36	36	31	858.2	858.5	47	Yes
L35424	CB35426	P35424	180	0.28	CIRCULAR	54	54	104	861.6	861.3	59	Yes
L35425	CB35403	CB35402	295	-0.1	CIRCULAR	36	36	21	857.1	856.9	24	Yes
L35426	CB35428	CB35427	374.3	0.11	CIRCULAR	48	48	49	862.6	862.4	41	Yes
L35427	CB34129	CB34128	41	0.39	CIRCULAR	36	36	42	856.6	856.5	25	Yes
L35428	CB35402	CB34129	502	-0.1	CIRCULAR	36	36	21	856.9	856.6	25	Yes
L35429	CB35434	CB35428	209.63	0.24	CIRCULAR	24	24	11	862.6	862.6	10	Yes
L35430	CB35430	CB35428	459	0.15	CIRCULAR	42	42	39	863.0	862.6	39	Yes
L35431	CB35432	CB35430	121.33	0.15	CIRCULAR	36	36	26	863.3	863.0	35	Yes
L35432	P35474	CB35432	331.18	3	CIRCULAR	15	15	11	867.1	863.3	2	No
L35434	CB35436	CB35434	50.99	0.59	CIRCULAR	12	12	3	862.3	862.6	4	Yes
L35436	P35438	CB35436	87.43	0.57	CIRCULAR	12	12	3	861.9	862.3	4	Yes
L35440	CB35442	CB35440	203.01	0.75	CIRCULAR	30	30	35	862.0	862.0	23	Yes
L35442	CB35444	CB35442	255.69	0.77	CIRCULAR	30	30	36	862.6	862.0	27	Yes
L35445	CB35454	P35446	497.39	0.6	CIRCULAR	30	30	32	866.7	866.7	18	Yes
L35446	CB35466	CB354466A	363	1	CIRCULAR	27	27	31	872.1	867.7	33	No
L35446A	CB354466A	CB35466B	180	4.28	CIRCULAR	27	27	64	867.7	866.7	33	No
L35446B	CB35466B	P35446	26	1.46	CIRCULAR	27	27	37	866.7	866.7	27	Yes

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L35447	CB35470	P35446	470.04	1.17	CIRCULAR	30	30	44	866.7	866.7	16	Yes
L35448	CB35448	P35446	187.07	4.01	CIRCULAR	21	21	32	866.8	866.7	17	Yes
L35449	CB35450	CB35448	492.25	0.81	CIRCULAR	18	18	9	868.3	866.8	6	No
L35450	CB35452	CB35450	332.39	3.16	CIRCULAR	15	15	11	877.9	868.3	3	No
L35454	CB35456	CB35454	121.65	2.06	CIRCULAR	24	24	32	866.7	866.7	4	Yes
L35455	CB35458	CB35454	110.77	0.45	CIRCULAR	24	24	15	866.7	866.7	7	Yes
L35458	CB35460	CB35458	127.61	1.41	CIRCULAR	18	18	12	866.7	866.7	3	Yes
L35460	CB35462	CB35460	41.58	0.48	CIRCULAR	15	15	4	866.7	866.7	2	Yes
L35462	P35464	CB35462	84.51	0.59	CIRCULAR	12	12	3	866.7	866.7	5	Yes
L35466	CB35468	CB35466	174.06	1.19	CIRCULAR	18	18	11	874.3	872.1	12	Yes
L35468A	CB35468A	CB35468	115	0.61	CIRCULAR	18	18	8	876.2	874.3	12	Yes
L35468B	CB35468B	CB35468A	40	0.6	CIRCULAR	18	18	8	877.2	876.2	12	Yes
L35470	CB35472	CB35470	545.93	0.22	CIRCULAR	24	24	11	866.7	866.7	6	Yes
P243	CB35476	CB35474	398.8	0.26	CIRCULAR	42	42	51	861.1	862.0	24	Yes
P244	CB35474	CB35418	399.36	0.27	CIRCULAR	42	42	52	862.0	861.6	34	Yes
P247	SB35411	CB35408	65	0.31	CIRCULAR	42	42	56	859.2	859.3	43	Yes
P248	CB35427	CB35426	518.65	0.11	CIRCULAR	48	48	48	862.4	861.6	59	Yes
P35418	P35422	CB35476	392.31	0.05	CIRCULAR	42	42	23	860.3	861.1	10	Yes

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
C11407	P11316	P11338	50	0.2	CIRCULAR	18	18	4	872.5	872.2	1	No
L11118	P11116	P11118	100	-1.1	CIRCULAR	18	18	11	879.2	874.1	1	No
L11120	P11118	P11402	100	1	CIRCULAR	18	18	11	874.1	871.5	9	No
L11204	P11206	J11204	85	0.24	CIRCULAR	24	24	11	872.5	872.0	7	No
L11211	P11202	J11206	398.43	-0.1	CIRCULAR	12	12	1	869.6	868.8	1	No
L11212	J11206	J11207	100	1	CIRCULAR	12	12	4	868.8	868.0	1	No
L11213	J11207	J11208	672.77	0.34	CIRCULAR	12	12	2	868.0	865.0	1	No
L11216	J11209	J11210	63.25	0.47	CIRCULAR	12	12	2	875.3	874.2	5	No
L11218	J11204	P11213	20	6.5	CIRCULAR	12	12	9	872.0	870.6	7	No
L11338	P11340	P11338	100	2	CIRCULAR	18	18	13	874.5	872.2	3	No
L11401	J11412	P11402	185	1.35	CIRCULAR	18	18	12	875.8	871.5	7	No
L12306	P12313	P12314	20	9	CIRCULAR	15	15	19	858.0	856.5	1	No
L13406	P13408	J13406	40	1	CIRCULAR	12	12	2	864.0	863.1	1	No
L14104	P14106	J14104	80	0.25	CIRCULAR	12	12	2	875.2	874.4	1	No
L14434	P14436	J14434	76	-0.66	CIRCULAR	15	15	5	871.5	870.6	3	No
L14435	P14401	O14429	715	0.91	CIRCULAR	15	15	7	874.9	866.3	8	Yes

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L34106	CB34108	CB34106	444.35	0.56	CIRCULAR	18	18	8	857.7	855.2	12	Yes
L34200	CB34202	O34300	181.87	7.15	CIRCULAR	27	27	83	849.7	843.0	15	No
L34201	CB34204	O34301	340.29	3.23	CIRCULAR	27	27	56	852.3	843.3	49	Yes
L34204	CB34106	CB34204	562.32	0.53	CIRCULAR	27	27	23	855.2	852.3	33	Yes
L34300	CB34302	O34400	43	0.67	CIRCULAR	24	24	19	847.7	843.6	59	Yes
L34302	P34304	CB34302	90	1.14	CIRCULAR	24	24	24	847.0	847.7	28	Yes
L34304	CB34306	P34304	150	0.5	CIRCULAR	27	27	22	848.1	847.0	33	Yes
L34305	CB34342	P34304	165	0.3	CIRCULAR	18	18	6	848.4	847.0	13	Yes
L34306	CB34308	CB34306	251	0.39	CIRCULAR	27	27	19	851.4	848.1	33	Yes
L34308	CB34310	CB34308	225	0.45	CIRCULAR	27	27	21	853.3	851.4	21	Yes
L34310	CB34412	CB34310	147	0.48	CIRCULAR	27	27	21	852.1	853.3	19	Yes
L34311	P34311	CB34310	65	1.08	CIRCULAR	15	15	7	852.0	853.3	6	Yes
L34328	CB34442	CB34440	279	0.42	CIRCULAR	27	27	20	854.9	854.4	14	No
L34340	CB34344	CB34342	320	0.37	CIRCULAR	18	18	6	854.0	848.4	13	Yes
L34342	CB34346	CB34344	270	0.26	CIRCULAR	18	18	5	854.8	854.0	7	Yes
L34344	CB34448	CB34346	472	0.2	CIRCULAR	18	18	5	854.8	854.8	6	Yes
L344100	CB34485	CB34487	28.54	0.7	CIRCULAR	30	30	34	854.3	854.3	2	Yes
L344101	CB34487	CB34489	33.67	0	CIRCULAR	30	30	2	854.3	854.3	2	Yes
L344102	CB34488	CB34489	46.54	5.35	CIRCULAR	18	18	24	854.3	854.3	0	No
L344103	CB34486	CB34485	71.93	1.11	CIRCULAR	18	18	11	854.3	854.3	0	Yes
L344104	CB34489	CB34497	241.59	0.41	CIRCULAR	30	30	26	854.3	854.3	2	Yes
L344105	CB34474	CB34476	97.57	1.47	CIRCULAR	30	30	50	854.3	854.3	0	No
L34412	CB34414	CB34412	217	0.3	CIRCULAR	27	27	17	855.5	852.1	19	Yes
L34414	P34418	CB34414	380	0.42	CIRCULAR	24	24	15	854.3	855.5	19	Yes
L34415	P34316	CB34414	30	12.17	CIRCULAR	15	15	23	852.3	855.5	4	No
L34416	CB34418	P34418	157	0.21	CIRCULAR	42	42	46	854.4	854.3	37	Yes
L34417	CB34430	P34418	51	1	CIRCULAR	18	18	11	854.4	854.3	9	Yes
L34418	CB34420	CB34418	155	0.43	CIRCULAR	36	36	44	854.4	854.4	35	Yes

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L34420	CB34422	CB34420	450	0.34	CIRCULAR	36	36	39	854.4	854.4	28	No
L34422	CB34424	CB34422	219	0.39	CIRCULAR	30	30	26	855.6	854.4	22	No
L34424	CB34426	CB34424	219	0.61	CIRCULAR	24	24	18	856.5	855.6	15	No
L34426	CB34428	CB34426	143	0.44	CIRCULAR	24	24	15	857.3	856.5	15	No
L34430	CB34432	CB34430	65	1.25	CIRCULAR	15	15	7	854.4	854.4	9	Yes
L34432	P34434	CB34432	32	3.28	CIRCULAR	15	15	12	854.4	854.4	4	Yes
L34433	CB34433	CB34432	30	1.97	CIRCULAR	15	15	9	855.5	854.4	11	Yes
L34434	CB34436	P34434	54	0.43	CIRCULAR	36	36	44	854.4	854.4	26	Yes
L34436	CB34438	CB34436	149	0.13	CIRCULAR	36	36	24	854.4	854.4	26	Yes
L34438	CB34440	CB34438	333	0.4	CIRCULAR	30	30	26	854.4	854.4	25	No
L34442	CB34444	CB34442	183	0.59	CIRCULAR	24	24	17	855.8	854.9	14	No
L34444	CB34446	CB34444	282	0.72	CIRCULAR	15	15	5	857.5	855.8	4	No
L34448	CB34450	CB34448	204	0.84	CIRCULAR	18	18	10	852.3	854.8	11	Yes
L34450	CB34454	CB34450	168	0.21	CIRCULAR	18	18	5	853.3	852.3	8	Yes
L34451	P34451	CB34450	32	0.31	CIRCULAR	18	18	6	852.2	852.3	15	Yes
L34452	P34452	CB34450	62	0.48	CIRCULAR	18	18	7	852.3	852.3	7	Yes
L34454	CB34456	CB34454	267	0.25	CIRCULAR	18	18	5	854.7	853.3	8	Yes
L34456	CB34458	CB34456	140	0.36	CIRCULAR	15	15	4	857.1	854.7	7	Yes
L34458	P34460	CB34458	2.61	100	CIRCULAR	27	27	310	855.0	857.1	84	No
L34459	CB34493	CB34494	33.37	0.27	CIRCULAR	18	18	5	854.3	854.3	0	No
L34460	CB34496	CB34497	122.82	1.15	CIRCULAR	18	18	11	854.3	854.3	1	Yes
L34461	CB34494	CB34496	136.81	1.36	CIRCULAR	18	18	12	854.3	854.3	0	No
L34462	CB34495	CB34496	103.55	0.69	CIRCULAR	18	18	9	854.3	854.3	2	Yes
L34463	CB34492	CB34493	81.16	0.36	CIRCULAR	18	18	6	854.3	854.3	0	No
L34464	CB34497	CB34498	38.88	1.8	CIRCULAR	36	36	90	854.3	854.3	3	Yes
L34465	CB34498	P34418	45	0.82	CIRCULAR	36	36	60	854.3	854.3	3	Yes
L34466	CB34491	CB34497	119.39	1.37	CIRCULAR	18	18	12	854.3	854.3	0	Yes
L34467	CB34490	CB34491	109.2	0.62	CIRCULAR	18	18	8	854.3	854.3	0	Yes

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L34468	CB344102	CB344103	36.58	0.36	CIRCULAR	18	18	6	854.3	854.3	0	Yes
L34469	CB344104	CB344105	132.01	-0.05	CIRCULAR	21	21	4	854.3	854.3	0	Yes
L34470	CB344103	CB344104	72.86	2.14	CIRCULAR	21	21	23	854.3	854.3	0	Yes
L34471	CB344105	CB344106	117.23	0.38	CIRCULAR	21	21	10	854.3	854.3	1	Yes
L34472	CB344106	P34418	47	0.21	CIRCULAR	24	24	10	854.3	854.3	1	Yes
L34473	CB344100	P34418	20	1	CIRCULAR	12	12	10	854.3	854.3	0	Yes
L34474	CB34499	P34418	20	1	CIRCULAR	12	12	7	854.3	854.3	0	Yes
L34475	CB34459	CB34460	31.4	7.36	CIRCULAR	12	12	10	858.5	856.2	0	No
L34476	CB34461	CB34462	23.73	12.73	CIRCULAR	12	12	13	858.5	855.5	0	No
L34477	CB34460	CB34462	69.2	0.94	CIRCULAR	18	18	10	856.2	855.5	0	No
L34478	CB34462	CB34463	77.68	0.33	CIRCULAR	18	18	6	855.5	855.3	0	No
L34479	CB34463	CB34465	94.68	0.25	CIRCULAR	18	18	5	855.3	855.0	0	No
L34480	CB34464	CB34465	24.77	4.84	CIRCULAR	12	12	8	856.2	855.0	0	No
L34481	CB34465	CB34474	38.36	5.14	CIRCULAR	18	18	24	855.0	854.3	0	No
L34482	CB34466	CB34467	36	0.44	CIRCULAR	12	12	2	855.9	855.8	0	No
L34483	CB34467	CB34468	42.89	0.49	CIRCULAR	12	12	2	855.8	855.6	0	No
L34484	CB34468	CB34469	89.41	0.83	CIRCULAR	18	18	10	855.6	854.8	0	No
L34485	CB34469	CB34470	179.48	0.53	CIRCULAR	18	18	8	854.8	854.3	0	No
L34486	CB34471	CB34472	32.86	0.79	CIRCULAR	12	12	3	855.9	855.6	0	No
L34487	CB34472	CB34470	61.69	2.8	CIRCULAR	12	12	6	855.6	854.3	0	No
L34488	CB34470	CB34473	60.49	0.31	CIRCULAR	18	18	6	854.3	854.3	0	No
L34489	CB34473	CB34474	59.35	1.1	CIRCULAR	18	18	11	854.3	854.3	0	No
L34490	CB34475	CB34476	42.98	7.38	CIRCULAR	18	18	29	854.8	854.3	0	No
L34491	CB34477	CB34478	35.24	6.07	CIRCULAR	18	18	26	854.3	854.3	0	No
L34492	CB34476	CB34478	147.21	0	CIRCULAR	30	30	1	854.3	854.3	1	Yes
L34493	CB34479	CB34480	139.99	0.34	CIRCULAR	18	18	6	854.5	854.3	0	No
L34494	CB34480	CB34481	118.29	0.74	CIRCULAR	18	18	9	854.3	854.3	0	No
L34495	CB34481	CB34483	99.83	0.56	CIRCULAR	18	18	8	854.3	854.3	0	No

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L34496	CB34482	CB34483	133.04	0.56	CIRCULAR	18	18	8	854.3	854.3	0	No
L34497	CB34483	CB34478	108.36	0.88	CIRCULAR	18	18	10	854.3	854.3	0	Yes
L34498	CB34478	CB34484	126.56	-0.37	CIRCULAR	30	30	25	854.3	854.3	1	No
L34499	CB34484	CB34485	123.45	0.5	CIRCULAR	30	30	29	854.3	854.3	2	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L01306	P01308	P01306	50	5	Filled Circula	6	18	4	871.1	867.4	1	No
L03312	P03314	J03312	70	1.43	CIRCULAR	18	18	11	882.7	881.1	4	No
L03419	P03432	P03418	150	0.67	CIRCULAR	18	18	7	888.8	888.3	0	No
L04402	P06404	J06402	98.38	0.51	CIRCULAR	18	18	6	888.4	887.3	9	No
L05336	P05338	J05136	20	5	CIRCULAR	42	42	195	887.2	885.2	32	No
L05338	P05340	P05338	150	2.67	CIRCULAR	42	42	142	891.2	887.2	31	No
L06408	P06410	J06408	107.95	0.93	CIRCULAR	18	18	9	891.0	889.1	6	No
L06412	P06414	J06412	96.03	2.08	CIRCULAR	18	18	13	902.5	900.1	2	No
L06416	P06418	J06416	99.94	2	CIRCULAR	18	18	13	901.5	899.1	3	No
L06419	J06420	J06419	39.28	20.37	CIRCULAR	18	18	41	909.0	900.2	20	No
L06422	P06424	J06422	106.7	0.47	CIRCULAR	18	18	6	910.3	909.6	1	No
L07102	P07107	P07102	100	0.5	CIRCULAR	24	24	14	892.2	892.2	6	yes
L07107	P07106	P07107	100	0.2	CIRCULAR	24	24	9	892.3	892.2	7	yes
L07202	P07204	J07202	300	4.33	CIRCULAR	18	18	13	885.6	872.4	3	No
L07204	P07206	P07204	77	10.39	CIRCULAR	18	18	20	900.4	885.6	20	No
L07206	J07208	P07206	100	0.5	CIRCULAR	18	18	6	901.3	900.4	13	yes
L07414	P07102	P07414	100	0.5	CIRCULAR	15	15	4	892.2	892.2	4	yes
L08302	P08304	J08302	90	2.78	CIRCULAR	18	18	15	886.4	883.6	1	No
L08328	P08330	J08328	91.17	1.1	Arch	60	108	481	870.2	870.1	81	No
L08406	CB08408	P08406	50	0.2	CIRCULAR	15	15	3	887.1	887.1	9	yes
L08407	P08418	P08408	50	11.4	CIRCULAR	18	18	22	892.4	885.0	10	No
L08408	P08416	P08408	35	0.57	CIRCULAR	15	15	4	885.0	885.0	8	yes
L08409	CB08406	P08406	50	3	CIRCULAR	18	18	16	888.6	887.1	19	yes
L08410	P07112	P08410	130	1.15	Arch	27.6	18	23	890.4	889.8	2	No
L08416	CB08420	P08416	30	13.33	CIRCULAR	15	15	20	885.0	885.0	10	No
L08417	CB08418	P08416	50	0.2	CIRCULAR	15	15	3	887.4	885.0	11	yes
L08418	P08420	P08418	105	1.05	CIRCULAR	15	15	6	896.2	892.4	9	No
L09123	P09434	P09122	1659.56	0.03	CIRCULAR	15	15	1	885.6	890.0	1	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L09218	P09320	J09218	110	0.23	Arch	60	108	219	867.1	866.9	89	No
L09324	P09426	P09424	100	0.5	CIRCULAR	15	15	4	892.8	892.0	0	No
L09326	P09428	P09426	1100.57	0.05	CIRCULAR	15	15	1	892.0	892.8	1	No
L09330	P09432	P09330	818.23	1.28	CIRCULAR	15	15	6	887.9	873.4	7	No
L10110	P10412	J10110	90	0.56	Arch	84	138	766	865.4	865.3	91	No
L10112	P10114	J10112	115	0.43	rizontal Ellip	18	24	11	886.8	885.7	6	No
L10122	P10122	P10120	100	1	CIRCULAR	15	15	6	888.5	888.6	1	No
L17405	P17407	P17404	100	3	CIRCULAR	15	15	10	873.5	874.2	0	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
2P Pipe	2P	1P	172	0.58	CIRCULAR	21	21	10	869.5	868.6	15	Yes
3P pipe	3P	2P	115	0.55	CIRCULAR	18	18	7	871.1	869.5	9	No
L17400	P17400	CB17400	107.87	-0.76	CIRCULAR	15	15	5	872.0	871.9	1	No
L17402	CB17401	MH17401	51.89	1.16	CIRCULAR	15	15	6	871.7	871.5	1	No
L174111	P17406	CB17402	100	0.3	CIRCULAR	15	15	3	873.3	873.0	0	No
L174112	CB17402	CB17403	31	0.65	CIRCULAR	15	15	5	873.0	872.8	0	No
L174113	CB17403	J17405	181.73	0.72	CIRCULAR	15	15	5	872.8	872.0	0	No
L18302	CB18304	J18302	195	0.39	CIRCULAR	24	24	14	883.1	868.7	27	No
L18304	CB18306	CB18304	48	0.15	CIRCULAR	24	24	9	883.2	883.1	8	No
L18305	CB18310	CB18304	168.05	1.79	CIRCULAR	15	15	9	885.4	883.1	8	Yes
L18306	CB18308	CB18306	224.92	0.12	CIRCULAR	15	15	2	883.7	883.2	5	Yes
L18307	CB18312	CB18304	484	0.4	CIRCULAR	15	15	4	886.5	883.1	6	Yes
L18312	CB18314	CB18312	169	0.5	CIRCULAR	15	15	5	887.0	886.5	6	Yes
L18316	J18318	L18316	164	6.9	CIRCULAR	15	15	15	879.2	868.5	6	No
L18318	CB18320	J18318	350	0.35	CIRCULAR	15	15	3	884.5	879.2	6	No
L18322	CB18324	J18322	320	4.54	CIRCULAR	15	15	14	881.9	868.6	12	No
L18326	CB18328	J18326	195	0.39	CIRCULAR	24	24	14	880.8	878.1	12	No
L18328	CB18330	CB18328	48	0.13	CIRCULAR	24	24	8	881.9	880.8	1	No
L18329	CB18340	CB18328	293	0.2	CIRCULAR	18	18	5	884.6	880.8	9	Yes
L18330	J18332	CB18330	275	0.1	CIRCULAR	15	15	2	882.5	881.9	1	No
L18336	CB18338	J18336	198	0.29	CIRCULAR	15	15	3	890.3	885.9	5	No
L18339	CB18339	CB18338	68	0.28	CIRCULAR	15	15	3	893.5	890.3	11	Yes
L20306	P20400	P20306	125	0	CIRCULAR	24	24	1	870.2	869.8	0	No
L21202-E	P21204-E	P21202-E	90	0.33	CIRCULAR	15	15	4	868.4	868.3	3	Yes
L21204-E	P21206-E	P21204-E	86	0.58	CIRCULAR	15	15	4	868.5	868.4	4	Yes
L21400	P21402	P21400	100	2	CIRCULAR	24	24	28	876.9	867.8	9	No
L27300	CB27302	J27300	176.06	0.01	CIRCULAR	18	18	15	863.5	863.4	5	No
L27301	P27306	J27300	120.3	0.06	CIRCULAR	18	18	3	862.9	863.4	4	No

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L27302	CB27304	CB27302	153.25	0.03	CIRCULAR	18	18	2	863.5	863.5	3	Yes
L27308	P34400	O27308	90	0	Arch	18	15	0	863.1	860.0	3	No
L28100	P28102	CB28100	1050	0.25	Arch	45	72	99	865.3	864.5	68	Yes
L28100-E	CB28102-E	CB28136	120.01	-0.52	CIRCULAR	24	24	16	865.5	865.4	11	Yes
L28101	J28116	P28102	10	0	CIRCULAR	15	15	1	865.3	865.3	5	Yes
9P outlet	9P	1P	108	4.31	CIRCULAR	15	15	12	868.6	868.6	3	Yes
L28102-E	P28104-E	CB28102-E	415	0.36	CIRCULAR	24	24	14	864.3	865.5	12	No
L28103	CB28130	P28102	50	0.1	CIRCULAR	24	24	7	865.4	865.3	21	Yes
L28104	CB28106	P28104	43	0.22	Arch	36	58	53	865.3	865.3	64	Yes
L28104-E	P28106-E	P28104-E	70	0.71	CIRCULAR	18	18	9	865.8	864.3	10	No
L28105	J28132	P28102	150	0.39	CIRCULAR	60	60	152	865.3	865.3	80	No
L28105-E	MH28154-E	P28104-E	90	0.11	CIRCULAR	18	18	42	865.9	864.3	8	No
L28106	CB28254	P28104	70	0.21	CIRCULAR	42	42	43	865.4	865.3	41	Yes
L28106a	CB28108	CB28106	56	0.2	Arch	36	58	50	865.4	865.3	58	Yes
L28106-E	CB28108-E	P28106-E	100	0.46	CIRCULAR	48	48	97	866.8	865.8	33	No
L28107	CB28120	P28104	67	0.55	CIRCULAR	33	33	36	865.4	865.3	37	Yes
L28107a	CB28146	P28102	50	0.76	CIRCULAR	48	48	116	865.3	865.3	76	Yes
L28107-E	CB28142-E	P28106-E	282.65	0.18	CIRCULAR	18	18	4	867.9	865.8	7	No
L28108	J28110	CB28108	208	0.5	CIRCULAR	36	36	44	868.1	865.4	28	Yes
L28108-E	CB28110-E	CB28108-E	94.51	0.28	CIRCULAR	30	30	22	867.8	866.8	31	No
L28109	J28156	P28102	120	0.1	CIRCULAR	54	54	58	865.3	865.3	58	Yes
L28109-E	CB28138-E	CB28110-E	209.73	1.56	CIRCULAR	12	12	4	868.5	867.8	2	No
L28110	CB28112	J28110	300	0.5	CIRCULAR	30	30	27	869.5	868.1	28	Yes
L28110-E	CB28112-E	CB28110-E	110	0.55	CIRCULAR	27	27	23	869.2	867.8	28	Yes
L28111	CB28256	P28104	50	0.38	CIRCULAR	21	21	9	865.3	865.3	5	Yes
L28111-E	CB28134-E	CB28110-E	163.57	0.41	CIRCULAR	15	15	4	868.2	867.8	4	Yes
L28112	CB28114	CB28112	320	0.5	CIRCULAR	24	24	15	870.0	869.5	13	Yes
L28112-E	CB28114-E	CB28112-E	186.54	0.36	CIRCULAR	27	27	19	870.6	869.2	23	Yes

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L28113-E	CB28140-E	CB28112-E	223.47	1.24	CIRCULAR	12	12	4	871.8	869.2	4	Yes
L28114-E	CB28116-E	CB28114-E	218.56	0.69	CIRCULAR	27	27	26	871.0	870.6	11	Yes
L17401	CB17400	CB17401	27	-0.3	CIRCULAR	15	15	3	871.9	871.7	1	No
L28115-E	CB28124-E	CB28114-E	62.98	0.79	CIRCULAR	24	24	20	870.9	870.6	14	Yes
L28116-E	CB28118-E	CB28116-E	286.64	0.23	CIRCULAR	21	21	8	871.8	871.0	6	Yes
L28118	P28104	N28118	10	0	CIRCULAR	15	15	1	865.3	865.3	7	Yes
L28118-E	CB28120-E	CB28118-E	134.75	1.22	CIRCULAR	15	15	7	870.9	871.8	1	No
L28119-E	CB28122-E	CB28118-E	78.67	0.6	CIRCULAR	18	18	8	872.6	871.8	5	Yes
L28120	J28122	CB28120	250	1	CIRCULAR	18	18	10	867.7	865.4	11	Yes
L28121	J28126	CB28120	191	0.5	CIRCULAR	30	30	27	865.8	865.4	24	Yes
L28122	P28124	J28122	40	0.5	CIRCULAR	18	18	7	868.2	867.7	12	Yes
L28124-E	CB28126-E	CB28124-E	332.53	0.23	CIRCULAR	24	24	11	871.3	870.9	11	Yes
L28126	CB28128	J28126	200	0.49	CIRCULAR	30	30	27	867.8	865.8	24	Yes
L28126-E	CB28128-E	CB28126-E	137.89	0.23	CIRCULAR	21	21	8	871.6	871.3	7	Yes
L28128-E	CB28132-E	CB28128-E	316.76	0.32	CIRCULAR	18	18	6	872.6	871.6	7	Yes
L28129-E	CB28130-E	CB28128-E	194.16	0.22	CIRCULAR	12	12	2	872.0	871.6	2	Yes
L28132	CB28134	J28132	300	0.09	CIRCULAR	60	60	74	865.3	865.3	81	No
L28134a	CB28136	CB28134	130	0.42	CIRCULAR	54	54	119	865.4	865.3	55	No
L28134-E	P28136-E	CB28134-E	193.08	0.83	CIRCULAR	15	15	6	867.8	868.2	4	No
L28136	J28138	CB28136	100	0.69	CIRCULAR	30	30	32	866.0	865.4	21	Yes
L28136-E	P21202-E	P28136-E	100	0.2	CIRCULAR	18	18	3	868.3	867.8	4	No
L28137	CB28144	CB28136	300	0.65	CIRCULAR	27	27	23	870.4	865.4	21	Yes
L28138	CB28140	J28138	250	0.44	CIRCULAR	27	27	19	869.9	866.0	21	Yes
L28143-E	MH28144-E	P28143-E	30	2.5	CIRCULAR	48	48	227	866.2	866.2	17	No
L28144-E	MH28146-E	MH28144-E	19.78	0.51	CIRCULAR	48	48	102	866.2	866.2	10	No
L28145-E	MH28148-E	MH28146-E	64.82	0.08	CIRCULAR	12	12	1	866.7	866.2	3	Yes
L28146	CB28148	CB28146	220	0.12	Arch	36	58	39	867.3	865.3	68	Yes
L28146-E	MH28150-E	MH28146-E	399.16	-0.03	CIRCULAR	36	36	11	866.4	866.2	7	No

