Winnebago County Watershed Improvement Plan: Buckbee Creek Watershed

Executive Summary

July 2013

The purpose of the Buckbee Watershed-Based Plan is to provide stakeholders a better understanding of the watershed and to promote the implementation of plan recommendations aimed at the protection and improvement of water quality , the preservation and restoration of natural areas, and the reduction of flood damages in the watershed.

NATURAL LAND INSTITUTE
Conserving Land in Northern Illinois

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Winnebago County (WC), the Rockford Metropolitan Agency for Planning (RMAP), the City of Rockford, the Rockford Park District, the Village of Cherry Valley, Cherry Valley Township, Rockford Township, the Winnebago County Soil and Water Conservation District (SWCD), the Kishwaukee River Ecosystem Partnership (KREP), and the Upper Rock River Ecosystem Partnership (URREP) all contributed personnel to fill leadership roles and carry out the work of the Winnebago County Watershed Improvement Plan Steering Committee and Executive Committee.

Many citizens also contributed numerous hours of time and work filling leadership roles and representing the interests of watershed residents at public meetings as well as meetings of the Steering Committee and Executive Committee.

Executive Committee members include:

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Gary McIntyre, RMAP

Vice-Chairpersons
Dennis Anthony, SWCD
Jerry Paulson, KREP

Secretary
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Buckbee Creek Watershed Co-Captains
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Hey and Associates, Inc., served as consultant for this grant. Deanna Doohaluk provided highly professional and tireless support to the Winnebago County Watershed Improvement Plan Steering Committee and Executive Committee as the principal grant administrator. Other Hey staff members who provided able support include Neal O'Reilly and Jeff Wickenkamp.

The following people generously gave their time serving the Steering Committee or speaking to the Committee and citizens at committee and public meetings:

Brent Denzin, Attorney at Law, Ancel, Glink, Diamond, Bush, DiCianni & Krafthefer, Chicago
Nathan Hill, Natural Areas Maintenance Coordinator, Rockford Park District
Brad Holcomb, Storm Water & Environmental Program Manager, City of Rockford

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Winnebago County Watershed Improvement Plan Executive Committee
July 31, 2013

Foreword

The Winnebago County Watershed Improvement Plan was developed through a cooperative effort between Winnebago County, local governments and agencies (including the Rockford Metropolitan Agency for Planning, the City of Rockford, the Rockford Park District, the Village of Cherry Valley, Cherry Valley Township, Rockford Township, and the Winnebago County Soil and Water Conservation District), watershed protection and improvement organizations (including the Kishwaukee River and the Upper Rock River Ecosystem Partnerships), and citizens. A Steering Committee was organized which included representatives of each of the stakeholder organizations and groups, and all interested citizens. A Chairperson was elected and an Executive Committee was organized to assist with the planning process.

By means of an invitation, interview, and selection process organized by the Steering Committee, a consultant was hired to prepare and submit grant applications for watershed-based planning for two adjacent but distinct watersheds to the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act. The proposals presented by the Steering Committee and consultant were approved by the IEPA and were combined into a single grant. Work proceeded on implementation of the improvement planning for each watershed.

Plans were developed to provide a blueprint for improving water quality and preserving the natural resources of each watershed. A related goal of the proposed improvements was to reduce flooding which contributes to the transportation of suspended solids and destruction of natural resources within the waterways of each watershed.

The plans are intended to assist individual citizens, citizen groups, local units of government, and governmental agencies with watershed management. The plans contain summaries of data collected for each watershed, quantify resource-related problems, present goals and objectives agreed upon by the stakeholder representatives, and recommend actions for effectively managing watershed resources in a cost-effective and environmentally sound manner. The plans also provide a basis for conducting inter-jurisdictional communication and coordination regarding water resource issues within the watersheds.

While the plans are advisory documents, the stakeholders are encouraged to endorse the plans, utilize them as reference guides, and pursue implementation of the recommended actions. The benefits of making improvements in the watersheds that improve the quality of life of both native species and human habitats can only be realized if the human partners pursue actions such as those recommended by these plans.

Winnebago County Watershed Improvement Plan Executive Committee
July 31, 2013

The Buckbee Creek Watershed

The Buckbee Creek watershed is located in south-central Winnebago County in northern Illinois (Figure 1). The watershed drains approximately 6.94 square miles (4,441.73 acres) of land into the Upper Rock River. From the confluence with Buckbee Creek, the Upper Rock River flows southwesterly before joining the Mississippi River at Rock Island, Illinois.

Figure 1: Buckbee Creek watershed within the context of Winnebago County

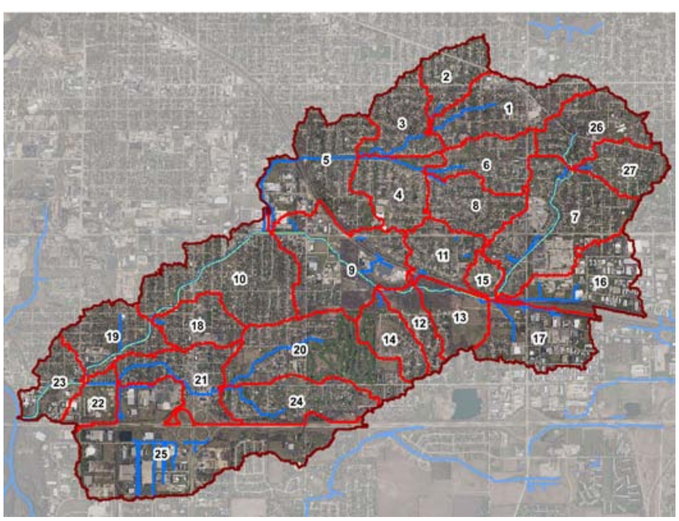
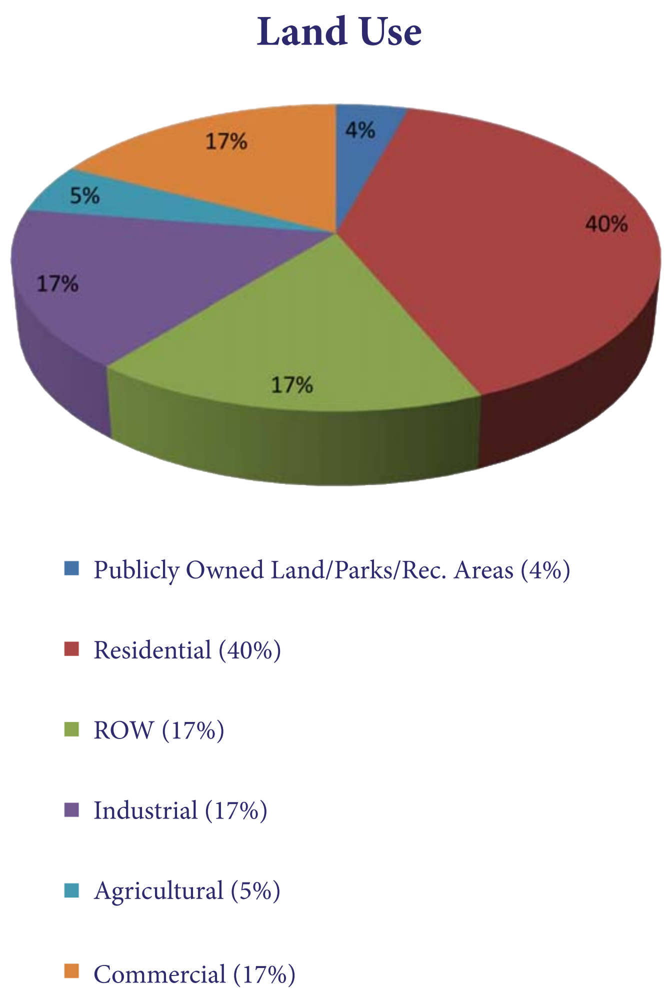


Figure 2: Buckbee Creek watershed

The Buckbee Creek system is comprised of the mainstem of Buckbee Creek and one tributary. Collectively, there are 5.57 stream miles in the Buckbee Creek with 4.2 miles being the mainstem (Figure 2). The majority of the stream miles in the watershed are comprised of a concrete channel. Available data indicates that there are only 0.65 acres of wetlands located within the Buckbee Creek watershed. There are no major impoundments on Buckbee Creek or its tributaries.

Approximately 91-percent (3,977.18 acres) of the watershed was incorporated as of 2012 in the City of Rockford. The remaining 9% of the watershed is unincorporated Winnebago County. The Buckbee Creek watershed is approximately 91% developed. Though primarily residential, land use in the watershed also includes commercial/industrial developments, open space, and agricultural lands.



The Watershed Over Time

Prior to development, in the early 1800s, the landscape of the watershed included prairies, wetlands, and widely scattered oaks and hickories. In the 1800s, due to the fertile soils and openness of the oaks and hickories, farmers began converting the land including the draining of wetlands for agricultural uses. Very quickly by the mid-1800s, the City of Rockford and Village of Cherry Valley were incorporated and urbanization of the watershed began. This development continued with the suburbanization following World War II and the watershed has now been converted to a mix of residential, commercial, and industrial land uses.

The Impact of Watershed Development

Under natural and undisturbed conditions, precipitation that falls onto the land surface is allowed to soak into the soil and become groundwater in a process referred to as infiltration or evaporated into the air by plants or from soil or surface waters in a process known as evapotranspiration. Typically, 75-90% of the rainfall either soaks into the ground or evaporates. Precipitation that is not infiltrated or evapotranspired is called runoff. Urban development in the watershed is reducing the amount of land available for the natural infiltration of rainfall into the ground (Figure 3). Instead of precipitation falling on vegetation where it can be infiltrated, it falls on parking lots, rooftops, and roads. The surfaces that prevent infiltration are known as impervious surfaces. From these impervious surfaces, the runoff is quickly conveyed into streams and creeks via a constructed drainage system comprised of drainage ditches, swales, and storm sewers. As a result, streams receive large pulses of water in shorter periods of time, resulting in erosion and destabilization of the stream channel and streambanks. As physical modification of the stream occurs, adjacent property can be damaged.

Additionally, when the landscape or stormwater system is insufficient to contain these pulses of water, flooding can occur.

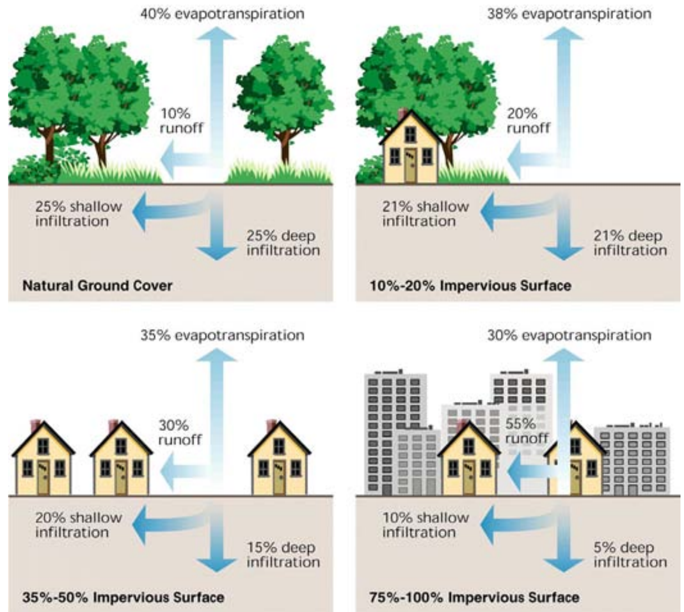


Figure 3: Impacts of increased urbanization on stormwater runoff (FISRWG)

In addition to the change of the volume and rate of runoff, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, parking lots, construction sites, lawns, roofs, and golf courses into streams. This type of pollution is called nonpoint source pollution. Additional pollutants include increased water temperature, altered pH, and low dissolved oxygen levels, all of which can make the streams unhealthy for fish and other aquatic species.

Thus, the health of the Buckbee Creek watershed is directly related to land use activities throughout the watershed. These activities not only impact the residents of the watershed but those of the communities, both human and natural, living downstream on the Kishwaukee River. Fortunately, there are proven measures and practices for addressing these impacts that watershed stakeholders can utilize to take positive action towards improving the watershed. One of the first steps in the process is to understand watershed problems and make a plan for moving forward – a watershed-based plan.

Watershed Planning

Watershed planning is a collaborative approach to addressing a variety of related water resource issues including water quality protection. This approach allows stakeholders to share information, better target limited financial resources, and address common water-related challenges. These challenges can include improving stream and lake water quality, preserving and protecting groundwater resources, managing stormwater, reducing soil erosion and flood damage, conserving open space, protecting wildlife habitat, providing safe recreational opportunities, supporting opportunities for economic development, and other issues of concern.

The following general steps were used in developing this watershed plan:

- Conduct periodic meetings of the Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC) with watershed stakeholders.
- Solicit public input on watershed problems and opportunities to develop watershed goals and objectives.
- Review and analyze existing studies, watershed conditions, and available watershed data to identify watershed problems and opportunities.
- Identify best management practices (BMPs) and polices to improve water resources.
- Develop a detailed watershed action plan and implementation plan.

Watershed Issues and Goals

Early in the planning process, WCWIPSC members, using input obtained from stakeholders during a public meeting, developed a list of watershed issues and concerns. Watershed concerns included:

Stakeholder Issues/Concerns

Stormwater
- Too much runoff and not enough infiltration and/or detention leading to flooding.
- Non-point source pollution.
- Hydromodification leading to erosion and sedimentation.

Need for recreational, greenway, and open space.

Lack of education for landowners along the creek, need to encourage riparian best management practices to prevent illicit dumping and bad-housekeeping.

Groundwater contamination/impacts.

Water quality impacts from the Sand and Gravel Quarry.

The ecological condition of the stream channels including lack of fish and wildlife habitat.

Lack of collaboration between government agencies, business and residents on water quality and flood related issues.

Stakeholder Goals

Protect and enhance overall surface and groundwater quality in the Madigan Creek watershed.

Reduce existing flood damage in the watershed and prevent flooding from worsening.

Improve aquatic and wildlife habitat in the Madigan Creek watershed.

Develop open space in the Madigan Creek watershed and provide recreational opportunities.

Increase coordination between decision makers and other stakeholders in the watershed.

Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship.

Figures 4, 5, and 6 below includes photos of problem areas identified in the watershed. Goals were drafted directly from the concerns expressed by the WCWIPSC and the stakeholders. Chapter 2 provides additional details on watershed goals and objectives.

Objectives assigned to each goal are intended to be measurable so that the WCWIPSC can assess future progress made towards each goal.

Figure 4: Concrete Drainage Channel

Figure 5: Slope Failure

Figure 6: Concrete Drainage Channel

Watershed Inventory and Assessment

Chapter 3 of this watershed-based plan is an assessment of watershed conditions based on available data, studies, and stakeholder input. The assessment includes information on stream corridor conditions, stormwater infrastructure, flooding, water quality, land use, wetlands, and other relevant information. This information not only provides a snapshot of current conditions but also serves as baseline data for comparing future watershed assessments. Four important conclusions based on this watershed assessment are summarized here.

- The Buckbee Creek watershed exhibits rapid increases and decreases in water flow and velocity. These frequent changes are causing significant water quality degradation, reductions in the quality of stream habitat, and destabilizing the stream channel leading to erosion and damage to infrastructure.

