



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2016 Work Plan

Date of Report: May 29, 2016
Date of Next Status Update Report: December 31, 2016
Date of Work Plan Approval: June 7, 2016
Project Completion Date: June 30th, 2020
Does this submission include an amendment request? NO

PROJECT TITLE: Agricultural and Urban Runoff Water Quality Treatment Analysis – Phase II

Project Manager: Craig Austinson, Blue Earth County Ditch Manager
Organization: Blue Earth County Drainage Authority
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Location:

Blue Earth County Ditch No. 57 (CD 57) within Mapleton and Beauford Townships. This drainage system is within the Le Sueur River Major Watershed (HUC 07020011).

Total ENRTF Project Budget:	ENRTF Appropriation:	\$105,000
	Amount Spent:	\$0
	Balance:	\$105,000

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 04s

Appropriation Language:

\$110,000 the second year is from the trust fund to the Board of Water and Soil Resources for an agreement with the Blue Earth County Drainage Authority to continue monitoring a model demonstration for storage and treatment options in drainage systems designed to improve agricultural and urban water quality by reducing soil erosion, peak water flows, and nutrient loading. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Agricultural Runoff Water Quality Treatment Analysis- Phase II

II. PROJECT STATEMENT:

A 2010 LCCMR ENTRF grant was awarded to Blue Earth County project: Mapleton Area Agricultural and Urban Runoff Water Quality Treatment Analysis. This innovative conservation drainage improvement on Blue Earth County Ditch No. 57 (CD 57) is now a model project in the Le Sueur River Watershed. Phase I showed how combining Agricultural Best Management Practices (BMPs) on a county drainage system can significantly improve water quality in an agricultural landscape. Initial water quality monitoring included collecting real time stage (depth) measurements throughout the ditch system. Initial water quality monitoring results were more successful than anticipated because of the reductions in Total Suspended Solids, Total Nitrogen and Total Phosphorus. Landowners, agencies and nonprofits are requesting more detailed data to further validate original results and to promote ongoing benefits of the BMPs. Table 1 summarizes the initial monitoring of the installed BMPs on the CD 57 System.

BMP	TSS % Reduction	TN % Reduction	TP % Reduction
Surge Pond	25	23	19
Two-Stage Ditch	5	4	10
Rate Control Weir	6	0	6

Phase II monitoring would incorporate the analysis of real-time flow velocity meters and multiple water quality samples taken during each rain event by Minnesota State University – Mankato (MSU). The majority of the monitoring equipment that will be utilized in Phase II will be provided by the Minnesota Department of Agriculture (MDA) and MSU. This equipment has been used in similar monitoring projects for water quality and will provide more data for analysis than the equipment used for Phase I. The same parameters will be analyzed for each BMP as done in Phase I and as shown in Table 1. Table 2 compares the Phase I and Phase II monitoring equipment.

Method Obtained	Phase I (2012-2014)	Phase II (2016-2020)
Flow	Depth Measurements every 5 minutes, flow data interpolated based on hydrologic model and topographic survey (MSU & ISG collected and analyzed)	Real time flow measurements from Area-Velocity Meter (MSU and MDA collection, ISG analyze similar to Phase I), depth measurements will also be taken as done in Phase I by ISG
Water Quality	1 water quality grab sample taken at peak flow after rain event (MSU sampled, MSU & ISG analyzed)	Multiple grab samples taken throughout a rain event with auto sampler (MSU and MDA collection, ISG analyze similar to Phase I)

A similar analysis that was utilized in Phase I is needed to further validate, measure potential backwater effects, and possibly reflect greater reductions than the Phase I results. Based on the results from Phase I, multiple

projects, using similar BMPs, have or will be installed in Blue Earth, Martin, Faribault, Watonwan, Nicollet and Jackson Counties. Continued monitoring to further analyze, validate, and to determine long term effectiveness is needed for the design of future projects. Further monitoring of these systems is also needed to determine a maintenance schedule and budget for these BMPs so they can be as effective as possible.