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L28148	CB28150	CB28148	600	0.21	CIRCULAR	27	27	13	869.6	867.3	23	Yes
L28149	CB28154	CB28148	350	0.54	CIRCULAR	33	33	36	871.1	867.3	24	Yes
L28150	CB28152	CB28150	320	0.13	CIRCULAR	27	27	11	871.8	869.6	6	Yes
L28150-E	MH28152-E	MH28150-E	296.88	0.13	CIRCULAR	30	30	15	866.5	866.4	4	No
L28154-E	P28143-E	MH28154-E	40	0	CIRCULAR	18	18	1	866.2	865.9	12	Yes
L28156	CB28158	J28156	100	0.1	CIRCULAR	27	27	9	865.4	865.3	21	Yes
L28157	CB28162	J28156	300	0.1	CIRCULAR	30	30	12	865.3	865.3	14	Yes
L28158	CB28160	CB28158	180	0.39	CIRCULAR	21	21	9	866.4	865.4	14	Yes
L28159	CB28164	J28156	280	0.1	CIRCULAR	42	42	30	865.3	865.3	25	Yes
L28164	CB28166	CB28164	365	0.1	CIRCULAR	42	42	29	865.4	865.3	24	Yes
L28188	J28490	J28488	400	0.5	CIRCULAR	36	36	41	865.8	870.0	27	Yes
L28201	P28310	J28202	20	-0.15	CIRCULAR	48	48	52	862.4	861.4	111	Yes
L28202	J28204	J28202	120.29	0.12	CIRCULAR	60	60	218	861.4	861.4	37	Yes
L28204	J28206	J28204	141	0.1	CIRCULAR	60	60	76	861.4	861.4	37	Yes
L28206	J28208	J28206	343	0.1	CIRCULAR	60	60	71	861.3	861.4	37	Yes
L28208	J28210	J28208	360	0.1	CIRCULAR	60	60	76	861.1	861.3	37	Yes
L28210	J28212	J28210	360	0.1	CIRCULAR	60	60	76	861.0	861.1	37	Yes
L28212	J28214	J28212	360	0.1	CIRCULAR	60	60	76	860.9	861.0	37	Yes
L28214	J28216	J28214	360	0.1	CIRCULAR	60	60	76	860.8	860.9	37	Yes
L28216	J28218	J28216	246	0.1	CIRCULAR	60	60	77	862.2	860.8	151	Yes
L28218	P28220	J28218	210	2.33	Rectangular	36	84	352	863.5	862.2	151	Yes
L28219	P28228	P28220	591	-0.04	Arch	72	114	135	863.4	863.5	150	Yes
L28220	J28222	P28220	106	-0.33	Arch	54	88	193	863.6	863.5	94	Yes
L28221	CB28250	P28220	150	-0.31	CIRCULAR	36	36	35	864.9	863.5	50	Yes
L28222	CB28224	J28222	179	0.13	Arch	54	88	123	863.8	863.6	94	Yes
L28223	CB28252	P28220	200	-0.21	CIRCULAR	30	30	17	864.5	863.5	28	Yes
L28224	CB28226	CB28224	500	0.1	Arch	54	87	104	864.2	863.8	73	Yes
L28225	J27300	P28220	341.37	1.74	CIRCULAR	24	24	30	863.4	863.5	4	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L28226	CB28100	CB28226	300	0.1	Arch	54	87	102	864.5	864.2	73	Yes
L28228	CB28230	P28228	239	0.07	Arch	72	114	181	863.4	863.4	152	Yes
L28230	CB28232	CB28230	365	0.07	Arch	54	88	88	863.4	863.4	104	Yes
L28231	J28246	CB28230	750	0.17	Arch	36	58	46	865.4	863.4	32	Yes
L28232	CB28234	CB28232	265	0.07	Arch	54	88	87	863.3	863.4	77	Yes
L28234	J28236	CB28234	440	0.07	Arch	54	88	88	863.8	863.3	80	Yes
L28236	J28238	J28236	340	0.13	Arch	54	88	121	864.1	863.8	80	Yes
L28237	P28244	J28238	125	1.18	Arch	31	51	85	864.6	864.1	36	Yes
L28238	J28240	J28238	260	0.1	CIRCULAR	60	60	75	865.0	864.1	45	Yes
L28240	P28242	J28240	200	0.11	CIRCULAR	42	42	30	864.4	865.0	18	Yes
L28244	P28326	P28244	200	0.38	Arch	31	51	48	865.2	864.6	33	Yes
L28246	P28248	J28246	280	0.1	CIRCULAR	33	33	16	864.0	865.4	13	Yes
L28300	J28302	J28300	300	1.63	CIRCULAR	42	42	111	851.7	846.7	28	No
L28301	P28334	Mh28305	44	-3	CIRCULAR	30	30	62	854.3	853.5	28	Yes
L28302	P28304	P28334	146	0.25	CIRCULAR	42	42	47	854.4	854.3	25	Yes
L28303	Mh28305	J28302	400	0.1	CIRCULAR	42	42	28	853.5	851.7	28	No
L28305	MH28306	J28302	129.86	0.32	CIRCULAR	42	42	2	851.7	851.7	0	No
L28306	J28200	I28337	6.03	3.48	CIRCULAR	72	72	785	854.4	862.0	4	No
L28310	CB28312	P28310	187	0.18	CIRCULAR	54	54	153	863.0	862.4	137	Yes
L28312	CB28314	CB28312	560	0.1	CIRCULAR	84	84	188	863.3	863.0	119	No
L28314	CB28316	CB28314	357	0.1	CIRCULAR	84	84	188	863.6	863.3	105	No
L28316	CB28318	CB28316	506	0.1	CIRCULAR	84	84	188	863.8	863.6	95	No
L28317	CB28400	CB28318	650	0.1	CIRCULAR	72	72	124	863.9	863.8	66	No
L28318	P28320	CB28318	340	0.2	CIRCULAR	48	48	60	864.3	863.8	50	Yes
L28320	CB28324	P28320	300	1.34	CIRCULAR	18	18	11	868.1	864.3	10	Yes
L28321	CB28322	P28320	660	0.26	CIRCULAR	24	24	11	865.1	864.3	7	Yes
L28326	CB28328	P28326	400	0.1	Arch	26	43	16	866.5	865.2	23	Yes
L28400	J28102	CB28400	500	0.1	CIRCULAR	72	72	122	863.9	863.9	38	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L28401	J28488	CB28400	600	0.2	CIRCULAR	36	36	28	870.0	863.9	27	Yes
L28402	J28404	J28102	125	0.05	CIRCULAR	42	42	20	863.9	863.9	34	Yes
L28403	CB28476	J28102	420	0.27	Arch	45	72	106	864.2	863.9	53	No
L28404	J28406	J28404	605	0.05	CIRCULAR	42	42	21	864.2	863.9	34	Yes
L28405	CB28454	P28408	220	0.1	CIRCULAR	72	72	122	864.3	864.3	100	No
L28406	P28408	J28406	100	0.15	Rectangular	24	60	33	864.3	864.2	130	Yes
L28407	CB28430	P28408	100	0.6	CIRCULAR	21	21	11	864.3	864.3	13	Yes
L28408	CB28410	P28408	215	0.05	CIRCULAR	54	54	41	864.5	864.3	33	No
L28409	J28432	P28408	150	0.27	CIRCULAR	60	60	126	864.3	864.3	14	No
L28410	P28412	CB28410	107	0.05	CIRCULAR	48	48	29	864.3	864.5	24	No
L28411	CB28426	CB28410	330	0.1	CIRCULAR	42	42	30	866.0	864.5	36	No
L28413	CB28470	P28408	100	0.14	CIRCULAR	48	48	50	864.3	864.3	40	Yes
L28414	P28416	P28414	116	0.22	CIRCULAR	30	30	18	867.2	864.3	36	No
L28415	CB28401	P28402	220	0.5	CIRCULAR	18	18	6	877.4	876.6	3	No
L28416	P29104	P28416	60	0.1	CIRCULAR	24	24	6	866.3	867.2	17	No
L28417	MH28401	MH28402	24.7	2.06	CIRCULAR	15	15	8	873.1	872.7	1	No
L28418	MH28402	MH28403	232.36	0.5	CIRCULAR	18	18	6	872.7	871.4	1	No
L28419	MH28403	MH28404	43.44	0.99	CIRCULAR	24	24	20	871.4	870.9	1	No
L28420	MH28404	MH28405	30.14	1	CIRCULAR	24	24	20	870.9	870.7	1	No
L28421	MH28405	CB28406	324.57	1.04	CIRCULAR	24	24	20	870.7	866.2	5	No
L28422	P28403	CB28406	432.27	0.14	CIRCULAR	27	27	10	866.4	866.2	1	No
L28423	CB28407	P28404	94.17	0.46	CIRCULAR	18	18	6	870.4	869.9	3	No
L28424	P28404	P28405	164.3	0.6	CIRCULAR	21	21	11	869.9	869.2	4	No
L28425	P28405	P28406	177.99	0.47	CIRCULAR	24	24	13	869.2	868.5	6	No
L28426	CB28428	CB28426	380	0.21	CIRCULAR	33	33	22	866.8	866.0	19	Yes
L28427	P28406	P28407	148.52	0.55	CIRCULAR	24	24	15	868.5	867.9	8	No
L28428	P28407	CB28408	168.11	0.47	CIRCULAR	24	24	13	867.9	866.8	9	No
L28429	CB28408	CB28409	140.84	0.5	CIRCULAR	30	30	25	866.8	865.9	9	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L28430	CB28409	CB28412	149.41	0.91	CIRCULAR	33	33	44	865.9	865.1	12	No
L28431	CB28406	CB28411	281.54	0.25	CIRCULAR	48	48	63	866.2	865.7	6	No
L28432	CB28434	P28440	214	0.26	Arch	45	72	103	864.3	863.6	32	No
L28433	CB28411	CB28412	315.8	0.14	CIRCULAR	60	60	84	865.7	865.1	18	No
L28434	CB28413	CB28411	142.32	1.1	CIRCULAR	36	36	61	866.4	865.7	11	No
L28435	CB28414	CB28413	87.52	1.58	CIRCULAR	30	30	45	867.8	866.4	7	No
L28436	CB28415	CB28414	109.46	0.59	CIRCULAR	24	24	15	868.8	867.8	7	No
L28437	CB28416	CB28415	98.08	0.53	CIRCULAR	18	18	7	869.0	868.8	3	No
L28439	P28410	CB28415	75.79	0.51	CIRCULAR	18	18	7	869.1	868.8	4	No
L28440	P28409	P28410	220.74	0.49	CIRCULAR	18	18	6	869.8	869.1	2	No
L28441	P28411	P28413	173.23	0.5	CIRCULAR	18	18	6	868.3	868.0	4	No
L28442	P28413	P28415	220.61	0.5	CIRCULAR	18	18	6	868.0	867.6	4	Yes
L28449	P28420	CB28412	142	0.39	CIRCULAR	15	15	3	861.8	865.1	0	No
L28454	CB28456	CB28454	300	0.23	CIRCULAR	54	54	88	865.3	864.3	80	No
L28455	J28466	CB28456	290	0.33	CIRCULAR	42	42	54	866.0	865.3	34	Yes
L28456	CB28458	CB28456	445	0.28	CIRCULAR	42	42	49	866.2	865.3	34	Yes
L28458	CB28460	CB28458	389	0.28	CIRCULAR	42	42	49	866.6	866.2	32	No
L28460	CB28462	CB28460	188	0.28	CIRCULAR	42	42	49	866.9	866.6	31	No
L28462	CB28464	CB28462	400	0.41	CIRCULAR	27	27	19	871.1	866.9	23	Yes
L28466	J28468	J28466	350	0.53	CIRCULAR	27	27	21	868.5	866.0	16	Yes
L28470	P28472	CB28470	360	0.13	CIRCULAR	33	33	18	864.4	864.3	23	Yes
L28472	P28474	P28472	150	0.1	CIRCULAR	33	33	16	865.0	864.4	23	Yes
L28475	CB28186	CB28476	100	0.27	CIRCULAR	54	54	95	864.2	864.2	1	No
L28476	J28478	CB28476	130	0.28	Arch	40	65	79	864.3	864.2	27	Yes
L28478	CB28480	J28478	210	0.1	CIRCULAR	42	42	30	864.5	864.3	28	No
L28480	CB28482	CB28480	170	0.11	CIRCULAR	42	42	30	864.7	864.5	25	No
L28482	CB28484	CB28482	150	0.11	CIRCULAR	42	42	31	864.8	864.7	18	No
L28484	P28486	CB28484	470	0.2	CIRCULAR	27	27	13	865.7	864.8	13	Yes

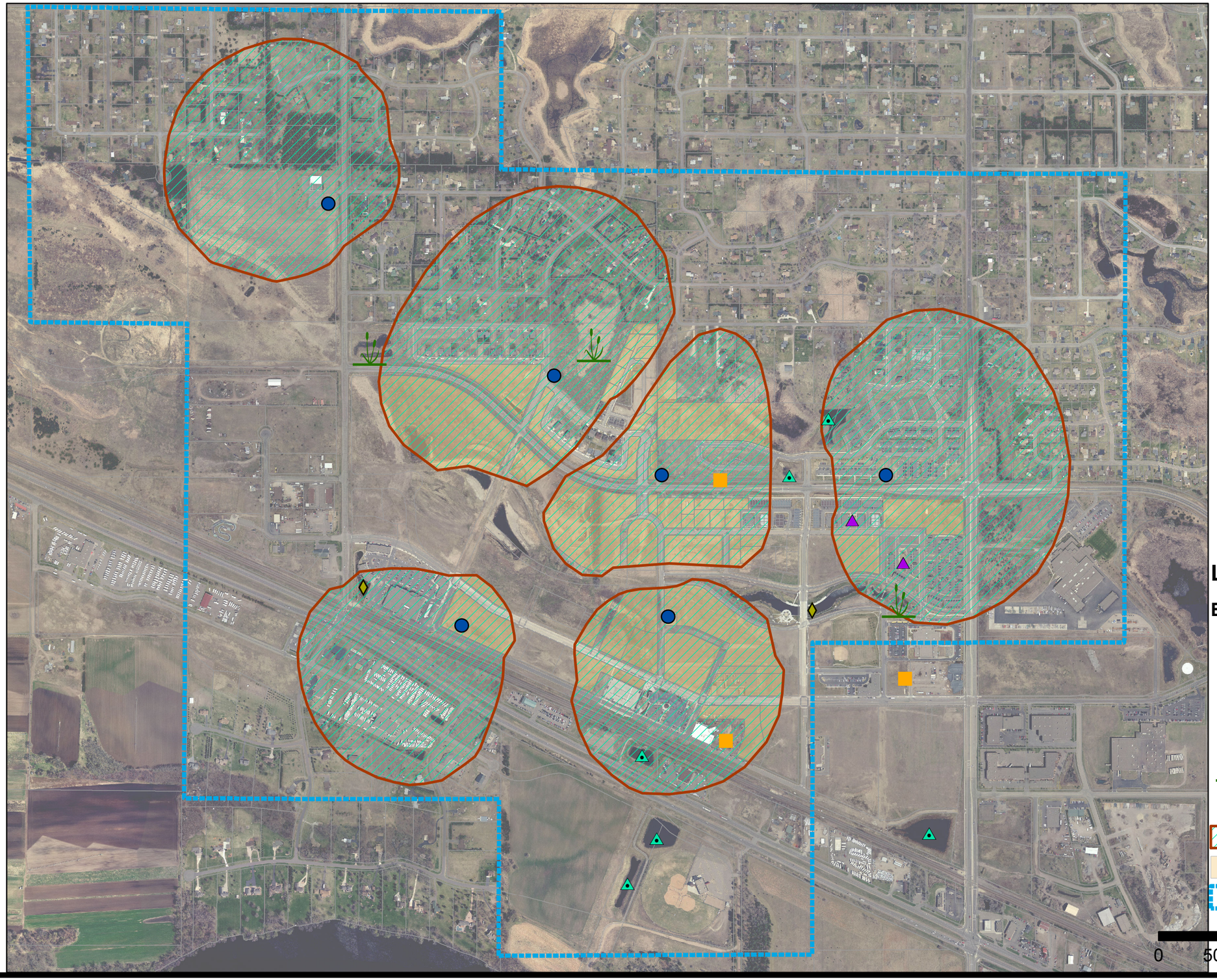
PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
L28490	P28492	J28490	56	-0.38	CIRCULAR	36	36	58	866.2	865.8	40	Yes
L28492	J28494	P28492	28	0.5	CIRCULAR	36	36	44	866.4	866.2	65	Yes
L28494	J28496	J28494	46	0.5	CIRCULAR	36	36	44	868.2	866.4	65	Yes
L28496	CB28498	J28496	12.5	0.4	CIRCULAR	36	36	39	869.0	868.2	65	Yes
L28497	CB29106	CB28498	80	0.2	CIRCULAR	36	36	28	869.4	869.0	39	Yes
L28498	CB28499	CB28498	76	0.5	CIRCULAR	24	24	15	870.1	869.0	25	Yes
L29100	P29102	CB29105	371.55	0.5	CIRCULAR	18	18	6	869.4	868.4	4	No
L29102	CB29105	P29100	26.71	1.87	CIRCULAR	18	18	12	868.4	868.4	4	Yes
L29104	CB29104	P29102	39.89	0.18	CIRCULAR	12	12	1	871.2	869.4	5	No
L30102	CB30104	O30101	345.94	0.23	CIRCULAR	24	24	11	852.8	849.0	16	Yes
L30104	CB30106	CB30104	244.41	0.08	CIRCULAR	18	18	36	852.0	852.8	9	Yes
L30106	CB30108	CB30106	802.88	1.18	CIRCULAR	12	12	4	862.0	852.0	4	Yes
L33404	J33408	O33404	10	10	CIRCULAR	4	4	1	842.5	850.5	4	Yes
L33408	J33410	J33408	176	1.51	CIRCULAR	42	42	107	861.3	842.5	98	Yes
L33410	J33412	J33410	294	1.5	CIRCULAR	42	42	114	843.0	861.3	28	No
L33412	J28300	J33412	300	1.49	CIRCULAR	42	42	114	846.7	843.0	28	No
L5065	5065	CB28100	257.71	0.57	CIRCULAR	24	24	15	867.8	864.5	22	Yes
L5066	5066	5065	214.13	0.51	CIRCULAR	24	24	14	866.4	867.8	11	Yes
L5067	5067	5066	218.78	0.42	CIRCULAR	18	18	6	867.5	866.4	4	Yes
L5073	5073	5065	66.74	0.72	CIRCULAR	15	15	5	868.9	867.8	4	Yes
L5074	5074	5066	65.95	0.86	CIRCULAR	21	21	13	866.5	866.4	10	Yes
L5200	5200	5067	103.59	0.29	CIRCULAR	15	15	3	866.5	867.5	2	Yes
L5202	5202	5067	41.18	0.44	CIRCULAR	18	18	6	867.2	867.5	3	Yes
L5203	5203	5202	94.35	0.35	CIRCULAR	18	18	5	867.2	867.2	4	Yes
L5204	5204	5203	99.58	0.27	CIRCULAR	18	18	5	866.7	867.2	5	Yes
L-A1	A1	5065	65	1	CIRCULAR	24	24	20	868.2	867.8	14	Yes
L-A2	A2	A1	165	1	CIRCULAR	21	21	14	868.2	868.2	9	Yes
L-A3	A3	A2	40	1	CIRCULAR	15	15	6	867.8	868.2	6	Yes

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
Link-05	J28353A	I28348	47	0.4	CIRCULAR	12	12	2	870.0	862.0	4	Yes
Link-06	J28376	J28374	7.13	1.96	CIRCULAR	18	18	13	874.0	873.9	0	No
Link-07	J28374	I28372	27.33	0.88	CIRCULAR	18	18	9	873.9	862.0	0	No
Link-08	J28362	P28336	127	0.31	CIRCULAR	30	30	23	860.8	860.4	23	No
Link-10	I28366	I28364	62.51	1.68	CIRCULAR	18	18	12	862.0	862.0	1	No
Link-11	CB28412	CB28434	57	0.14	Arch	45	72	72	865.1	864.3	32	No
Link-12	I28362	I28364	34.22	0.7	CIRCULAR	18	18	8	862.0	862.0	0	No
Link-13	I28364	I28368	56.5	0.81	CIRCULAR	18	18	8	862.0	862.0	2	No
Link-14	J28380	I28380	61.28	0.46	CIRCULAR	18	18	6	870.8	862.0	1	No
Link-15	I28380	J28378	21.43	1.49	CIRCULAR	18	18	11	862.0	870.3	2	No
Link-25	I28337	P28304	91.97	0.34	CIRCULAR	72	72	228	862.0	854.4	17	No
Link-26	J28433	P28418	371.31	0.08	CIRCULAR	42	42	25	867.3	867.2	13	Yes
Link-27	J28431	J28433	130.06	1.66	CIRCULAR	24	24	25	867.4	867.3	9	Yes
Link-30	P28415	P28417	162.38	0.5	CIRCULAR	21	21	10	867.6	867.3	7	Yes
Link-31	P28417	J28430	95.49	1.15	CIRCULAR	24	24	21	867.3	870.9	5	Yes
Link-32	J28430	J28433	163.57	0.62	CIRCULAR	33	33	36	870.9	867.3	12	Yes
Link-35	P-6	P29104	50	-1.6	CIRCULAR	36	36	219	874.3	866.3	4	No
Link-40	1P	1P outlet	32	-5	CIRCULAR	18	18	20	868.6	868.0	8	Yes
Link-42	1P outlet	RTC Connect	426	0.12	CIRCULAR	36	36	20	868.0	868.0	0	Yes
P-33	I28360	I28358	10.85	1.66	CIRCULAR	18	18	12	862.0	862.0	0	Yes
P-38A	I28352	I28356	69.17	0.39	CIRCULAR	15	15	4	862.0	862.0	3	No
P391	I28372	I28370	73.42	6.69	CIRCULAR	18	18	24	862.0	862.0	0	No
P392	I28370	J28372	92.42	0.94	CIRCULAR	18	18	9	862.0	868.6	5	No
Pipe - (11)	I28348	I28346	37.5	0.51	CIRCULAR	15	15	5	862.0	862.0	4	No
Pipe - (28)	I28378	I28376	36	0.33	CIRCULAR	18	18	10	862.0	862.0	2	No
Pipe 10	I28336	I28334	35	0.26	CIRCULAR	15	15	3	862.0	862.0	3	No
Pipe 11	CBMH13	J28360	55	0.58	CIRCULAR	24	24	17	862.0	857.6	8	No
Pipe 12	J28360	J28358	454	0.22	CIRCULAR	24	24	11	857.6	856.8	8	No

PIPE ID	FROM NODE	TO NODE	LENGTH (ft)	AVERAGE PIPE SLOPE %	PIPE SHAPE	PIPE DIAMETER (in)	PIPE WIDTH (in)	DESIGN FLOW CAPACITY (cfs)	MAXIMUM US HGL (ft)	MAXIMUM DS HGL (ft)	PEAK FLOW DURING ANALYSIS (CFS)	PIPE FLOWING FULL?
Pipe 14	CBMH 14	CBMH13	34	0.5	CIRCULAR	18	18	7	862.0	862.0	7	No
Pipe 15	I28340	I28338	36.74	0.49	CIRCULAR	15	15	5	862.0	862.0	2	No
Pipe 16	P28336	CBMH 14	116	0.72	CIRCULAR	15	15	6	860.4	862.0	6	No
Pipe 18	J28364	J28362	164	0.44	CIRCULAR	30	30	27	861.6	860.8	23	No
Pipe 19	J28366	J28364	243	0.44	CIRCULAR	30	30	27	862.6	861.6	23	No
Pipe 20a	I28338	J28366	320.21	0.44	CIRCULAR	30	30	27	862.0	862.6	23	No
Pipe 21	I28342	I28338	195	0.35	CIRCULAR	30	30	24	862.0	862.0	20	No
Pipe 22	I28346	I28342	164	0.35	CIRCULAR	27	27	18	862.0	862.0	17	No
Pipe 24	I28344	I28342	38.2	0.5	CIRCULAR	18	18	7	862.0	862.0	2	No
Pipe 25	J28368	I28346	384	0.24	CIRCULAR	27	27	15	866.3	862.0	12	No
Pipe 27	J28370	J28368	248	0.25	CIRCULAR	27	27	15	866.8	866.3	12	No
Pipe 28	I28354	J28370	236	0.49	CIRCULAR	24	24	16	862.0	866.8	12	No
Pipe 29	I28376	I28368	34	0.32	CIRCULAR	18	18	6	862.0	862.0	2	No
Pipe 3	J28356	I28337	96	0.36	CIRCULAR	18	18	6	861.8	862.0	0	No
Pipe 30	I28368	I28370	38	0.34	CIRCULAR	18	18	6	862.0	862.0	4	No
Pipe 31	I28374	J28376	33	0.64	CIRCULAR	18	18	8	862.0	874.0	0	No
Pipe 312	J28358	I28337	267	0.22	CIRCULAR	24	24	11	856.8	862.0	10	No
Pipe 32	J28372	I28354	121	0.6	CIRCULAR	18	18	8	868.6	862.0	5	No
Pipe 35	I28356	I28354	39.01	1.1	CIRCULAR	18	18	11	862.0	862.0	6	No
Pipe 36	J28378	I28378	34	0.5	CIRCULAR	15	15	5	870.3	862.0	2	No
Pipe 37	I28350	I28352	10.54	1.23	CIRCULAR	15	15	8	862.0	862.0	3	No
Pipe 4	J28354	J28356	164	0.35	CIRCULAR	18	18	6	862.4	861.8	0	No
Pipe 40	P28342	J28354	115.58	-1.3	CIRCULAR	18	18	10	861.7	862.4	5	No
Pipe 5	J28352	J28354	93	0.35	CIRCULAR	18	18	6	863.7	862.4	5	No
Pipe 6	J28350	J28352	321	0.35	CIRCULAR	18	18	6	864.8	863.7	5	No
Pipe 8	I28334	J28350	115	0.35	CIRCULAR	18	18	6	862.0	864.8	6	No
Pipe PL	P28340	I28344	26	1.96	CIRCULAR	12	12	5	867.3	862.0	0	No

Figures

2015 Infiltration Exhibit



N
W E
S

City of RAMSEY

Legend

BMP_Style

- Lined Pond
- Pond
- Raingarden
- Underground Infil
- Wetland
- Public Wells
- 10 Year Capture Zone
- COR Parcels in 10 Year Zone
- Drinking Water Supply Managment Area

0 500 1,000 2,000 3,000 Feet

City of RAMSEY

SLOPE AREAS MAP

FIGURE NO. 1
OCTOBER, 2015

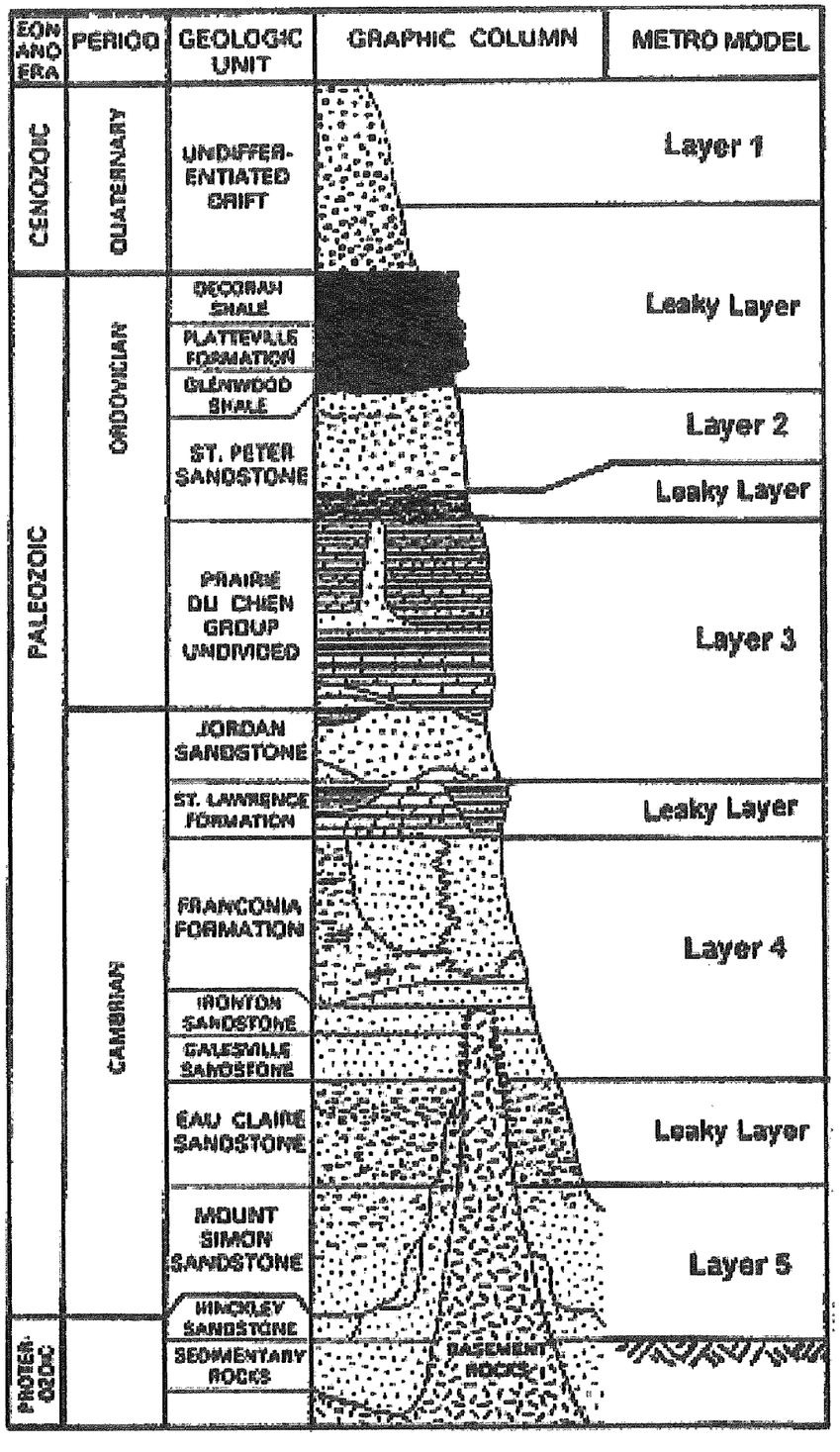
Legend

SLOPES

- Less than 12% Slopes
- 12% - 18% Slopes
- Greater than 18% Slopes

N

0 2,000 4,000 8,000 Feet



Source http://pca.state.mn.us/water/groundwater/mnoverview.html
2015 -Link Broken

City of RAMSEY

HYDROSTRATIGRAPHIC COLUMN AND CONCEPTURAL MODEL METROPOLITAN AREA GROUNDWATER MODEL - CONCEPTUAL

FIGURE 2
OCTOBER, 2015

GEOLOGIC SENSITIVITY OF THE UPPERMOST AQUIFER TO POLLUTION

FIGURE NO. 3
OCTOBER, 2015

Legend

Sensitivity Ratings

- Very High - Hours to Months
- High - Weeks to Years
- Moderate - Years to Decades
- Low - Decades to Years
- Water
- City Limits

Estimated travel time for water-borne contaminants at the land surface to reach the uppermost aquifer.