- Water quality is impacted by low dissolved oxygen levels and high phosphorus concentrations. Large impervious surface areas are significant contributors to water runoff and pollution.

- Hydromodification including streambank erosion and channelization is prevalent through the watershed. These conditions have lead to severely degraded instream and streamside habitat.

- Municipalities, residents, business owners, landowners, and other watershed stakeholders lack the coordination and communication necessary to improve watershed resources.

Watershed Best Management Practices (BMPs) and Solutions Toolbox

Chapter 4 of the watershed-based plan includes a description of BMPs and solutions that when properly applied can reduce stormwater impacts and improve water quality and stream habitat. The toolbox contains BMPs that can be implemented by all levels of watershed stakeholders from residents and landowners to municipalities. BMPs and solutions in the toolbox include:

BMPs and Associated Solutions

Stabilizing and restoring streambanks using bioengineering techniques.

Installing rain gardens and bioinfiltration practices to help slow, infiltrate, cool, and cleanse stormwater runoff before being discharged into stream.

Constructing new and retrofitting existing detention basins to help reduce volume and rate of stormwater released during storm events into streams.

Reducing the area of impervious surfaces and using permeable pavements that allow water to infiltrate into the ground instead of running off as stormwater runoff.

Restoring and maintaining native riparian buffers along stream and detention basins.

Prioritized Action Plan

The effectiveness of the Buckbee Creek Watershed-Based Plan will be largely dependent on the successful implementation of the Prioritized Action Plan by watershed stakeholders. The Action Plan serves as a roadmap for watershed improvement and provides the "who, what, where, and when". The Prioritized Action Plan includes programmatic, policy, and site-specific recommendations.

Programmatic Actions are focused on watershed-wide action items that are not site specific while the Site Specific Action Plan identifies specific and actual locations where water quality, hydrological modification, and/or flood reduction/prevention projects can be implemented (Figures 7, 8, 9). The eight most important general recommendations include:

- A stormwater management plan feasibility study for the Madigan Creek watershed should be completed to obtain a better understanding of how stormwater runoff can be better managed within the watershed.
- Remediate existing flood problems and protect future flooding by reducing stormwater runoff and preserving and restoring areas for surface water storage such as depressional areas, floodplains, and wetlands. These areas also provide water quality improvement benefits.
- Construct new and retrofit existing stormwater management system including detention basins and storm sewer outfall culverts to reduce runoff volume and rate and improve water quality in streams.
- Reduce impervious areas by incorporating permeable pavements and bioinfiltration practices such depressed islands and rain gardens in parking lots and streets throughout the watershed.
- Stabilize streambanks to reduce erosion, protect property and infrastructure, and improve water quality and habitat.
- Remove the concrete channel and replace with a more naturalized channel using bioengineering techniques in order to improve water quality and habitat.
- Provide public education and outreach to all watershed stakeholders as means of enhancing the understanding of watershed resources and provide opportunities for stakeholders to become involved in plan implementation.
- Monitor and evaluate watershed plan implementation and changes in watershed conditions to gauge progress on reaching watershed goals.

Figure 7: Permeable Paver Parking Lot

Figure 8: Naturalized Detention Basin

Figure 7: Stream Riffles/Slope Stabilization

Monitoring and Evaluation Plan

The final chapter of the watershed plan (Chapter 6) includes the Monitoring and Evaluation Plan. The Monitoring and Evaluation Plan was designed to provide a straightforward means of measuring progress towards watershed goals and plan implementation.

Stakeholders should utilize this plan to monitor watershed resources and track whether meaningful progress is being made towards reaching the watershed-based plan's goals. The monitoring plan includes a series of Report Cards developed for each of the goals. The Report Cards are intended to provide a brief description of current conditions, suggest performance indicators that should be evaluated and monitored, milestones to be met, and remedial actions if milestones are not being met.

Where Do We Go From Here?

Urbanization has played a significant role in the degradation of water resources in the Buckbee Creek watershed. Fortunately, there are actions outlined in this plan can be taken to mitigate existing issues and prevent additional future problems. The future health of the watershed is largely dependent on how stormwater is managed. The business-as-usual approach using conventional development practices, stormwater management techniques and landscape management practices will result in a continued decline of the watershed resources and water quality. A new approach that includes proven and environmentally-sensitive practices and approaches to stormwater management can reverse this trend and begin to improve water quality and stream health in the watershed.

There is no single fix for the water quality and flooding problems in the Buckbee Creek watershed. These problems are the cumulative result of decisions made since urbanization accelerated in the mid-1900s. It will take the decisions and actions of every stakeholder living in the watershed to work together to improve the health of the watershed. Likewise, actions will need to be taken on every scale from the individual lot to the neighborhood to the municipalities in order to positively impact watershed resources.

This watershed-based plan is the first step in helping watershed residents and stakeholders understand what can be done to restore the valuable resources of the Buckbee Creek watershed.

Executive Summary

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Chapter 1.0 Introduction

1.1 The Buckbee Creek Watershed

1.1.1 Watershed Setting

A watershed is a land area that contains a common set of streams or rivers that drains to a common body of larger water such as larger rivers, lakes, estuaries, wetlands, or even the ocean (Figure 1-1). Topography is the key element affecting this area of land. The boundary of a watershed is defined by the highest elevations surrounding the stream with water flowing towards the lower elevations within the watershed. Theoretically, a drop of rainwater that falls on the highest elevation within the watershed will eventually make it to the lowest point. Rainfall that falls outside this boundary will enter another watershed and flow to a different stream. Whether you know it or not, you live in a watershed. Watersheds exhibit a complex interaction between land, climate, water, vegetation, humans, and animals. Watersheds are shown to be dynamic, constantly seeking states of equilibrium while being affected by man-made influences and natural daily changes in weather and climate.

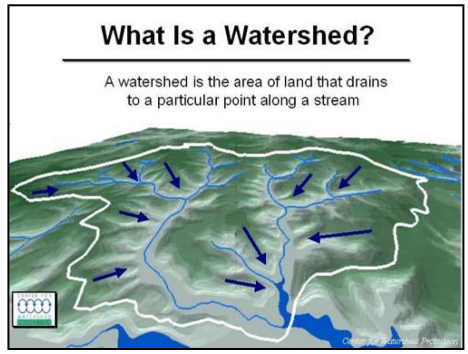

Figure 1-1 What is a watershed? (CWP)

Watersheds come in all shapes and sizes and can cross county, state, and even international borders. Other common names of watershed, depending on size, include basins, sub-basins, and catchments. For example, the United States Geological Survey (USGS) developed a national framework for categorizing watersheds based on geographical scale. This hierarchy of scales utilized a hydrologic unit cataloging (HUC) system. HUC's divide all of the United State's watersheds into boundaries using four different classifications and the cataloging unit is the smallest to define the watershed. The 10-digit HUC code (HUC 10) for Buckbee Creek is 709000504.

The Buckbee Creek watershed is located in south-central Winnebago County in northern Illinois (Figure 1-2). Prior to the development of the watershed-based plan, Buckbee Creek did not have a formal name and was referred to locally as the Welworth-Wentworth Creek/Ditch. During the planning process, watershed stakeholders chose the name Buckbee for the watershed. The name, Buckbee, is a reference to the Buckbee family that lived and farmed in the watershed. An elementary school and street also share the name. The Buckbee Creek watershed drains approximately 6.94 square miles (4,441.73 acres) of land into the Upper Rock River. From the confluence with Buckbee Creek, the Upper Rock River flows southwestly before joining the Mississippi River at Rock Island, Illinois.

The Buckbee Creek system is comprised on the mainstem of Buckbee Creek and one tributary, Tributary #1. Collectively, there are 5.57 stream miles in the Buckbee Creek with 4.2 miles being the mainstem. The majority of the stream miles in the watershed are comprised of a concrete channel. Available data indicates that there are only 0.65 acres of wetlands are located within the Buckbee Creek watershed. There are no major impoundments on Buckbee Creek or its tributaries.

Approximately 91-percent (3,977.18 acres) of the watershed was incorporated as of 2012 in the City of Rockford. The remaining 9% of the watershed is unincorporated Winnebago County. The Buckbee Creek watershed is approximately 91% developed. Though primarily residential, land use in the watershed also includes commercial/industrial developments, open space, and agricultural lands.

The Illinois Environmental Protection Agency (Illinois EPA) has identified no impaired waters in the Buckbee Creek watershed. However significant water quality concerns including channelization and hydromodification have been identified in the watershed. Erosion and sedimentation is prevalent along the waterways in the watershed. Additionally, the majority of the stream channels in the watershed are concrete-lined. This plan aims at addressing identifying causes and sources of these impacts and developing programmatic and site specific recommendations for restoring the water quality and hydrology of Buckbee Creek.

1.1.2 The Watershed Over Time

Prior to development, in the early 1800s, the landscape of the watershed included prairies, wetlands, and widely scattered oaks and hickories. In the 1800s, due to the fertile soils and openness of the oaks and hickories, farmers began converting the land including the draining of wetlands for agricultural uses. Very quickly by the mid-1800s, the City of Rockford was incorporated and urbanization of the watershed began. This development continued with the suburbanization following World War II and the watershed has now been converted to a mix of residential, commercial, and industrial land uses.

1.1.3 Impacts of Watershed Development

Under natural and undisturbed conditions, precipitation that falls onto the land surface is allowed to soak into the soil and become groundwater in a process referred to as infiltration or evaporated into the air by plants or from soil or surface waters in a process known as evapotranspiration. Typically, 75% of the rainfall either soaks into the ground or evaporates. Precipitation that is not infiltrated or evapotranspired is called runoff. The runoff can be stored in wetlands or depressional areas where it can be infiltrated into the soil or flow across the vegetated land surface and into creeks, stream, rivers, and lakes. As the runoff passes through the vegetation, the flow of the water is slowed allowing for additional infiltration and reducing the potential for high flows to rush into the surface waters. Additionally, the flowing of the runoff through vegetation provides water quality benefits such as the settling out of soil and other solids and nutrient removal by plants. This process is known as the hydrologic cycle (Figure 1-3).

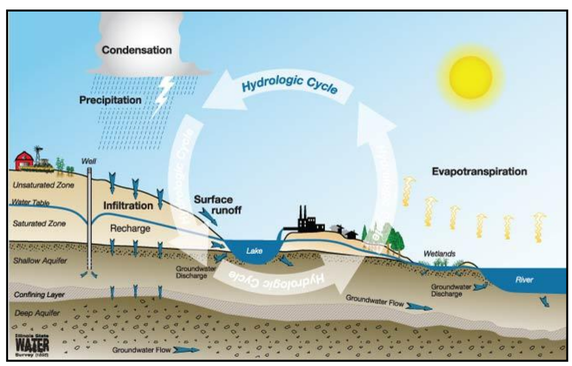

Figure 1-3: Hydrologic Cycle (ISWS)

Urban development in the watershed is reducing the amount of land available for the natural infiltration of rainfall into the ground. Instead of precipitation falling on vegetation where it can be infiltrated, it falls on parking lots, rooftops, and roads. The surfaces that prevent infiltration are known as impervious surfaces. From these impervious surfaces, the runoff is quickly conveyed into stream and creeks via a constructed drainage system comprised of drainage ditches, swales, and storm sewers. The discharge of runoff into the surface waters by the constructed drainage ditches is known as stormwater runoff.

Stormwater runoff tends to enter streams and creeks at a much more rapid rate than runoff from undeveloped areas. This rapid drainage results in what is called "flashy" hydrology. A "flashy" hydrology means that the water level in the stream rises very quickly during a storm and falls quickly afterward. Since less water is infiltrated into the ground to later seep out and create a steady base flow within the stream, low flows are considerably lower or less consistent. Likewise, because less water is absorbed by the ground and more water is flowing into the streams, high flows are considerably higher. These combined effects are referred to as hydromodification.

As a result of hydromodification, stream and creeks received large surges of water in short periods of time. The high flows cause erosion of the streambanks and/or streambeds. As the streambed erodes, the channel deepens and becomes more entrenched (or incised). If the streambed is composed of a stable substrate such as large gravel or stone or when structures provide grade control, the banks will erode and the channel will become wider instead of the channel deepening. As the physical modification of the stream occurs, adjacent property can be damaged.

The flows between these surges can include range from extremely low flows to no flows as there is limited groundwater to maintain base flow to the creek. Decreased low flows degrade aquatic habitat because low flows have low levels of dissolved oxygen necessary for aquatic animals and because, in extreme cases, the stream can dry up completely for periods of time.

In addition, to problems created by the flashiness of the stream, the duration of high flows can also be a significant problem. High flows that cannot be contained within the stormwater conveyance system or within the stream channels can result in localized flooding of homes, business, and roads caused by over-bank topping, culvert backups, and storm sewer surges and backups. The resulting flooding caused property damage and can make travel difficult and unsafe due to standing water. The heavy flows damage stormwater infrastructure including culverts and discharge pipes by causing dislodgement or erosion around the infrastructure. The high flows also have the ability to carry debris including logs, branches, and trash which can be deposited in debris jams and block the conveyance system.

In addition to the change of the volume and rate of runoff, urbanization can also lead to increased pollutants loadings. This kind of pollution is called nonpoint source pollution. Unlike pollution from industrial and sewage treatment plants, nonpoint source pollution comes from many diffuse sources. Nonpoint pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, and ground waters.

Nonpoint source pollution can include:

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas;
- Oil, grease and toxic chemicals from urban runoff and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;
- Salt from roads and irrigation practices and acid drainage from abandoned mines;
- Bacteria and nutrients from livestock, pet wastes and faulty septic systems;
- Atmospheric deposition; and
- Hydromodification.

In addition to chemicals and other substances, nonpoint source pollution also includes other parameters that affect water quality such as temperature, pH, and the amount of oxygen in the water. Each of these parameters plays an important role in the health of aquatic organisms such as fish, macroinvertebrates, and other insects that live in and near streams and waterways. For example, aquatic organisms require oxygen that is dissolved in the water to live and propagate. Low flows and nonpoint sources of pollution can cause the dissolved oxygen levels to become so low that the organisms are killed or need to leave the area in order to find livable conditions.

Temperature is also critical for the health of aquatic organisms. Many fish require cool or cold flowing water in order to successfully breed and survive. Stormwater runoff is typically higher in temperature than the groundwater that feeds streams in an urbanized area. As stormwater runoff flows off of impermeable surfaces and through the stormwater infrastructure it is warmed, leading to elevated water temperatures in the receiving streams. Pollutants picked up along the way can also change the pH of the water making it more acidic or more alkaline. Significant changes towards acidic or alkaline can also have a negative impact on the health of a stream.

Many studies have shown a direct negative impact between the urbanization (or increase in impervious surface area) on water quality and stream health and increase risk of flooding. Thus, the health of the Buckbee Creek watershed is directly related to land use activities throughout the watershed. These activities not only impact the residents of the watershed but all of those of the communities, both human and natural, living downstream on the Kishwaukee River.