Phase II monitoring is not a part of regular ditch maintenance, as it solely focuses on the BMPs installed on CD 57. These results are important because they will help maximize the life of each BMP. It will also aid in planning for future projects. Phase I has been used for the following drainage projects:

- Blue Earth CD 28 – Rate Control Weir – to be constructed in 2016
- Blue Earth County CD 34 – Rate Control Weir – to be constructed in 2016
- Blue Earth County JD 38 – Rate Control Weir – Built in 2014
- Martin and Watonwan JD 2 – surge pond and rate control weir – built 2015
- Martin County JD 367 – 30 acre pond – to be built in 2016
- Jackson County JD 46 – Surge Pond – Constructed in 2015
- Jackson County JD 35 – Two Stage Ditch – to be constructed in 2016
- Jackson County JD 30 – Rate Control Weir and Surge Pond – to be constructed in 2016
- Watonwan County JD 13 – Surge Pond – Constructed in 2014 and 2015

Phase II results will be used to plan for future BMP's on county ditch projects throughout Minnesota.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of December 31, 2016:

Project Status as of June 30, 2017:

Project Status as of December 31, 2017:

Project Status as of June 30, 2018:

Project Status as of December 31, 2018:

Project Status as of June 30, 2019:

Project Status as of December 31, 2019:

Overall Project Outcomes and Results: August 2020

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: *Monitoring of Installed Best Management Practices*

Description: Monitoring of Installed BMPs includes installation of stage data logging equipment and in channel staff gauges as used in the previous years of monitoring. Monthly maintenance is needed for this equipment to ensure its accuracy. Maintenance includes monthly data collection, inspection of monitoring equipment, debris removal from in channel monitoring equipment, and replacement of damaged equipment.

Also included in the monitoring is yearly topographic survey of the BMPs for analysis of their effectiveness and to create a maintenance schedule for the installed BMPs. The topographic survey includes using conventional survey methods to obtain horizontal and vertical locations of all installed BMPs, sediment accumulations,

damages or repair areas of each BMP, and identifying exact locations of all monitoring equipment for future analysis.

In addition to the monitoring outlined above, flow and water quality data will be collected by MSU and will be provided to Blue Earth County for additional analysis to determine BMP effectiveness and maintenance needs. This information will be compared to the previous 3 years of monitoring completed in Phase I. Monitoring equipment for this portion was purchased and provided in kind by MDA and MSU and is separate from Activity 1.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 26,500
Amount Spent: \$ 0
Balance: \$ 26,500

Outcome	Completion Date
<p>1. Long Term Viability of BMPs: Determine the long-term effectiveness, required maintenance, and associated costs to keep the system functioning. The monitoring will help determine when maintenance is required for installed BMPs. Review repair costs since construction, and physically measure sediment in the BMPs to determine lifetime repair costs. Develop a maintenance schedule for BMPs based on real data (e.g. cleaning out sediment from a storage pond and maintenance on a two-stage ditch).</p>	<p>8/31/2020</p>

Project Status as of December 31, 2016:

Project Status as of June 30, 2017:

Project Status as of December 31, 2017:

Project Status as of June 30, 2018:

Project Status as of December 31, 2018:

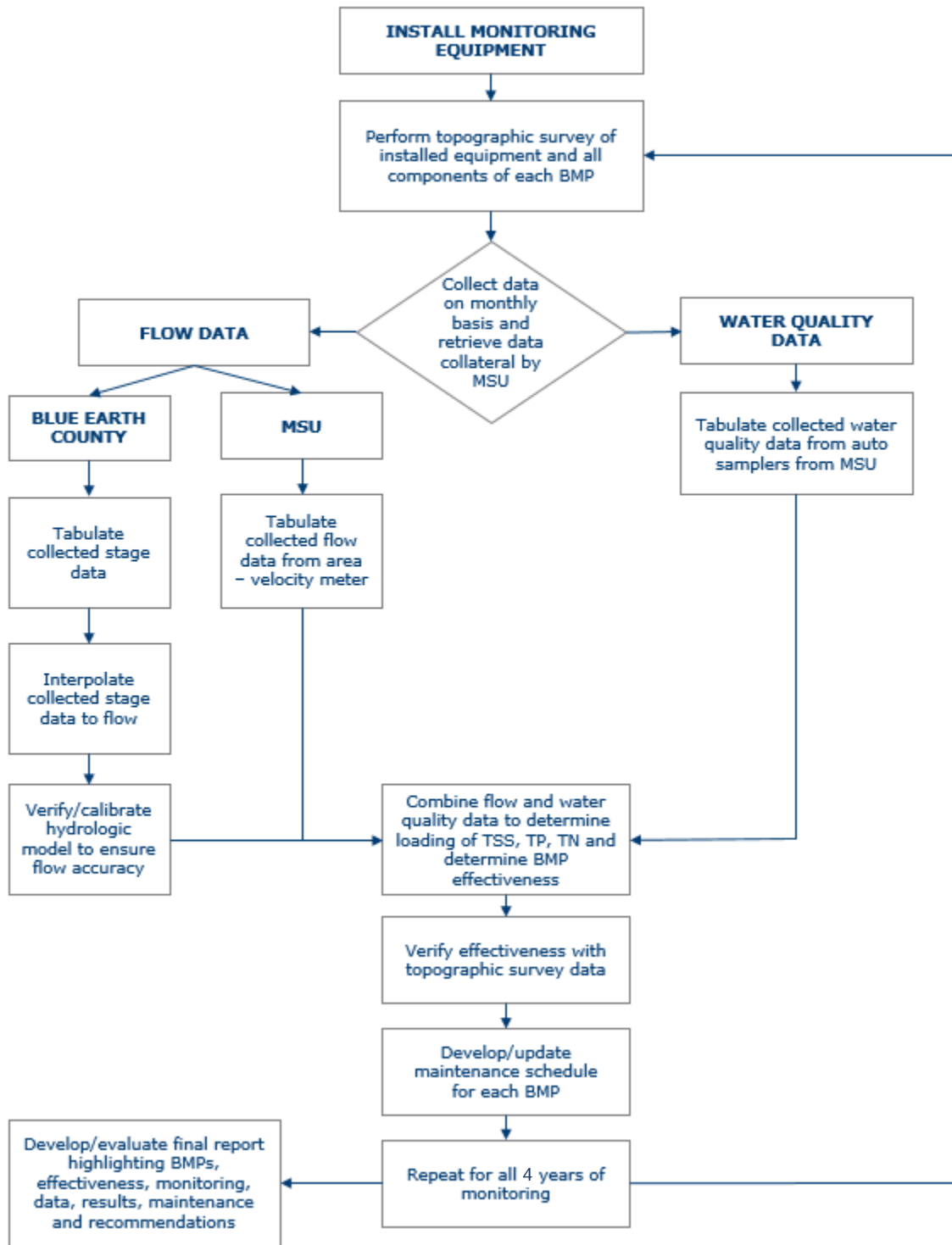
Project Status as of June 30, 2019:

Project Status as of December 31, 2019:

Final Report Summary: August 2020

ACTIVITY 2: Develop a Final Report and Analysis for BMPs

Description: The analysis for Phase II of the monitoring will be completed similarly to the analysis done in Phase I in order to ensure accuracy of the results. The analysis will supplement the development of a final report for Phase II which includes determining the effectiveness of each installed BMP and comparing those results to Phase I. The analysis and final report is described in the following flowchart.



Summary Budget Information for Activity 2:

ENRTF Budget: \$ 58,500
Amount Spent: \$ 0
Balance: \$ 58,500

Outcome	Completion Date
1. Collect and analyze annual data to <i>determine effectiveness of each BMP and compare it to previous monitoring results.</i>	August 2020
2. <i>Develop a final report highlighting the data collection and analysis of Phase II and a comparison to results of Phase I. Also include the developed maintenance schedule for each BMP and recommendations moving forward for BMP installation.</i>	August 2020
3. <i>Provide the report to Drainage Authorities, Watersheds, State Agencies and Landowners to educate them on how these practices can be effectively incorporated into a drainage system including maintenance schedules, costs and practices.</i>	August 2020

Project Status as of December 31, 2016:

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Project Status as of June 30, 2019:

Project Status as of December 31, 2019:

Final Report Summary: August 2020

ACTIVITY 3: *Engagement/Promotion of Practices*

Description: Presentations/workshops and/or field days will be conducted to present the findings to the public and interested agencies. These events will provide an opportunity to educate the public on best management practices within drainage systems and to facilitate conversations on water quality in drainage systems and BMP implementation requirements.