N

0 2,000 4,000 8,000 Feet

DRINKING WATER SUPPLY MANAGEMENT AREA MAP

FIGURE NO. 4
OCTOBER, 2015

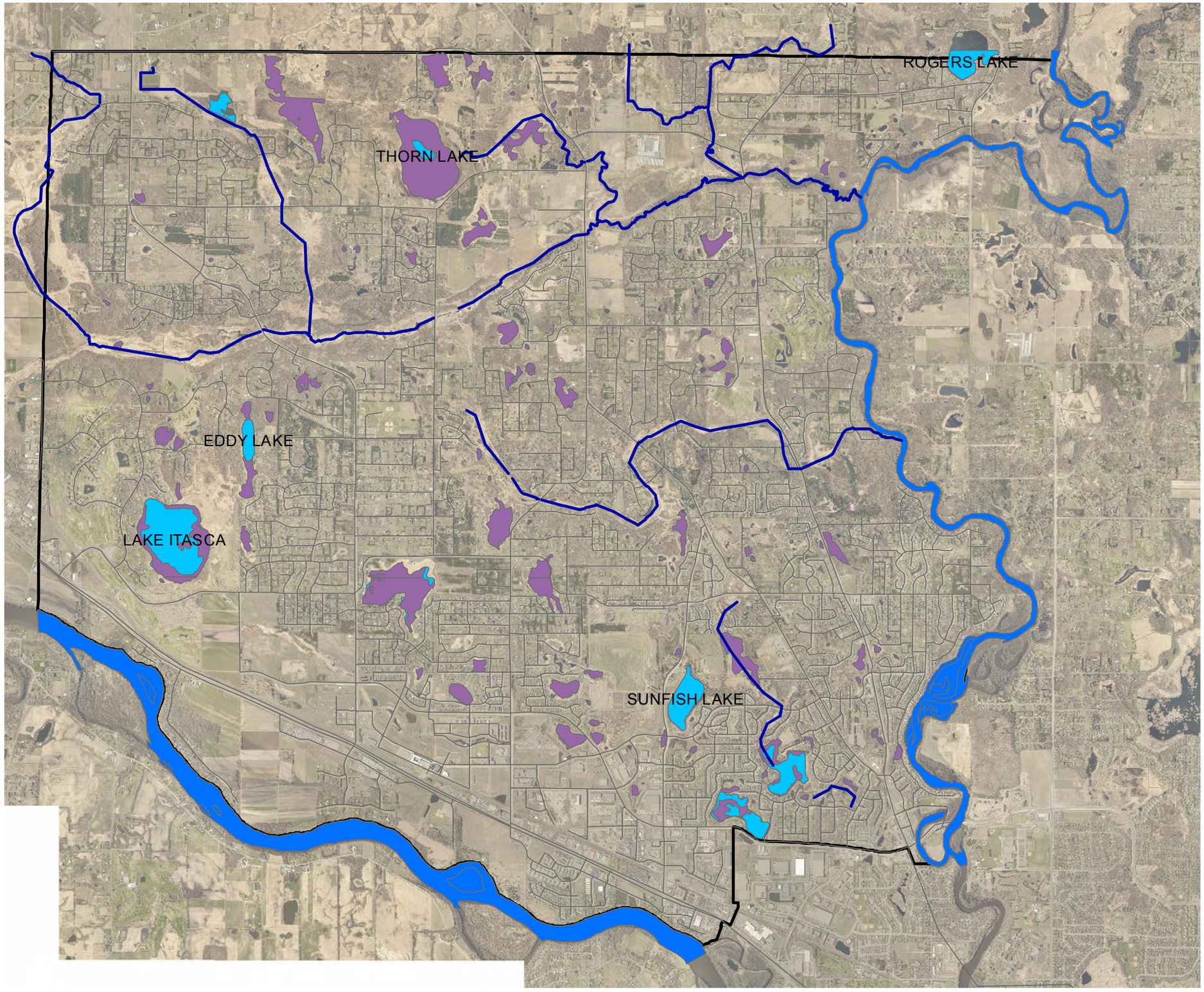
Legend

NWI_CODE

- Protected Waters
- Lakes and Ponds
- Capture Zones
- dwsma

N

0 2,000 4,000 8,000 Feet



City of RAMSEY

PUBLIC WATERS INVENTORY MAP

FIGURE NO. 5
OCTOBER, 2015

Legend

Creeks and Ditches

Rivers

NWI_CODE

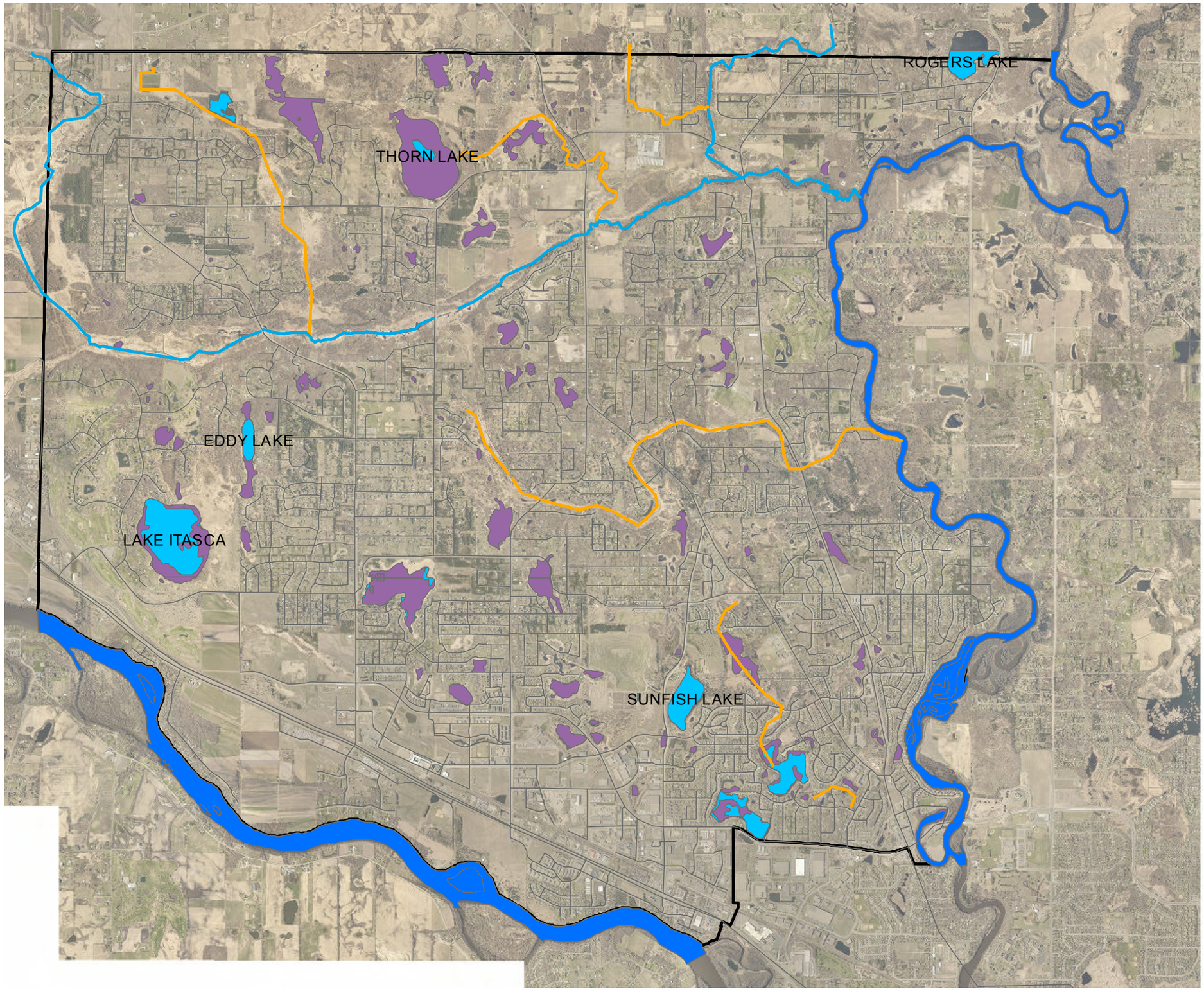
Protected Waters

Lakes and Ponds

N

Feet

0 2,000 4,000 8,000



City of RAMSEY

PUBLIC WATERS INVENTORY MAP WITH PUBLIC DITCHES (MS 103E)

FIGURE NO. 5A
OCTOBER, 2015

Legend

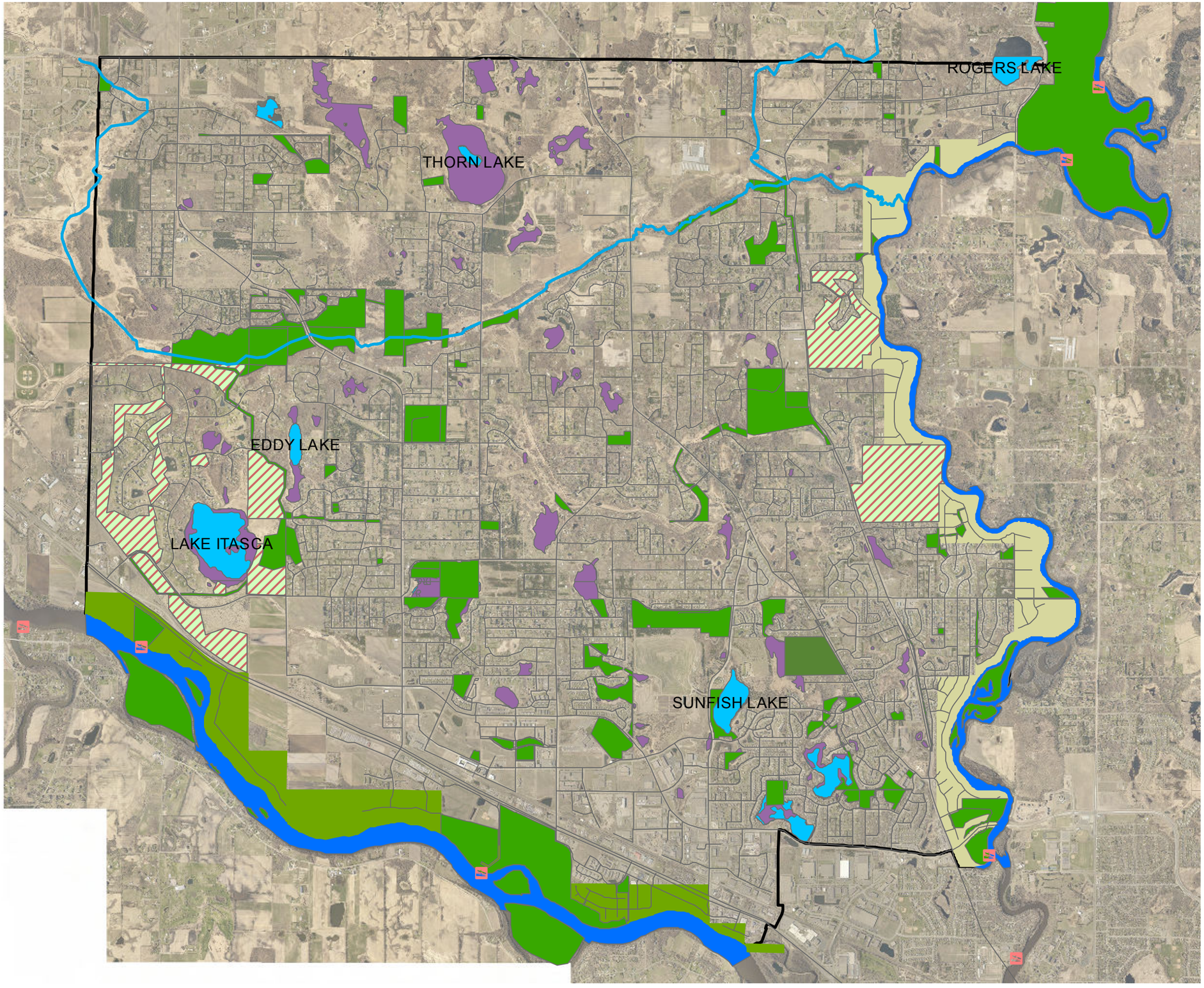
- County Ditches
- Brooks
- Rivers

NWI_CODE

- Protected Waters
- Lakes and Ponds

N

0 2,000 4,000 8,000 Feet



City of RAMSEY

PARKS MAP

FIGURE NO. 6
OCTOBER, 2015

Legend

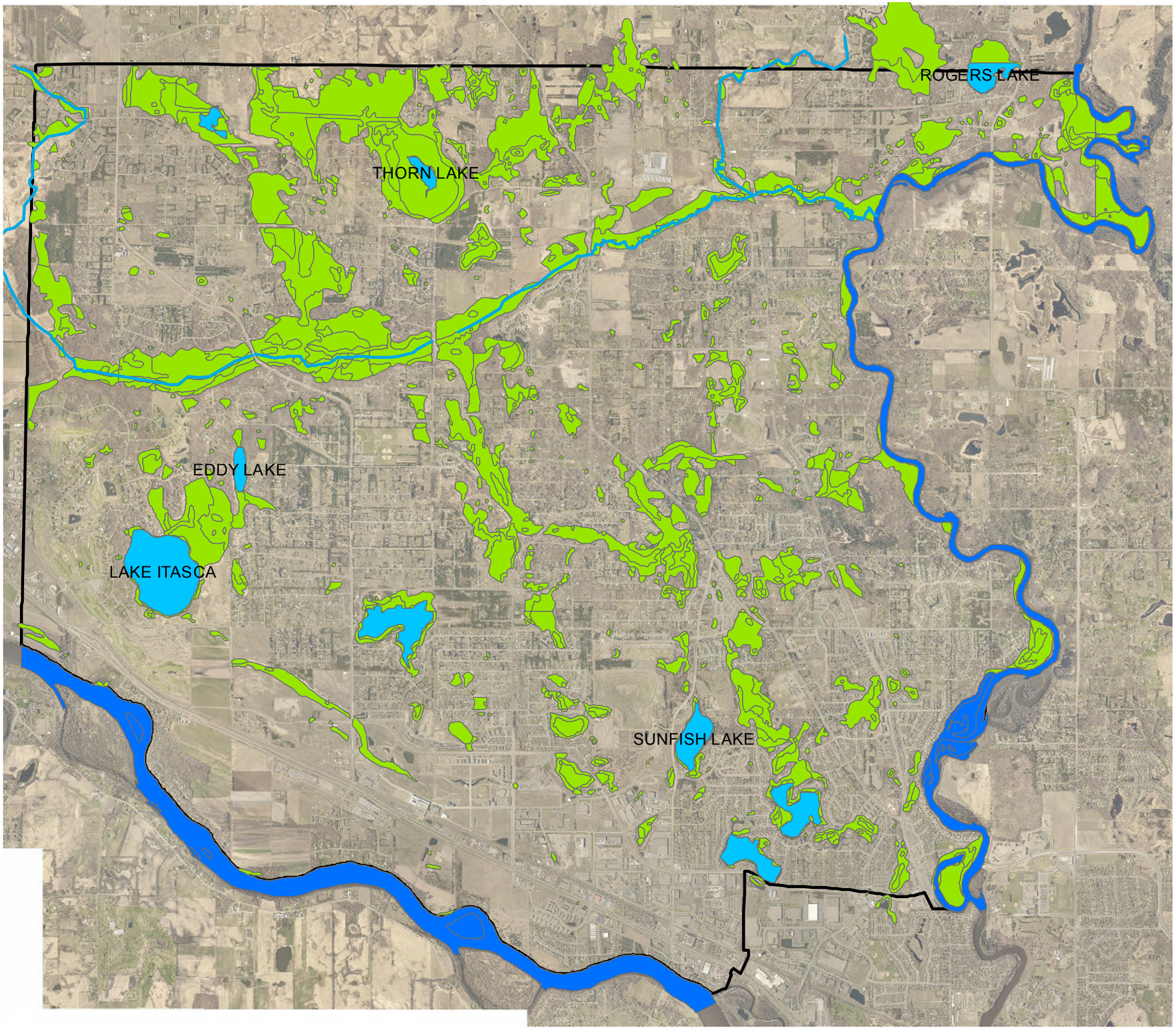
- Water Access Points
- Brooks
- Parks
- School
- Club Recreation Areas
- Mississippi River Corridor Critical Area
- Rum River Scenic Land Use District
- Rivers

NWI

- Protected Waters
- Lakes and Ponds

N

0 2,000 4,000 8,000 Feet



City of RAMSEY

NATIONAL WETLAND INVENTORY MAP

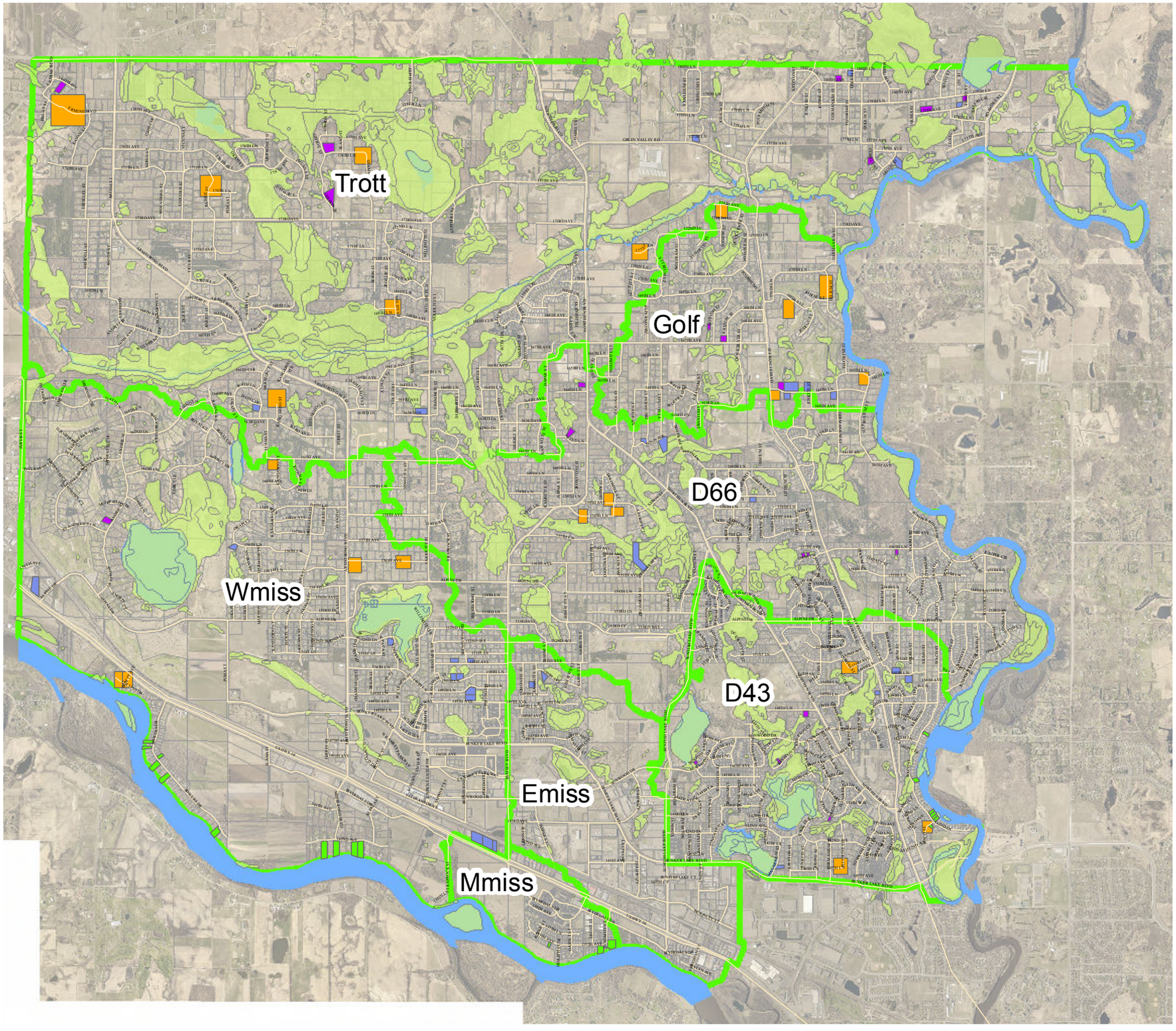
FIGURE NO. 7
OCTOBER, 2015

Legend

- Brooks
- Rivers
- Lakes and Ponds
- NWI

N

Feet
0 2,000 4,000 8,000



City of RAMSEY

GENERAL WATERSHED MAP WITH HISTORIC FLOODING LOCATIONS

FIGURE NO. 8
OCTOBER, 2015

Legend

- Streets

HISTORIC FLOODING

- 10-18-85 CITY COUNCIL MEETING
- 1997 LIST
- CITY STAFF 2007
- 2011 LIST
- 2014 LIST
- NWI
- Creeks
- Rivers
- Lakes, Ponds
- City Limits
- Watersheds
- Parcels

N

0 2,000 4,000 8,000 Feet

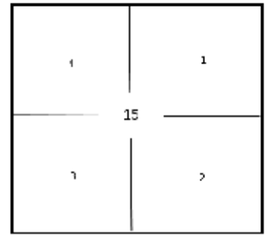
COUNTY SECTION NUMBERING AND MODELING ELEMENT NAMING CONVENTION

FIGURE NO. 9
OCTOBER, 2015

Trott
Golf
D66
Wmiss
D43
Emiss
Mmiss

Modeling Element Naming Convention

Elements are named based on the location of the item in the quadrant of the County Section, then numbered sequentially based on its relative position to the outfall. Outfall begins with 0, unless multiple outfalls exist in a given quadrant, and additional elements are numbered in the upstream direction. Pipes and Channels share sequencing numbers with the Junction, Catch Basin or Pond to which it flows. Also, catchbasins share sequence numbers with the Junction, Catch Basin or Pond to which it flows. There are exceptions to these, like where elements were added due to new developments, or when the sequencing numbers wouldn't fall in exact numerical order. Please see the figure below for the quadrant order and example. The thick black lines in the section outline with the section number in the middle. The quadrant numbers start in the northeast quadrant and move counter-clockwise.



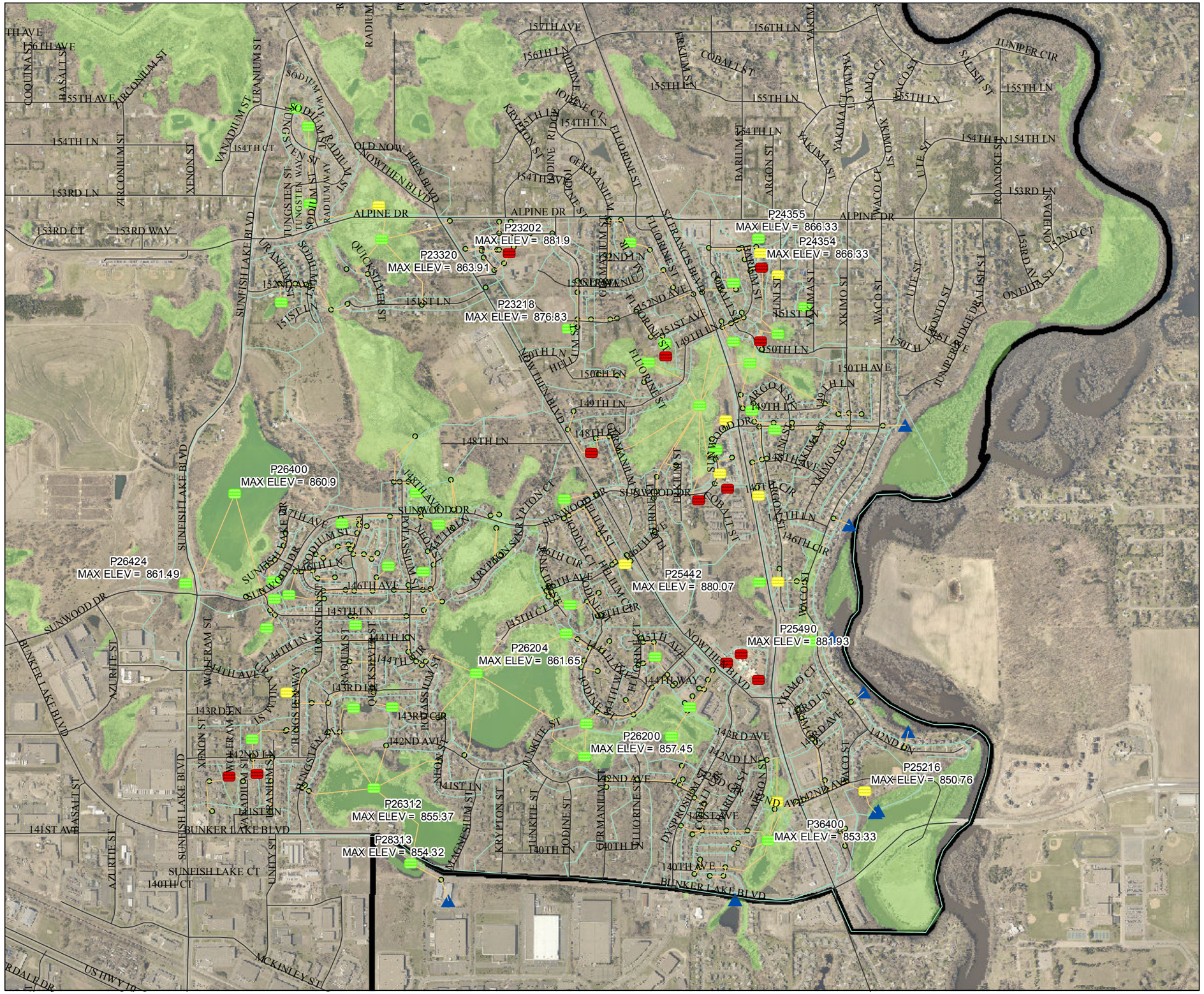
Example: C5_5106
This would be catch basin number 5 located in quadrant 1 of section 15.

Legend

- Streets
- NWI
- Creeks
- Rivers
- Lakes, Ponds
- Watersheds
- Section_only
- Section_qtr
- City Limits

N

0 2,000 4,000 8,000 Feet



D43 POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 10
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 500 1,000 2,000 Feet

City of RAMSEY

D43 PIPE SUMMARY
10 YEAR PIPE CAPACITY

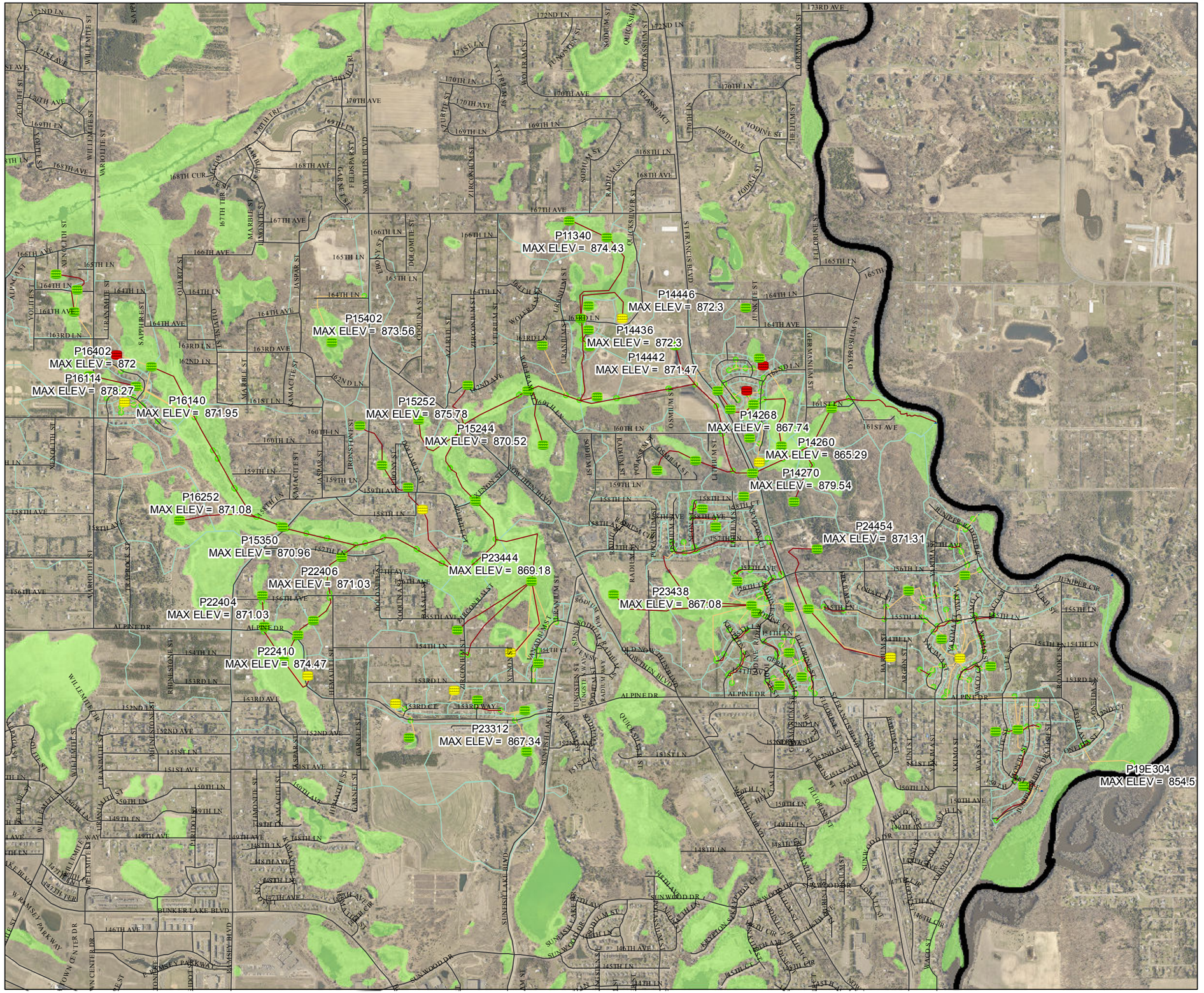
FIGURE NO. 11
OCTOBER, 2015

Legend

- Pond
- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 500 1,000 2,000 Feet



D66 POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 12
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

- Channel
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,000 2,000 4,000 Feet

City of RAMSEY

D66 PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 13
OCTOBER, 2015

Legend

- Pond

PIPE_FULL

- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,000 2,000 4,000 Feet

EMISS POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 14
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 500 1,000 2,000 Feet