1.1.4 Where Do We Go From Here

As discussed in Section 1.1.3, urbanization has played a significant role in the degradation of water resources in the Buckbee Creek watershed. Fortunately, there are actions that can be taken to mitigate existing issues and prevent additional future problems. This watershed-based plan outlines the recommended actions to restore water quality and stream health, and prevent and reduce flooding. The future health of the watershed is largely dependent on how stormwater is managed. The business-as-usual approach using conventional development practices, stormwater management techniques and landscape management practices will result in a continued decline of the watershed resources and water quality. A new approach that includes proven and environmentally-sensitive practices and approaches to stormwater management, can reverse this trend and begin to improve water quality and stream health in the watershed.

There is no single fix for the water quality and flooding problems in the Buckbee Creek watershed. These problems are the cumulative result of decisions made since urbanization accelerated in the mid-1900s. It will take the decisions and actions of every stakeholder living in the watershed to work together to improve the health of the watershed. Likewise, actions will need to be taken on every scale from the individual lot to the neighborhood to the municipalities to positively impact watershed resources.

This watershed-based plan is the first step in helping watershed residents and stakeholders understand what can be done to restore the valuable resources of the Buckbee Creek watershed.

1.2 About this Watershed-Based Plan

1.2.1 Project Purpose

Watershed planning is a collaborative approach to addressing a variety of related water resource issues including water quality protection. This approach allows stakeholders to share information, better target limited financial resources, and address common water-related challenges. These challenges can include improving stream and lake water quality, preserving and protecting groundwater resources, managing stormwater, reducing soil erosion and flood damage, conserving open space, protecting wildlife habitat, providing safe recreational opportunities, supporting opportunities for economic development, and other issues of concern.

The scope of this project is to develop a watershed-based plan for the Buckbee Creek watershed. The purpose of the plan is to address nonpoint-source pollution prevention and water resource protection needs in the Buckbee Creek watershed as well as provide a unique forum for public education, involvement, outreach, and community-capacity building opportunities. If no action is taken, our watershed resources will continue to degrade. Water quality will continue to decline, streambank erosion will continue to erode and impact property and infrastructure and the potential for flooding will increase.

This plan provides information and a set of recommendations for municipalities, developers, residents, and others to effectively plan in a way that is appropriate for the protection of the watershed's resources. It provides guidance on water quality improvement, habitat restoration, development standards, and education and outreach programs.

1.2.2 Winnebago County Watershed Improvement Plan Steering Committee

The Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC) is a consortium of municipalities in the Buckbee Creek watershed, resource agency professionals, environmental advocates, and local residents that established itself in April 2010 to guide the development of strategies to protect and restore Buckbee Creek and its tributaries. The origin of the WCWIPSC occurred following a meeting on April 27, 2010, of interested parties invited to discuss storm water issues regarding the Buckbee Creek watershed. Approximately two dozen people attended the meeting including Winnebago County Board members, the County Engineer and Highway Department staff members, and representatives of the Cherry Valley Township, City of Rockford, Rockford Township, Rockford Park District, the Illinois Department of Natural Resources, the Kishwaukee River Ecosystem Partnership (KREP), and the Rockford Metropolitan Agency for Planning (RMAP). After a discussion of water quality and stormwater problems and the need to coordinate the studies and planning required to implement solutions to the problems, the County Board Chairman agreed that the Winnebago County Highway Department would be the lead agency responsible for taking steps to formally organize the WCWIPSC and applied for the CWA Section 319 grant for the preparation of a watershed-based plan on behalf of the WCWIPSC. The Section 319 grant was funded by the Illinois Environmental Protection Agency in Spring 2011 (See Section 1.2.3 for more information).

WCWIPSC met numerous times during the planning process to oversee the development of the watershed-based plan. In addition, a series of public meeting were held to inform the general public of the watershed planning process and solicit input on the plan. A list of meeting is included in Table 1-1. Copies of meeting minutes are included in Appendix A.

Table 1-1 Summary of WCWIPSC Activities

Meeting Number	Date	Meeting Type	Agenda / Topics Covered
1	April 20, 2011	WCWIPSC	Project kickoff; Stakeholder identification; Goal and Objective Setting
2	July 13. 2011	WCWIPSC	Public meeting planning; Water Resource Inventory; Stream walk
3	September 1, 2011	Public Meeting	Watershed planning process; Watershed concerns; Regulatory concerns
4	November 2, 2011	WCWIPSC	Finalize Goals & Objectives; Watershed concerns; Land use issues
5	January 23, 2012	WCWIPSC	Water Resource Inventory; Pollutant load modeling
6	March 16, 2012	WCWIPSC	Water Resource Inventory; Pollutant load modeling
7	July 25. 2012	WCWIPSC	Flood and drainage issue problem area assessment, Technical advisory committee
8	October 10, 2012	WCWIPSC	Flood location identification, Pollutant load modeling
9	November 13, 2012	Public Education Session	Green Infrastructure Best Management Practices, Good Housekeeping Measures
10	March 6, 2013	WCWIPSC	Pollutant load modeling; Programmatic and Site Specific Recommendations
11	March 20, 2013	WCWIPSC	Programmatic and Site Specific Recommendations

Meeting Number	Date	Meeting Type	Agenda / Topics Covered
12	April 25, 2013	WCWIPSC Executive Committee	Public meeting agenda
13	May 23, 2013	Public Meeting	Programmatic and Site Specific Recommendations

1.2.3 Project Funding

The project was initiated and funded by the Winnebago County Highway Department with a grant from the Illinois Environmental Protection Agency Section 319 grant program. Participating stakeholders contributed staff time to provide information and participate in the watershed planning progress. They include the Upper Rock River Ecosystem Partnership (URREP), City of Rockford, Rockford Park District, Winnebago County, Winnebago County Soil and Water Conservation District, and watershed residents.

1.2.4 Watershed-Based Plan Elements

The "Nonpoint Source Program and Grant Guidelines for States and Territories" written by United States Environmental Protection Agency (Illinois EPA) provides guidance for the production of Section 319 funded watershed-based plans. This guidance manual was created to ensure that all Section 319 funded projects including watershed-based plans are aimed at restoring waters impaired by nonpoint source pollution. The guidance manual outlines nine requirements that must be met by the plan in order for the plan to be considered a Watershed-Based Plan. These nine elements are:

1. Identification of causes and sources that will need to be controlled to achieve load reductions estimated within the plan;
2. Estimate of load reductions expected for management measures described in number 3 below;
3. Description of the non-point source pollution management measures that need to be implemented in order to achieve the load reductions estimated in number 2 above and an identification of critical areas
4. Estimate the amounts of technical and financial assistance needed; costs; and the sources and authorities that will be relied upon to implement the plan;
5. Information and public education component;
6. Implementation schedule;
7. Description of interim, measurable milestones for determining whether non-point source pollution measures or other actions are being implemented;
8. Criteria to measure success and re-evaluate the plan; and
9. Monitoring component to evaluate effectiveness of implementation efforts over time.

The Buckbee Creek Watershed-Based Plan meets all of the nine minimum criteria outlined by the USEPA. As such, the Buckbee Creek stakeholders will be able to apply for Section 319 funding for the implementation of non-point source pollution control projects outlined in the plan.

1.2.5 Prior Watershed Studies and Plans

In 2007, the City of Rockford commissioned a drainage study of the Harmon Park Basin. The Harmon Park basin (680 acres) is known locally as "Rolling Green" and is located in the northern portion of the Buckbee Creek watershed between Broadway Avenue and Harrison Avenue. Although the Rolling Green neighborhood does not have any major drainageways passing through it, and is not located in the floodplain, the area experiences frequent flooding. Runoff flows into Rolling Green whose topography concentrated the runoff into the low-lying portions of the neighborhood. Although the area's topography is rolling, as its name indicates, it is basically bowl-shaped with the centrally located neighborhood park (Harmon Park) occupying the lowest point. Because the original design of the neighborhood did not provide for positive drainage, there is no route other than overland drainageways or the existing streets to accommodate overflow when storm sewer capacity is exceeded. As the neighborhood is densely built and the low lying areas when runoff accumulated have homes constructed on them, flood events cause major damage to private property.

The drainage study produced a plan that includes the construction of stormwater detention facilities throughout the neighborhood to mitigate flooding. Using local funds, Rockford is the process of implementing the plan by acquiring properties that have been severely damaged by historical flooding and demolishing the structures to create sites for future detention facilities. Rockford has also constructed a series of detention facilities and connected storm sewers along the path of overland flow through the neighborhood. Additional improvements including constructing a regional storage basin at Harmon Park are planned and will be constructed as funding is available.

1.2.6 Process and Plan Organization

This watershed-based plan was produced via a comprehensive watershed planning approach that involved input from local residents, municipal officials, municipal employees, and representatives from natural resource agencies.

The Winnebago County Watershed Improvement Planning Steering Committee (WCWPSC) held meetings throughout 2010 to 2013 to direct the development of the watershed plan. In the Summer of 2010, WCWIPSC established goals and objectives to focus the watershed planning activities.

Information obtained from watershed stakeholders and numerous natural resource agencies was then used to assess the overall condition of the watershed including water quality, natural resources, and flood risks. Using this information, a series of recommended management practices aimed at improving the water quality and natural resources conditions of the watershed was developed. Potential funding sources and strategies for the implementation and monitoring of the identified recommended projects were also included in the watershed-based plan. Using the guidance provided by the "Guidance for Developing Actions Plans in Illinois" prepared by Chicago Metropolitan Planning Agency (CMAP), the format for the Buckbee Creek Watershed-Based Plan includes five main sections.

- Goals and Objectives
- Water Resources Inventory and Assessment
- Stormwater Retrofit Toolbox
- Action Plan
- Monitoring Plan

Goal and Objectives

Watershed stakeholders developed a list of watershed issues, goals, and objectives. The major topics of concern included: hydromodification, water quality, flooding, watershed coordination, watershed hydrology, and instream habitat.

Water Resources Inventory and Assessment

The project planning team assessed watershed conditions and prepared a series of watershed maps based on data, studies, inventories, and stakeholder input. The assessment includes information on stream corridor conditions, stormwater infrastructure, flooding, water quality, land use, wetlands, and other relevant information. This information not only provides a snapshot of current conditions but also serves as baseline data for comparing future watershed assessments.

Stormwater Best Management Practices and Solutions Toolbox

After the watershed condition was determined, a stormwater solutions toolbox was assembled to identify the range of actions needed to improve watershed resources. This toolbox includes practices in the areas of policy and planning, development standards, stormwater management, erosion control, streambank stabilization, yard and landscape management, habitat restoration, natural area preservation, and flood reduction.

Prioritized Action Plan

The effectiveness of the Buckbee Creek watershed plan will be largely dependent on the quality of the action plan. The action plan provides the "who, what, where and when" for watershed improvement and includes programmatic (general) and site-specific recommendations. The site specific action items are tied to a particular location in the watershed or along the stream corridor, and they include details such as area, cost, responsibility, schedule, and priority.

Monitoring Plan

A monitoring and evaluation plan was developed to provide stakeholders and other implementers with a way to monitor watershed conditions and track whether meaningful progress is being made towards plan goals. The monitoring plan includes milestones, parties responsible for monitoring, and the frequency and method for collecting data.

1.3 Using This Plan

For those unfamiliar with watershed-based planning, this plan likely seems overwhelming. There are pages of information to absorb, tables to navigate, and numerous costly recommendations that a single resident could not possibly begin to implement. But there are simple, straightforward actions that each person can take immediately to help improve the watershed.

Remember that every action, no matter how small, can have an impact and improve watershed resources. The Executive Summary of the plan provides a concise overview of what this plan is all about. For additional details, browse the Table of Contents and flip to the relevant section, or refer to Table 1-2 and the suggestions that follow to help find more information.

Table 1-2 Priority Actions by Stakeholder Group

If you are a….	Your top priority action items include:
Resident	1. Join the Upper Rock River Ecosystem Partnership to stay engaged in watershed activities. 2. Restore native riparian buffers, and remove excess debris from stream channels. 3. Capture stormwater runoff using rain gardens, rain barrels or other retrofits and to avoid discharging roof and sump pump runoff directly to the stream. 4. Dispose of yard and municipal waste appropriately, not into stream channels, storm sewers or drainageways. 5. Do not construct structures such as sheds or gazebos in drainage ways or detention facilities.
Business owner	1. Manage your property appropriately by regularly cleaning parking lots and using environmentally-friendly lawn care practices. 2. Incorporate stormwater retrofits to reduce and slow stormwater runoff from your property.
Developer or Homebuilder	1. Incorporate stormwater best management practices into all new development and redevelopment sites aimed at slowing, infiltrating, storing, and cleaning stormwater runoff. 2. Use conservation development or low impact development for a new and redevelopment sites.
Government Official or Staff	1. Incorporate watershed-based plan recommendations into local plans, policies, and regulations. 2. Prepare a detailed stormwater management plan for the watershed. 3. Manage, retrofit, and stabilize the stormwater management system including detention basins, culverts, drainageways, and discharge pipes. 4. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality. 5. Require the use of stormwater BMPs and/or stormwater retrofits in all new or redevelopment projects.

To find out….

…what this plan is intended to achieve, read about the watershed goals and objectives in Chapter 2.0.

…detailed information about the watershed, its resources, and problems, read the water resources inventory and assessment included in C 3.0.

…to locate watershed problems close to your home or business, refer to the watershed maps included in Chapter 3.0 to find out what subbasin is closest to the area you are interested in. The maps and text in Chapter 3 will help you locate the watershed resources and problem areas near you.

…what can be done to prevent and mitigate water quality and flooding problems in the watershed, read Chapter 4.0, Stormwater Retrofit Tool Box and Chapter 5, Section 2, the Programmatic Action Plan.

…what types of solutions are available to fix a problem in a specific area, read Chapter 4.0, Stormwater Retrofit Tool Box and Chapter 5, Section 3, the Site Specific Action Plan. The Site Specific Action plan is presented by municipality.

…what king of funding is available for watershed projects, refer to Chapter 6, Section 3, and Funding Sources.

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Legend

Buckbee Creek Watershed
Streams & Flowlines
Winnebago County

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Winnebago County Watershed Planning

Buckbee Creek - General Location of Watershed

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	1-2
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

FINAL

Chapter 2.0 Goals and Objectives

2.1 WCWIPSC Goals

The Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC) is a consortium of municipalities in the Buckbee Creek watershed, resource agency professionals, environmental advocates, and local residents dedicated to the development of strategies to protect and restore Buckbee Creek and its tributaries. WCWIPSC's primary goal is to work effectively to reduce nonpoint source pollution inputs in the Buckbee Creek watershed, reduce flooding and improve water quality and stream habitat, while engaging a wide range of audiences in the WCWIPSC's efforts.

2.2 Watershed Goals and Objectives

One of the WCWIPSC's first tasks was the discussion and establishment of goals for the Buckbee Creek watershed. Stakeholders included in the goal setting process included the members of the WCWIPSC and watershed residents that attended the watershed public meetings. At the April 2011, July 2011, and November 2011 WCWIPSC members dedicated a significant portion of the committee meeting to the identification of watershed concerns and setting of watershed goals. See Appendix A for the minutes of WCWIPSC meetings. Additionally, at the July 2011 public meeting, attendees that included more than 50 watershed residents, County Board members and representatives from various local and state agencies were asked to express their watershed concerns and vision for the Buckbee Creek watershed. As part of the public meeting, attendees were split into breakout groups and asked to provide input on general and specific water quality and flooding concerns and who they view as responsible for fixing the identified problems. The information provided by the attendees was utilized by WCWIPSC in preparing the goals and objectives for the Buckbee Creek Watershed-Based Plan.