Presentations will include an update to agricultural drainage and water quality, recommended BMPs, their effectiveness and most appropriate use, results and final report summary of Phase II, and any other appropriate presentations at that time. Also included will be a site visit to CD 57 showcasing the install BMPs, their function relating to the ditch system, what makes them effective, and a description of any necessary maintenance required. Also presented at the field day will be the monitoring equipment and a brief demonstration of how the data is collected.

Also included in Activity 3 is printing for handout materials during the presentations/workshop/field day as well as travel associated with the field day and site visit.

Similar field days and workshops have been held in the past during the summer of 2012, 2013, and 2015 with nearly 200 attendees per event. Attendees for the event will include producers, government agencies, county

drainage authorities, conservationists, and soil and water conservation groups. These field days serve as a model for the future of agricultural drainage and water quality for all parties attending.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 20,000
Amount Spent: \$ 0
Balance: \$ 20,000

Outcome	Completion Date
<i>1. Inform landowners, producers, and agencies through a workshop on the effectiveness of installing these BMPs in an agricultural watershed</i>	8/31/2020
<i>2. Share monitoring methods and results via print materials, electronic documents, and presentations</i>	8/31/2020
<i>3. Hold a Field Day event at the site with a tour of the BMPs throughout the watershed focusing on long-term maintenance.</i>	8/31/2020

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Final Report Summary: August 2020

V. DISSEMINATION:

Description:

- Final Report – Submitted to local agencies and posted on Blue Earth County and ISG websites. Final report to be published in January of 2021, as adequate time is needed to compile the data from 2020 and analyze and finalize the report.
- Workshop and/or presentation on findings of MSU water quality data collection/analysis and individual analysis by Blue Earth County to be completed by August 31, 2020.
- Coordination between MSU, Blue Earth County, ISG, and MDA will be ongoing during data collection, analysis and final report/presentation preparation.
- Data collected by MSU will be posted on Hydrostat. A M.S. thesis will be written and published (journal TBD) based on the data collected and general analysis of BMPs effect on water quality and quantity.

Websites include Blue Earth County (<http://www.blueearthcountymn.gov/>) and ISG (www.is-grp.com)

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Final Report Summary: August 2020

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	\$85,000	ISG - Time required for: data analysis, report preparation, workshops/presentations
Presentations/Workshop/Field Day	\$20,000	Includes organizing event, renting space to hold event, printing of all invitations and materials handed out during the event, presenters/speakers expenses, and travel to field day/site visit
TOTAL ENRTF BUDGET:	\$105,000	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: None – In Kind by Blue Earth County

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds: Monitoring equipment provided by MDA and MSU includes area velocity meters, water quality auto sampling devices, electronic rain gauges, and all associated housing and electronic components. Also included is funding for analytical analysis of the water quality samples, labor and transportation for data collection by MSU. The total other funding for the project is \$119,161. It shall be noted that a majority of the equipment provided for the MSU monitoring was in kind from MDA and MSU and does not have attached funding with it.

VII. PROJECT STRATEGY:

A. Project Partners:

Blue Earth County Drainage Authority (Craig Austinson, Drainage Manager): Project management, project administration, review and approval of project, act as funding mechanism for drainage improvements. In-kind contributor and will receive funding.

Minnesota Department of Agriculture: Assist with monitoring, technical memorandum, and presentations.

Landowners in Blue Earth County Ditch 57 (Various): Allowing access to drainage system for monitoring. Recipient of monitoring outcomes and project goals. Pay for repairs done to the system and no funding received from this grant.

ISG (Chuck Brandel, PE and Team): Acting as engineer for the Blue Earth County Drainage Authority – Assistance with project administration, assist with monitoring, and technical memorandum, and presentations (Not a contributor and will not receive grant funding. Will serve as a contract service provider).

Blue Earth Soil and Water Conservation District (Jerad Bach and John Billings): Assist with monitoring, technical memorandum, and presentations (In-kind contributor with staff time and will not receive grant funding).

Minnesota State University Biology Department (Bryce Hoppie) Received grant from MDA for completion of monitoring, purchase and use equipment, take samples and get samples analyzed at lab. The results from this monitoring will be shared with Blue Earth County and ISG for analysis.