City of RAMSEY

EMISS PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 15
OCTOBER, 2015

Legend

- Pond

PIPE_FULL

- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

Feet
0 500 1,000 2,000

GOLF POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 16
OCTOBER, 2015

Legend

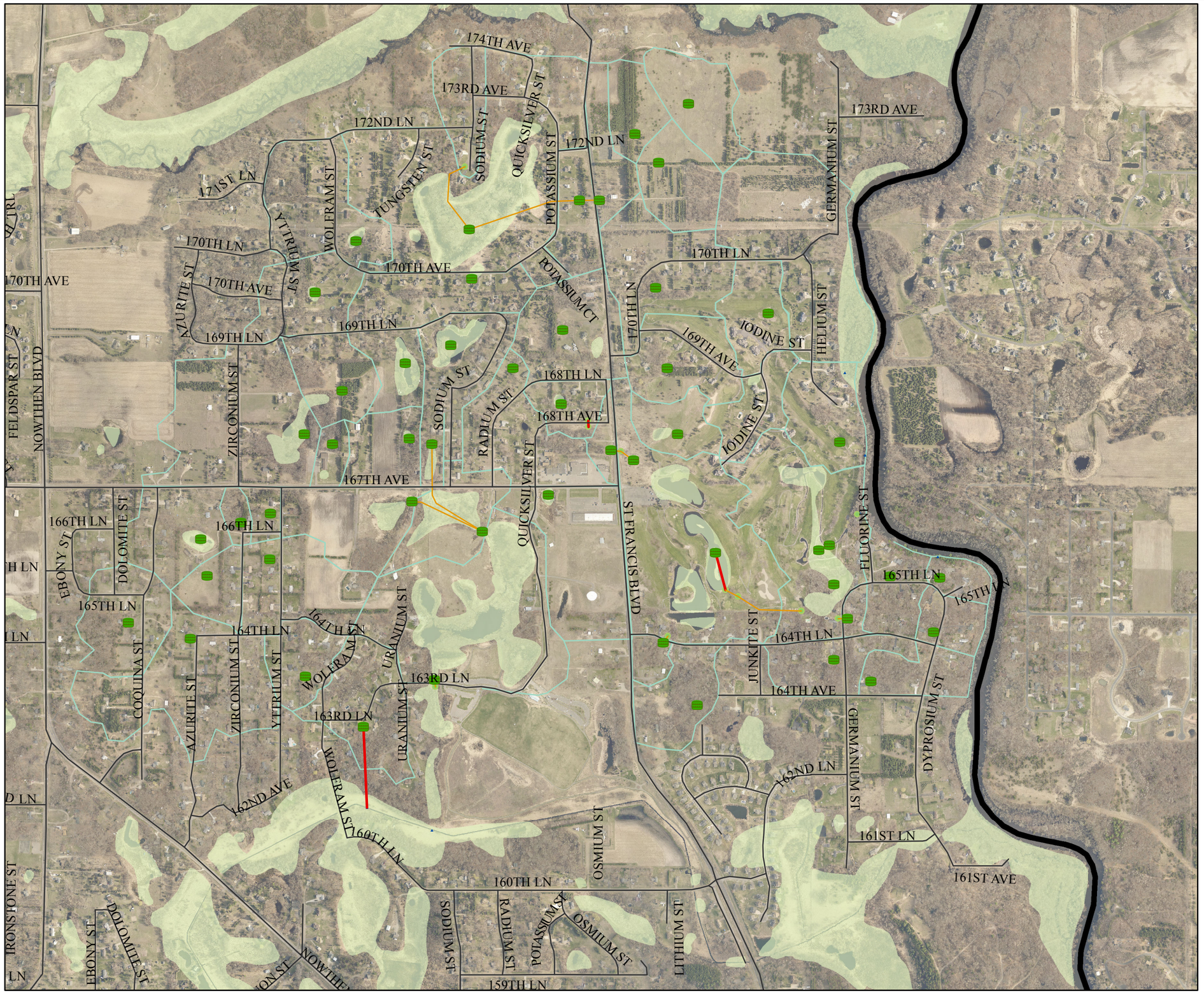
Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

- Channel
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 500 1,000 2,000 Feet



GOLF PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 17
OCTOBER, 2015

Legend

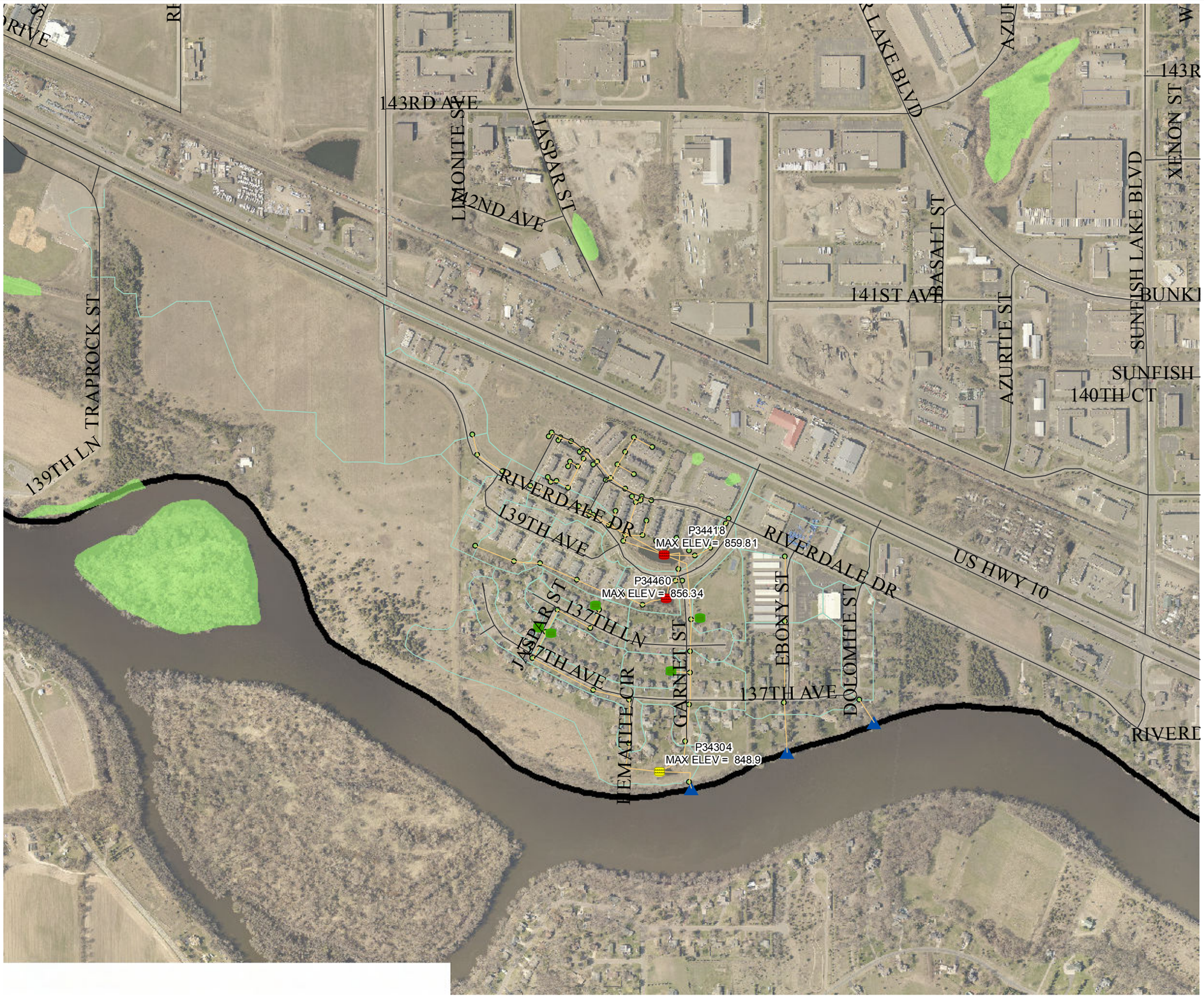
- Pond

PIPE_FULL

- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 500 1,000 2,000 Feet



MMISS POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 18
OCTOBER, 2015

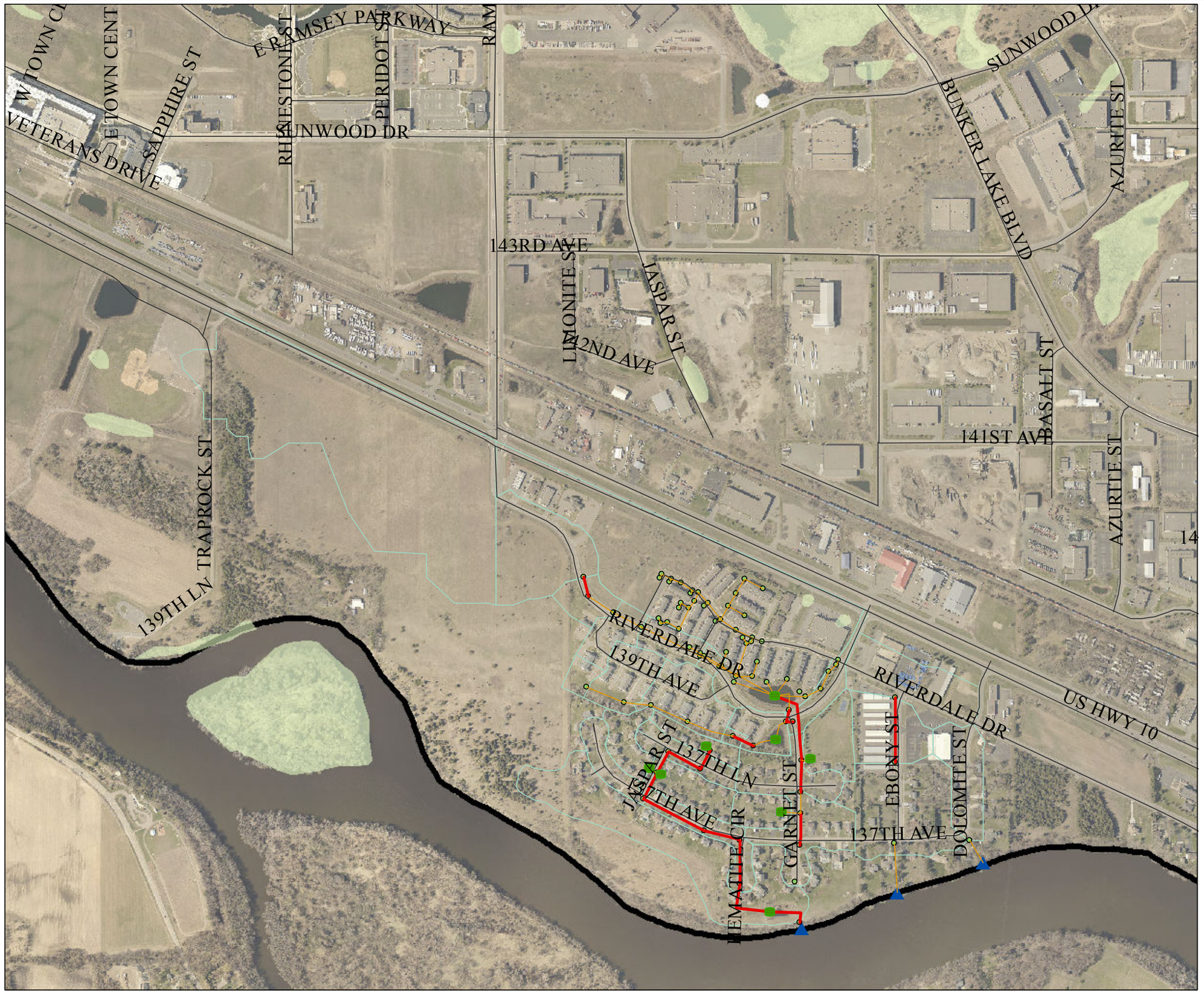
Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 300 600 1,200 Feet



MMISS PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 19
OCTOBER, 2015

Legend

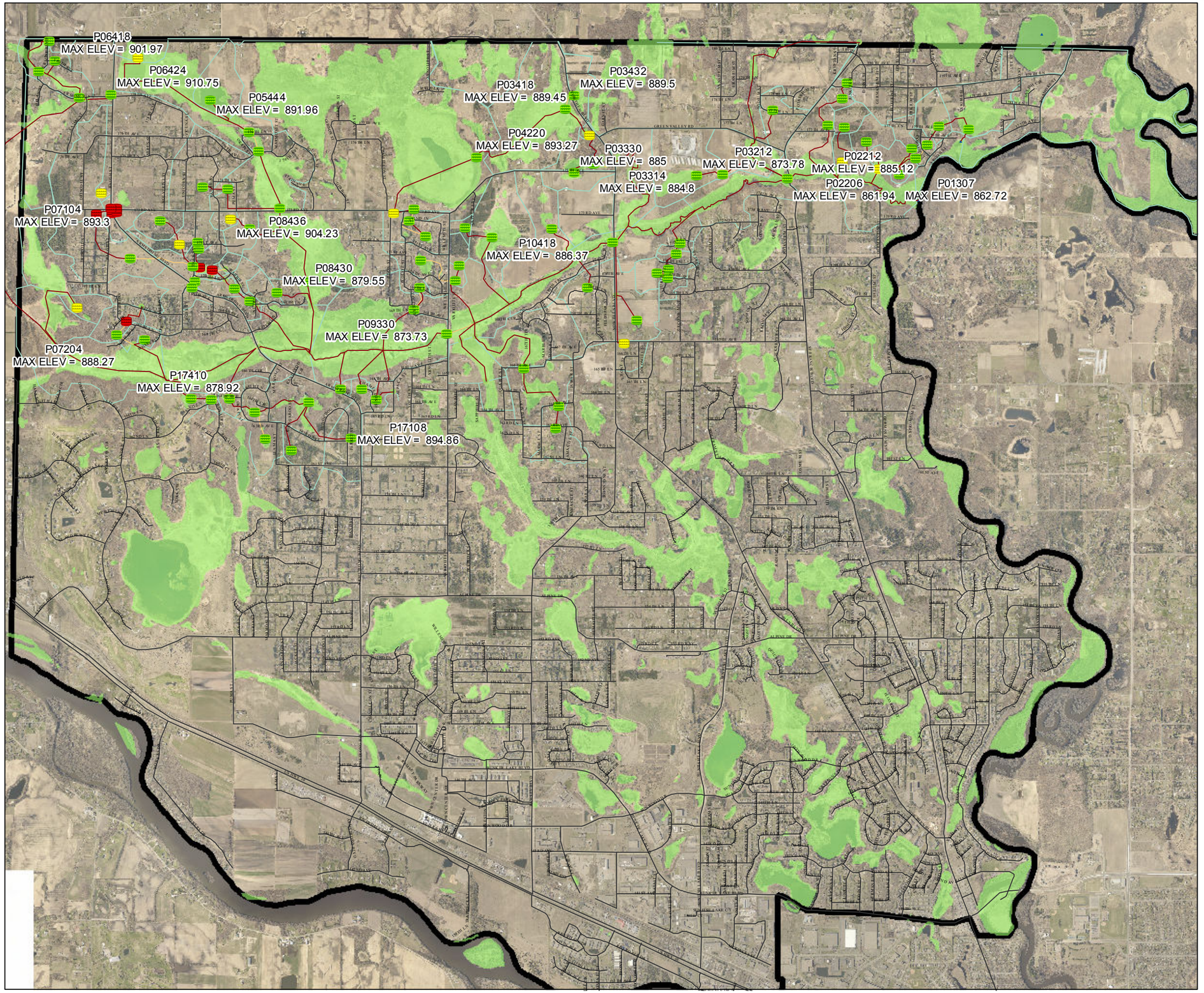
- Pond

PIPE_FULL

- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 300 600 1,200 Feet



TROTT POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 20
OCTOBER, 2015

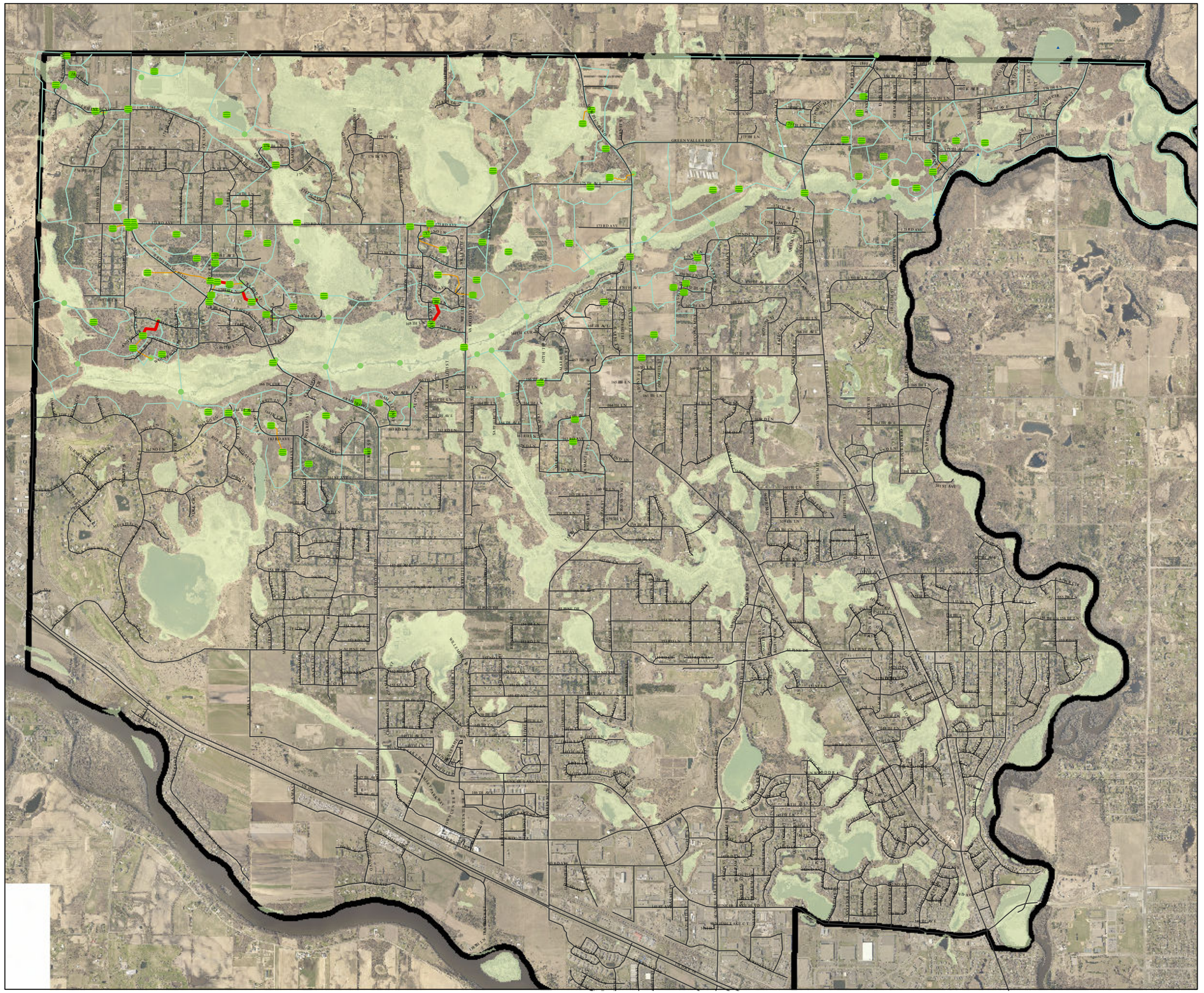
Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Channel
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,500 3,000 6,000 Feet



TROTT PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 21
OCTOBER, 2015

Legend

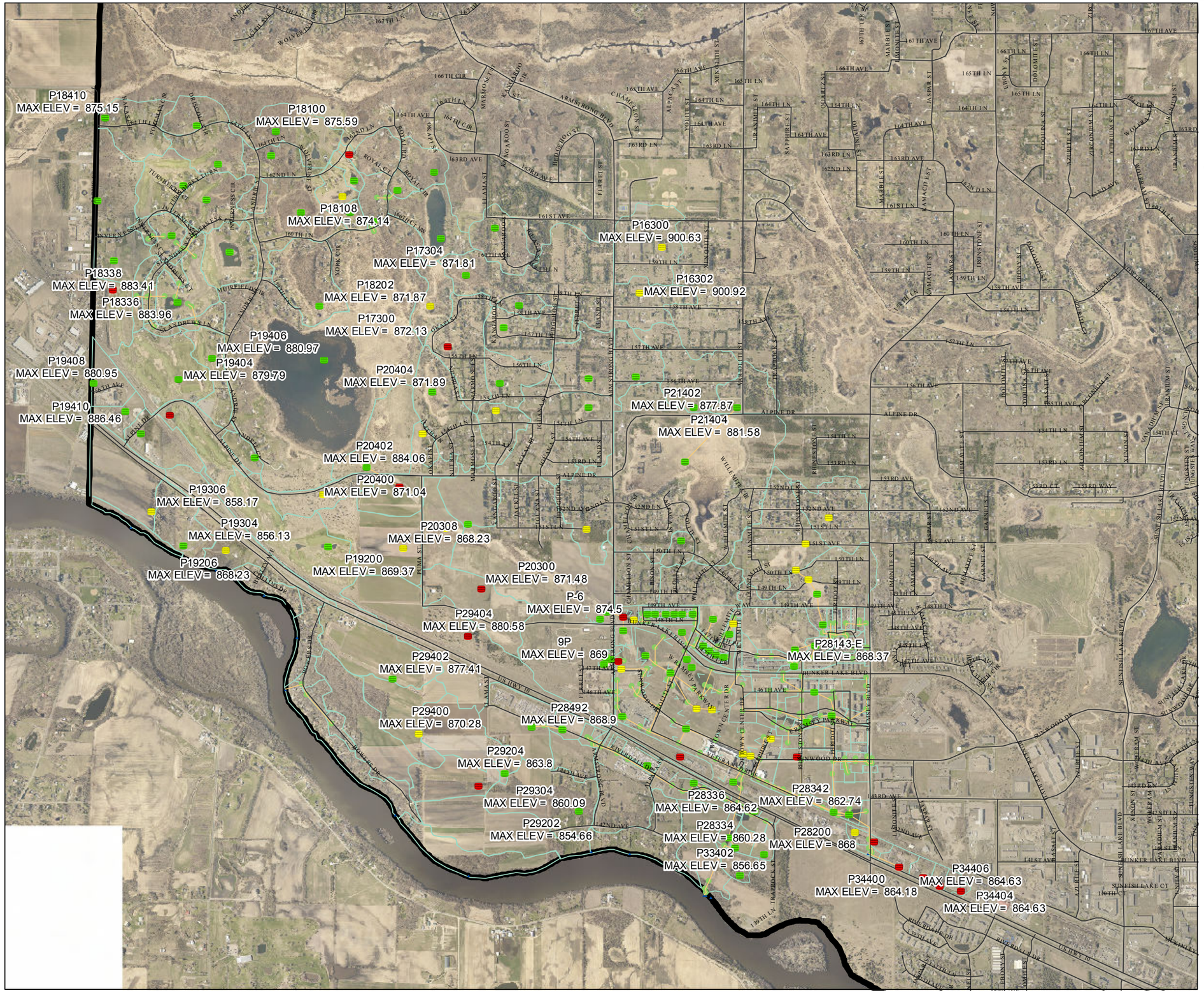
- Pond
- Streets2012

PIPE_FULL

- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,500 3,000 6,000 Feet



City of RAMSEY

WMISS POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 22
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Streets2012
- Pipe
- Junc
- Outfall
- Subbasin
- City Limits

N

0 1,000 2,000 4,000 Feet

City of RAMSEY

WMISS PIPE SUMMARY
10 YEAR PIPE CAPACITY

FIGURE NO. 23
OCTOBER, 2015

Legend

- Pond
- Pipe
- Pipe Flowing Full
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,000 2,000 4,000 Feet

City of RAMSEY

FEMA FLOODPLAIN BOUNDARIES MAP

FIGURE NO. 24
OCTOBER, 2015

THORN LAKE

ROGERS LAKE

EDDY LAKE

LAKE ITASCA

SUNFISH LAKE

Legend

- Streams and Ditches
- Lakes_Ponds

FLD_ZONE

- 500 YR
- 100 YR Approximate
- 100 YR Detailed
- 100 YR Shallow
- Rivers

N

0 2,000 4,000 8,000 Feet

City of RAMSEY

HYDROLOGIC SOILS MAP

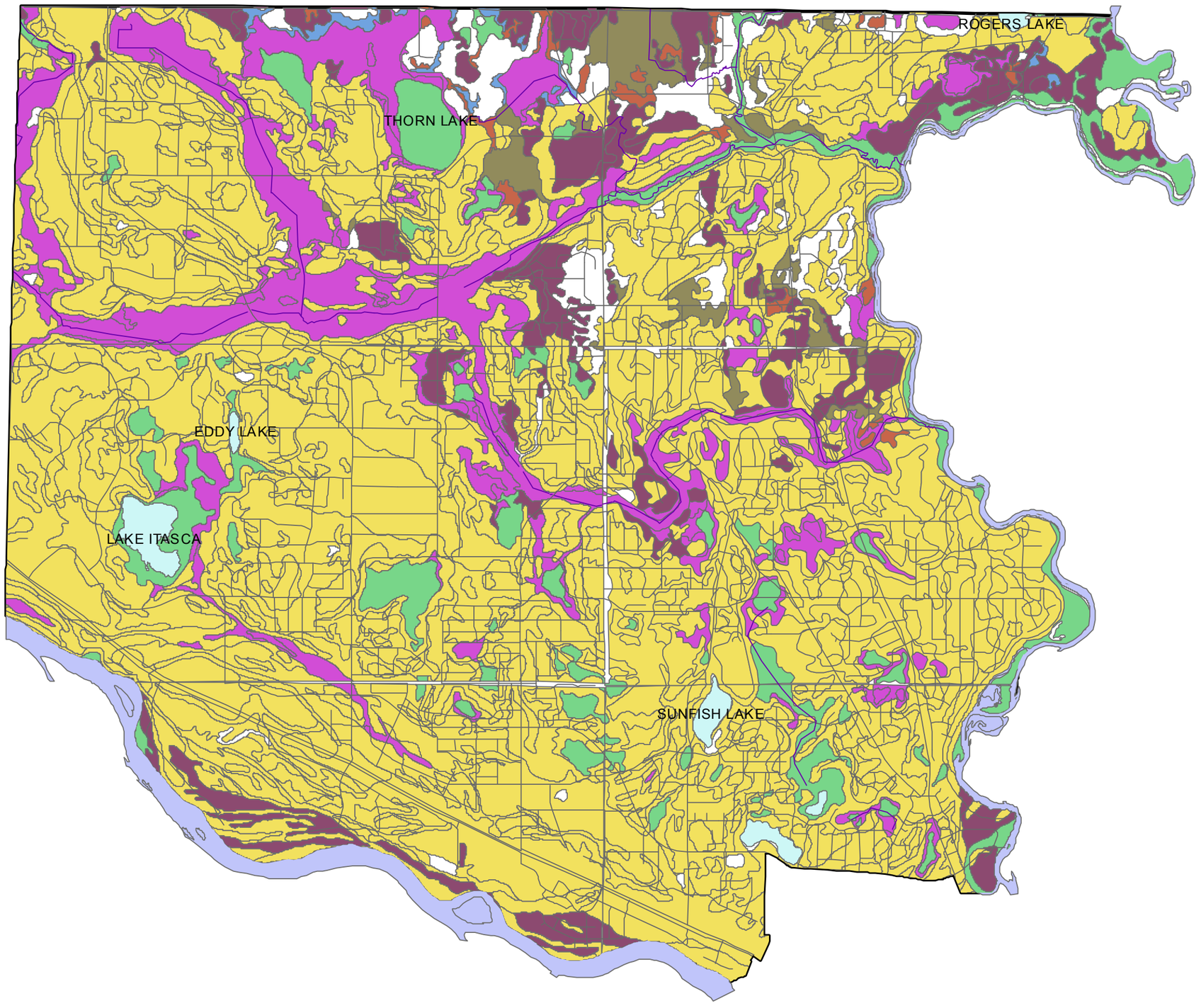


FIGURE NO. 25
OCTOBER, 2015

Legend

Streams and Ditches

Soil Hydrologic Groupings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Lakes_Ponds
- Rivers

N

Feet
0 2,000 4,000 8,000

City of RAMSEY

EXISTING LAND USE MAP

FIGURE NO. 26A
OCTOBER, 2015

Legend

EXISTING LAND USES

- Agricultural
- Rural Estate Residential
- Single Family Residential
- Multi-Famil;y Residential
- Commercial
- Industrial
- Landfill
- Public/Quasi-public
- Park
- Vacant
- Right-of-Way
- Water

N

0 2,000 4,000 8,000 Feet

City of RAMSEY

FUTURE LAND USE MAP

FIGURE NO. 26B
OCTOBER, 2015

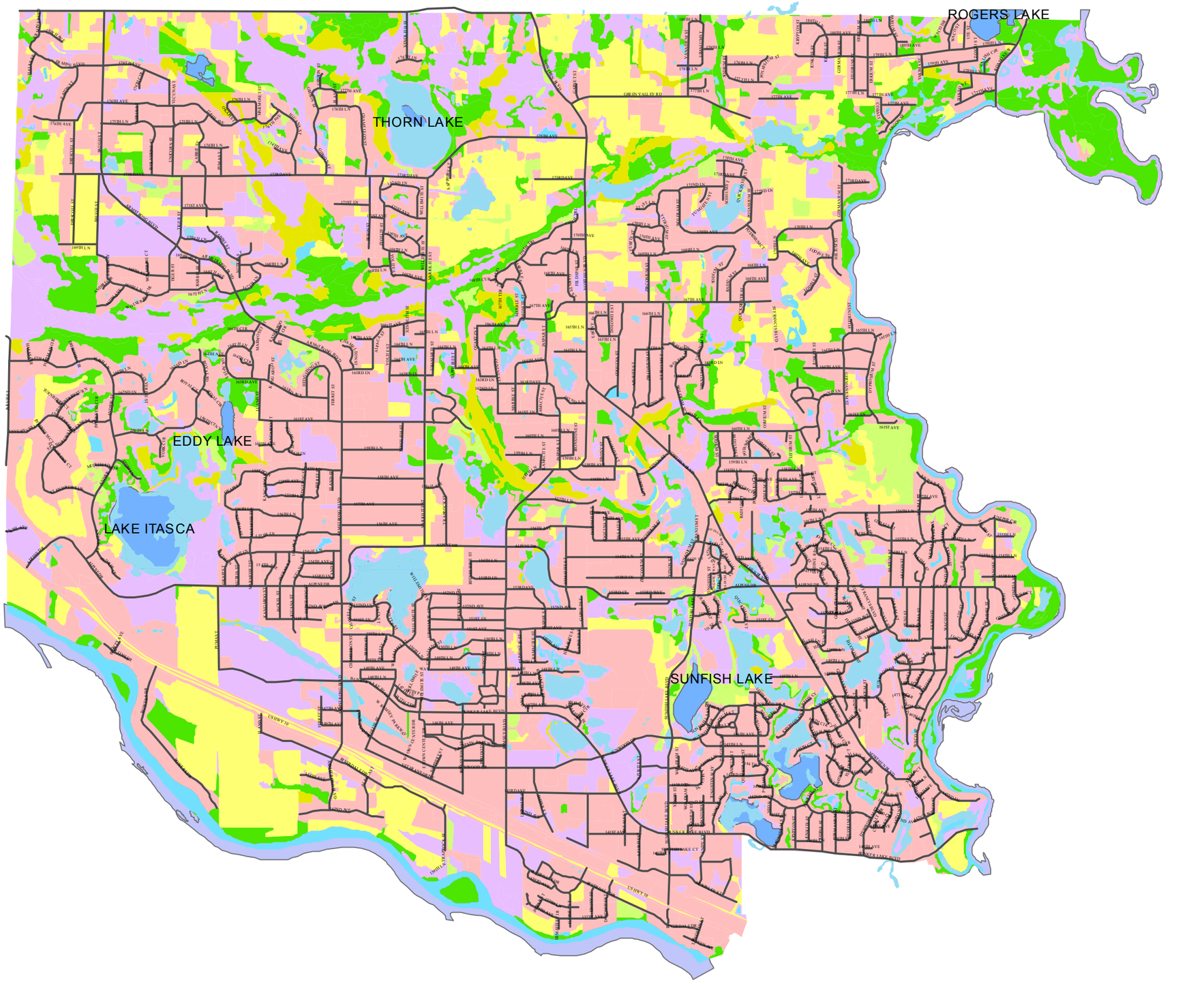
Legend

Future Land Use

- LDR
- MDR
- HDR
- Office Park
- Commercial
- MU
- Business Park
- Public
- Rural Developing
- Rural Preserve
- Park