As discussed above, prior to setting goals, stakeholders were asked to communicate their concerns and vision for the Buckbee Creek watershed. Stakeholder concerns included:

- Stormwater
    - Too much runoff and not enough infiltration and/or detention leading to flooding
    - Non-point source pollution
    - Hydromodification leading to erosion and sedimentation
- Need for recreational, greenway, and open space
- Lack of education for landowners along the creek, need to encourage riparian best management practices to prevent illicit dumping and bad housekeeping
- Groundwater contamination/impacts
- Water quality and groundwater impacts from the Rockford Groundwater Contamination Site
- The ecological condition of the stream channels including lack of fish and wildlife habitat
- Lack of collaboration between government agencies, business and residents on water quality and flood related issues

Goals were drafted directly from the concerns expressed by the stakeholders. The final goals were adopted on November 2, 2011 and capture the desired outcomes and vision for the Buckbee Creek watershed. Objectives assigned to each goal are intended to be measurable so that the WCWIPSC can assess future progress made towards each goal. The goals are not listed by order of importance.

A. Protect and enhance overall surface and groundwater quality in the Buckbee Creek watershed

   Objectives
   1) Identify design alternatives to the concrete channel that will provide water quality and groundwater benefits.
   2) Reduce sediment loading in streams by stabilizing stream banks.
   3) Implement stormwater best management practices (BMPs) throughout the watershed to improve water quality and reduce runoff.
   4) Retrofit existing stormwater management facilities and design new facilities within urbanized areas to reduce nutrient and sediment loading.
   5) Restore riparian buffers along Buckbee Creek and its tributaries.
   6) Implement infiltration BMPs throughout the watershed to encourage groundwater infiltration.
   7) Educate the public about the need for groundwater protection.

B. Reduce existing flood damage in the watershed and prevent flooding from worsening

   Objectives
   1) Encourage decision makers to undergo a detailed hydraulic and hydrology study of the watershed.
   2) Mitigate for existing flood damage by identifying parcels suitable for flood mitigation projects such as compensatory storage basins.
   3) Identify design alternatives to the concrete channel in order to reconnect the channel to the floodplain.
   4) Reconnect channelized stream segments to the floodplain where feasible.
   5) Implement stormwater best management practices (BMPs) throughout the watershed designed to reduce runoff and encourage infiltration.
   6) Protect undeveloped floodplain from development.

C. Improve aquatic and wildlife habitat in the Buckbee Creek watershed

   Objectives
   1) Identify opportunities for improving habitat along degraded stream channels using a natural channel design.
   2) Restore riparian buffers along Buckbee Creek and its tributaries.
   3) Encourage local residents to utilize native species in their landscapes.
   4) Identify opportunities for habitat improvements at parks and natural areas.

D. Develop open space in the Buckbee Creek watershed and provide recreational opportunities

Objectives

1) Identify open space along the waterways that would provide access to the waterway.
2) Identify open space for natural resources and provide passive recreational opportunities.

E. Increase coordination between decision makers and other stakeholders in the watershed.

Objectives

1) Ensure communities adopt the Buckbee Creek Watershed-Based Plan.
2) Encourage the adoption and/or revision of comprehensive plans and ordinances that support the watershed plan's goals and objectives.
3) Encourage communities to continue to be an active member of the WCWIPSC following plan development.

F. Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship

Objectives

1) Encourage stakeholder to join the Upper Rock River Ecosystem Partnership.
2) Encourage stakeholders to participate in WCWIPSC activities and educational workshops.
3) Provide watershed stakeholders with an education plan that gives them the skills needed to implement the watershed plan.

Chapter 3: Watershed Resource Inventory and Assessment

3.1 Introduction

An understanding of the unique features and natural processes associated with the Buckbee Creek watershed, as well as the current and potential future condition, is critical to developing an effective watershed-based plan. This watershed inventory and assessment organizes, summarizes, and presents available watershed data in a manner that clearly communicates the issues and processes that are occurring in the watershed so that stakeholders living the Buckbee Creek watershed can make informed decisions about the watershed's future. The inventory and analysis identifies the causes and sources of watershed degradation and provides the basis for recommending both programmatic and site specific actions intended to improve the watershed, which are found in Chapter 5.

As part of the preparation of the Watershed Resource Inventory and Assessment, WCWIPSC collected and reviewed available watershed data, conducted an investigation of stream reaches in the field, and gathered input from watershed stakeholders. Examples of information investigated includes water quality, streambank erosion, soils, wetlands, flood damage areas, the detention and drainage system, population, and current and future land use.

Geographic Information System (GIS) software was used to compile, analyze, and display this detailed information in graphical and map format so that stakeholders can easily understand the condition and location of watershed resources. The amounts of different pollutants that are expected from various land uses to enter Buckbee Creek was also investigated.

This chapter presents the results of the inventory and analysis in a series of maps, tables, graphs, and narrative format. A summary of the watershed assessment is included at the end of the chapter.

3.2 Watershed Setting

The Buckbee Creek watershed is located in the central portion of Winnebago County in northern Illinois (Figure 3-1). The watershed drains approximately 6.94 square miles (4,411.72 acres) of land into the Rock River. The Rock River flows to the southwest before joining the Mississippi River in the Quad Cities area (Moline, Illinois; Rock Island, Illinois, Davenport, Iowa; and Bettendorf, Iowa).

3.3 Water Resources

Buckbee Creek is approximately 4.2 miles in length and is primarily a concrete channel. In addition to the mainstem of Buckbee Creek, there is one major tributary situated in the northern portion of the watershed. Collectively, there are 5.57 stream miles in the Buckbee Creek watershed. Available data indicates that 0.65 acres of wetlands are located within the Buckbee Creek watershed near its confluence with the Rock River. There are no major impoundments on Buckbee Creek or its tributaries.

3.4 Geology/Topography

During the Pleistocene Era or "Ice Age" advancing and receding glaciers covered much of North America. The Illinoian glacier extended to southern Illinois between 300,000 and 125,000 years ago. It is the Illinoian glacier that is responsible for the flat, farm-rich areas in the southern half of the state. The northeastern portion of Illinois including the watershed area was also covered by the most recent glacial event known as the Wisconsinan. The Wisconsinan began approximately 70,000 years ago and ended around 14,000 years ago. It was during this time that the temperatures began to rise and the ice retreated to form a landscape similar to the Alaskan tundra. As the temperatures began to rise, the tundra was replaced by cool moist deciduous forests, and eventually oak-hickory forests and prairies. The final retreat of the Lake Michigan lobe of the Wisconsin glacier is responsible for the formation of the Great Lakes and the landscape of the watershed. This landscape contains moraines, flood plains, bogs, outwash plains, lake plains, beaches, stream terraces, kames, ridges, and kettle holes (wetlands, ponds, and lakes).

Topography refers to the elevations of landscape that describes the configuration of its surface. Topography is an essential tool in the watershed planning process because topography defines the boundaries of the Buckbee Creek watershed. For this watershed-based plan, the Online Watershed Delineation (HYMAPS-OWL) tool, created by Department of Agriculture and Biological Engineering at Purdue University was use to create the initial subwatershed boundaries. The subwatershed (also referred to as subbasin) boundaries generated by HYMAPS-OWL were then cross referenced with boundaries obtained by inputting 2-foot topography into the GIS-based model, Arc Hydro. This combined data generated a Digital Elevation Model (DEM) that was used to delineate and refine the watershed and subwatershed boundaries for Buckbee Creek. Inconsistencies in the two model's delineations were adjusted to reflect field-verified conditions and more accurately depict the hydrologic boundaries. Most of these inconsistencies occurred in areas divided by roadways that were not accounted for the in model. Figure 3-2 depicts the DEM and boundary of Buckbee Creek.

The Buckbee Creek watershed generally drains from northeast to southwest to the Rock River. The highest point in the watershed (912 feet) is located XX. The lowest point in the watershed (685 feet) is located near the creek's confluence with the Rock River. The difference in the highest and lowest points reflects a 225-foot change in elevation as you traverse from the northern to the southern section of the watershed.

3.5 Climate and Precipitation

3.5.1 Climate

Illinois is situated midway between the Continental Divide and the Atlantic Ocean and is often times underneath the polar jet-stream. The polar jet-stream is a focal point for movement between cold polar air masses from the north moving southward and warmer, tropical air from the south moving northward. The convergence of polar and tropical air causes Illinois to have a humid continental climate with hot humid summers and cool to cold winters with short frequent fluctuations in wind direction, cloudiness, humidity, and temperature.

Data collected in Rockford, Illinois best represents the overall climate and weather patterns experienced in the watershed. The average annual temperature for Rockford, Illinois is 47.7°F. The winter months (December – February) are cold with an average temperature of 21.7°F with the lowest temperature on record of -27°F recorded on January 10, 1982. There is an average of 144 annual days below freezing. The summer months are hot and humid with an average temperature of 71°F. The highest temperature on record for Rockford, Illinois is 112°F recorded on July 14, 1936.

3.5.2 Precipitation

Average yearly precipitation for Illinois varies from just over 48 inches at the southern tip of the state to just under 32 inches in the northern portion of the state. May and June are the wettest months of the year. Flooding is the most damaging weather hazard within the state. Increased warming within urban heat islands leads to an increase in rainfall downwind of cities. Lake Michigan leads to an increase in winter precipitation along its south shore due to lake effect snow forming over the relatively warm lakes. Normal annual snowfall exceeds 38 inches in Chicago, and the southern portion of the state normally receives less than 14 inches. Storms exceeding the normal winter value are possible within one day. In summer, the relatively cooler lake leads to a more stable atmosphere near the lake shore, reducing rainfall potential. Illinois averages around 50 days of thunderstorm activity a year which puts it somewhat above average for number of thunderstorm days in the United States. Illinois is also vulnerable to tornadoes with an average of 35 occurring annually.

The average annual rainfall for Rockford, Illinois is 36 inches. Average snowfall for the area is 39 inches. The most rainfall received in one year occurred in 2008 when more than 51 inches of rain fell. The snowiest winter in the history of the city was the winter of 1978-1979, when 75 inches of snow fell. The one-day maximum precipitation (3.45 inches) occurred on September 26, 2011.

3.6 Soils

Deposits left during by the Lake Michigan lobe of the Wisconsin glacier are the raw materials of the soils currently found in the Buckbee Creek watershed. A combination of biological, physical, and chemical variables such as climate, drainage patterns, vegetation, and topography have all interacted together to form the soils found today. Soils are identified by a name associated with each series or class of soils with similar characteristics. A soil series is commonly derived from a town or landmark in or near the areas where the soil series was first identified, although sometimes naming conventions vary by county. Soil series are differentiated based on the amounts and size of particles making up the soil, water-holding capacity, the slopes where they are located, permeability characteristics, and organic content.

Table 3-1 lists the dominant soil series located within the watershed

Table 3-1 Soil Series in the Buckbee Creek Watershed

Soil Series	Hydric	Highly Erodiable	Hydrologic Soil Group	Acres	% of Watershed
Griswold	No	Yes	B	1698.97	38.26%
Flagler	No	No	B	852.04	19.19%
Comfrey	Yes	No	B/D	340.12	7.66%
Winnebago	No	Potential	No	274.50	6.18%
Urban Land	N/A	N/A	N/A	257.13	5.79%
Warsaw	No	No	B	182.98	4.12%
Ringwood	No	Yes	B	99.48	2.24%
Ogle	No	Potential	B	96.12	2.16%
Orthents	No	Potential	C	90.71	2.04%
Beardstown	No	No	C/D	87.90	1.98%
Billet	No	No	B	70.73	1.59%
Flagg	No	Potential	B	67.57	1.52%
Argyle	No	Potential	B	43.83	0.99%
Assumption	No	Potential	B	35.52	0.80%
Martinsville	No	Yes	B	34.40	0.77%
Greenbush	No	No	B	28.27	0.64%
Virgil	No	No	B	26.61	0.60%
Quarry Pits	N/A	N/A	N/A	24.44	0.55%
Non-Dominant Soil Types	N/A	N/A	N/A	129.86	2.92%

There are 37 soil series found in the Buckbee Creek watershed. Of these 37, 18 are considerate dominant soil types (greater than 0.5% of the watershed). The remaining 19 soils have been classified as "non-dominant soils". The "non-dominant soils cover 2.92% of the Buckbee Creek watershed.

Griswold is the predominant soil type in the watershed, covering 1698.97 acres or approximately 38.26% of the watershed. Flagler soils are the next most dominant soil series covering approximately 19.19% or 852.04 acres of the watershed. The majority of the soils located in the watershed are well drained, non-hydric soils. Native plant communities in the watershed were likely comprised of prairie grasses.

3.6.1 Hydric Soils

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that are formed under conditions of saturation, flooding, or ponding and retain moisture long enough during the growing season to develop anaerobic (oxygen-deprived) conditions in the soil layers closest to the surface. Hydric soils are important because they indicate the presence of existing or historical wetlands and depressional areas. Thus areas of hydric soils may be suitable for wetland restoration. Often, drain tiles are found in areas of hydric soils but because the tiles are draining water away from the area, wetlands that were once present are no longer present. By breaking these tiles and restoring the natural flow of water to these areas, wetland hydrology can potentially be restored and with a properly designed excavation, planting and management plan, a high quality wetland can be established. Table 3-2 identified the hydric soils in the Buckbee Creek watershed and Figure 3-3 displays the coverage of hydric soils. 4006.89 acres (90.21%) of non-hydric soils comprise the majority of the watershed. Hydric soils comprise 305.65 acres or 6.88% of the Buckbee Creek watershed and hydric soil inclusions comprise 129.19 acres or 2.91% of the watershed. Hydric inclusion soils are upland soils that have the potential to have pockets of hydric soils contained within them.

Table 3-2 Percent Coverage of hydric and non-hydric soils in the Buckbee Creek Watershed

Soil	Total area (acres)	Percentage of Watershed
Non-Hydric Soils	4006.89	90.21%
Hydric Soils	305.65	6.88%
Hydric Inclusion Soils	129.19	2.91%
Total	4441.73	100%

3.6.2 Soil Erodibility

Soil erosion and sedimentation are significant causes of degraded water quality in Illinois. Soil erosion is the process in which soil is detached and moved by flowing water, wave action or wind. Through erosion, sediment is transported from its original location and deposited in a new location such as a stream, river, lake, or other ground surface. This deposition process is commonly referred to as sedimentation. The movement of eroded soils into streams, rivers, and lakes affects water quality chemically, biologically, and physically. Damage from sediment can be expensive both environmentally and economically. Over time, sediment deposits can blanket rock, cobble, and sandy substrate needed by fish and macroinvertebrates for habitat, food, and reproduction; reduce useful storage volumes in ponds, reservoirs, and lakes; and increase the need for costly water filtration systems for municipal drinking water supplies. Often times, the impacts of erosion and sedimentation are additive and the effects and costs of the sedimentation can be severe, both for those immediately affected and for those who must mitigate subsequent problems.