B. Project Impact and Long-term Strategy:

This project will provided information on the effectiveness and long term maintenance requirements of BMPs established in a drainage system for water quality improvements. Information obtained from previous and on-going monitoring on CD 57 will be evaluated and conclusions will be shared with the public and applicable agencies through presentations and a final report. This information can be used by those involved in drainage water management and organizations concerned with water quality to better plan the location and type of BMPs installed on other drainage systems.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
ENRTF – M.L. 2010, Chp. 362, Sec. 2, Subd. 5d	2010-2014	\$485,000

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List: N/A

B. Acquisition/Restoration Information: N/A

IX. VISUAL COMPONENT or MAP(S):

- Exhibit: *CD 57 Project Map*

X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than:

Year 1: December 31, 2016; June 30, 2017;

Year 2: December 31, 2017; June 30, 2018;

Year 3: December 31, 2018; June 30, 2019.

Year 4: December 31, 2019; June 30, 2020. Four year appropriation = 2020.

**Environment and Natural Resources Trust Fund
M.L. 2016 Project Budget**



Project Title: Agricultural and Urban Runoff Water Quality Treatment Analysis – Phase II

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 04s

Project Manager: Craig Austinson

Organization: Blue Earth County Drainage Authority

M.L. 2016 ENRTF Appropriation: \$105,000

Project Length and Completion Date: 4 Years, June 30, 2020

Date of Report: May 29, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Activity 1: Monitoring of Installed Best Management Practices</i>			<i>ACTIVITY 2: Develop a Final Report and Analysis for BMPs</i>			<i>ACTIVITY 3: Engagement/Promotion of Practices</i>				
Professional/Technical/Service Contracts - ISG	\$26,500			\$58,500			\$20,000			\$105,000	
<i>Installation of Monitoring equipment - \$5,000 Estimate</i>											
<i>Maintenance and Data Collection - \$5,000 Estimate</i>											
<i>Topographic Survey - \$16,500 Estimate</i>											
<i>Flow and water quality data tabulation, interpolation, hydrologic model calibration - \$15,000 Estimate</i>											
<i>Quantify loading and effectiveness of BMPs with tabulated data from flow and water quality - \$13,500 Estimate</i>											
<i>Develop and update BMP maintenance schedule for all BMPs included - \$10,000 Estimate</i>											
<i>Develop and update final report with all analyzed data (effectiveness, monitoring, results, etc.)- \$20,000 Estimate</i>											
<i>Workshop/presentations setup, coordination, location determination, scheduling, etc.- \$15,000 Estimate</i>											
<i>Printing Invitations and postage, agendas, handout materials, presentations - \$3,500 Estimate</i>										\$0	\$0
<i>Field day expenses (Bus Rental for Tour, Tent, Chair and Table Rental)- \$1,500 Estimate</i>											
COLUMN TOTAL	\$26,500	\$0	\$26,500	\$58,500	\$0	\$58,500	\$20,000	\$0	\$20,000	\$105,000	\$105,000