N

0 2,000 4,000 8,000 Feet



City of RAMSEY

MINNESOTA LAND COVER CLASSIFICATION SYSTEM MAP

FIGURE NO. 26C
OCTOBER, 2015

Legend

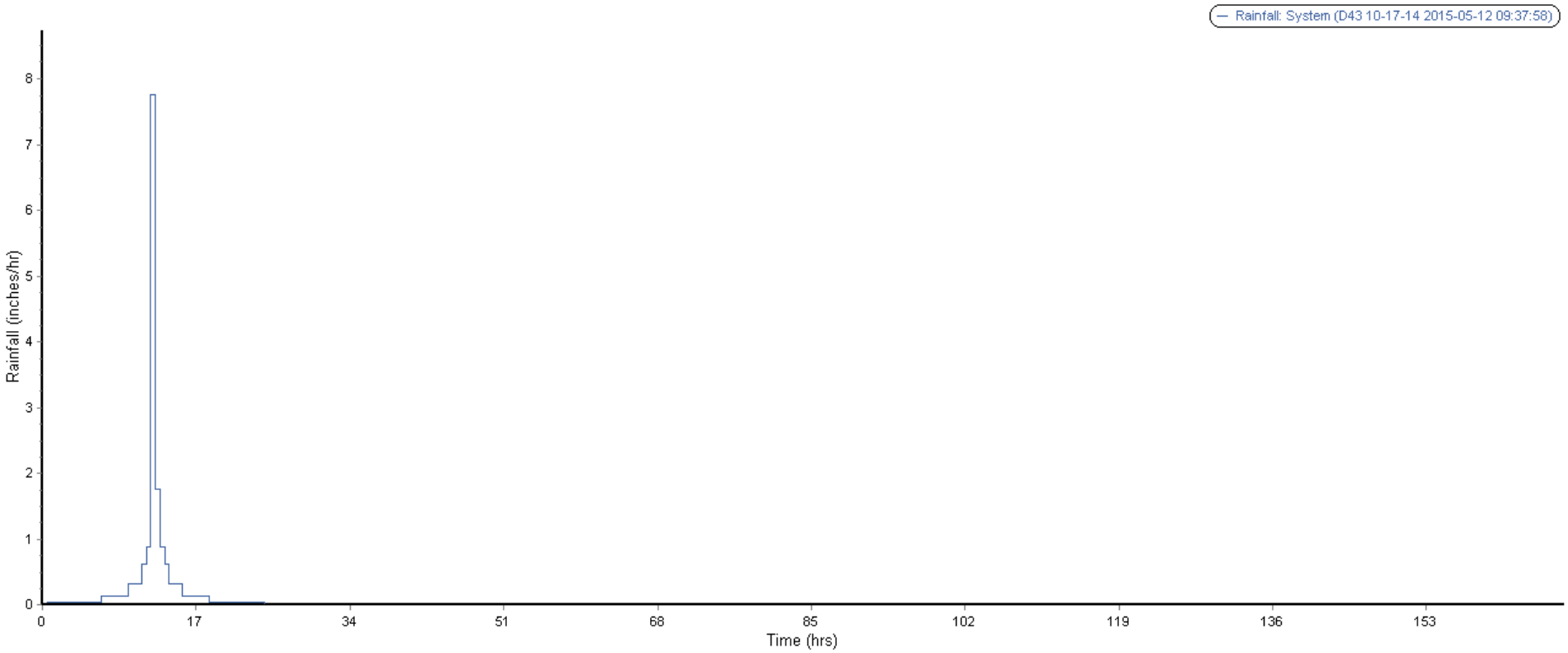
- NWI
- Protected Waters

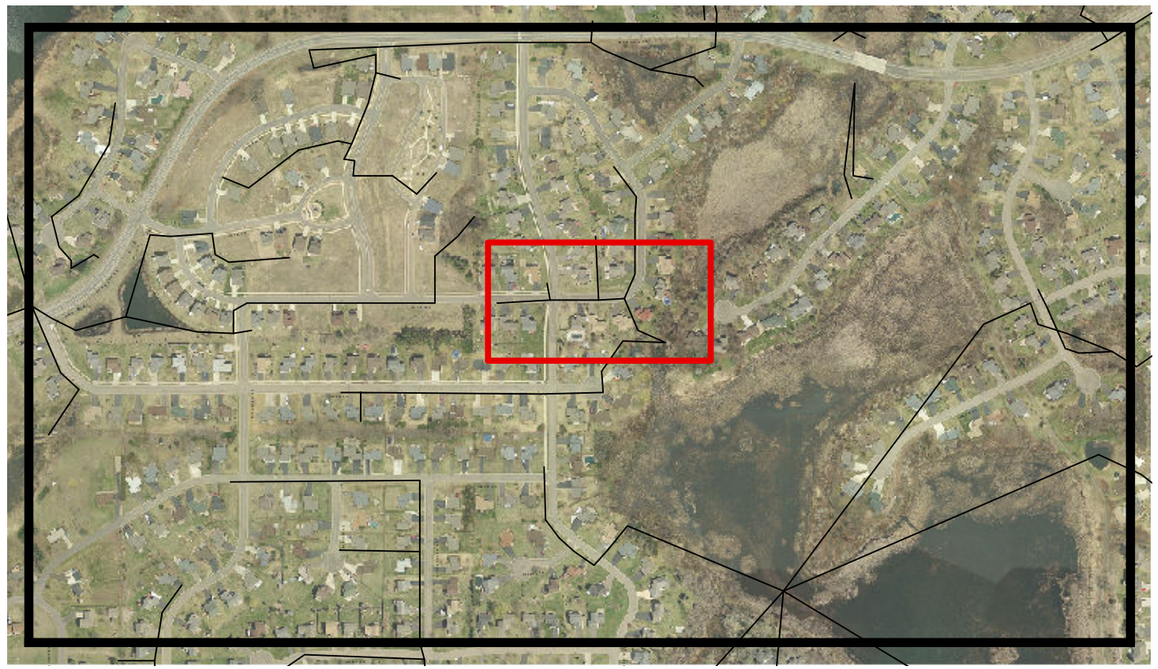
MLCCS

- <all other values>
- Artificial Surfaces and Associated Area
- Planted or Cultivated Vegetation
- Forests
- Woodland
- Shrubland
- Herbaceous
- Water
- Rivers

N

0 2,000 4,000 8,000 Feet


Rainfall: System (D43 10-17-14 2015-05-12 09:37:58)
Rainfall (inches/hr)
0
1
2
3
4
5
6
7
8
0
17
34
51
68
85
102
119
136
153
Time (hrs)



City of RAMSEY

PLAN VIEW PLOT OF 146TH AVENUE NW

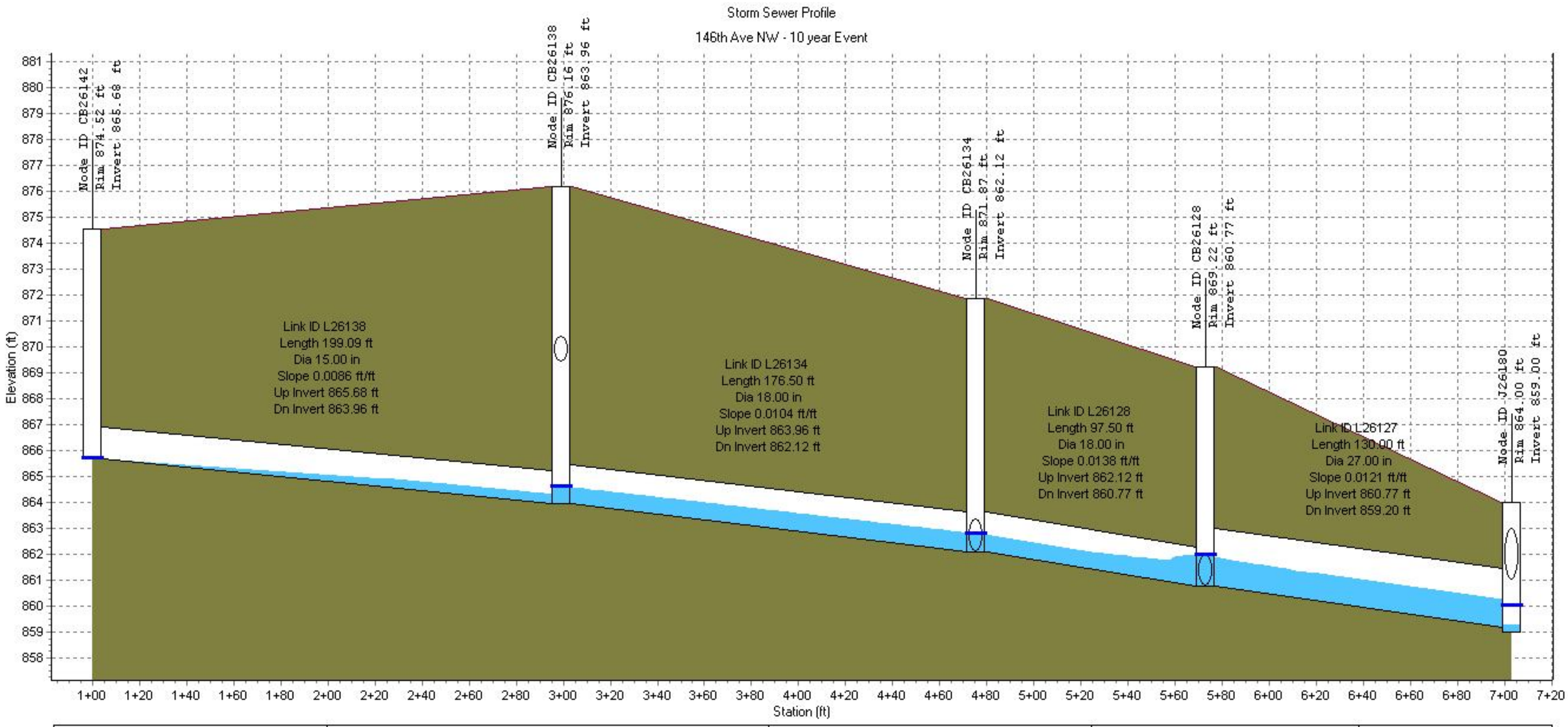
FIGURE NO. 28
OCTOBER, 2015

Legend

- Pond
- Pipe
- Junc
- Outfall
- Subbasin
- City Limits

N

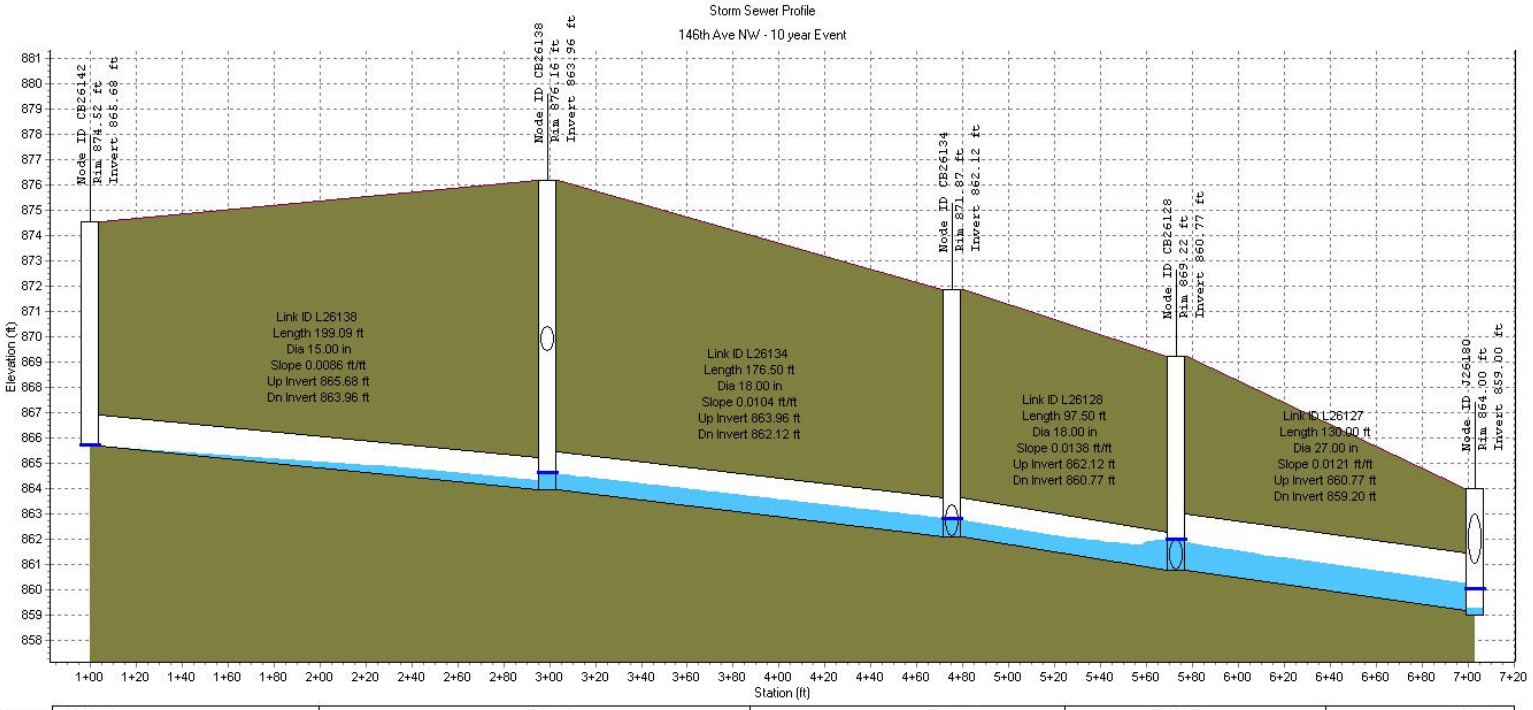
0 50 100 200 Feet



Node ID:	CB26142	CB26138	CB26134	CB26128	J26180
Rim (ft):	874.52	876.16	871.87	869.22	864.00
Invert (ft):	865.68	863.96	862.12	860.77	859.00
Min Pipe Cover (ft):	0.00	0.00	8.25	0.00	1.00
Max HGL (ft):	865.68	864.61	862.81	861.99	860.03

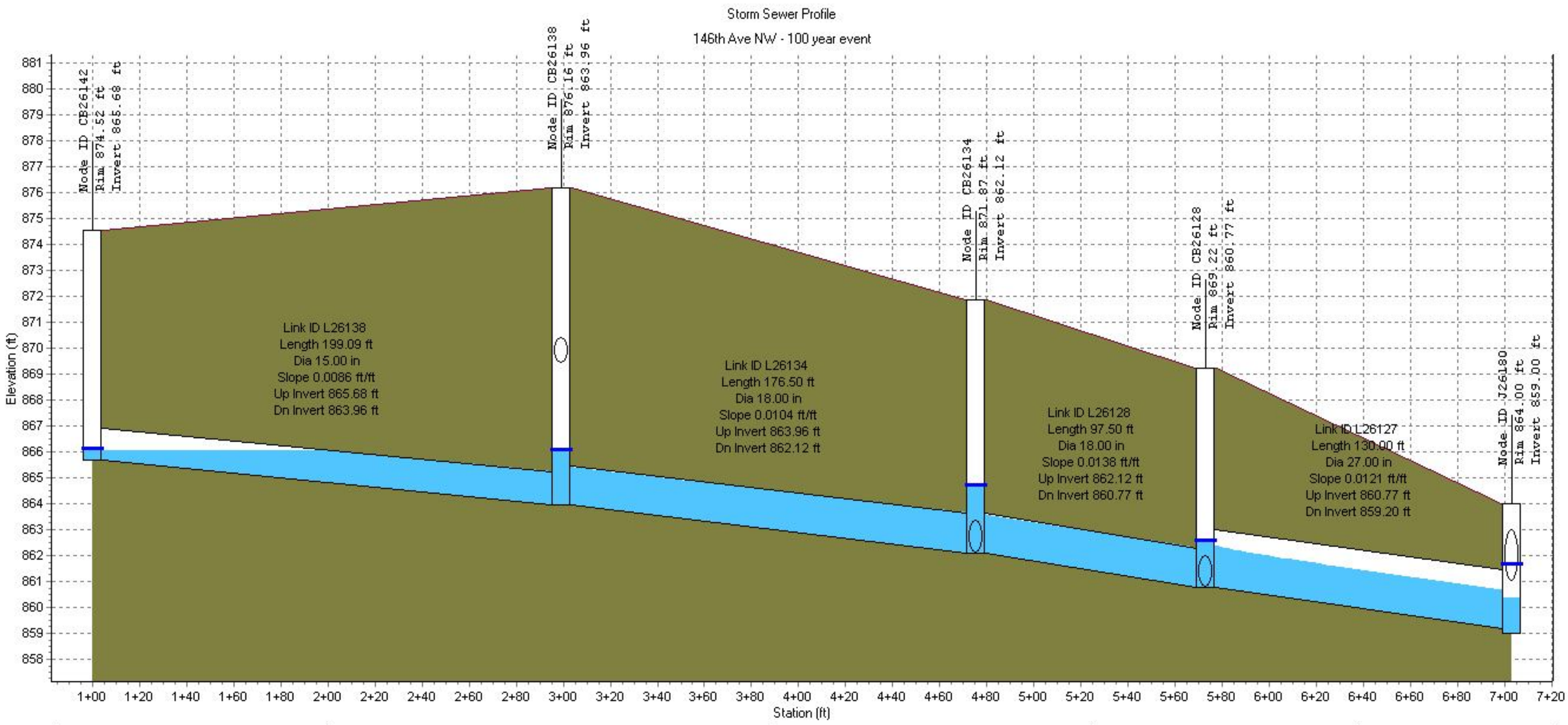
Link ID:	L26138	L26134	L26128	L26127
Length (ft):	199.09	176.50	97.50	130.00
Dia (in):	15.00	18.00	18.00	27.00
Slope (ft/ft):	0.0086	0.0104	0.0138	0.0121
Up Invert (ft):	865.68	863.96	862.12	860.77
Dn Invert (ft):	863.96	862.12	860.77	859.20
Max Q (cfs):	0.00	4.00	5.41	15.23
Max Vel (ft/s):	0.00	5.31	5.07	7.59
Max Depth (ft):	0.33	0.66	0.94	1.12

Figure 29



Node ID:	CB26142	CB26138	CB26134	CB26128	J26180
Rim (ft):	874.52	876.16	871.87	869.22	864.00
Invert (ft):	865.68	863.96	862.12	860.77	859.00
Min Pipe Cover (ft):	0.00	0.00	8.25	0.00	1.00
Max HGL (ft):	865.68	864.61	862.81	861.99	860.03

Link ID:	L26138	L26134	L26128	L26127
Length (ft):	199.09	176.50	97.50	130.00
Dia (in):	15.00	18.00	18.00	27.00
Slope (ft/ft):	0.0086	0.0104	0.0138	0.0121
Up Invert (ft):	865.68	863.96	862.12	860.77
Dn Invert (ft):	863.96	862.12	860.77	859.20
Max Q (cfs):	0.00	4.00	5.41	15.23
Max Vel (ft/s):	0.00	5.31	5.07	7.59
Max Depth (ft):	0.33	0.66	0.94	1.12



Node ID:	CB26142	CB26138	CB26134	CB26128	J26180
Rim (ft):	874.52	876.16	871.87	869.22	864.00
Invert (ft):	865.68	863.96	862.12	860.77	859.00
Min Pipe Cover (ft):	0.00	0.00	8.25	0.00	1.00
Max HGL (ft):	867.19	867.19	866.52	863.37	861.65

Link ID:	L26138	L26134	L26128	L26127
Length (ft):	199.09	176.50	97.50	130.00
Dia (in):	15.00	18.00	18.00	27.00
Slope (ft/ft):	0.0086	0.0104	0.0138	0.0121
Up Invert (ft):	865.68	863.96	862.12	860.77
Dn Invert (ft):	863.96	862.12	860.77	859.20
Max Q (cfs):	0.77	9.33	14.65	32.70
Max Vel (ft/s):	0.95	5.83	8.29	8.73
Max Depth (ft):	0.83	1.50	1.50	1.63

Figure 30

City of RAMSEY

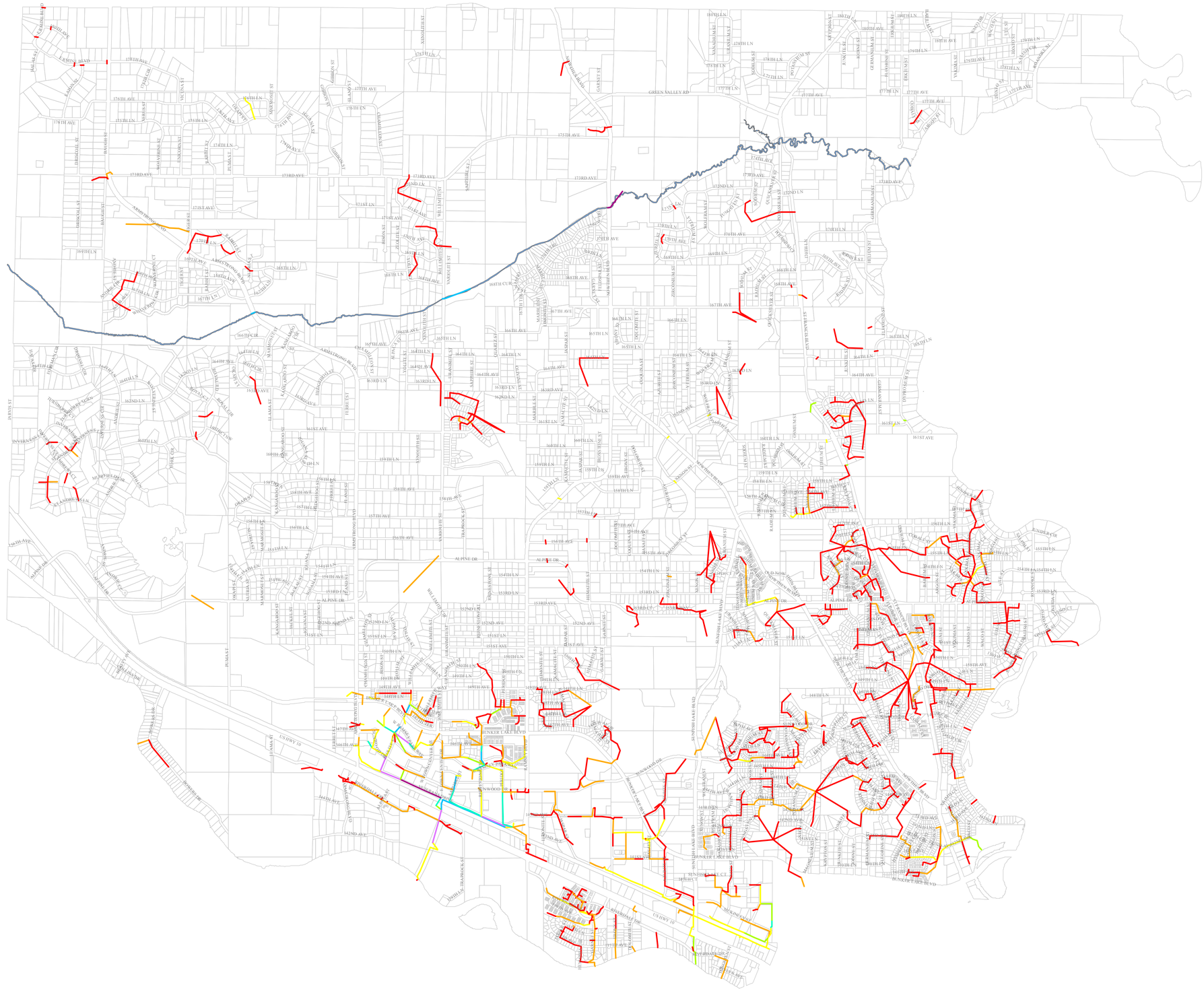
STORM SEWER SYSTEM MAP

FIGURE NO. 31
OCTOBER, 2015

Legend

DIAMETER

- 12" - 21"
- 24" - 33"
- 36" - 42"
- 48"
- 54"
- 60
- 72
- 84
- Creeks
- Parcels