A map identifying the highly erodible soils in the watershed was created (Figure 3-4) by selecting soils that have been classified as highly erodible by the Natural Resource Conservation Service (NRCS). It is important to map the highly erodible soils because they represent those areas that have the highest potential to degrade water quality. As identified in Table 3-3, 33.25% (1443.65 acres) of the soils within the watershed are highly erodible. Additionally, another 26.51% (1,150.78 acres) are considered to have the potential to be highly erodible.

Table 3-3 Highly erodible soils in the Buckbee Creek Watershed

Soil Name	Soil Code	Acres	Percent of Watershed
Griswold	363D2	1220.87	28.12%
Ringwood	297D2	99.48	2.24%
Flagg	419C2	63.67	1.47%
Martinsville	570D2	34.40	0.77%
Winnebago	728C2	14.42	0.33%
Kidder	361D3	3.80	0.09%
Rockton & Dodgeville	566C2	3.51	0.08%
Pecatonica	21C2	2040	0.08%
McHenry	310D2	0.10	<0.01%

3.6.3 Hydrologic Soil Groups

The permeability and surface runoff potential of the soils in the United States have been classified by the NRCS into Hydrologic Soil Groups (HSGs). HSGs are based on a soil's infiltration and transmission (or permeability) rates and are used by engineers to estimate runoff curve numbers. Runoff curve numbers are an estimate of runoff potential of different soil types with different land covers. The curve numbers allow engineers to estimate the amount of direct runoff from a rainfall event in a particular area. HSGs are classified into four primary categories: A, B, C, and D, and three dual classes, A/D, B/D, and C/D.

- Group A is comprised of the most permeable soil types and have the lowest runoff potential. These soils consist of mainly deep, well drained to excessively drained sands or gravelly sands. Group A soils have a high rate of water transmission.
- Group B soils have a moderate infiltration rates and are moderately deep, moderately well drained or well drained with fine texture to moderately course texture (silt and sand). Group B soils have a moderate rate of water transmission.
- Group C soils have slow infiltration rates because of a fine texture soil layer comprised of silt and clay that impedes the downward migration of water. Group C soils have a slow rate of water transmission.
- Group D soils have the slowest infiltration rates and a high runoff potential. These soils are typically clay and exhibit very very slow rates of water transmission.
- Dual hydrologic groups (A/D, B/D, and C/D) are classified differently. The first letter represents the HSGs for the artificially drained soils in the area. The second letter represents the HSGs for the undrained, natural conditions. Only soils that are rate D in the natural conditions are assigned to dual classes.

The location of Group A and Group B soils within a watershed is imperative to a watershed planning process. Many of the BMPs included in watershed plans rely on infiltration to maximize performance including rain gardens, bioswales, and infiltration basins. Table 3-4 summarizes the HSGs and their corresponding attributes. Figure 3-5 depicts the location of each HSG within the watershed while Table 3-5 summarizes the acreage and percent of the watershed for each HSG. 81.33% of the soils in the Buckbee Creek watershed as Group B with 7.81% classified as Group B/D. The remaining 10.86% of soils are comprised of Group A, C, C/D, and unclassified soils. There are no Group A/D or D soils in the Buckbee Creek watershed.

Table 3-4 Hydrologic Soil Groups and their corresponding attributes

HSG	Soil Texture	Drainage Description	Runoff Potential	Infiltration Rate	Transmission Rate
A	Sand, loamy sand, or sandy loam	Well to excessively well drained	Low	High	High
A/D	Sand or silt loam to clay	Well drained to poorly drained	High to Low	High to Very Low	High to Very Low
B	Silt loam or loam	Moderately well to well drained	Moderate	Moderate	Moderate
B/D	Silt loam, silty clay loam, clay	Moderately well to poorly drained	Moderate to Low	Moderate to Low	Moderate to Very Low

HSG	Soil Texture	Drainage Description	Runoff Potential	Infiltration Rate	Transmission Rate
C	Sandy clay loam	Somewhat poorly drained	High	Low	Low
C/D	Sandy clay loam, silty clay loam, clay	Somewhat poorly drained to poorly drained	High	Low to Very Low	Low to Very Low
D	Clay loam, silty clay loam, sandy clay loam, silty clay, clay	Poorly drained	High	Very Low	Very Low

Table 3-5 Hydrologic Soil Groups including acreage and percent of watershed

HSG	Total Acreage	Percent of Watershed
A	28.88	0.65%
A/D	0	0%
B	3611.61	81.33%
B/D	340.12	7.81%
C	90.71	2.08%
C/D	87.90	2.02%
D	0	0%
Unclassified	281.67	6.11%

While the HSG classification system designated a large portion of the watershed's soils to have moderate permeability and runoff potential, there are opportunities for infiltration. The B Soil group is desirable as it provides moderate infiltration and increased groundwater recharge.

3.7 Watershed Jurisdictions

One county, 1 municipality and 1 township comprise the Buckbee Creek watershed (Table 3-6, Figure 3-6). The watershed is located completely in Winnebago County and the City of Rockford (3977.18 acres/89.54%) is the only municipality located in the watershed. All remaining land in the watershed (464.54 acres/10.46%) is Unincorporated and under the jurisdiction of the Rockford and Cherry Valley Townships. Additional entities with jurisdiction in the watershed include:

1. Winnebago County Board Districts (District 9, 10, 12, 15, and16)
2. Winnebago County Soil and Water Conservation District
3. Illinois State Representative District (District 67 and 68)
4. Illinois State Senatorial District (District 34 and 35)
5. US Congressional District (District 16)

Table 3-6 County, municipal, and township jurisdictions in the Buckbee Creek watershed

Jurisdiction	Acres	Percent of Watershed
Winnebago County	4442	100%
Municipalities		
Rockford	3977	89.54%
Unincorporated Areas	465	10.46%
Townships		
Rockford	3118	70.02%
Cherry Valley	1324	29.8%
Winnebago County Soil and Water Conservation District	4442	100%
County Board of Directors		
District 9	999	22.5%
District 10	529	11.9%
District 12	131	3.0%
District 15	2218	50.0%
District 16	6	0.1%
District 18	559	12.6%
Congressional District		
US House District 16	4442	100%
State Senate		
District 34	4226	95.1%
District 35	216	4.9%
State Assembly		
District 67	4276	96.3%
District 68	166	3.7%

One Watershed: Multiple Decision Makers

As watershed boundaries do not typically follow political boundaries, one of the greatest challenges faced during watershed planning and implementing a watershed plan is that watersheds typically include multiple jurisdictions that have varying interests, resources, and responsibility. Actions by one jurisdiction in the watershed impact others in watershed both negatively and positively. By actively working together, jurisdictions within the watershed can ensure that that goals, objectives, and projects outlined in the watershed plan are considered in each of the jurisdiction's decision making process on policies, projects, and programs.

As part of the watershed planning process, the Winnebago County Watershed Plan Steering Committee (WCWPSC) was formed. WCWPSC has been successful in bringing together representatives from the county, municipalities, townships, the Rockford Park District, and Winnebago County Soil and Water Conservation District. Additionally, the WCWPSC includes watershed residents and members of the Upper Rock River Ecosystem Partnership (URREP). Ensuing that the WCWPSC or a similar watershed council continues to be active after the watershed planning process is complete is a necessity to provide a venue for communication, coordination, and collaboration between the multiple watershed jurisdictions and ensure the implementation of the watershed plan.

Chapter 5 Section 2 provides details on the role each jurisdiction and other stakeholders play in watershed planning, water quality protection and improvement, and nonpoint source pollution control.

3.8 Watershed Demographics

The Rockford Metropolitan Agency for Planning (RMAP) is the designated Metropolitan Planning Organization (MPO) for the Rockford region. Under Federal law urbanized areas with populations exceeding 50,000 are required to have an organization that plans and coordinates decision regarding the area's transportation systems. RMAP is governed by a Cooperative Agreement that has been adopted by the Cities of Rockford, Belvidere and Loves Park, the Village of Machesney Park, the Counties of Boone and Winnebago and the Illinois Department of Transportation.

Planning for transportation, land use and environmental issues were traditionally undertaken separately by various agencies within an urban area. This separation made it difficult to understand the connection among various subjects and how changes in one area may affect another. Over the past several decades, an integrated approach to transportation planning has evolved to create a system that incorporates environmental, economic development and community goals.

According to RMAP's 2040 forecasts for population, number of households and employment, with the exception of employment, the Buckbee Creek is expected to experience growth (Tables 3-7 to 3-9). Growth within the watershed has the potential to impact watershed conditions through changes in land use.

Table 3-7 RMAP 2000 to 2040 Population Forecast Data for the Buckbee Creek Watershed

Population	2000	2040	Change	% Change
Buckbee Creek	27,619	31,260	3,641	13.18%

Table 3-8 RMAP 2000 to 2040 Household Forecast Data for the Buckbee Creek Watershed

Households	2000	2040	Change	% Change
Buckbee Creek	11,803	12,678	875	7.41%

Table 3-9 RMAP 2000 to 2040 Employment Forecast Data for the Buckbee Creek Watershed

Employment	2000	2040	Change	% Change
Buckbee Creek	20,866	19,694	-1,172	-5.61%

It should be noted that the population and household data were obtained from the 2010 Decennial Census and are based on block group census geography. As such, the boundaries extend beyond the natural watershed boundaries, potentially leading to inflated estimates for each watershed. The total for each block group that intersected with the watershed was included. Additionally, the employment data came from the U.S. Census Bureau 2010 Longitudinal Employer-Household Dynamics (LEHD). This data follows TAZ (Traffic Analysis Zone) geography, which again extends beyond the natural watershed boundaries, producing inflated estimates for each watershed.

Using 2000 base year data, RMAP was able to use our Travel Demand Model (TDM) to forecast these figures out to 2040. For the TDM, RMAP uses PTV software to project current and future travel volumes for the region's roadways. The model uses demographic and land-use forecasts as a major source of data input for the model. The study area is divided into Transportation Analysis Zones (TAZs) for the purpose of the modeling effort, utilizing trip generation, trip distribution and trip assignment to execute the modeling process. Modeling begins with historic and current data inputs such as current traffic, population, employment and land use, and ties in predictions of future land use to determine how the population, dwelling units (households) and employment will be distributed in the study area. The model runs on the assumption that each land use classification will produce or attract a certain amount of vehicle trips. The model is based on the most recent Census data available for TAZs, Woods and Poole state profile data for regional demographics and economics, as well as employment data from the Illinois Department of Employment Security. The data is projected out to 2040 using employment and dwelling unit data based upon the adopted land use plans of all the local and county jurisdictions.

3.9 Land Use

Land use and cover refer to the type of use assigned to a parcel, such as residential or commercial, and the type of surface coverage found on a parcel, such as forest and grassland, respectively. This information is necessary for understanding the impact of current and future land use on watershed resources and the restoration potential.

3.9.1 Historical Land Use

1972 Land Use data for the Buckbee Creek watershed was obtained from the United States Geological Survey (USGS) GIRAS Land Use and Land Cover database. USGS GIRAS Land Use and Land Cover for the Buckbee Creek watershed is summarized in Table 3-10 and depicted in Figure 3-7.

Table 3-10 Geological Survey (USGS) GIRAS Land Use and Land Cover for the Buckbee Creek Watershed

USGS GIRAS Land Use and Land Cover Type	Acres	Percent of Watershed
Residential	2232.79	54.23%
Commercial and Services	579.86	14.08%
Industrial	425.23	10.33%
Transportation, Communications, and Utilities	109.92	2.67%
Other Urban Built-up	263.15	6.39%
Cropland and Pasture Lands	506.59	12.30%
Reservoirs	0.08	0.00%

Definitions of each land use/cover types listed in Figure 3-7 and Table 10 are as follows:

Residential: Land cover than contains residential areas ranging from high density to low density.

Commercial and Services: Land cover that contains commercial areas used predominately for the sale of products and services. Includes such land uses are urban business districts, shopping centers, commercial strip developments, junkyards, resorts, etc. Institutional land uses just as educational, religious, health, correctional and military facilities are also included in this land use.

Transportation, Communications and Utilities: Land cover that includes roads, railways, airports, seaports, and major lake ports.

Other Urban or Built-Up Land: Land cover consisting of golf driving ranges, zoos, urban parks, cemeteries, waste sumps, water-control structures and spillways, golf courses, and ski areas.

Cropland and Pasture: Land cover consisting of agricultural land used for harvest and pasture.

Deciduous Forest: Land cover consisting of all forested areas having a predominance of trees that lose their leaves at the beginning of the forest system or at the beginning of a dry season.

Mines: Land cover consisting of extractive mining activities with a significant surface expression.

Transitional Areas: Land cover in areas that are in transition from one land use activity to another.

3.9.2 Existing Land Use

Existing land use data was not readily available for the Buckbee Creek watershed. In order generate this data; zoning information provided by the county was overlayed with the 2000 aerial photograph as a means of generating existing land use data. Existing Land Use and Land Cover for the Buckbee Creek watershed is summarized in Table 3-11 and depicted in Figure 3-8.

Table 3-11 Existing Land Use and Land Cover for the Buckbee Creek Watershed

USGS GIRAS Land Use and Land Cover Type	Acres	Percent of Watershed
Agriculture	175.92	3.96%
Commercial	197.47	4.45%
Other	-	-
Publicly Owned Land/Parks/Rec. Areas	222.13	5.00%
Residential	2072.03	46.65%
Right-of-Way	895.99	20.17%
Industrial	878.19	19.77%

Definitions of each land use/cover types listed in Figure 3-8 and Table 3-11 are as follows:

Agriculture: Land cover consisting of agricultural land used for harvest and pasture.

Commercial: Land cover that contains commercial areas used predominately for the sale of products and services. Includes such land uses are urban business districts, shopping centers, commercial strip developments, junkyards, resorts, etc.

Other: Land cover consisting of extractive mining activities with a significant surface expression.

Publically Owned/Land/Parks: Land cover consisting of parks, golf courses, nature preserves, playgrounds and athletic fields when associated with another open space activity. Institutional land uses just as educational, religious, health, correctional and military facilities are also included in this land use.

Residential: Land cover than contains residential areas ranging from high density to low density.

Right of Way (ROW): Land cover that includes roads, railways, airports, seaports, and major lake ports.

Industrial: Land cover consisting of manufacturing and processing, warehousing and distribution centers, wholesale facilities, and industrial parks.

3.9.3 Future Land Use

Through land use decisions and development standards and controls, Rockford and Winnebago County have the majority of the land use discretion to determine the future of the watershed. Without proper attention to development location and design, future impacts to watershed could include increased flooding and streambank erosion and the degradation of water quality, and aquatic habitat.

Much of what is currently agriculture, or other is expected to be converted to urban land uses. As detailed in Table 3-11, approximately 4% of the watershed may be available for additional development in the future. Based on the location of these areas, it is likely that these lands will be converted into residential and commercial uses. Land use conversion from primarily open to a residential and commercial uses will increase the impervious cover of the watershed, which will also have a significant impact on flooding, water quality, and other watershed resources. To help reduce the negative impact of additional impervious surfaces, best management practices should be integrated into development designs wherever possible. Conservation development, practices that attempts to preserve the natural drainage and infiltration capacity of the developed landscape, is another very effective way to reduce the negative effects of land use changes and increased impervious areas.