DRAINAGE AND WATER QUALITY

Case Study: Blue Earth County Ditch 57



I+S GROUP



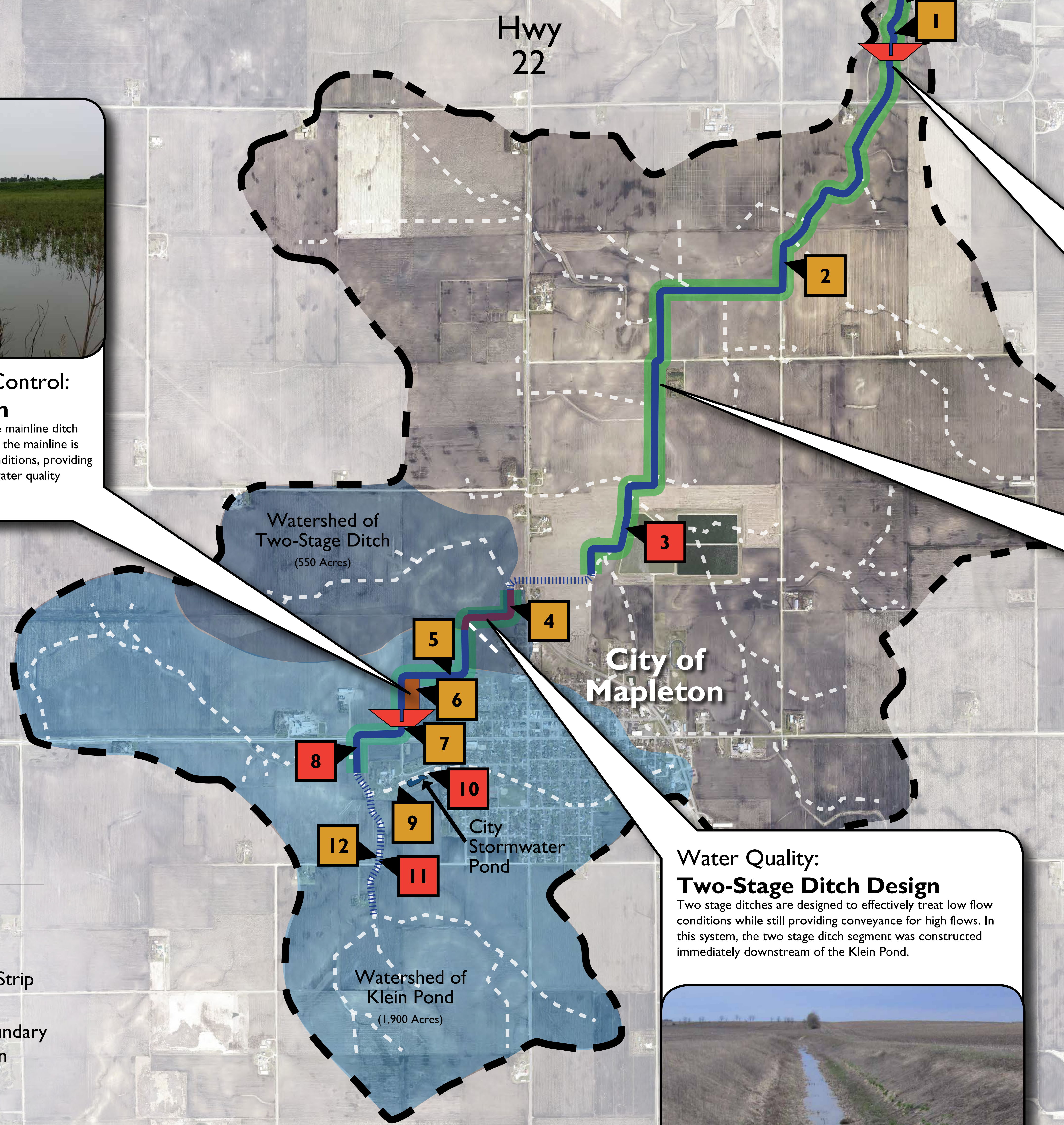
Water Quality and Rate Control: Klein Pond/Surge Basin

The Klein Pond was excavated adjacent to the mainline ditch in an area that often flooded out. Runoff from the mainline is diverted into the pond under normal flow conditions, providing both rate control (reducing peak flows) and water quality improvements.



Water Quality and Rate Control: Weir Structure

This weir, placed at the outlet of the system prior to discharge into the Big Cobb River. This structure reduces the peak discharge rate during smaller storm events by detaining water upstream of the weir. This detention has the added benefit of improving water quality.



Key:

- Drainage Ditch
- Tile Improvements
- Two-Stage Ditch
- Native Plantings/Buffer Strip
- Drain Tile
- BEC57 Watershed Boundary
- Weir Structure Location
- Klein Pond/Surge Basin
- Sample Sites
- Flow Monitoring

Water Quality: Native Plantings/Buffer Strip

Native vegetation has a number of benefits over domesticated cover crops, including deep roots systems and high tolerance to environmental conditions. Native vegetation was specified in areas that were suitable to assist with infiltration, nutrient uptake, and ongoing maintenance costs.



Water Quality: Two-Stage Ditch Design

Two stage ditches are designed to effectively treat low flow conditions while still providing conveyance for high flows. In this system, the two stage ditch segment was constructed immediately downstream of the Klein Pond.



Funding provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the LCCMR.