N

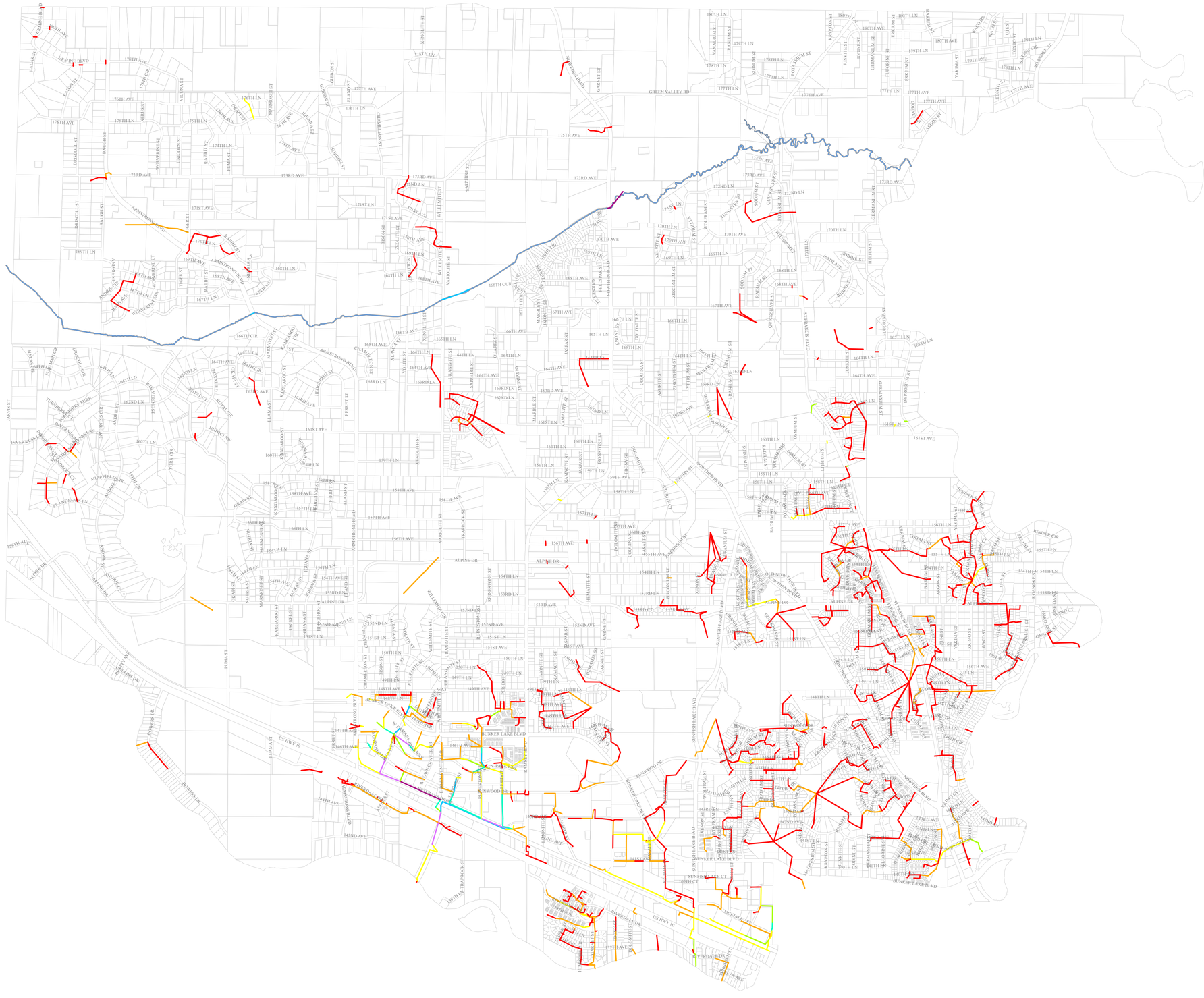
0 1,500 3,000 6,000 Feet

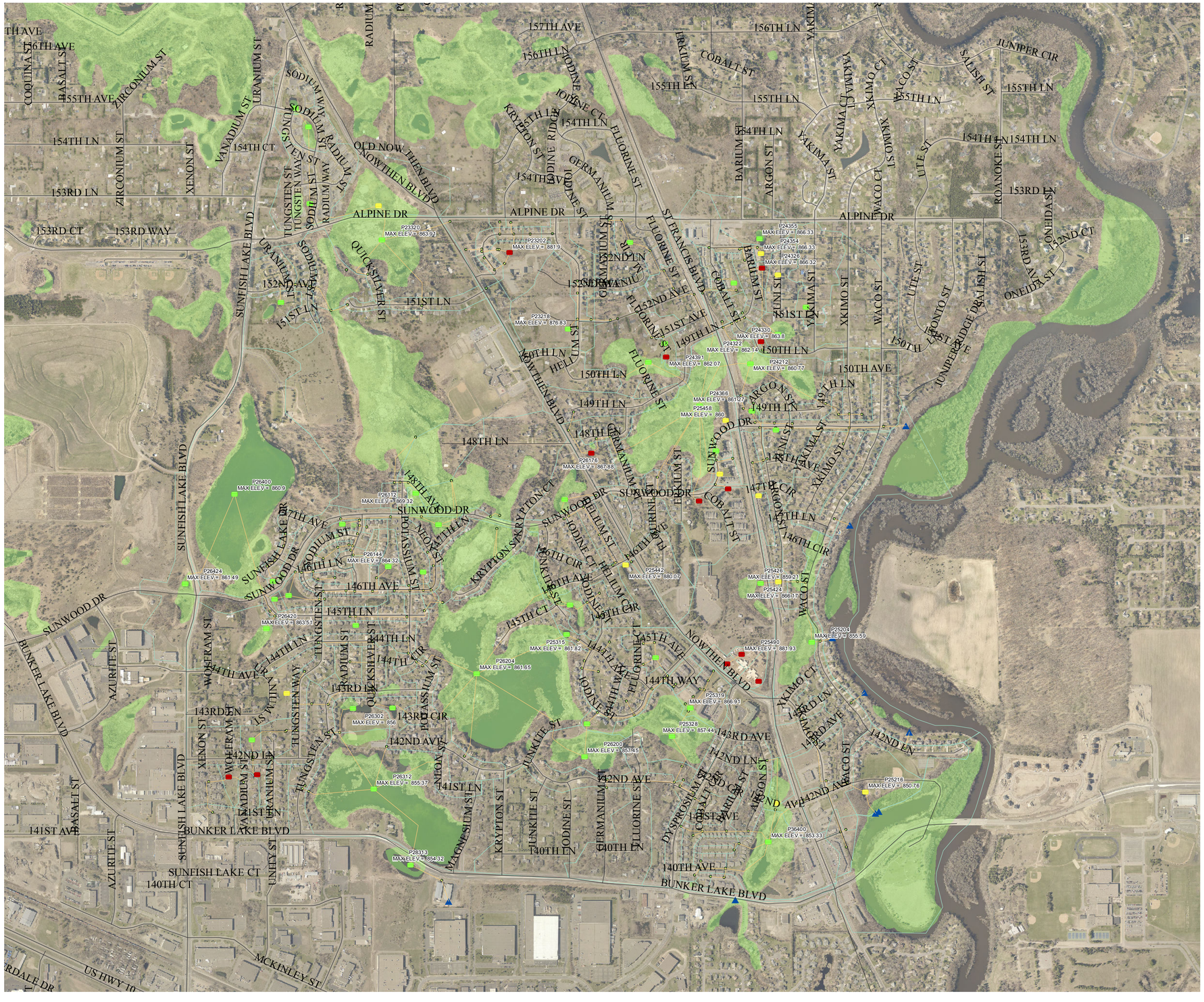
City of RAMSEY

2014 SURFACE WATER MANANGEMENT PLAN

STORM SEWER SYSTEM MAP

FIGURE NO. 31
OCTOBER, 2015





D43 POND SUMMARY 100 YEAR PEAK ELEVATION

FIGURE NO. 32
OCTOBER, 2015

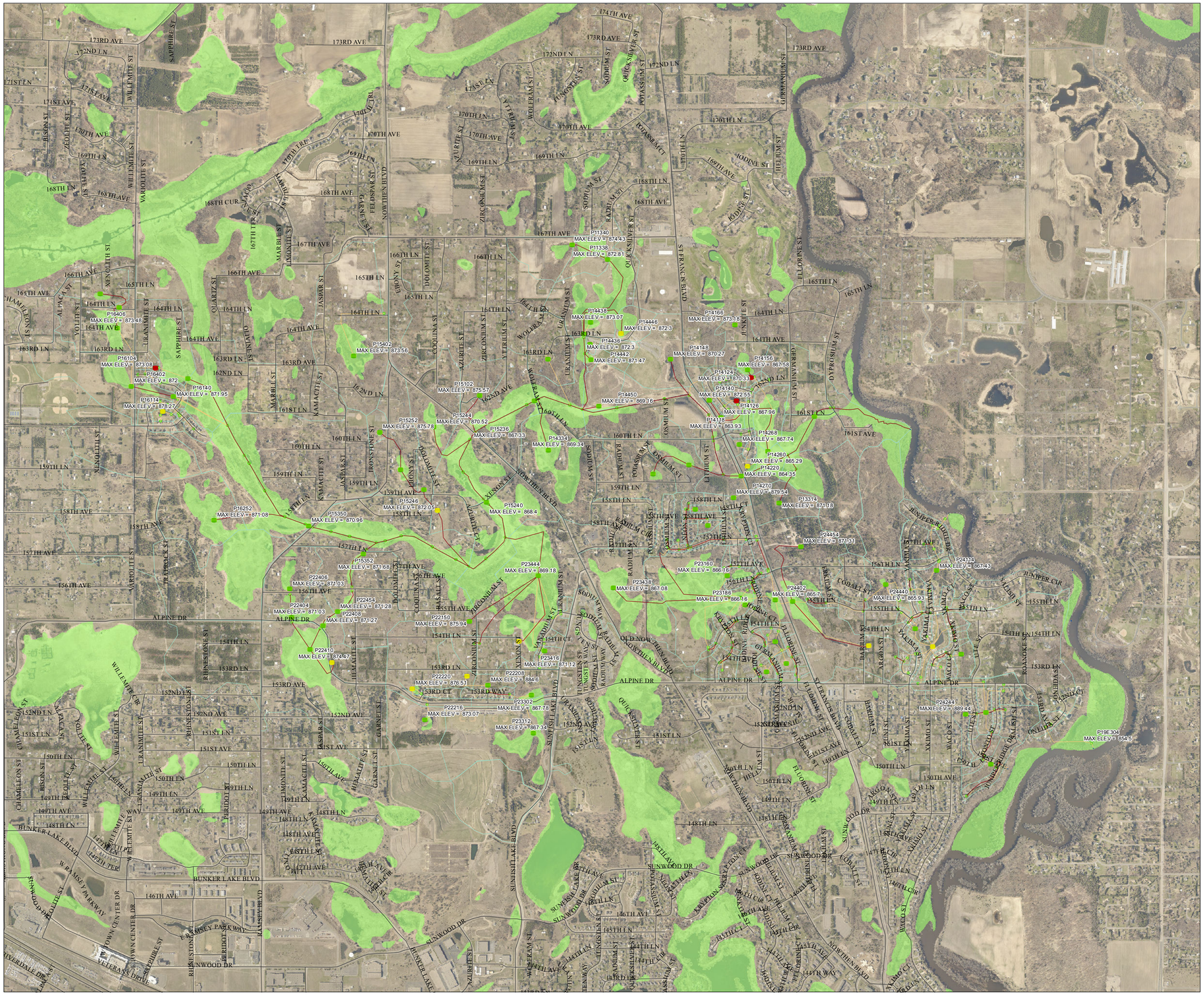
Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,000 2,000 4,000 Feet



D66 POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 33
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

Channel

Pipe

Junc

Outfall

Subbasin

NWI

City Limits

N

0 1,500 3,000 6,000 Feet

EMISS POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 34
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

Pipe

Junc

Outfall

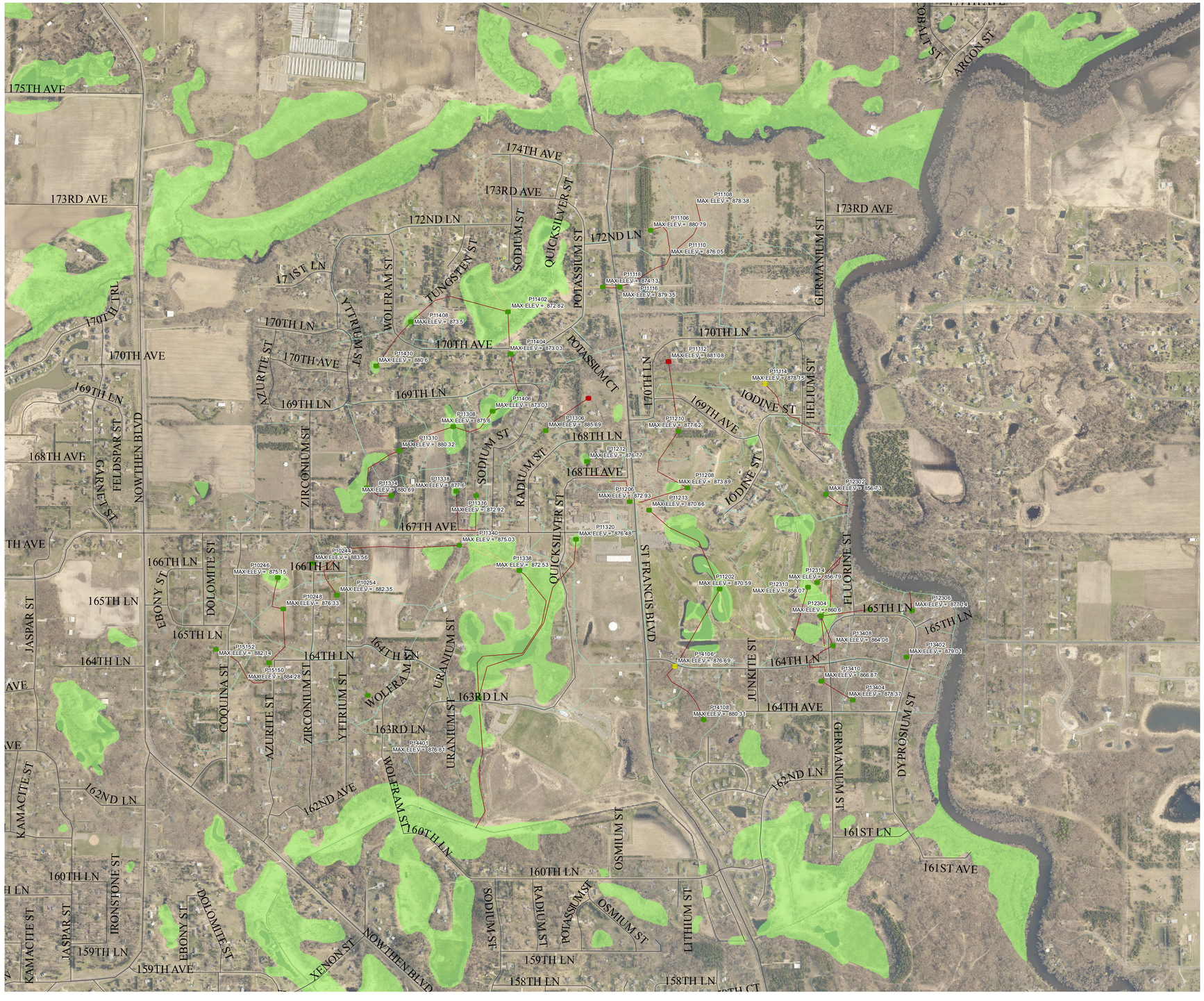
Subbasin

NWI

City Limits

N

Feet
0 1,000 2,000 4,000



GOLF POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 35
OCTOBER, 2015

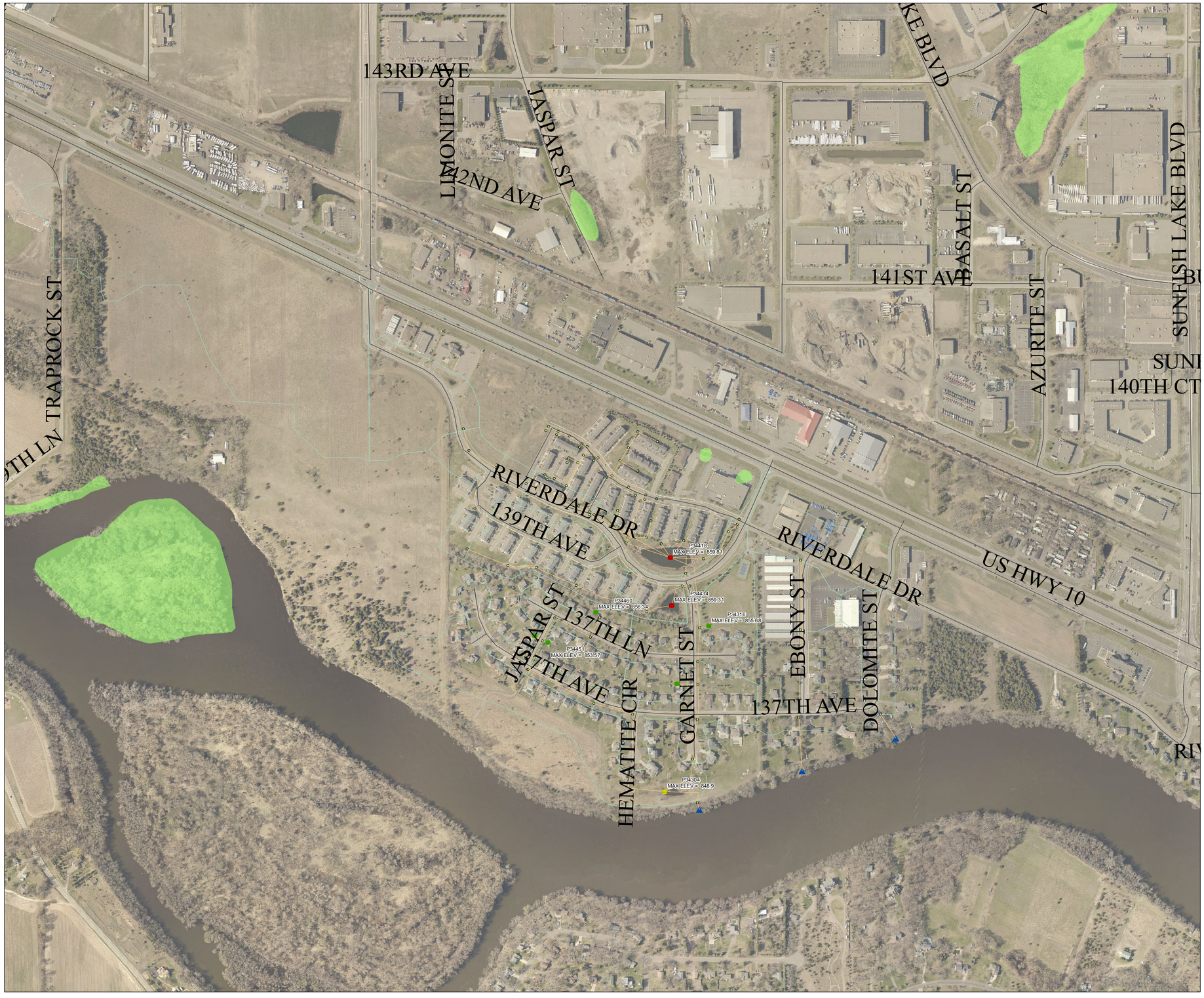
Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures
- Channel
- Pipe
- Junc
- Outfall
- Subbasin
- NWI
- City Limits

N

0 1,000 2,000 4,000 Feet



City of RAMSEY

MMISS POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 36
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

Pipe

Junc

Outfall

Subbasin

NWI

City Limits

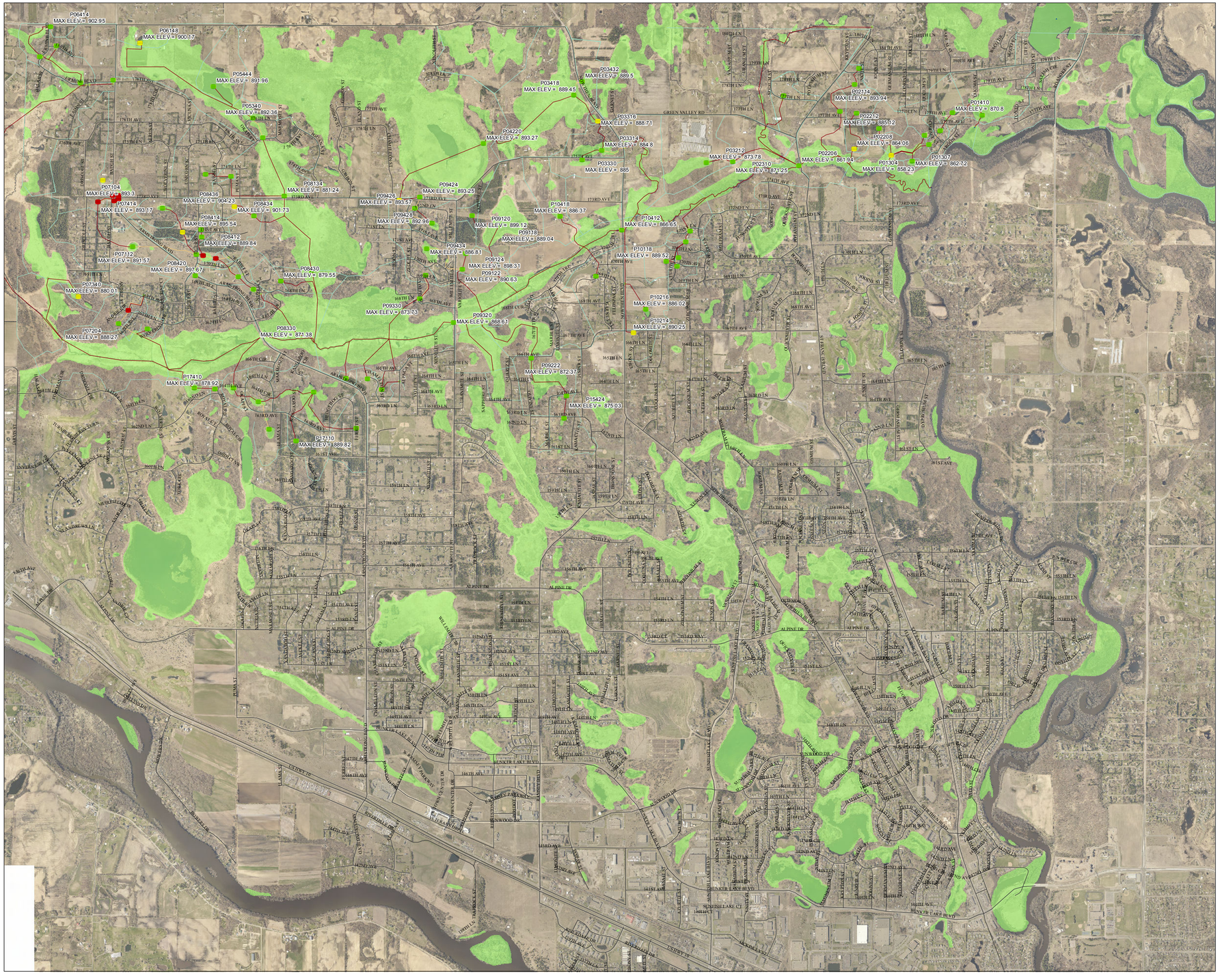
N

0 500 1,000 2,000 Feet

City of RAMSEY

TROTT POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 37
OCTOBER, 2015



Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

Channel

Pipe

Junc

Outfall

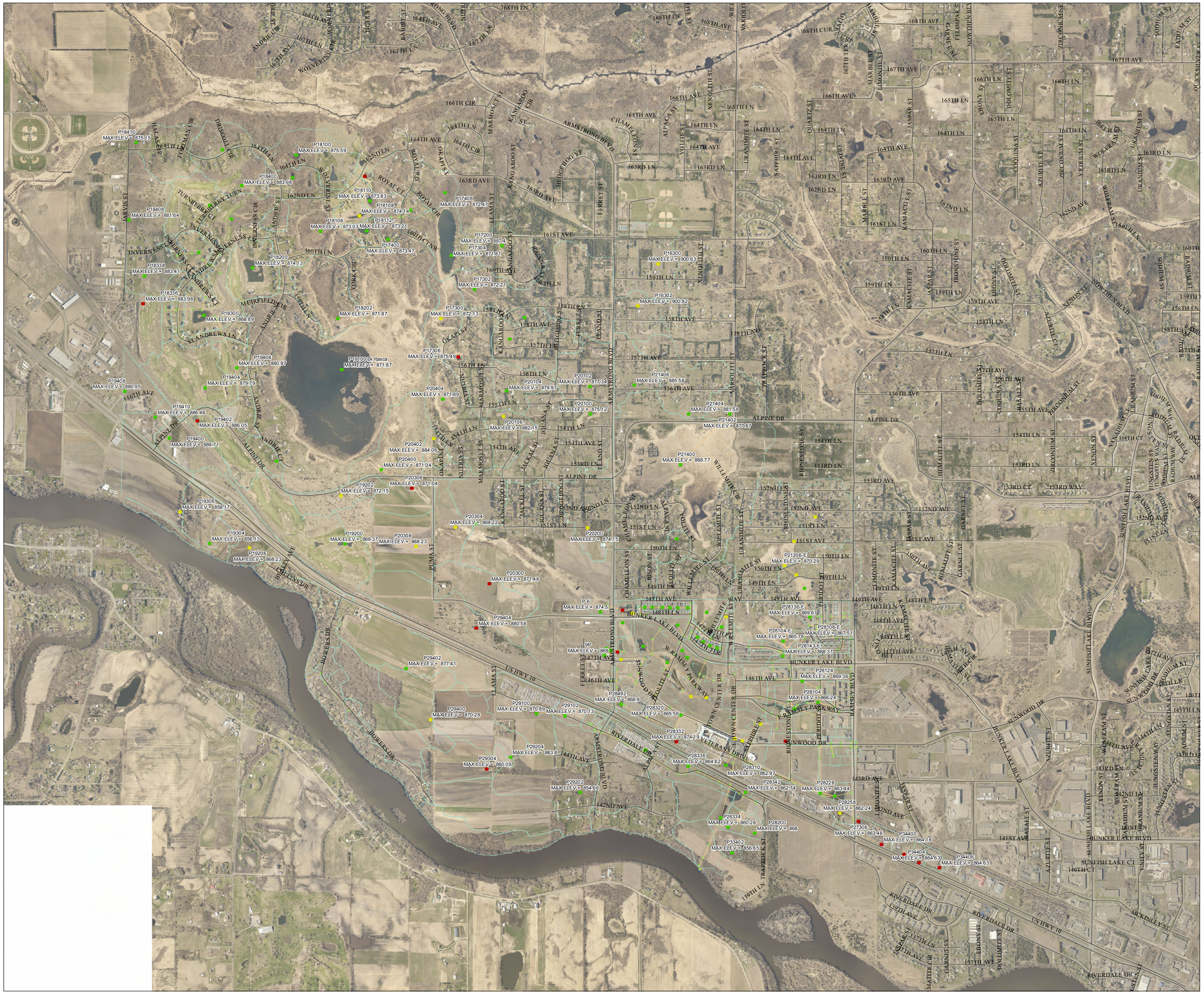
Subbasin

NWI

City Limits

N

0 3,000 6,000 12,000 Feet



WMISS POND SUMMARY
100 YEAR PEAK ELEVATION

FIGURE NO. 38
OCTOBER, 2015

Legend

Pond Flood Status

- Functioning Properly
- EOF Utilized
- Potential Threat to Structures

Streets2012

Pipe

Junc

Outfall

Subbasin

Feet
0 1,500 3,000 6,000

Appendix A

Ramsey City-wide

Storm Water Pollution Prevention Plan

City of Ramsey, Minnesota

2006 Stormwater Pollution Prevention Program

Prepared

~~**May 31, 2006**~~
Revised February 4, 2009

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Executive Summary

The City of Ramsey is required to apply for coverage under the National Pollutant Discharge Elimination System Phase II/ State Disposal System program as administered by the US Environmental Protection Agency and the Minnesota Pollution Control Agency. This document outlines the steps Ramsey will take during the next permit cycle of 5 years to reduce stormwater pollution and is commonly referred to as a Stormwater Pollution Prevention Plan (SWPPP).

The SWPPP must address six (6) major areas:

Public Education and Outreach
Public Participation/ Involvement
Illicit Discharge Detection and Elimination
Construction Site Stormwater Runoff Control
Post-Construction Stormwater Management in New Development and Redevelopment
Pollution Prevention/ Good Housekeeping

Detailed sheets have been developed addressing sub-topics in each of these areas. Goals and timelines have been established for each sheet. The City will prepare an annual report summarizing the activities for the past year. The report will be available for review at the annual meeting held for review of the SWPPP. Comments received will be evaluated and incorporated into the SWPPP and annual report as appropriate.

The City of Ramsey currently has systems in place for reviewing new construction plans and requiring installation of erosion control measures prior to construction. This includes notifications and corrective measures for sites found to be out of compliance with the requirements. The City participates in the Environmental Expo held every spring. Information is distributed on methods to reduce stormwater pollution. The new resident packet contains useful information on recycling, lawn care and is distributed to all who purchase new homes in the city.

The City has inspected all known outfalls where stormwater leaves the boundaries of the city annually since 2003. These inspections were during dry weather and flows were not observed during the inspections. This is a good indicator that sanitary sewer lines are not connected to the storm sewer system. The inspection program has been expanded to include inspecting 20% of the ponds annually.

The city will be improving the website content and establishing a collection of educational materials for various audiences as part of this new permit.

The City of Ramsey has programs in place for reducing stormwater pollution and this SWPPP is a guide for additional measures that will be implemented over the next 5 years to further improve the stormwater quality in Ramsey. The City has adopted a stormwater pollution control ordinance to guide plan reviews for new development and construction of those new developments.
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Introduction

The City of Ramsey is bordered by two natural flowing rivers, the Mississippi River and the Rum River and is therefore committed to protecting the quality of water and limiting the impacts of new developments on our watershed. Ramsey is required to apply for a permit from the National Pollutant Discharge and Elimination System Phase II/ State Disposal System program as administered by the United States Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA). The permit requires preparation of a Stormwater Pollution Prevention Plan (SWPPP). This document is the SWPPP for Ramsey Minnesota. Portions of this document were prepared for the 2003 permit application. The 2003 permit were challenged in court and modifications were required as a result of the challenge.

Self-Assessment Description
Before beginning to select BMPs and Measurable Goals, city staff undertook a self-assessment of our city's stormwater system. This was an evaluation of our city's conditions, needs, and practices. The objective of this process was to provide a knowledge base upon which to structure our SWPPP in order to meet the Permit's Maximum Extent Practicable standard.

The self-assessment was guided by materials included in the League of Minnesota Cities NPDES Phase II MS4 Guide Plan. This self-assessment process had two major components:

- The first workshop session organized as part of the LMC Guide Plan project included a self-assessment component led by Pat Collins of AMEC Earth & Environmental. This included:
    - discussion of physical and socio-political watershed and organizational conditions and issues that should guide the selection of BMPs and Measurable Goals
    - review of two examples of cities with different characteristics to demonstrate how local conditions should shape the selection of BMPs and Measurable Goals
    - a series of exercises in which our city staff considered the local conditions for our community and how they should guide our selection of BMPs and Measurable Goals.
- After the workshop session, we worked with the NPDES Phase II Program Assessment Questionnaire that was included in the LMC Guide Plan notebook. This was a twelve-page document with a comprehensive list of questions that we used to guide us through a self-assessment activity, including consideration of a wide range of stormwater approaches.

The results of this process include:

- a set of understandings among city staff
- written notes of the self assessment meeting
- completed Program Assessment Questionnaires from key personnel

Together, these items represent our knowledge of our local stormwater system and the conditions that shape it. We have used the results of this self-assessment process to guide our selection of BMPs and Measurable Goals that make up the SWPPP for our Permit Application.

Based on this self-assessment process, our staff has considered the following factors in order to meet the Maximum Extent Practicable standard set forth in the Permit:

- sources of pollutants
- potentially polluting activities being conducted in the watershed
- sensitivity of receiving waters

- uses of receiving waters
- specific local concerns
- the size of our community
- climate
- implementation schedules
- current ability to finance stormwater programs
- hydrology
- geology
- capacity to perform operation & maintenance
- local land uses
- rate and type of development
- characteristics of our watershed
- organizational characteristics of our city.

In addition to the self-assessment process discussed above, our staff has also considered the following non-stormwater discharges to determine whether they should be identified as significant contributors of pollutants to our stormwater system:

- water line flushing
- landscape irrigation
- diverted stream flows
- rising ground waters
- uncontaminated ground water infiltration
- uncontaminated pumped ground water
- discharges from potable water sources
- foundation drains
- air conditioning condensation
- irrigation water
- springs
- water from crawl space pumps
- footing drains
- lawn watering
- individual residential car washing
- flows from riparian habitats and wetlands
- de-chlorinated swimming pool discharges
- street wash water
- discharge or flows from fire fighting activities.

During the self-assessment process, the City of Ramsey did not find any of the additional referenced non-stormwater discharges listed above to be significant contributors of pollutants to the stormwater system.

The Rum River and Mississippi River are classified as Outstanding Resource Value Waters and new discharges are prohibited or restricted. The rivers and Rogers Lake in the northeast corner of the City are classified as impaired waters, discharges will be required to meet Total Maximum Daily Load targets as they are established. An Impaired Waters BMP Summary sheet and a Protected Discharge Assessment BMP Summary Sheet have been added after the Minimum Control Measure 6 sheets.

Minimum Control Measure Summary

The Revised Permit requires developing goals in six (6) areas which are: Public Education and Outreach, Public Participation/ Involvement, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Control, Post Construction Stormwater Management in New Construction and Redevelopment and Pollution Prevention/ Good Housekeeping. This document contains the 34 Best Management Practice Summary Sheets (BMPs) required for a complete permit application. The Minimum control measures are as follows:

Public Education and Outreach

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
1a-1	Distribute Educational Materials	**V.G.1.a**
1b-1	Implement an Education Program	**V.G.1.b**
1c-1	Education Program: Public Education and Outreach	**V.G.1.c**
1c-2	Education Program: Public Participation	**V.G.1.c**
1c-3	Education Program: Illicit Discharge Detection and Elimination	**V.G.1.c**
1c-4	Education Program: Construction Site Run-off Control	**V.G.1.c**
1c-5	Education Program: Post-Construction Stormwater Management in New Development and Redevelopment	**V.G.1.c**
1c-6	Education Program: Pollution Prevention/Good Housekeeping for Municipal Operations	**V.G.1.c**
1d-1	Coordination of Education Program	**V.G.1.d**
1e-1	Annual Public Meeting	**V.G.1.e**

Public Participation/ Involvement

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
2a-1	Comply with Public Notice Requirements	**V.G.2.a**
2b-1	Solicit Public Input and opinion on the Adequacy of the SWPPP	**V.G.2.b**
2c-1	Consider Public Input	**V.G.2.c**

Illicit Discharge Detection and Elimination

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
3a-1	Storm Sewer System Map	**V.G.3.a**
3b-1	Regulatory Control Program	**V.G.3.b**
3c-1	Illicit Discharge Detection and Elimination Plan	**V.G.3.c**
3d-1	Public and Employee Illicit Discharge Information Program	**V.G.3.d**
3e-1	Identification of Non Stormwater Discharges and Flows	**V.G.3.e**

Construction Site Stormwater Runoff Control

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
4a-1	Ordinance or other Regulatory Mechanism	**V.G.4.a**
4b-1	Construction Site Implementation of Erosion and Sediment Control BMPs	**V.G.4.b**
4c-1	Waste Controls for Construction Site Operators	**V.G.4.c**
4d-1	Procedure for Site Plan Review	**V.G.4.d**
4e-1	Establishment of Procedures for the Receipt and Consideration of Reports of Stormwater Noncompliance	**V.G.4.e**
4f-1	Establishment of Procedures for Site Inspections and Enforcement	**V.G.4.f**

Post-Construction Stormwater Management In New Development And Redevelopment

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
5a-1	Development and Implementation of Structural and/or Non-structural BMPs	**V.G.5.a**
5b-1	Regulatory Mechanism to Address Post Construction Runoff from New Development and Redevelopment	**V.G.5.b**
5c-1	Long-term Operation and Maintenance of BMPs	**V.G.5.c**
5d-1	Maintenance of Surface Water Protection Area	**IX.H**

Pollution Prevention/Good Housekeeping

Key to Unique BMP ID Numbers	Required BMP Title	Permit Reference
6a-1	Municipal Operations and Maintenance Program	**V.G.6.a**
6a-2	Street Sweeping**	
6b-2	Annual Inspection of All Structural Pollution Control Devices	**V.G.6.b.2**
6b-3	Inspection of a Minimum of 20 percent of the MS4 Outfalls, Sediment Basins and Ponds Each Year on a Rotating Basis	**V.G.6.b.3**
6b-4	Annual Inspection of All Exposed Stockpile, Storage and Material Handling Areas	**V.G.6.b.4**
6b-5	Inspection Follow-up Including the Determination of Whether Repair, Replacement, or Maintenance Measures are Necessary and the Implementation of the Corrective Measures	**V.G.6.b.5**
6b-6	Record Reporting and Retention of all Inspections and Responses to the Inspections	**V.G.6.b.6**
6b-7	Evaluation of Inspection Frequency	**V.G.6.b.7**

Summary of Ramsey Program

The City of Ramsey reviews all new subdivision plans at least 3 times prior to authorizing construction. The plan reviews look at stormwater ponding, rate control and erosion control. The plans for all developments over 1 acre are also reviewed by the Lower Rum River Water Management Organization (LRRWMO). The City has aligned its requirements with those of the LRRWMO to provide consistent guidelines for developers.