3.10 Cultural Resources

Cultural resources are sites, structures, buildings, landscapes, districts, and objects that are significant in history, prehistory, archeology, architecture, engineering, and/or culture. Knowing the culture resources of a watershed provides information on changes that occurred in the landscape and help define information related to historical vegetative communities, climate changes, wildlife populations, and historic uses of the land. All of which could be useful during the watershed planning process. Additionally, as cultural resources provide learning opportunities for the public, the preservation and protection of the cultural resources located in the watershed from development and damage is an important objective of watershed planning.

In 1966, the National Historic Preservation Act was passed to manage and protect cultural resources by requiring Federal and State agencies to establish historic preservation programs to identify, evaluate, and protect important sites under their jurisdiction. The National Park Service administers the National Register of Historic Places as part of the requirements of the National Historic Preservation Act. Properties in the Register include districts, sites, buildings, structures, and objects that are significant in American history, archeology, architecture, engineering, and culture. The National Register sites have been nominated by governments, organizations, and individuals according to defined, uniform set of standards. According to the National Register of Historical Places, there are no National Register for Historic Places listed for the Buckbee Creek watershed.

In Illinois, the Illinois Historical Preservation Agency (IHPA) preserved and protects public and private historical properties and library collections. The IHPA Historic Architecture and Archeological Resource Geographic Information System (HAAGIS) (http://gis.hpa.state.il.us/hargis/) was utilized to locate and identify the historical properties in the Buckbee Creek database. There are no sites within the Buckbee Creek watershed identified on the HAAGIS site as historic site.

3.11 Transportation

Approximately 20% of the Buckbee Creek watershed is right-of-way for roads, trails, and railroads. The impact of streets and highways on the watershed, particularly water quality, is significant. Table 3-12 lists a number of water quality pollutants and their sources, all of which are associated with the transportation system. Rain water flowing over the surface of our streets can carry these pollutants into our wetlands and stream, where they can accumulate and impair the quality of these resources for aquatic life.

Table 3-12 Transportation Related Pollutants

Pollutant	**Primary Sources**
Particulates	Pavement wear, atmosphere, vehicles
Nutrients including nitrogen and phosphorus	Atmosphere, fertilizer application
Lead	Tire wear, exhaust
Zinc	Tire wear, motor oil and grease
Iron	Rust, steel highway structures, engine parts
Copper	Metal plating, break lining wear, engine parts, bearing and bushing wear, fungicides and pesticides
Cadmium	Tire wear, insecticides
Chromium	Metal plating, engine parts, break lining wear
Nickel	Diesel fuel, gasoline, oils, metal plating, break lining wear, asphalt paving
Manganese	Engine parts
Cyanide	Anticake compound used in deicing salts

Pollutant	Primary Sources
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Fuel, deicing salts
Petroleum	Spills and leaks of motor oils, antifreeze and hydraulic fluids, asphalt surface leachate

3.11.1 Existing Transportation Network

US 20 runs east to west through the southwest portion of the watershed. In addition US 20, several secondary roads traverse the Buckbee Creek watershed: Charles Street, Harrison Road, Sandy Hollow Road, Alpine Road, and 11th Street. Charles Street is located in the northeast corner of the watershed and generally run at a diagonal from northwest to southeast. Residential and commercial properties are situated along Charles Street. Harrison Avenue runs east to west through the central part of the watershed. In the eastern portion of the watershed Harrison Avenue is primarily residential with commercial properties located at significant intersections. However, in the western portion of the watershed (west of 20th Street), industrial properties are located along Harrison Street. Sandy Hollow Road also run east to west and is located in the southern portion of the watershed. Similar to Harrison Avenue, the primarily land use along Sandy Hallow Road is residential, however, commercial/industrial properties are located on its eastern and westerns most points in the watershed. Alpine Road is runs north to south in the eastern portion of the Buckbee Creek watershed. Commercial, industrial, and residential properties are located along Alpine Road. 11th Street also run north to south and is located in the western portion of the watershed. Industrial and commercial properties are situated along 11th Street.

Four rail lines are located in the Buckbee Creek watershed. Two parallel sets of tracks run in a northwesterly to southeasterly direction through the center of the watershed. The northern set of these tracks is owned by Union Pacific and the southern set is owned by Canadian National Railway. Two sets of parallel tracks are also located in the western portion of the watershed and run north to south. The eastern set of these tracks is owned by Canadian National Railway and the western set is owned by Illinois Railway.

3.11.2 Proposed Transportation Projects

There are no significant road construction or road widening projects proposed in the Buckbee Creek watershed. As such, no changes to the existing transportation network are presumed to occur in the watershed.

3.12 Natural Resources

This section of the plan describes the natural areas within the Buckbee Creek watershed, including natural areas, parks, recreational trails plant and animal species concerns, wetlands, and groundwater.

3.12.1 Natural Areas

There are no properties listed on the Winnebago County Natural Areas Inventory (NAI) or Illinois NAI sites in the Buckbee Creek watershed.

3.13.2 Recreational Parks

The Rockford Park District manages fifteen recreational parks located entirely or partially within the Buckbee Creek watershed. These facilities and a description of their amenities are include in Table 3-13 and depicted on Figure 3-10.

Table 3-13 Natural Areas and Recreational Parks in the Buckbee Creek watershed

Park Name	Address	Total Acreage	Acreage in Watershed	Natural Areas	Playground	Tennis Count	Ball Diamond	Basketball Court	Soccer Field
Rolling Green School Park	3261 West Gate, Parkway, Rockford, IL	8.27	8.27		✓	✓	✓		
Twenty-Fifth Street Park	3200 25th Street, Rockford, IL	6.04	6.04	✓	✓		✓	✓	✓
Ekberg Pine Manor Park	3750 Balsam Lane, Rockford, IL	6.86	6.86	✓	✓	✓		✓	
Don Schmidt Youth Fields/Riverdahl Park	871 Sandy Hollow Road, Rockford, IL	32.23	32.23		✓				
Sawyer Park	2249 Sawyer Road, Rockford, IL	6.70	6.70		✓		✓		✓
Ken Rock Park	2930 Bildahl Street, Rockford, IL	6.32	5.91		✓		✓	✓	
Ohio Triangle	2002 Ohio Parkway, Rockford, IL	0.11	0.11	✓					
Mariposa Park	2175 Arnold Avenue, Rockford, IL	6.05	0.58		✓	✓	✓	✓	✓
Froberg School Park	4551 20th Street, Rockford, IL	9.72	0.002		✓		✓		
Sandy Hallow Golf Course	2670 Sandy Hollow Road, Rockford, IL	122.59	122.59	Facility is a Golf Course					
Jamestown Park	1823 Sandy Hollow Road, Rockford, IL	3.75	3.75		✓		✓		
Harmon Park	1924 East Gate Parkway, Rockford, IL	5.64	5.64	✓	✓		✓	✓	
Carolina Triangle	Carolina and Nebraska Avenue, Rockford, IL	0.02	0.02	✓					

Park Name	Address	Total Acreage	Acreage in Watershed	Natural Areas	Playground	Tennis Count	Ball Diamond	Basketball Court	Soccer Field
Swan Hillman Park	3701 Greendale Drive, Rockford, IL	6.4	4.83		✓	✓	✓		
Westgate Parkway	West Gate Parkway and Broadway, Rockford, IL	0.47	0.47	✓					

3.12.3 Pedestrian Trails

The Charles Street Community Path is located in the northeast corner of the watershed along Charles Street (Figure 3-11). This 2.6 mile asphalt-paved path begins at the intersection of Charles Street and Quentin Street near Alpine Park and terminates in the outside the watershed at the intersection of Charles Street and Perryville Road near the CherryVale Mall. The Charles Street Community Path also provides access to AC Thompson Elementary School. Approximately 0.86 miles of the Charles Street Community Path is located within the Buckbee Creek watershed. According to the Greenway Plan prepared by RMAP, there are plans to extend the St. Charles Path to connect with the Perryville Path and the Cherry Valley Path.

3.12.4 Threatened and Endangered Species

The Illinois Endangered Species Protection Board was created by the passage of the Endangered Species Protection Act in 1972 and determines which plant and animal species are threatened or endangered (T&E) in the state. The Illinois Endangered Species Protection Board also advises the Illinois Department of Natural Resources (IDNR) on means of conserving those species. State listed T&E species are designated "endangered" if a species is in danger of extinction as a "breeding" species and is considered "threatened" if the species includes any which is likely to become an endangered species within the foreseeable future. The Illinois Endangered Species Protection Board's Natural Heritage Database October 2012 Endangered and Threatened Species List identifies 54 T&E species in Winnebago County. A more refined of the Buckbee Creek watershed search using the IDNR's Ecological Compliance Assessment Tool (EcoCat) identified three species located in the vicinity of the watershed (Table 3-14). Additionally, the US Fish and Wildlife Service has identified the three Federally listed T&E species in Winnebago County (Table 14-15).

Table 3-14 State T&E Species Identified in the Vicinity of the Buckbee Creek watershed

Common Name	Scientific Name	State Protection	# of occurrences	Last Observed
Wooly Milkweed	*Asclepias lanuginosa*	Endangered	3	06-2002
Gravel Chub	*Erimystax x-punctatus*	Threatened	9	06-06-2012
Black Sandshell	*Ligumia recta*	Threatened	8	06-06-2012

Table 3-15: Federal T&E Species Identified in Winnebago County

Common Name	Scientific Name	Federal Protection
Prairie bush-clover	*Lespedeza leptostachya*	Threatened
Indiana bat	*Myotis sodalis*	Endangered
Eastern prairie fringed orchid	*Platanthera leucophaea*	Threatened

Based on a review of the critical habitat requirements for each of the state and federal T&E species there is very low potential that the species are currently present within the Buckbee Creek watershed.

3.12.5 Wetlands

Wetlands, once prevalent within Illinois, have continued to decline in area and quality. Wetlands are of interest to watershed studies of this sort due to the benefits they provide. Wetlands do more for water quality improvement and flood damage reductions than any other natural resource within a watershed. Wetlands provide a multitude of ecological, economic and social benefits. They provide habitat for fish, wildlife and a variety of plants. Wetlands are also important landscape features because they hold and slowly release flood water and snow melt, recharge groundwater, recycle nutrients, and provide recreation and wildlife viewing opportunities for residents.

The National Wetlands Inventory (NWI) was established by the US Fish and Wildlife Service (FWS) to conduct a nationwide inventory of U.S. wetlands to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. The NWI maps are prepared from the analysis of high altitude imagery, vegetation, visible hydrology, and geography. Field inspections and wetland delineations were not utilized in the preparation of the NWI maps. Additionally, certain wetland habitats are not included on their maps due to limitations of aerial reconnaissance to properly identify these habitats as wetlands. According the NWI map, there are 0.65 acres of wetland (0.01% of the watershed). As can be seen from Figure 3-12, the majority of the NWI wetlands in the Buckbee Creek watershed have been impacted by development.

In order to protection wetlands, projects and other activity should be designed to avoid and minimize any disturbance to the wetland, stream, or other aquatic area. However, if there is an unavoidable impact or disturbance to a wetland or stream, a Clean Water Act Section 404 permit must be obtained from the US Army Corps of Engineers (USACE). The USACE has jurisdiction over waters of the United States (WOUS) including connected wetlands and navigable streams and rivers. For wetlands and WOUS in the Buckbee Creek watershed, the USACE Rock Island District is the responsible entity for permitting any activities that impact jurisdictional wetlands and WOUS. The Rock Island permit program includes a series of regional permits (RP) for various activities such as bank stabilization, flood damage control and road crossings. Activities outside the RP categories are required to obtain an individual permit (IP). The USACE permits must be applied for and issued before any wetland or WOUS disturbance or impacts occur.

3.12.6 Potential Wetland Restoration Sites

Wetland restoration and creation could be beneficial to the Buckbee Creek watershed. By restoring the environmental functions of impacted wetlands or creating new wetlands in suitable areas, wetland restoration and wetland creation could potentially reduce flood volumes and rates, increase plant and animal diversity, and improve water quality conditions. Potential restoration sites were identified using a Geographic Information System (GIS) exercise. As part of this exercise, specific criteria essential for the restoration of a functional and beneficial wetland were utilized and included:

- Site contains NWI wetland
- Site contains at least 2.5 acres of hydric or hydric inclusion soils
- Site is located on an parcel containing no or very few structures

The GIS analysis revealed one location that could potentially be suitable for wetland creation/restoration –a 64 acre parcel of land in the center of the watershed. It should be noted that the majority of this land is part of the Southeast Rockford Groundwater Contamination site which could limit the use of this property for wetland creation or restoration.

3.12.7 Drinking and Groundwater Wells

Aquifers in the glacial drift (sand and gravel) of the Quaternary age (less than 75,000 year old) and the carbonate deposits (dolomite and limestone) of the Platteville and Galena Group of Ordovician age (about 450 million years old) are the major sources of groundwater in the watershed. These glacial drift and Galena-Platteville aquifers are considered to be extremely susceptible to contamination as the aquifer is near the land surface, typically at a depth of less than 50 feet, and the soils compose and overlie the aquifers have relatively high hydraulic conductivity of at least 1 foot per day. According to the US Geological Survey (USGS), Winnebago County is considered to have the greatest potential for ground-water contamination in Illinois.

Residents in the Buckbee Creek watershed utilize groundwater for a variety of purposes including drinking water, irrigation, and industrial process water. The City of Rockford uses groundwater as its drinking water supply. While under natural undisturbed conditions, groundwater in the Buckbee Creek watershed is of high quality and meets the drinking and groundwater standards set for different contaminants by the Illinois Pollution Control Board. Due to the nature of the aquifers in the region, impacts associated with urbanization have the potential to negatively impact drinking and groundwater. Potential sources for contamination associated with urbanization include septic system effluent, oil, gasoline, animal wastes, industrial effluent, paint, solvents, road salt, and lawn and household chemicals.

In order to protect groundwater in Illinois in 1987, the General Assembly passed the Illinois Groundwater Protection Act (IGPA). The IGPA emphasizes the comprehensive management of groundwater resources by requiring the implementation of practices and policies to protect groundwater. These include setting groundwater protection policies such as setback zones; assessing the quality and quantity of groundwater resources being utilized; and establishing groundwater standards.

Illinois State Geological Survey Well Database

According to the Illinois State Geological Survey (ISGS) database, there have been 297 wells installed in the Buckbee Creek watershed. Table 3-16 depicts the quantity and type of each well and Figure 3-13 illustrated the location of each well in the watershed. The ISGS database contains information on wells that was supplied to the agency and has not been field verified.

Table 3-16 ISGS Wells in the Buckbee Creek Watershed

ISGS Well Type	Number of Wells in Watershed
Water Well Monitoring Well	6
Water Well	288
Temporarily Abandoned	0
Engineering Test	1
Dry and Abandoned Well	0
Other Well	2

Illinois Department of Health Well Database

According to the Illinois Department of Health (IDH), there are 15 community and non-community wells in the Buckbee Creek watershed. Of the 18 IDH wells, 8 are community wells and 7 are non-community wells. Community wells are public wells that serve residents year round. A public well is defined as well with more than 15 service connections or any well that serves 25 people for at least 60 days per year. A non-community well is public wells that serve nonresidents such as at a restaurant, motel, school, or camp ground. Owners of the community and non-community wells are subject to the requirements of the Safe Drinking Water Act (SWDA) and are responsible for meeting all of the requirements outlined in the Act including conduction drinking water sampling, maintenance of the system and reporting to IDH. Table 3-17 depicts the owner and type of each well and Figure 3-14 illustrated the location of each well in the watershed.