The City of Ramsey currently has a system in-place for issuing notices to contractors that do not properly maintain erosion control measures. The City adopted a Stormwater Pollution Control Ordinance which went into effect January 2007. It incorporated the conditions spelled out in the model ordinance provided by the MPCA. The city sweeps all streets in the spring to collect sand and prevent it from washing into the storm sewer system. The city also sweeps all streets in the fall to collect leaves. All outfalls where water leaves the MS4 boundaries have been inspected annually since 2003. These inspections were all during dry weather and discharges have not been detected during these inspections. The database of stormwater structures has been created listing the outfalls, ponds and structural water quality treatment structures. This list is used for scheduling inspections and tracking of repairs performed on the system.

The city will be improving the website content and establishing a collection of educational materials for various audiences as part of this new permit.

The City of Ramsey has programs in place for reducing stormwater pollution and this SWPPP is a guide for additional measures that will be implemented over the next 5 years to further improve the stormwater quality in Ramsey.

Ramsey is bounded by the Rum and Mississippi Rivers which are classified as restricted discharge waters. The area adjacent to the Rum River is mostly developed; redevelopment is not anticipated in the near future. The majority of the development is large lot single family residences with wells and septic systems. The bank area between the houses and the water's edge is natural vegetation; pipes have been pushed from the top to the bottom of the bank to provide an outlet for stormwater. Most of the pipes connect to vegetated ditches that provide drainage for the roadway areas. There is one development with urban lots served by municipal sewer, water and storm sewer. One development was approved within the last the 16 years; the remainder were constructed previous to that time. There are ponding areas immediately adjacent to the Rum River Outfalls. They are inspected when the outfalls are inspected each year. A water quality treatment structure was added to upstream of an outfall to the Rum River when drainage improvements were required in the area. This is the proposed course of action for adding additional water quality treatment structures along the Rum River.

The Mississippi River is also bounded by a combination of large lot single family residences and urban lots. The recent urban lots were developed with ponds to provide water quality treatment. The older developments may be retrofitted with water quality treatment structures when other work is required in the area. A county park occupies a significant portion of the undeveloped area along the Mississippi River, minimal development is proposed for this park. There are several large tracts under consideration by developers at this time. The schedule for development has not been established; however, these new developments will be within 2000 feet of the river and will require additional storm water measures under the Construction Permit Program prior to being approved.

The storm drainage for the City ultimately reaches the Rum or Mississippi Rivers except for some land locked basins. The land locked basins are connected to areas that drain to the rivers when feasibility studies indicate a benefit will be provided by the improvement. The rivers are the only available

outlets from stormwater discharge from the City of Ramsey and are listed as restricted discharges. The City will be incorporating volume reduction strategies into the Post Construction Stormwater Ordinance.

The 2008 Comprehensive report summarizes the land uses and projected changes through 2030. The data is tabulated below:

Land Use Classification	% City Land Area 2008	% City Land Area 2030	% Change
Agricultural/ Vacant	17		-*
Rural Developing		35	-*
Commercial/ Industrial/ Multifamily	6	10	4
Single Family Residential	38	15	-*
Park/ Quasi Public	7	9	2
Right-of-Way (State, County, Railroad, City)	11	11	0
Water/ Wetland	21	21	0

-* Classifications changed

The 2030 projections show a combination and re-division of the present Agricultural/ Vacant and Single Family Residential categories into Rural Developing and Single Family Residential categories. A slight increase is projected for the Commercial/ Industrial/ Multifamily The Parks and Right-of-Way will also increase as a result of the projected development.

All new developments are reviewed by the City and the LRRWMO prior to construction and must limit the rate of discharge from the site to pre-development rates and provide water quality treatment. Developments within the corridors adjacent to the rivers must meet density and open space standards along with preserving natural vegetation. The City adopted an updated Surface Water Management Plan in 2008 which will require all future developments to limit the rate of stormwater discharge to 75% of the existing discharge. This will be combined with the new Post Construction Discharge ordinance to address new or expanded discharges to the Rum and Mississippi rivers. Prohibiting all new stormwater discharges will deprive landowners of full use of their property and is contrary to the goals of the Metropolitan Council and the City of Ramsey Comprehensive Plan. The City of is Ramsey included in the 2030 Guide Plan for the Metropolitan Council which is looking at managing growth for the region. The new ordinance will be drafted to accommodate the required growth and limit discharges.

The City has modified construction plans to protect endangered species. The state list of endangered and threatened species is reviewed when developments are proposed near potential habitat. The City has a wetland buffer ordinance which also requires evaluation of potential impacts to endangered species habitat. Projects adjacent to potential habitat will be reviewed by the LRRWMO and with other agencies as appropriate.

The City is not aware of any properties eligible for listing in the National Register of Historic Places or Archeological sites. Environmental Assessment Worksheets have been completed for numerous projects in the city. These reports have not identified Historic or Archaeological sites within the boundaries of the city. We will continue to review all proposals for development and will require additional protection measures be implemented if sites of significance are identified in or adjacent to proposed developments.

The Drinking Water Supply Management Area has been mapped by the Minnesota Department of Health. The map is included in Appendix 2. The mapped area includes existing developments and the Ramsey Town Center Project. The Ramsey Town Center project utilizes regional ponds for stormwater rate control with additional water quality treatment practices required on each site in the development. Several of the regional ponds will have liners to maintain water levels for aesthetic purposes. The liners will prevent stormwater from entering the groundwater in the Drinking Water Supply Management Area.

Appendix 1

Best Management Practice Summary Sheets

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **1-Public Education And Outreach**

Unique BMP Identification Number: 1a-1

***BMP Title:** Distribute Educational Materials

***BMP Description:**

The City of Ramsey will distribute educational materials to the general public including City residents, homeowners, business owners and school children.

Location(s) in SWPPP of detailed information relating to this BMP:

The specific materials and audiences are described in 1c-1 – 1c-6.

***Measurable Goals:**

The effectiveness of the BMP will be measured by :

- recording the number of calls received in response to the educational materials
- recording the number of stormwater management assistance requests
- conduct period surveys to assess the implementation of methods

***Timeline/Implementation Schedule:**

In the 2009 the City will compile an inventory of existing educational materials and identify distribution formats beyond the periodic City news letter.
On an ongoing basis the city shall publish materials a minimum of four times in the City periodic newsletter, The Ramsey Resident.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1b-1

***BMP Title:** Implement an Education Program

***BMP Description:**

The education program will consist of brochures, handouts, web page content, posters, displays and community interaction. The program will explore placing public service announcements with local media outlets.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Record the distributions outlets and materials distributed to the public.

***Timeline/Implementation Schedule:**

Annually - Prepare report on the locations and numbers of the educational materials distributed.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1c-1

***BMP Title:** Education Program: Public Education and Outreach

***Audience(s) Involved:**

General public including city residents, homeowners, business owners and school students (K-12)

***Educational Goals for Each Audience:**

Increase public awareness and understanding of stormwater runoff and pollution potentials with in the community.
Demonstrate correlation between stormwater runoff and water quality.

***Activities Used to Reach Educational Goals:**

1. Stormwater Hotline
2. Website pages with stormwater information and links
3. Participate in annual Environmental Expo
4. Place articles in the Ramsey Resident regarding stormwater

***Activity Implementation Plan:**

Annually - prepare report on activities conducted.
Ongoing -Stormwater Hotline
Semiannually Update -Website pages with stormwater information and links
Annually each spring - Participate in City sponsored Environmental Expo
Quarterly - Place articles in the Ramsey Resident regarding stormwater

***Performance Measures:**

Record hotline calls received and response to the calls.
Record website hits, number of participants at educational events, materials handed out and published articles.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1c-2

***BMP Title:** Education Program: Public Participation

***Audience(s) Involved:**

General Public including City Residents, homeowners and business owners.

***Educational Goals for Each Audience:**

Increase public awareness and understanding of stormwater issues within the community.
Inform and educate the public about the impacts of stormwater runoff on water quality and what they can do to actively protect local lakes and streams from polluted stormwater runoff.
Inform and educate the public about how the City manages stormwater runoff through its' Stormwater Pollution Prevention Program (SWPPP).

***Activities Used to Reach Educational Goals:**

The City will report in the Ramsey Resident on activities related to managing stormwater and implementing the SWPPP. Topics for the newsletter may include information about the water quality of our City lakes and streams; events and programs the public can participate in to raise awareness about stormwater impacts; specific stormwater management activities the City is implementing; and the stormwater budget/ fees.
Displays and handouts will be available at the annual Environmental Expo.

***Activity Implementation Plan:**

Annually – Publish articles on stormwater management and the SWPPP in the Ramsey Resident, update web content.
Annually in spring – Participate in the Environmental Expo.
Ongoing – provide pet waste bags in city parks

***Performance Measures:**

Survey citizens to determine if stormwater articles were read and if their knowledge of stormwater issues was increased.
Track number of persons participating in Environmental Expo.
City will evaluate effectiveness of Education program after 2 years and make adjustments as needed to make program more effective.
Pet waste bag dispensers have been placed in parks. The public is using the bags, reducing the amount of waste before it can wash into ponds and wetlands.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1c-3

***BMP Title:** Education Program: Illicit Discharge Detection and Elimination

***Audience(s) Involved:**

The City of Ramsey will distribute educational materials to the general public including City residents, homeowners, business owners and City Staff regarding Illicit Discharge Detection and Elimination.

***Educational Goals for Each Audience:**

Raise public awareness of illicit discharges within all groups.
Educate city staff on ways to detect potential illicit discharges.

***Activities Used to Reach Educational Goals:**

Insert brochures in new resident packet.
Provide information to business owners.
Educate Public Works staff during monthly meetings.
Provide display at environmental expo calling attention to potential for illicit discharge

***Activity Implementation Plan:**

Annually in December - Update brochures for new resident packet
Annually in Spring – Provide display at the environmental expo
Biannually in even numbered years - Send information to business owners
Biannually in even numbered years - review keys to recognition of illicit discharges with Public Works staff

***Performance Measures:**

Record training dates
Record contacts with business owners and training sessions
Prepare summary report of environmental expo

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey
Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH
Unique BMP Identification Number: 1c-4

***BMP Title:** Education Program: Construction Site Run-off Control

***Audience(s) Involved:**

Developers(including their Engineers and Contractors) and City Staff

***Educational Goals for Each Audience:**

Reinforce the need for use and maintenance of erosion control BMP's on construction sites.

***Activities Used to Reach Educational Goals:**

Publish Ramsey BMP construction activity guide
Comment on erosion control practices on site plan reviews
Review erosion control issues at preconstruction conferences with contractors

***Activity Implementation Plan:**

2009 - The codification of the BMPs will take place as noted in section 5 of City Code.
Ongoing as site plans, building permits and construction projects occur.

***Performance Measures:**

Record number of site plan, building permits and construction projects reviews.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1c-5

***BMP Title:** Education Program: Post-Construction Stormwater Management in New Development and Redevelopment

***Audience(s) Involved:**

The City of Ramsey will distribute educational materials to the general public including City residents, homeowners, business owners and City Staff regarding Post-Construction Stormwater Management in New Development and Redevelopment.

***Educational Goals for Each Audience:**

Increase public awareness and understanding of stormwater runoff and pollution potentials with in the community. Demonstrate correlation between stormwater runoff and water quality.

***Activities Used to Reach Educational Goals:**

The materials developed in 1c-1 will be used in this BMP also.

***Activity Implementation Plan:**

The schedule will be the same as 1c-1.

***Performance Measures:**

See section 1c-1.

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1c-6

***BMP Title:** Education Program: Pollution Prevention/Good Housekeeping for Municipal Operations

***Audience(s) Involved:**

City Public Works Staff

***Educational Goals for Each Audience:**

Review need for an increased awareness of Good Housekeeping practices in municipal operations within the Public Works Department.

***Activities Used to Reach Educational Goals:**

Brochures, handouts and training sessions.

***Activity Implementation Plan:**

Annually – at one of the monthly public works all staff meetings.

***Performance Measures:**

Annually – report on training session conducted

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1d-1

***BMP Title:** Coordination of Education Program

***BMP Description:**

Annually review the content of programs and brochures being used within the program. Update materials were necessary and review related agency materials for consideration of new or improved materials.

Location(s) in SWPPP of detailed information relating to this BMP:

BMP 1

***Measurable Goals:**

Report on program content and material changes.

***Timeline/Implementation Schedule:**

Annually - prepare report on material and program modifications

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: PUBLIC EDUCATION AND OUTREACH

Unique BMP Identification Number: 1e-1

***BMP Title:** Annual Public Meeting

***BMP Description:**

Hold annual public meeting. Meeting will be scheduled to allow time for preparation of annual report for previous calendar year. Annual report will be available at the meeting for review. Comments received will be reviewed and incorporated in the annual report as appropriate.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Advertise and hold annual meeting.

***Timeline/Implementation Schedule:**

Annually – hold annual meeting.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **2-Public Participation/ Involvement**

Unique BMP Identification Number: 2a-1

***BMP Title:** Comply with Public Notice Requirements

***BMP Description:**

The annual meeting will be advertised at least 30 days in advance. The paper used for all official notices of the city will be used. The meeting date will also be posted at City Hall and on the website.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Record notice of Publication of notice in annual report.

***Timeline/Implementation Schedule:**

Annually- publish meeting notice.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 2-PUBLIC PARTICIPATION/INVOLVEMENT

Unique BMP Identification Number: 2b-1

***BMP Title:** Solicit Public Input and opinion on the Adequacy of the SWPPP

***BMP Description:**

The SWPPP will be available at City Hall in the Engineering Department and on the Website. Instructions for providing written comments will be available. Contact information is provided to accommodate written and oral comment.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Recording the number of responses and comments on the SWWPPP
Record attendance at the annual meeting

***Timeline/Implementation Schedule:**

Annually – Hold public meeting

Annually- Submit comments provided by the public in the annual report..

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 2-PUBLIC PARTICIPATION/INVOLVEMENT

Unique BMP Identification Number: 2c-1

***BMP Title:** Consider Public Input

***BMP Description:**

Public input will be gathered from review of the SWPPP and at the Annual meeting. The information gathered will be reviewed and a response shall address the concern or comment. A summary of proposed changes to the SWPPP will be addressed in the annual report.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Hold public meeting
Record comments and responses on the SWPPP into the annual report.

***Timeline/Implementation Schedule:**

Annually – Prepare report, hold meeting and submit report to MPCA

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **3-Illicit Discharge Detection And Elimination**

Unique BMP Identification Number: 3a-1

***BMP Title:** Storm Sewer System Map

***BMP Description:**

The City of Ramsey will develop a Storm Sewer System Map that will assist us in determining the presence of Illicit Discharges. The map will also aid in inspection of the storm sewer system and to prioritize the annual maintenance required to optimize the use of the storm sewer system to reduce pollution in disharges to the waters of the State.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Completed Storm Sewer System Map
Identification of needed maintenance

***Timeline/Implementation Schedule:**

December 2006 – Compilation of As-built information
December 2007 – Completion of Storm Sewer System Map
June 30, 2008 Storm Sewer System Map Completed
Annually – Update map with new projects and reconstruction

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 3-ILLICIT DISCHARGE DETECTION AND ELIMINATION

Unique BMP Identification Number: 3b-1

***BMP Title:** Regulatory Control Program

***BMP Description:**

The State of Minnesota has regulations prohibiting the connection of non-stormwater discharges into the storm sewer system. The City has adopted an Individual Sewage Treatment System Ordinance. The city will adopt an Illicit Discharge Detection and Elimination Ordinance.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Completed review of existing regulations
Adopt new ordinance

***Timeline/Implementation Schedule:**

December 2006 - Completed draft ordinance
December 2007 - Completed ordinance

Specific Components and Notes:

The city has inspected all known outfalls from the MS4 to the Rum and Mississippi Rivers annually since 2003. These were all dry weather inspections and flow was not observed in the pipes during these inspections.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 3-ILLICIT DISCHARGE DETECTION AND ELIMINATION

Unique BMP Identification Number: 3c-1

***BMP Title:** Illicit Discharge Detection and Elimination Plan

***BMP Description:**

The City of Ramsey currently offers a recycling program to the residents. The program includes curbside pickups and a semi-annual recycling day for electronics and larger items not accepted in the curbside program. The City of Ramsey has been recognized by Anoka County for exceeding participation goals in the recycling program.

The City has had a mandatory septic tank pumping ordinance in place since 2005.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Completed Recycling days
Quantity of materials recovered from solid waste stream
Number of septic systems reported pumped

***Timeline/Implementation Schedule:**

Annually – report number of septic systems pumped
Annually – inspect outfalls and act on dry weather flows observed

Specific Components and Notes:

Curbside recycling
"Recycling Day"
Maintenance vehicle liquid recycling
The city has inspected all known outfalls from the MS4 to the Rum and Mississippi Rivers annually since 2003. These were all dry weather inspections and flow was not observed in the pipes during these inspections.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 3-ILLICIT DISCHARGE DETECTION AND ELIMINATION

Unique BMP Identification Number: 3d-1

***BMP Title:** Public and Employee Illicit Discharge Information Program

***BMP Description:**

Education of Employees and Public on Illicit Discharge Program

Ramsey will develop a strategy to inform City Employees, property owners, local businesses and the public about the hazards associated with illicit discharges and improper waste disposal.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

City staff trained in Illicit Discharge Recognition.
Distribution of educational materials on Illicit Discharge Detection and Elimination.
Summarize recycling volume in annual report
Include summary of disseminated educational material with annual report

***Timeline/Implementation Schedule:**

Annually review shop procedures regarding vehicle fluids
June 2009 compile resources for Illicit Discharge Recognition training Program
January 2010 Complete staff Illicit Discharge Recognition Training
Annually IDDE refresher training, disseminate literature

Specific Components and Notes:

Use "Rubber Ducky" or similar public service announcements via local cable
Review maintenance vehicle fluid procedures at Employee meetings
Distribute recycling information to residents through newsletter, website and Environmental Expo

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 3-ILLICIT DISCHARGE DETECTION AND ELIMINATION

Unique BMP Identification Number: 3e-1

***BMP Title:** Identification of Non Stormwater Discharges and Flows

***BMP Description:**

The City is in the process of indentifying drainage areas and has completed a comprehensive stormwater model for all drainage areas in the City. The model will be used in conjunction with the Storm Sewer Map and field observations to determine areas where illicit discharges may exist.

The City will develop a process to determine whether any of the following categories of non-stormwater discharges or flows are significant contributors of pollutants to our MS4:

Waterline flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated groundwater infiltration, uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, de-chlorinated swimming pool discharges, street wash water, and discharges or flows from fire fighting activities.

For any non-stormwater discharges or flows which the City finds to be a significant contributor of pollutants to the MS4 the City will develop an action plan to evaluate and address the impact the discharge is having on stormwater quality.

Location(s) in SWPPP of detailed information relating to this BMP:

MCM 3.C

***Measurable Goals:**

Completion of the study
Develop a process to investigate and evaluate the potential for the non-stormwater discharges identified above to be significant contributors of pollutants to our MS4.
Conduct investigation and evaluation of non-stormwater discharges and flows.
Develop an action plan for flows identified as significant contributors of pollutants to our MS4.
Implement action plan for significant non-stormwater discharges and flows.

***Timeline/Implementation Schedule:**

May 2007 – Selected Consultant to prepare comprehensive stormwater study
October 2008 – City Council accepted comprehensive stormwater study
August 2009 Complete ordinance modifications required in comprehensive stormwater study.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **4-Construction Site Stormwater Runoff Control**

Unique BMP Identification Number: 4a-1

***BMP Title:** Ordinance or other Regulatory Mechanism

***BMP Description:**

Construction Site Stormwater Runoff Control and Enforcement is addressed in section 9.27 of City Code and went into effect on January 2, 2007.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Adoption of Ordinance

***Timeline/Implementation Schedule:**

June 2006 Adopt Ordinance
Ongoing - Work with builders to raise awareness of ordinance and enforce provisions of ordinance.

Specific Components and Notes:

Required Components in ordinance:

- Submittal of Erosion and Sediment Control plans by site Operators to MS4
- Site Plan Review and Approval before construction
- Site operators maintain records on rainfall and inspections
- Regular inspections by site operators
- Specify requirements for dewatering or basin draining at site
- Specify requirements for BMP maintenance
- Specify controls for managing solid and hazardous wastes
- Specify requirements for permanent stormwater controls
- Specify requirements for perennial vegetative cover on exposed soils
- Compliance includes Verbal warnings, written warnings, stop-work orders, fines, forfeit of security bond money and/or withholding of certificate of occupancy.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 4-CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Unique BMP Identification Number: 4b-1

***BMP Title:** Construction Site Implementation of Erosion and Sediment Control BMPs

***BMP Description:**

Installation and maintenance of erosion control measures on construction sites.

The City of Ramsey will continue to utilize the MPCA "Protecting Water Quality in Urban Areas" manual, BWSR "MN Construction Site Erosion and Sediment Control" handbook, Met Council's "Small Site BMP" manual and the MPCA " Minnesota Stormwater Manual" for BMP selection. Developers are directed to these manuals for preparation of their plans. City review of all development plans requires incorporation of the BMPS presented in these manuals.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Ongoing – Review and comment on erosion control measures on construction plans in conjunction with Preliminary and Final Plat Approvals

***Timeline/Implementation Schedule:**

Ongoing - The city currently reviews and comments on erosion control measures and BMP's on all construction plans. The process continues in the field, our construction observers monitor all construction sites and issue repair notices to sites where BMP's are not controlling erosion.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 4-CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Unique BMP Identification Number: 4c-1

***BMP Title:** Waste Controls for Construction Site Operators

***BMP Description:**

City Code requires dumpsters or debris containment areas on all construction sites. Inspections can be withheld if debris is not picked up.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Minimize complaints from residents about construction debris.

***Timeline/Implementation Schedule:**

Ongoing – review construction site waste controls, enforce existing regulations.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

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BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 4-CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Unique BMP Identification Number: 4d-1

***BMP Title:** Procedure for Site Plan Review

***BMP Description:**

The City development approval process includes three (3) phases, Sketch Plan, Preliminary Plat and Final Plat for subdivision of land. Site plans have 2 phases Preliminary Site plan and Final Site Plan. Staff reviews the plans at each phase and provides a review letter to the development team. Sites over 1 acre also require a permit from the Lower Rum River Water Management Organization (LRRWMO). The reviews from both agencies address erosion control, temporary sedimentation basins and final stormwater ponding requirements. The city has established a system of notices for construction site erosion control problems. The notices are provided to the contractor specifying the work to be done and the timeframe to complete the work. The system includes means for the City to perform the work if the contractor fails to act.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Continue plan review; implement changes in process if necessary.

***Timeline/Implementation Schedule:**

Ongoing – review development plans, require implementation of appropriate Construction Site BMPs for controlling stormwater runoff.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 4-CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Unique BMP Identification Number: 4e-1

***BMP Title:** Establishment of Procedures for the Receipt and Consideration of Reports of Stormwater Noncompliance

***BMP Description:**

The current system of erosion control notices addresses Stormwater Noncompliance. A Stormwater Hotline and website will be added to provide additional avenues for reporting stormwater violations. Currently, calls received on violations are routed to field staff for observation of the condition and preparation of a notice as necessary.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Record all calls received including corrective measures performed.
Record all notices issued for stormwater noncompliance.

***Timeline/Implementation Schedule:**

December 2006 – Implement Hotline and Website.
Ongoing - Observe construction sites and issue notices as needed; receive and follow-up on calls and web postings regarding stormwater noncompliance.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 4-CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Unique BMP Identification Number: 4f-1

***BMP Title:** Establishment of Procedures for Site Inspections and Enforcement

***BMP Description:**

Inspect construction sites for stormwater noncompliance. Issue notices for corrective actions, follow-up to ensure compliance. The City has established a system of notices that are issued for erosion control non-compliance as noted in 4d-1.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Log of completed inspections and notices issued.

***Timeline/Implementation Schedule:**

Ongoing – Continue site inspections, issuing notices and following up on notices.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **5-Post-Construction Stormwater Management In New Development And Redevelopment**

Unique BMP Identification Number: 5a-1

***BMP Title:** Development and Implementation of Structural and/or Non-structural BMPs

***BMP Description:**

The City of Ramsey will evaluate and select the BMPs necessary to achieve the balance between water quality and water quantity to ensure that the waters of the community are clean and residents and property are not damaged.

The City of Ramsey has accepted innovative water quality treatment devices and will continue to evaluate new technologies for implementation in the City.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Selection of BMPs
Publication of accepted BMPs
Implementation of BMPs

***Timeline/Implementation Schedule:**

December 2007 – BMPs codified
December 2008 – BMPs published

Specific Components and Notes:

Construction erosion and sedimentation control ordinance
Evaluate and select BMPs

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 5-POST-CONSTRUCTION STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT

Unique BMP Identification Number: 5b-1

***BMP Title:** Regulatory Mechanism to Address Post Construction Runoff from New Development and Redevelopment

***BMP Description:**

Adoption of Post Construction Runoff Ordinance
The City of Ramsey will have a Post Construction Runoff Ordinance in place within 6 months of extension of permit coverage.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Evaluation of existing ordinance
Adoption of Ordinance

***Timeline/Implementation Schedule:**

December 2008 – Evaluation of Ordinance
December 2009 – Adoption of Ordinance

Specific Components and Notes:

The City of Ramsey currently operates under a Subdivision Ordinance. The City will evaluate the BMPs and existing ordinance to see that the provisions of the SWPPP are being accomplished and develop a Post Construction Ordinance in the 5th year of the permit cycle.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 5-POST-CONSTRUCTION STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT

Unique BMP Identification Number: 5c-1

***BMP Title:** Long-term Operation and Maintenance of BMPs

***BMP Description:**

The City of Ramsey will monitor and maintain BMPs installed in the City.

The City established a stormwater utility in 2000. The fund has been used to fund needed storm sewer improvements.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Update storm sewer system database with location of Structural BMPs.
Annual report on BMP maintenance.

***Timeline/Implementation Schedule:**

December 2007 – Update storm sewer system database with Structural BMPs
Annually – Prepare report on maintenance of structural BMPs

Specific Components and Notes:

The City has included a vacuum truck in the 5 year Capital Equipment Plan that can be used for maintenance of structural BMPs (oil/water separators, sump manholes, water quality treatment structures). Current needs are met by contracting for needed services.

The public works department monitors and repairs the current BMPs.

The City acquired a vacuum truck in December 2008 that will be used to maintain the structural BMP's.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 5-POST-CONSTRUCTION STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT

Unique BMP Identification Number: 5d-1

***BMP Title:** Maintain Source Water Protection Area

***BMP Description:**

The map of the Source Water Protection Area (SWPA) is included in Appendix 2. The SWPA covers the Ramsey Town Center Area which is bounded on the east by Ramsey Boulevard, on the west by Armstrong Boulevard, on the South by the Burlington Northern Santa Fe Railroad. The northern boundary is approximately at 149th Avenue which is not continuous in this area. The Ramsey Town Center development included regional ponds for rate control, individual developments are required to provide additional treatment on site such as water quality treatment manholes, infiltration basins or pervious pavement. Each proposed BMP is evaluated as part of the plan review process. Several of the regional ponds are lined to maintain water levels and provide water features. These ponds are nearest to most of the municipal water supply wells. The remaining regional ponds are south of the municipal wells. The surface water aquifer flow is from north to south in this area.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Maintain ponds and BMPs in this area. Record work done.
Continue requirement for additional on-site measures as Ramsey Town Center develops.
Coordinate development reviews for this area with Well Head protection requirements to ensure protection of the Drinking Water Source Area.

***Timeline/Implementation Schedule:**

Ongoing – Monitor and maintain ponds and BMPs

Specific Components and Notes:

The City will incorporate the MDH Stormwater Guidance manual into plan reviews for projects in proximity to the wellhead protection areas.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: **6-Pollution Prevention/ Good Housekeeping**

Unique BMP Identification Number: 6a-1

***BMP Title:** Municipal Operations and Maintenance Program

***BMP Description:**

The City of Ramsey will develop a collection of training materials that will be used to educate staff about pollution prevention and good housekeeping. These resources will come from applicable external sources, such as the EPA and may be supplemented with materials developed by our own organization.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Completed training materials
Employee training

***Timeline/Implementation Schedule:**

December – 2006 Evaluation of outside agency materials
December – 2007 Compilation of training resource reference folder
Annual updates

Specific Components and Notes:

Equipment and Hazardous Material Storage
Information Management System
Employee training

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6a-2

***BMP Title:** Street Sweeping**

***BMP Description:**

The City of Ramsey will semi-annually sweep the streets of the City to remove potential pollution materials before they can enter the storm sewer system.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Number of lane miles swept

***Timeline/Implementation Schedule:**

Annually

Specific Components and Notes:

Sweeping schedule
Sweeper maintenance schedule.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-1

***BMP Title:** Annual Inspection of All Structural Pollution Control Devices

***BMP Description:**

Inspection of Structural Pollution Control Devices – the locations of these devices are being compiled as part of the Storm Sewer Mapping program.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Prepare annual report on inspection results

***Timeline/Implementation Schedule:**

December 2007 – Completion of Storm Sewer mapping, database of devices and first round of inspections of Structural Pollution Control Devices.

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-2

***BMP Title:** Inspection of a Minimum of 20 percent of the MS4 Outfalls, Sediment Basins and Ponds Each Year on a Rotating Basis

***BMP Description:**

Inspection of MS4 Outfalls, Sediment Basins and Ponds on a rotating basis, creating work orders for repairs as needed.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Inspection of 20 percent of the MS4 Outfalls, Sediment basins and Ponds Each Year
Preparation of annual inspection report

***Timeline/Implementation Schedule:**

December 2006 Complete Annual Inspection
Annually thereafter – Complete Inspection

Specific Components and Notes:

The city has identified all of the MS4 outfalls and is still adding ponds to the storm sewer map.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1440
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-3

***BMP Title:** Annual Inspection of All Exposed Stockpile, Storage and Material Handling Areas

***BMP Description:**

Inspect City owned Stockpile, Storage and Material Handling areas.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Completion of annual inspection report.