Table 3-17 Community and Non-Community Wells in the Buckbee Creek Watershed

Owner	Well Type	Number of Wells Owned
American MPH	Community	2
Barrets MPH	Community	2
Bill-Mar HTS MHP	Community	1
City of Rockford	Community	3
BJ's Place	Non-Community	1
El Rebosos	Non-Community	1
John's Pizza	Non-Community	1
McDonald's	Non-Community	1
Opsahl's	Non-Community	1
Taco Jon's- Now Cash & Carry Cars	Non-Community	1
Victory Tap	Non-Community	1

See Section 3.13.7 for information regarding groundwater contamination at the Southeast Rockford Ground Water Contamination Superfund site.

3.12.8 Agricultural Best Management Practices

Various programs sponsored by the Natural Resource Conservation Service (NRCS) and Farm Service Agency Wetlands Reserve Program (WRP), Grasslands Reserve Program (GRP), Wildlife Habitat Incentives Program (WHIP), Environmental Quality Incentives Program (EQIP), Conservation Reserve Enhancement Program (CREP), and Conservation Reserve Program (CRP) promote and fund the construction of agricultural BMPs on farmland. Currently there are no agricultural BMPs sponsored by these programs located within the watershed.

3.13 Natural Drainage System

This section describes the conditions and characteristics of the natural drainage system of the Buckbee Creek watershed.

3.13.1 Stream Flow

There are no USGS gauging stations on Buckbee Creek or within the Buckbee Creek watershed.

3.13.2 Watershed Hydrology and Hydraulics

Hydrology and hydraulics are commonly used terms to describe the effects or precipitation, runoff, and evaporation on the flow of water in streams and rivers and on adjacent land surfaces. The basis for hydrology and hydraulics studies typically start with an understanding of how topography delineates the land into watershed and subwatersheds. As discussed in the Topography section of this report, the Online Watershed Delineation (HYMAPS-OWL) tool, created by Department of Agriculture and Biological Engineering at Purdue University was use to create the initial subwatershed boundaries. The subwatershed boundaries generated by HYMAPS-OWL were then cross referenced with boundaries obtained by inputting 2-foot topography into the GIS-based model, Arc Hydro. This combined data generated a Digital Elevation Model (DEM) that was used to delineate and refine the watershed and subwatershed boundaries for Buckbee Creek. Inconsistency in the model's delineations was adjusted to reflect field-verified conditions and more accurately depict the hydrologic boundaries. Most of these inconsistencies occurred in areas divided by roadways that were not accounted for the in elevation model.

The Buckbee Creek watershed drains 6.94 square miles. Broad assessment of conditions such as soils, wetlands, and water quality are often evaluated at a watershed levels and provide great information of the overall condition of the watershed. However, a more detailed looks at smaller drainage areas or subwatershed will often be helpful in finding specific problem areas. The Buckbee Creek contains 27 subwatersheds (Table 3-18). Figure 3-15 depicts the location of each of the subwatershed within the Buckbee Creek watershed.

Table 3-18 Subwatersheds in the Buckbee Creek Watershed

Subwatershed	Total Acres	Percent of Watershed
1	192.53	4.33%
2	98.86	2.23%
3	129.29	2.91%
4	136.25	3.07%

Subwatershed	Total Acres	Percent of Watershed
5	260.04	5.85%
6	121.20	2.73%
7	317.44	7.15%
8	125.70	2.83%
9	279.15	6.28%
10	299.19	6.74%
11	108.94	2.45%
12	64.55	1.45%
13	104.62	2.36%
14	93.19	2.10%
15	34.01	0.77%
16	177.09	3.99%
17	177.96	4.01%
18	95.53	2.15%
19	140.25	3.16%
20	275.27	6.20%
21	154.88	3.49%
22	62.83	1.41%
23	93.93	2.11%
24	165.17	3.72%
25	484.98	10.92%
26	150.21	3.38%
27	98.66	2.22%

3.13.3 Flow Paths

The Buckbee Creek watershed is drained by the mainstem of Buckbee Creek and one tributary, Tributary #1. The mainstem of Buckbee Creek has its headwaters near the intersection of Welworth Avenue and Wentworth Avenue in a residential area located in the northeast corner of the watershed. At its headwaters, Buckbee Creek is a series of small, undefined roadside swales. From this point, Buckbee Creek flows to the southwest to just north of the intersection of Skokie Drive and Winnetka Drive where the creek has been placed in a concrete lined channel. The concrete lined channel continues to flow to the southwest and crosses under Harrison Road. From this point to the crossing at Harrison Road, the creek is in an underground storm sewer. The storm sewer daylights on the west side of Alpine Road just north of Manchester Drive. From this point, the creek flows in a naturalized channel in a southwesterly direction through a residential neighborhood. After flowing under the Union Pacific and Canadian National Railroads, the creek flows towards the east. From this point until 22nd Street, the creek is in a naturalized channel with a forested riparian buffer. However, at 22nd Street, the mainstem is placed back into a concrete lined channel and is contained within this channel until its confluence with the Rock River.

Tributary #1 has its headwaters near the intersection of Ohio Parkway and Wesleyan Avenue. Tributary #1 flows in a westerly direction from its headwaters before turning south just west of the Union Pacific and Canadian National Railroads. Tributary #1 flows into Buckbee Creek near the intersection of Harrison Avenue and Congress Drive. From its headwaters to its confluence with Buckbee Creek the creek is in a concrete-lined channel.

Historically, there were additional tributaries to Buckbee Creek and Tributary #1 that appear to have been significantly modified by development. These tributaries are no longer surface waters and have potentially been placed in municipal storm sewers system (MS4).

3.13.4 Channel Conditions

Urban development in the watershed is reducing the amount of land available for the natural infiltration of rainfall into the ground, where it can be intercepted and absorbed by vegetation or stored in depressional areas and wetlands in the watershed. With increasing amounts of impervious surface and an extensive network of storm sewers that convey the increased volume of runoff to the stream channel faster, a stream channel experiences what is called "flashy" hydrology. "Flashy" hydrology means that the water level in the stream rises very quickly during a storm and falls quickly afterward. Since less water is infiltrating into the ground and constantly seeping out and creating a steady base flow within the stream, low flows are considerably lower. Likewise, because less water is absorbed by the ground and more water is flowing into the streams, high flows are considerably higher. High flows can result in damage to property of watershed residents, erosion, flooding, and pollution. Decreased or low flows degrade aquatic habitat because low flows have low levels of dissolved oxygen necessary for aquatic animals and because, in extreme cases, the stream can dry up completely for periods of time.

A number of factors were inventoried to better describe the condition of the Buckbee Creek Watershed. The degree of hydromodification and channelization, are both measures of the health and condition of a river or stream.

<u>Channelization</u>

Channelization is the practice of dredging and straightening stream channels to increase flow rates and carrying capacities. In some cases, the stream channel will be paved with concrete during channelization. Traditionally, channelization was done to move as much water as possible away from an area in a short period of time and prevent flooding. However, there are problems resulting from channelization. Channelization is detrimental for the health of streams and rivers through the elimination of suitable instream habitat for fish and wildlife and the creation of excessive flows in the stream leading to hydromodification both within and downstream of the channelized areas.

Channelization is prevalent throughout the Buckbee Creek watershed and is the most significant cause of water quality degradation in the watershed. Figure 3-16 depicts the location of severe channelization in the Buckbee Creek watershed. The figure also denoted which portions of the surface waters are concrete-line.

<u>Hydromodification</u>

Hydromodification is a term that is used to describe human induced activities that change the dynamics of surface or subsurface flow. Historically, the most prevalent form of hydromodification was the draining of wetlands and channelization of streams to increase agricultural production. Early settlers of the Midwest quickly realized that the soils found under wetlands and wet prairies were ideal for crop production once the water was removed. In order to “dry” the wetlands and the wet prairies, systems of sub-surface drainage tiles were installed in order to re-route the groundwater away from the wetlands and wet prairies and discharged in to surface waters. Given that the drain tiles were drained by gravity flow, the receiving surface water needed to be a lower elevation that the tile. As such, naturalized stream channels were often excavated to a deeper depth and straightened to facilitate quicker drainage of the fields. Once the water was removed, these areas could be put into successful agricultural production. This increased agricultural production came at the at the cost of a loss of wetlands, wet prairies, and riparian habitat. Hydromodification attributed to the installation of drain tiles is not prevalent in the Buckbee Creek watershed.

In the Buckbee Creek watershed, hydromodification attributed to urbanization is prevalent. The process of urbanization affects streams by altering watershed hydrology and sediment-transport patterns. Development increases the amount of impervious surfaces (parking lots, rooftops, highly compacted ground, etc) on formerly undeveloped landscapes. This reduces the capacity of the remaining pervious surfaces to capture, filter rainfall, and allow the rainfall to infiltrate into the ground. As a result, a larger percentage of rainfall becomes runoff during any given storm. Subsequently, runoff reaches stream channels much more quickly, and peak discharge rates are higher than before development for the same size rainfall event.

The short-term impact result of this type of hydromodification is localized, overbank flooding. Over the long term, hydromodification will cause the stream channel to expand as a means of handling the higher flows. As the stream channel expands, the banks will erode and the bottom will become deeper. This deepening of the stream channel is called incision. The process of stream bank erosion and channel incision causes a significant amount of sediment to be generated within the stream and carried through the watershed and into the stream's receiving water. Channel incision also leads to a disconnect between the stream and its floodplain. Once separated, high flows that were once stored in the floodplain and slowly released back into the stream are forced to remain in the channel. These "trapped" flows have high velocities leading to additional streambank erosion and incision of the stream channel. It becomes a vicious pattern where with each rainfall event; the creek continues to erode adding additional sediments to the watershed and further preventing the creek to access the floodplain.

Hyrdomodification attributed to urbanization is prevalent throughout the Buckbee Creek watershed in the few areas where the creek has not been lined with concrete. Figure 3-17 depicts significant hydromodification impacts in the Buckbee Creek watershed.

3.13.5 Hydraulic Structures

Hydraulic structures are categorized as bridges, culverts, levees, weirs, dams, fencing and any other human made structures located in or over the stream channel. The location and condition of hydraulic structures is a valuable piece of information as hydraulic structures may act as possible constrictions in conveying river flow, increase the potential for backwater flooding problems, and impede the movement of fish and other aquatic species up and down the stream.

Hydraulic Structures

Hydraulic structures include bridges, culverts, dams, weirs, levees, and fences that are located in or across a creek or stream channel. These structures modify both the flow pattern and amount of flow in the channel and act as constriction points impeding flow and causing localized flooding. As part of the watershed planning process, 22 hydraulic structures were surveyed in the Buckbee Creek watershed (Table 3-19 and Figure 3-18).

Table 3-19 Hydraulic Structures Surveyed in the Buckbee Creek Watershed

<table>
<tr><th>Structure No.</th><th>Type</th><th>Opening</th><th>Length</th><th>Slope</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">RCP Elliptical</td><td>2 @ 54"</td><td rowspan="2">50'</td><td rowspan="2">0.74%</td></tr>
<tr><td>Equiv. Diameter</td></tr>
<tr><td rowspan="2">2A</td><td rowspan="2">RC Box</td><td>1 @ 7' x 4' (up-stream)</td><td rowspan="2">1230'</td><td rowspan="2">1.20%</td></tr>
<tr><td>1 @ 11' x 7' (dn-stream)</td></tr>
<tr><td>2B</td><td>RC Box</td><td>1 @ 11' x 7'</td><td>86'</td><td>1.92%</td></tr>
<tr><td>3</td><td>CMP Arch</td><td>2 @ 98" x 69"</td><td>69'</td><td>0.93%</td></tr>
<tr><td>4A</td><td colspan="4">Railroad Bridge</td></tr>
<tr><td>4B</td><td>CMP</td><td>72" Dia.</td><td>48'</td><td>0.00%</td></tr>
<tr><td>5</td><td colspan="4">Railroad Bridge</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">RCP</td><td>2 @ 27" Dia. (outer)</td><td rowspan="2">33'</td><td rowspan="2">1.45%</td></tr>
<tr><td>2 @ 36" Dia. (inner)</td></tr>
<tr><td>7</td><td>RC Box</td><td>2 @ 15' x 6'</td><td>106'</td><td>0.28%</td></tr>
<tr><td>8</td><td>RC Box</td><td>2 @ 14' x 3.5'</td><td>212'</td><td>0.67%</td></tr>
<tr><td>9</td><td>RC Box</td><td>2 @ 12' x 4'</td><td>24'</td><td>1.00%</td></tr>
<tr><td>10</td><td>RC Box</td><td>2 @ 12' x 4'</td><td>24'</td><td>0.12%</td></tr>
<tr><td>11</td><td>RC Box</td><td>3 @ 11' x 6'</td><td>26'</td><td>0.43%</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">RC Box</td><td>2 @ 10.5' x 6' (outer)</td><td rowspan="2">90'</td><td rowspan="2">0.18%</td></tr>
<tr><td>1 @ 13' x 6' (inner)</td></tr>
<tr><td>13</td><td>RC Box</td><td>3 @ 9' x 6'</td><td>55'</td><td>0.27%</td></tr>
<tr><td>14</td><td>RC Box</td><td>3 @ 9' x 6.25'</td><td>48'</td><td>0.23%</td></tr>
<tr><td>15</td><td>RC Box</td><td>3 @ 9' x 6'</td><td>46'</td><td>0.51%</td></tr>
<tr><td>16</td><td>RC Box</td><td>3 @ 9' x 6.25'</td><td>92'</td><td>0.53%</td></tr>
<tr><td>17</td><td>RC Box</td><td>3 @ 10' x 6'</td><td>45'</td><td>0.27%</td></tr>
<tr><td>18</td><td>RC Box</td><td>3 @ 10' x 6'</td><td>102'</td><td>0.47%</td></tr>
<tr><td>19</td><td colspan="4">Railroad Bridge</td></tr>
<tr><td>20</td><td>RC Box</td><td>3 @ 10' x 6'</td><td>44'</td><td>0.72%</td></tr>
<tr><td rowspan="3">21</td><td rowspan="3">RC Box</td><td>13.75' x 11.5' (N cell)</td><td>90'</td><td rowspan="3">0.20%</td></tr>
<tr><td>17.5' x 12' (center)</td><td>99'</td></tr>
<tr><td>13.75' x 12.5' (S cell)</td><td>113'</td></tr>
</table>

With the exception of the railroad bridges, all of the hydraulic structures surveyed were in-stream culverts under road crossings. Culverts are metal, plastic, or concrete pipes that transport water, most commonly used under roadways or driveways. Culverts may be round, oval, rectangular, or other shapes, and they can be open or closed on the bottom. A number of these within the watershed are exhibiting clogging, wear and tear, erosion, and near failure in some locations.

Dams can serve as potential barriers to the movement and dispersal of aquatic organisms such as fish and may limit available habitat for breeding and feeding. There are no dams in the Buckbee Creek watershed.