***Timeline/Implementation Schedule:**

December 2006 Complete Annual Inspection of exposed Stockpile, Storage and Material Handling Areas

Specific Components and Notes:

The City will be installing an enclosed Salt Storage building in 2006. The current Salt Storage covers the stockpile; however the loading operations are enclosed. This facility will provide room for loading inside. The other material stock piles are located away from storm inlets, ponds and ditches.

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 421-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-4

***BMP Title:** Inspection Follow-up Including the Determination of Whether Repair, Replacement, or Maintenance Measures are Necessary and the Implementation of the Corrective Measures

***BMP Description:**

Review Inspection notes and schedule appropriate repair, replacement and maintenance measures noted in inspection reports.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Preparation of Inspection Follow-up Report

***Timeline/Implementation Schedule:**

December 2006 Prepare report
Annually thereafter prepare report

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-5

***BMP Title:** Record Reporting and Retention of All Inspections and Responses to the Inspections

***BMP Description:**

Establish record retention system for all MS4 related Inspections.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Establish and utilize record retention system

***Timeline/Implementation Schedule:**

December 2006 Establish record retention system

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey

Minimum Control Measure: 6-POLLUTION PREVENTION/GOOD HOUSEKEEPING

Unique BMP Identification Number: 6b-6

***BMP Title:** Evaluation of Inspection Frequency

***BMP Description:**

Evaluate Inspection Results and adjust frequency if needed.

Location(s) in SWPPP of detailed information relating to this BMP:

***Measurable Goals:**

Prepare report on evaluation of Inspection Results

***Timeline/Implementation Schedule:**

December 2008 Evaluate inspection results for first 3 years of program.
Annually incorporate latest inspections into evaluation

Specific Components and Notes:

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness.*

BMP Summary Sheet

MS4 Name: City of Ramsey
Permit Condition: IV.D Section 303(d) listings
Unique BMP Identification Number: IV.D – 1

BMP Title: Impaired Waters Review Process

BMP Description:

The City of Ramsey will review all discharges from our MS4 system to impaired waters, as defined by the current USEPA approved 303(d) list. Using the data from this review, we will determine if any changes to the existing stormwater system or BMPs are needed to minimize the impact of discharges from our MS4 to the impaired waters. If changes are needed the City of Ramsey will modify our SWPPP and submit these modifications to the MPCA with our current annual report.

Measurable Goals:

- The City of Ramsey has determined that discharges from our MS4 system enter the following impaired waters, as defined by the current USEPA approved 303(d) list: (Water Body, Impairment)
    - Mississippi River - Mercury in Fish Tissue, PCB in Fish Tissue
    - Rogers Lake - Aquatic Recreation
    - Rum River - Mercury in Fish Tissue
- This determination was made using the Storm Sewer Map and citywide stormwater model. The mercury TMDL is being addressed state wide and it is assumed the discharge from Ramsey is not a source of mercury. The PCB in fish tissue TMDL plan has not been approved as of June 2008. The TMDL for Rogers Lake is not scheduled to start until 2015.
- The Mississippi River and the Rum River are both classified as ORVW waters. A separate BMP Summary sheet has been prepared for Discharges to Waters with Prohibited or Restricted Discharges Assessment.
- The watersheds, hydrology and impacts will be developed simultaneously for the Impaired Waters and Prohibited Discharge Waters.

Timeline/Implementation Schedule:

December 2008	The City of Ramsey has identified the Rum River, Mississippi River and Rogers Lake as Impaired Waters receiving impacts from its MS4 discharges. A map has been prepared showing the Impaired Waters. A city wide stormwater model has been developed.
May 2009	The City will correlate the Impaired Waters watersheds with the stormwater model and will complete an evaluation of hydrology, land use and runoff. The City will evaluate changes to its storm sewer system to reduce the impacts to the Impaired Waters.
June 30 2009	The City of Ramsey will submit as an attachment to the Annual Report to the MPCA, the assessment, response to any public comments, plan for ongoing work elements and any proposed changes to the SWPPP that have been deemed necessary through this assessment process.
Ongoing	The City of Ramsey will review, evaluate and incorporate changes to the SWPPP as TMDL goals are established and published for these waters.

Specific Components and Notes:

This process is to be reassessed annually over the course of the permit cycle. As new 303(d) lists with additional impaired waters listed are published in the future, City of Ramsey will review changes to the list and conduct the necessary review of additional listed waters likely to be impacted by the MS4's stormwater discharges.

When an USEPA approved TMDL is finalized, the City of Ramsey intends to fully comply with all limits and requirements set forth in the TMDL in accordance with the schedule(s) outlined in the TMDL and the MS4 Permit.

Responsible Party for this BMP:

Name: Leonard Linton

Department: Engineering

Phone: 763 427-1410

E-mail: llinton@ci.ramsey.mn.us

BMP Summary Sheet

MS4 Name: City of Ramsey

Permit Condition: IX. Appendix C. Part A and/or Part B.

Unique BMP Identification Number: IX. A. and/or IX. B.

***BMP Title:** Discharges to Waters with Prohibited or Restricted Discharges Assessment

***BMP Description:** City of Ramsey Practices for discharges to ORVW waters

- This BMP includes establishment of a baseline of information– determine what processes are in place and what has already been accomplished that will help meet the permit conditions
- This BMP includes preparation of a written inventory of all stormwater discharges to the prohibited or restricted water(s) from within the jurisdictional boundaries of the MS4; compile necessary detail about the stormwater discharges to assess the impacts and alternatives
- Prepare a map that includes all the delineated sub-watershed(s) covering the MS4 that discharge to the ORVW, including the identified discharge points and routes to the ORVW waters that the MS4 discharge may impact.
- Evaluate past and future changes in the watersheds, projected out at least through the year 2020.
- Determine if a new or expanded discharge has or would occur and the magnitude of the potential changes.
- Evaluate alternatives to the discharge.
- Propose methods of eliminating the discharge.

Activity Implementation Plan

As an MS4 located within a watershed that discharges to ORVW waters, City of Ramsey will submit an assessment and other documentation required in Appendix C of permit MNR040000 of which the following are major components:

1. The City of Ramsey topography generally slopes from northwest to southeast. The eastern boundary is the Rum River and the southern boundary is the Mississippi River. Both Rivers are designated ORVW's. Many of the developments in the City, especially along the rivers, were in place prior to designation of the rivers as ORVW's. Development has continued since the designation and the level of storm water treatment has increased with time. Development is anticipated to continue in the future.

2. The City has prepared a stormwater model for the entire city based on the existing storm sewer system. The model has identified areas that are landlocked and do not discharge to the rivers, excluding these areas all runoff reaches either the Rum River or the Mississippi River.

3. The City has prepared a map showing when plats were approved for determination of where discharges have occurred since the ORVW was designated. It appears that new or expanded discharges have occurred since the ORVW was designated. The City has prepared a stormwater model for the entire city that will be used in conjunction with the plat date map to evaluate changes to the discharges.
4. The City adopted an updated Surface Water Management Plan in 2008. The plan calls for all new developments to incorporate infiltration practices and to limit discharge rates to 75% of the existing runoff rates. The city will evaluate Low Impact Development, infiltration and volume reduction strategies and will adopt ordinances requiring the practices that are best suited for the unique conditions in Ramsey.

***Timeline/Implementation Schedule:**

December 2008	The City of Ramsey has identified the Rum River and Mississippi River as ORVW waters receiving impacts from its MS4 discharges. A map has been prepared showing developments approved after the ORVWs were designated. A city wide stormwater model has been developed.
May 2009	The City will correlate the post ORVW development watersheds with the stormwater model and will complete an evaluation of hydrology, land use and runoff. The City will evaluate volume reduction strategies and will adopt an ordinance requiring the use of volume reduction strategies in future development/ redevelopment projects.
June 30 2009	The City of Ramsey will submit as an attachment to the Annual Report to the MPCA, the assessment, response to any public comments, plan for ongoing work elements and any proposed changes to the SWPPP that have been deemed necessary through this assessment process.

Specific Components and Notes: Provide any clarification or other work related to this action here.

***Responsible Party for this BMP:**

Name: Leonard Linton
Department: Engineering
Phone: 763 427-1410
E-mail: llinton@ci.ramsey.mn.us

**Indicates a REQUIRED field. Failure to complete any required field will result in rejection of the application due to incompleteness*

Appendix 2

MPCA/ DNR Exhibits

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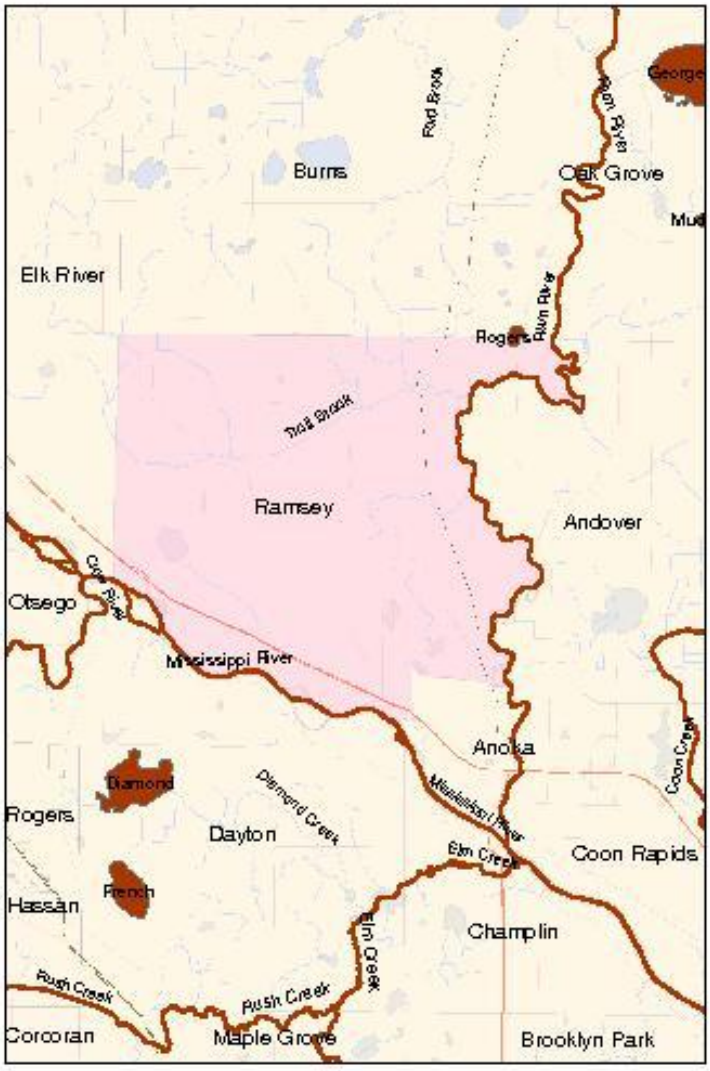
ATTACHMENT
LIST OF SPECIAL WATERS
(MPCA)

Excerpt from MPCA Special Waters List

County	Waterbody	Designation	Location
…			
Anoka	Mississippi River	Scenic/ Rec River	State Aid Highway 7 bridge in St. Cloud to NW Anoka City Limits
Anoka	Rum River	Scenic/ Rec River	Highway 27 Bridge in Onamia to Rice and Madison Streets in Anoka
….			

Ramsey City MS4
Impaired Waters 8/1/2006



Legend

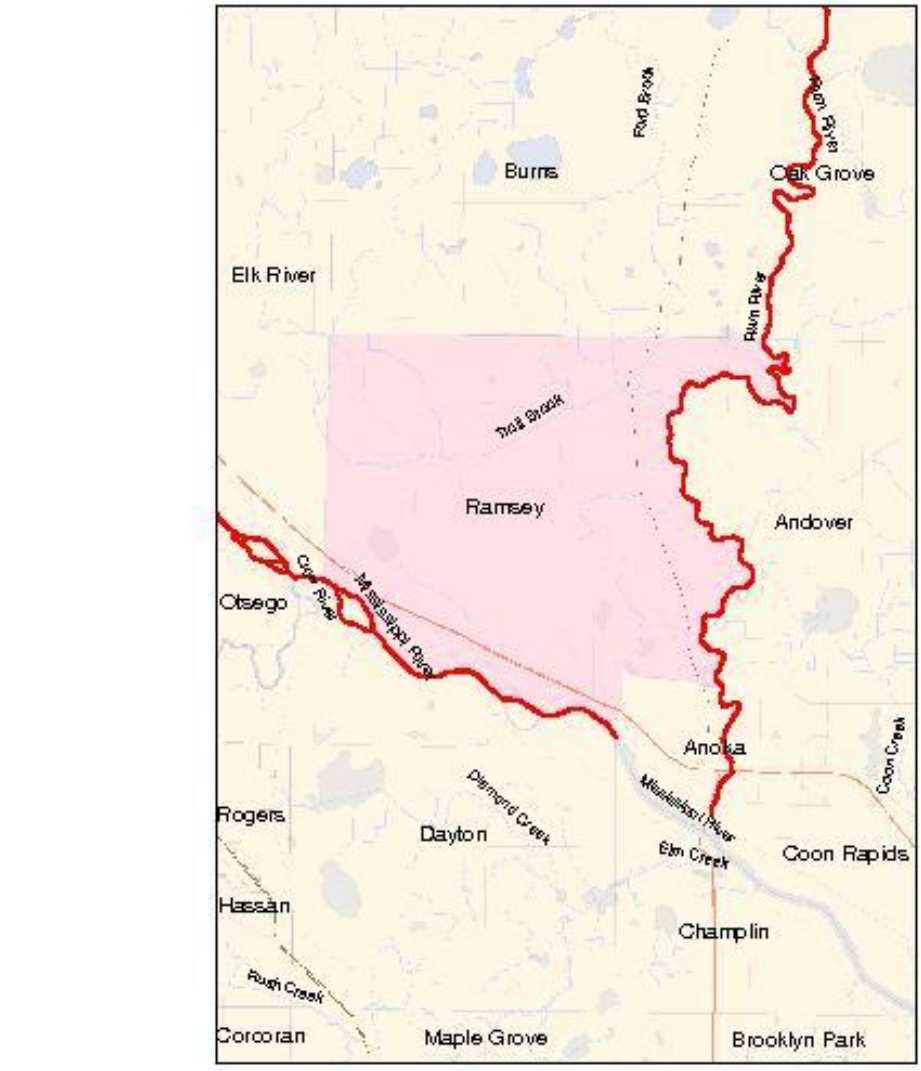
- Impaired Streams
- Impaired Lakes
- Your MS4
- Cities/Townships
- Lakes
- Rivers

Roads

- Interstate
- US Highway
- MN Highway
- CSAH
- County Road

0 1,600 3,200 6,400
Meters

Ramsey City MS4
Waters of Interest 8/1/2006



Legend

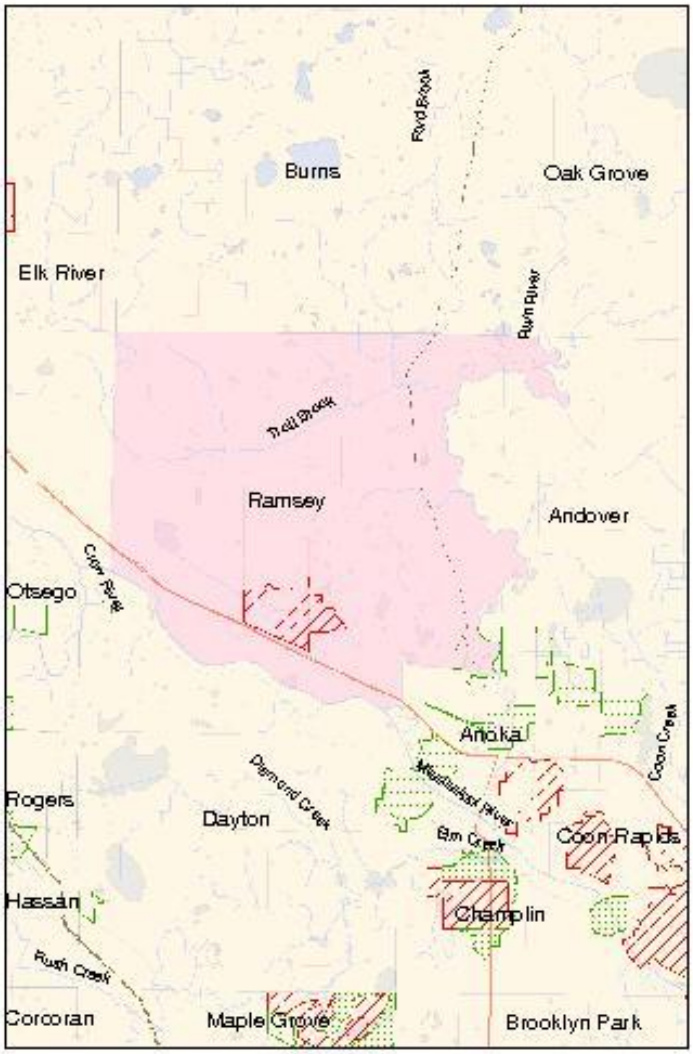
- ORVW Streams
- Your MS4
- Cities/Townships
- Lakes
- Rivers

Roads

- Interstate
- US Highway
- MN Highway
- CSAH
- County Road

0 1,600 3,200 6,400
Meters

Ramsey City MS4 DSW 8/1/2006



Legend

Drinking Source Waters
- Low Vulnerability
- Vulnerable
- Your MS4
- Cities/Townships
- Lakes
- Rivers

Roads
- Interstate
- US Highway
- MN Highway
- CSAH
- County Road

0 1,650 3,300 6,600 Meters

Appendix B

Comment Letters

June 22, 2015

Mr. Bruce Westby
City Engineer
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

RE: City of Ramsey Surface Water Management Plan (plan)
Metropolitan Council Review File No. 21414-1

Dear Mr. Westby:

The Metropolitan Council (Council) has completed its review of the above plan, dated May 12, 2015. The plan is consistent with Council policies and the Council's *Water Resources Policy Plan*. The Council finds the plan fulfills the requirements for a local water management plan, and provides an excellent framework for managing storm water in the city.

We do have several minor comments on the plan:

- Page 1 of the plan refers to the Council's 2030 Water Resources Management Policy Plan; the Metropolitan Council adopted its *2040 Water Resources Policy Plan* on May 20, 2015.
- In *Section X, C. Recommendations* and in some of the policies, actions are referred to as things that "should" be done. The plan needs to have specific language as to what will be done and by whom.
- In *Section X, E. Model Results*, the text refers to figures in the plan, however the figure numbers given appear to be incorrect. For example, the text heading says, "*Figures 15 &16 EMISS Watershed.*" However Figure 16 is actually the Golf watershed 100 year pond summary.

Thank you for considering our comments on the city's plan. Again, the Council believes Ramsey's Surface Water Management Plan provides an excellent framework for managing storm water in the city and protecting water quality and quantity. If you have any questions regarding these comments, please contact Joe Mulcahy, at 651-602-1104.

Sincerely,

Leisa Thompson
General Manager, Environmental Services Division

cc: Todd Hass, Chair, Lower Rum River Watershed Management Organization
Edward Reynolds, Metropolitan Council District 9
Sam Paske, Assistant General Manager, Environmental Quality Assurance Department
Annalee Garletz, Metropolitan Council Sector Representative
Reya Ismacili, Metropolitan Council Referrals Coordinator
Joe Mulcahy, Water Resources Assessment Section

390 Robert Street North Saint Paul, MN 55101-1805
651.602.1000 | TTY 651.291.0904 metrocouncil.org

METROPOLITAN COUNCIL

Anoka Conservation District
1318 McKay Drive NE, Suite 300
Ham Lake, Minnesota 55304
Ph: 763-434-2030 Fx: 763-434-2094
www.AnokaSWCD.org

July 2, 2015

Bruce Westby, City Engineer
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

Mr. Westby,

The Anoka Conservation District is reviewing the City of Ramsey's draft Local Surface Water Management Plan (received 5-12-2015) on behalf of the Lower Rum River Watershed Management Organization. City local water plans (LWP) must be consistent with the WMO plan. Please consider the comments on the following pages.

Barr Engineering is also conducting a review of regulatory elements of the plan on behalf of the WMO which you will receive under separate cover. I have reviewed those comments and agree with them, however they are generally not re-stated in this letter.

After revision of this plan, please resubmit it to the LRRWMO. A letter summarizing actions taken to address our concerns would be appreciated to expedite our review.

The City is reminded that local controls and ordinances must be amended to be in conformance with state and WMO standards within 180 days after LWP approval. (MN Statutes 103B.235 subd. 4).

Respectfully,

Jamie Schurbon

Water Resource Specialist

LRRWMO Plan Requirement	WMO Page	Comments/Suggested Actions
Education		
Local plans must include education. An education program must be part of local plan development.	53	Reference the SWPPP where a more detailed education plan is already in place for the City.
Wetlands		
"Wetland excavation for the enhancement of wildlife habitat will only be allowed if the project proposer applies for a LRRWMO approval and the excavation is in conformance with the WCA as well as guidance from the BWSR, DNR, and USACOE"	57	The city must develop wetland buffer standards consistent with LRRWMO standards. Please see Barr Engineering's review.
City must have wetland standards consistent with the LRRWMO standards.	Appendix G	DOES IT APPLY TO CONST. OF IND. HOME
Stormwater		
"New or expanded stormwater discharges to the Rum River are not allowed" because it is classified as an Outstanding Resource Value Water by the DNR.	46	Add corresponding language.
City must have stormwater standards consistent with the LRRWMO standards.	Appendix E	Add a summary of LRRWMO standards.
WMO encourages stormwater pond design to include habitat enhancement and aesthetic features.	54	Add a similar policy, perhaps under goal 3.
Anoka Dam		
An ownership /responsibility plan for the Anoka Dam will be developed with the member cities.	61	Add discussion of Anoka Dam management planning, including any collaborative work with Anoka and Andover.
Water Quality		
The LRRWMO will "work cooperatively with other agencies and communities on TMDLs…" Cities should recognize impaired waters in their local plan and provide plan for addressing.	43, 55	The MPCA is in the process of announcing new impaired waters designations. Trott Brook is being listed as impaired for macroinvertebrates, fish, dissolved oxygen and E. coli. Update the plan with this information.
Other		
"Municipalities will apply for grants through the LRRWMO with the municipalities providing match funds required"	49	The city is strongly encouraged to use their stormwater utility fund in partnership with LRRWMO. State grants can be pursued if local matching dollars are provided; this will make local dollars go much farther.
		Consider mentioning new state buffer laws.

resourceful. naturally.
engineering and environmental consultants

BARR

June 19, 2015

Mr. Bruce Westby
City Engineer
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

Re: Local Surface Water Management Plan: City of Ramsey

Dear Mr. Westby:

The Lower Rum River Watershed Management Organization's (LRRWMO) *Third Generation Watershed Management Plan* (LRRWMO WMP) was approved by the Board of Water and Soil Resources (BWSR) on December 11, 2011. MN Rules 8410.016 requires that local municipal storm water plans shall be adopted within 2 years of the BWSR board's approval of the last organization plan (Watershed District or Water Management Organization) that affects local units of government. The city of Ramsey, lying totally within the LRRWMO, has submitted their *Local Surface Water Management Plan* (Ramsey Plan) to the LRRWMO on May 12, 2015. The Plan must, at a minimum, meet the requirements for local plans as outlined in Minnesota Statutes 103B.235, except as provided by the LRRWMO WMP under Minnesota Rule 8410.0110, subpart 3.

Barr Engineering Co. (Barr) and the Anoka Conservation District (ACD) are reviewing the Ramsey Plan and are submitting comments to the LRRWMO on compliance and conformance with the LRRWMO WMP. Barr's review and comments are primarily on the storm water management component of the Ramsey Plan. The ACD's comments, submitted under separate cover, are on the goals and policies component of the Ramsey Plan. State Statute requires the LRRWMO complete its review and provide comments by July 11, 2015, 60 days of the submittal of the Ramsey Plan. E-mail correspondence from the City has stated that the review period can be extended to July 16, 2015, the next regularly scheduled meeting of the LRRWMO.

Review Comments of the Storm Water Management Plan

1. The storm water requirements (Appendix E of the LRRWMO WMP) of the LRRWMO need to be stated in the Ramsey Plan and at a minimum adopted by the City. This includes rate control, volume retention, water quality management, and flood control/management. The LRRWMO criteria are stated frequently throughout the text of the Ramsey Plan. However in addition, if in one statement in one location within the Ramsey Plan it is stated that the City adopts/references the requirements of Appendix E, this would provide greater clarity to the Ramsey Plan user of the applicable storm water requirements.

2. Page 6, Item 7 of the Ramsey Plan states; *The wetland buffers recommended in the Wetland Function assessment were approved by City Council when the 2008 SWMP was approved. Further review of the buffers by the City Council resulted in a policy to delay the implementation of the wetland buffer recommendations.*

   - This statement is also mentioned in several places throughout the Ramsey Plan. Wetland Protection Standards for the LRRWMO are outlined in Appendix G of the LRRWMO WMP. The Ramsey Plan must specifically identify these standards, how the City will be implementing these standards and any wetland requirements, such as buffers, that the City will be implementing through ordinance.

3. Page 14, Item B of the Ramsey Plan states; *Figure 4 shows the 10-year capture zone (Well Head protection Area, WHPA) as well as the Drinking Water Supply Management Area (DWSMA) for the seven municipal drinking water wells in Ramsey. Storm water infiltration will not be allowed inside these zones.*

   Page 34, Item D of the Ramsey Plan states (last sentence); *City Policy adopted in conjunction with infiltration requirements of the LRRWMO Third Generation Plan permits infiltration in areas within the Drinking Water Supply Area (DWSMA), so long as it is not also within the 10-year capture zone.*

   - These two statement appear to somewhat be in conflict with each other.

   - The Ramsey Plan needs to address how volume retention requirement is to be complied with in areas such as the DWSMA or in areas that are non-conducive for infiltration.

4. Page 16, Item #2 of the Ramsey Plan states; *The bounce from the normal water level to the high water level does not exceed two feet.*

   - It is recommended that this comment be replaced with, The impacts of storm water from new development discharging into a wetland will be determined through a Minnesota Routine Assessment Methodology (MnRAM) assessment of the wetland.

     A MnRAM provides a quantitative and qualitative assessment of the impacts that storm water has and will have on a wetland.

5. Page 18, Table 16; of the Ramsey Plan. It is recommended that the Design Infiltration Rates in the Minnesota Storm Water Manual, as amended, be used and referenced rather than the information from Urban Hydrology for Small Watersheds, (SCS, 1986).

6. Page 19, Item #11 of the Ramsey Plan - Unique Features and Scenic Areas; The City Codes referenced, Chapter/Section 177, must comply with the revised MDNR's Wild and Scenic River Management requirements.

7. Page 20 of the Ramsey Plan: The highlighted text states NEED TO ADD WEB PAGE, the web page needs to be provided.

8. Page 31 of the Ramsey Plan, last paragraph states; *Elevation of **the lowest opening** of a structure shall be a minimum of 1 foot above the Emergency Overflow, or 2 feet above the HWL of the nearby pond or waterbody, whichever is higher.*

   - The LRRWMO WMP criteria states; The **low floor** elevation of all development, including basements, must be at least 3 feet above the highest anticipated groundwater table, 2 feet above the designated or designed 100-year flood elevation, or 1 foot above the emergency overflow, whichever is higher. The statement in the Ramsey Plan must be corrected.

9. Page 35, Item 4 of the Ramsey Plan – Pond and Pipe Design Criteria: The Peak Flow Rate Control criteria described on page E-5 of the LRRWMO WMP should be included in the discussion.

10. Page 37 of the Ramsey Plan, Group C states; *Includes soils that are low in organic content and made-up of clay loams and soils high in clay.*

    - The Minnesota Storm Water Manual identifies a Hydrologic Soil Group C as a sandy-loam, ML, silts, very fine sand, silty or clayey fine sands. Please verify the description in the SWMP or consider using the description in the Minnesota Storm Water Manual.

11. Page 41, Policy 2.1 of the Ramsey Plan: The policy should be modified to read, *The City will adopt best management practices for development that will result in an annual removal efficiency of 60% total phosphorus and 90% total suspended solids.*

12. Page 41, Policy 3 of the Ramsey Plan should be Policy 3.4. See previous comments regarding wetland protection standards, Item 2. Also, it appears that the last sentence of this policy statement beginning with Policy 3.5 should either be modified or be a standalone Policy.

13. Page 42, Goal 4 of the Ramsey Plan; A policy needs to be added that the City's newsletter or web site will provide information regarding water resource management and a summary of the on-going activities of the LRRWMO (page 53, Policy 1, Education of the LRRWMO WMP).

14. Page 42, Policy 6.3 of the Ramsey Plan; Hydraulic Soil Types A and B are most conducive to infiltration but infiltration is/should not be limited to these two soil types.

15. Page 43, Policy 6.5 of the Ramsey Plan states; *The use of grassed waterways shall be encouraged to maximize infiltration. Proper grades shall be maintained or underdrain systems installed as part of an overall site plan to insure positive drainage.*

    - The use of an underdrain system does not provide for infiltration but rather filtration of storm water.

16. Page 43, Goal 7 – Wetlands of the Ramsey Plan; A policy should be provided that the LRRWMO is the Local Governmental Unit (LGU) administering the requirements of the Wetland Conservation Act (WCA) in Ramsey.

17. Page 43, Policy 7.1 of the Ramsey Plan states; *Use and Function of all wetlands greater than ¼ acre in size has been determined as part of the 2008 SWMP preparation.*

    - In other Sections of the Ramsey Plan it has been stated that the Use and Function of the wetland has been prepared but will not be used at this time. This needs to be clarified and describe how the requirements of Appendix G – Wetland Protection Standards in the LRRWMO WMP are to be complied with.

18. Page 46, Policy 12.7 of the Ramsey Plan states; *The City will perform regular wet storage volume surveys of its storm water quality ponds on a 10-year rotating basis.*

    - Is this consistent with the requirements of the City MS4 permit requirements?

General Comments

1. The figures for the various Study Areas show "Potential Threat to Structures" designation. A table or some form of reference to the structure location (address), low floor elevation and flood elevation would be useful information in the Ramsey Plan.
2. The flood elevations and discharges shown in the tables are listed to the hundredth (0.01) of a foot and hundredth (0.01) of a cubic foot per second (c.f.s.), respectively. Because of the numerous assumptions and variables used in these calculations, it is recommended that flood elevations be shown to the whole foot (no less than a tenth of a foot – 0.1) and discharges be shown to the whole c.f.s (no less than a tenth of a c.f.s. – 0.1).

Thank-you for the opportunity of providing our review comments regarding the *Local Surface Water Management Plan* for the city of Ramsey submitted to the LRRWMO in accordance with MN Rule 8410.016.

If you have any questions or request further clarification of our comments, please contact Todd Haas, LRRWMO Board Chairman or me at 952-832-2857, bobermeyer@barr.com.

Sincerely,

Robert C. Obermeyer P.E.
Lower Rum River Watershed Management Organization Engineer

C: Lower Rum River Watershed Management Organization Members
Jamie Schurbon; ACD
Leonard Linton; city of Ramsey

BCO/ymh