3.13.6 Instream and Riparian Habitat Assessment

Water quality criteria were originally published as guidance under Section 304(a) of the Clean Water Act to allow states to derive site-specific water quality criteria for the protection of stream health. In addition, to these water quality guidance criteria, the US EPA established guidance, *Water Body Survey and Assessment Guidance for Conducting Use Attainability Analysis*, to determine if a surface water is meeting its established criteria. The US EPA has updated this guidance and published the *Rapid Bioassement Protocol (RBP) for Stream and Rivers.* The RBP includes methods for conducting cost effective biological assessments of stream and rivers including sampling methods for periphyton, benthic macroinvertebrates, fish, and habitat. During the Buckbee Creek watershed streamwalk in June 2011, the RBP methodologies were utilized to evaluate habitat conditions at 17 sites within the watershed (Figure 3-19).

The RBP scoring assessment was used to estimate the habitat quality and conditions at each of the 17 sites on Buckbee Creek. The following a list of the physical, water quality, and habitat parameters evaluated at each site:

- **Physical Parameters**
    - Predominate surrounding land use
    - Local watershed nonpoint source pollution
    - Stream depth and width
    - Dams
    - Channelization
    - Canopy Cover
    - Sediment odors
    - Sediment oils
    - Substrate texture
    - Aesthetics
- **Water Quality Parameters**
    - Water odors
    - Surface odors
    - Turbidity
    - Stream type and state class
- **Habitat Parameters**
    - Substrate cover for aquatic organisms
    - Embeddedness
    - Flow
    - Channel alteration
    - Bottom scour/deposition
    - Run/bend ratio
    - Bank stability
    - Bank vegetation
    - Streamside cover
    - Undercut banks

- Bank slope

The results of the Habitat RBP are presented in Tables 3-20 to 3-24. Field data sheets are included in Appendix B.

Table 3-20 Buckbee Creek RBP Physical Characteristic - Instream Features

Station	Instream Features							
	Est. Stream Width	Est. Stream Depth	Canopy Cover	Proportion of Reach Represented by Stream Morphology Types			Channelized?	Dam Present?
				Riffle	Pool	Run		
1	No defined channel	Dry	Partly Open			100%	Yes	No
2	2- 24" culverts	Dry	Shaded			100%	Yes	No
3	24 ft concrete channel	Dry	Shaded			100%	Yes	No
4	26 ft concrete channel	Dry	Open			100%	Yes	No
5	34 ft concrete channel	Dry	Open			100%	Yes	No
6	10 ft	1/2 in	Open			100%	Yes	No
7	1.3 ft	0.3 ft	Shaded			100%	Yes	No
8	11.5 ft	Dry	Partly Shaded			100%	Yes	No
9	9.5 ft	Dry	Partly Open			100%	Yes	No
10	0.7 ft	0.2 ft	Shaded			100%	Yes	No
11	6 ft	0.1 ft	Shaded			100%	Yes	No
12	9.8 ft	0.1-0.2 ft	Partly Shaded			100%	No	No
13	8 ft	0.1 ft	Shaded			100%	Yes	No
14	17 ft	Dry	Partly Shaded			100%	Yes	No
15	8 ft	Dry	Partly Shaded			100%	Yes	No
16	30.5 ft concrete channel	Dry	Partly Open			100%	Yes	No
17	34 ft concrete channel	Dry	Open			100%	Yes	No

Table 3-21 Buckbee Creek RBP Physical Characteristic -Watershed Features and Riparian Habitat

Station	Watershed Features			Riparian Vegetation	
	Predominant Surrounding Land Use	**Local Watershed NPS Pollution**	**Local Watershed Erosion**	**Dominant Type**	**Dominant Species**
1	Residential	Obvious sources	None	Grasses	Turf
2	Residential	Obvious sources	None	Grasses	Turf
3	Residential	Obvious sources	None	Grasses	Turf
4	Residential	Obvious sources	None	Grasses	Turf
5	Residential/industrial	Obvious sources	None	Grasses	Turf
6	Road/commercial	Obvious sources	Moderate	Grasses	Turf
7	Commercial/vacant land	Some potential sources	Moderate	Trees	Maple
8	Residential	Obvious sources	Moderate	Trees	Oaks
9	Residential	Obvious sources	Heavy	Grasses	Turf
10	Rail/agriculture	Some potential sources	Moderate	Trees/Shrubs	Cottonwood
11	Rail/agriculture	Some potential sources	Moderate	Trees	Maple
12	Residential	Some potential sources	Moderate	Trees/Shrubs	
13	Residential/Forested	Some potential sources	Moderate	Trees/Shrubs	
14	Industrial/Forested	Some potential sources	Moderate	Trees/Shrubs	
15	Industrial/Forested	Some potential sources		Trees/Shrubs	
16	Industrial/commercial	Obvious sources	None	Grasses	Turf
17	Industrial	Obvious sources	None	Grasses	Turf

Table 3-22 Buckbee Creek RBP Physical Characteristic – Substrate Components

Station	Inorganic Substrate Components							Organic Substrate Components		
	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Detritus	Muck-Mud	Marl
1	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%
2	Concrete							0%	0%	0%
3	Concrete							0%	0%	0%
4	Concrete							0%	0%	0%
5	Concrete							0%	0%	0%
6	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%
7	0%	0%	50%	50%	0%	0%	0%	30-40%	0%	0%
8	0%	0%	30%	50%	20%	0%	0%	0%	0%	0%
9	0%	0%	40%	40%	20%	0%	0%	0%	0%	0%
10	0%	0%	40%	40%	20%	0%	0%	0%	0%	0%
11	0%	0%	0%	20%	80%	0%	0%	0%	0%	0%
12	0%	0%	15%	0%	85%	50%	0%	0%	0%	0%
13	0%	0%	30%	70%	0%	0%	0%	0%	0%	0%
14	0%	0%	30%	70%	0%	0%	0%	0%	0%	0%
15	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	Concrete							0%	0%	0%
17	Concrete							0%	0%	0%

Table 3-23 Buckbee Creek Watershed RBP Habitat Assessment Results

Station	Stream Type	Epifaunal Substrate/Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability		Vegetative Protection		Riparian Vegetative Zone		Total Score
									Left	Right	Left	Right	Left	Right	
1	Intermittent	0	0	0	19	0	20	0	10	10	7	7	1	1	60
2	Intermittent	0	0	0	20	0	20	0	10	10	0	0	0	0	41
3	Intermittent	0	0	0	0	1	20	0	10	10	0	0	0	0	40
4	Intermittent	0	0	0	19	1	0	0	10	10	0	0	0	0	20
5	Intermittent	0	0	0	0	0	0	0	10	10	0	0	0	0	59
6	Intermittent	1	3	0	17	3	19	0	5	5	1	1	2	2	123
7	Intermittent	15	19	8	19	4	13	5	9	9	9	9	2	2	65
8	Intermittent	3	0	0	20	0	10	4	5	5	7	7	2	2	45.5
9	Intermittent	1	0	11	18.5	3	1	3	2	2	2	2	0	0	71
10	Intermittent	13	9	11	8	6	7	2	1	1	1	1	3	8	92
11	Intermittent	1	9	7	8	8	6	1	8	8	8	8	10	10	70
12	Intermittent	1	8	3	9	1	9	11	2	2	2	2	10	10	67
13	Intermittent	3	8	4	18	1	6	1	2	2	2	2	10	8	53
14	Intermittent	3	8	4	18	1	6	1	2	2	2	2	2	2	30
15	Intermittent	1	0	0	7	0	6	0	7	7	1	1	0	0	40
16	Intermittent	0	0	0	20	0	0	0	10	10	0	0	0	0	66
17	Intermittent	1	1	13	19	1	2	1	6	6	7	7	1	1	60

Table 3-24 Buckbee Creek RBP Physical Characteristic – Water Quality and Soil Conditions

Station	Water Quality			Sediment			
	Water Odors	**Water Surface Oils**	**Turbidity**	**Odors**	**Deposits**	**Oils**	**Black Rock Undersides?**
1	Dry	Dry	Dry	Normal	None	Absent	No
2	Dry	Dry	Dry	Normal	None	Absent	No
3	Dry	Dry	Dry	Normal	None	Absent	No
4	Dry	Dry	Dry	Normal	None	Absent	No
5	Dry	Dry	Dry	Normal	None	Absent	No
6	None	None	Clear	Normal	None	Absent	No
7	None	None	Clear	Slight	None	Absent	No
8	Dry	Dry	Dry	Normal	None	Absent	No
9	Dry	Dry	Dry	Normal	None	Absent	No
10	None	None	Clear	Normal	None	Absent	No
11	None	None	Clear	Normal	None	Absent	No
12	None	None	Clear	Normal	None	Absent	No
13	None	None	Clear	Normal	None	Absent	No
14	Dry	Dry	Dry	Normal	Sand	Absent	No
15	Dry	Dry	Dry	Normal	None	Absent	No
16	Dry	Dry	Dry	Normal	None	Absent	No
17	Dry	Dry	Dry	Normal	None	Absent	No

Each of the habitat parameters listed in Table 3-23 were visually evaluated and assigned a conditions number using the scale in Table 3-25. The habitat parameter evaluation criterion is detailed on the Field Sheets included in Appendix XX. For the purposes of the watershed plan, a Cumulative Habitat Condition Category and Scale was developed in order to assign each sampled site a habitat category from poor to optimal (Table 3-26).

Table 3-25 RBP Buckbee Creek Watershed RBP Habitat Condition Category and Scale

Condition Category			
Poor	**Marginal**	**Suboptimal**	**Optimal**
0-5	6-10	11-15	16-20

*Bank Stability, Vegetative Protection, and Riparian Vegetative Zone Width are scored for each bank using a scale of 1-10 and then summed for a score between 1-20.

Table 3-26 RBP Buckbee Creek Watershed Cumulative Habitat Condition Category and Scale

Condition Category			
Poor	**Marginal**	**Suboptimal**	**Optimal**
0-50	50-110	100-150	150-200

Based on the cumulative habitat condition scale outline in Table 3-26, 7 sites within the Buckbee Creek watershed are categorized as poor, 11 are marginal and 1 is suboptimal. No sites were identified as having optimal habitat conditions (Table 3-27).

Table 3-27 Cumulative RBP Scores and Conditions in the Buckbee Creek Watershed

Site	Cumulative Score	Condition Category
1	60	Marginal
2	41	Poor
3	40	Poor
4	20	Poor
5	59	Marginal
6	123	Suboptimal
7	65	Marginal
8	45.5	Poor
9	71	Marginal
10	92	Marginal
11	70	Marginal
12	67	Marginal
13	53	Marginal
14	30	Poor
15	40	Poor
16	66	Marginal
17	60	Marginal
18	60	Marginal
19	41	Poor

Benthic Monitoring

RiverWatch volunteers conducted a macroinvertebrate survey on Buckbee Creek near its confluence with the Kishwaukee River at the Mill Road Bridge on 07/15/2011. Macroinvertebrates are small animals that do not have a backbone and can be seen with the naked eye. Macroinvertebrates include animals such as insects, crustaceans, mollusks, arachnids, and annelids. As macroinvertebrates live in water for all or part of their lives, their survival is related to water quality. These animals are sensitive to different chemical and physical conditions in the water such as increased water pollution or changes in water flow. As such, the richness of macroinvertebrate community composition in a stream or river can be used to provide an estimate of stream health.

After collecting the macroinvertebrates, the volunteers calculated a Macroinvertebrate Biotic Index (MBI). The MBI is designed to rate water quality using the pollution tolerance of macroinvertebrates and is an estimate of the degree and extent of organic pollution and disturbance in the stream. The MBI is a modification of the Hilsenhoff Biotic Index (HBI) first used in Wisconsin streams. Following data collection, the macroinvertebrates are identified and given a predetermined pollution tolerance rating. The MBI is calculated by taking the average of tolerance ratings weight by the number of individuals in the sample. MBI scores of less than 4.35 represent excellent water quality while scores greater than 6.26 indicate poor water quality.

As the sampling site is just upstream of Buckbee Creek's confluence with the Rock River, the site provides a "snapshot" of water quality for the entire watershed. The results of the macroinvertebrate sampling resulted in a MBI of 7.80 or poor water quality. No macroinvertebrates of special interest such as native mussels were observed.

With the exception of the one RiverWatch sample noted above, no additional biological data is known to exist for the Buckbee Creek watershed.

3.13.7 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Sites

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. The collected tax funds a trust fund aimed at cleaning up abandoned or uncontrolled hazardous waste sites. There 1 CERCLA sites in the Buckbee Creek Watershed: Southeast Rockford Groundwater Contamination Site (Figure 3-20).

The Southeast Rockford Groundwater Contamination (Southeast Rockford) site is generally situated between Harrison Avenue to the north, Sawyer Road to the south, Alpine Road to the east, and 8th Street to the west. The Southeast Rockford site was placed on the federal Superfund list in 1989, because private wells were contaminated with industrial solvents from unknown sources. Primary site contaminants include high levels of chlorinated solvents in the soil and groundwater along with localized high groundwater contamination of volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, and xylene. Additionally, site investigations have also identified chlorinated solvents, waste oils and fuels, paint sludge, tank bottoms, hospital waste, and general refused buried on the site. Investigations have identified four source areas for the contamination: Source Area 4, 7, 9/10, and 11. Two of which are located within the Buckbee Creek watershed: Source Area 4 and Source Area 7 (Figure XX).

Source Area 4 is located near the intersection of Harrison Avenue and Marshall Street. At source Area 4, investigation results showed free product and contaminated soil near the building and closer to the surface than expected. The Illinois EPA removed 185 cubic yards of this soil on September 15 and 16, 2005. Additionally in October 200, the Illinois EPA installed five additional monitoring wells in the vicinity of Source Area 4.

Source Area 7 is located near Ekberg/Pine Manor Park. Investigations at Source Area 7 included a soil gas survey, groundwater monitoring, and the collection of subsurface soil samples. The soil gas survey indicated that Area 7 source area extends approximately 100 feet north of Ekberg/Pine Manor Park in the general vicinity of the small valley running north and south. Soil samples revealed the presence of free product and elevated concentrations of VOCs just north of the park. A groundwater remediation system has been constructed at Ekberg/Pine Manor Park to treat the contaminated groundwater.

In addition to the soil and groundwater remediation activities conducted at Source Area 4 and 7, since 1990, over 810 properties in the vicinity of the NPL site have been connected to the Rockford Public Water Supply system because of contamination or threatened contamination of private wells.

3.14 Water Quality

Water quality is impacted by pollutants from a number of point and non-point sources. Point sources are discharges from a single source such as a pipe conveying wastewater from a wastewater treatment facility into the stream. Nonpoint sources contribute pollutants to the water system from across the landscape including runoff from yards, rooftops, roads, parking lots, and other urban and nonurban surfaces. During storms, pollutants on the landscape are washed from the ground and impervious surfaces into storm sewers and roadside drainage ditches, and ultimately into the Buckbee Creek stream system. Physical changes in the watershed, such as hydromodification, channelization and the loss of riparian vegetation and wetlands, also impact water quality and aquatic habitat.

The causes and sources of water quality problems in the Buckbee Creek watershed are urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to agricultural to urban. These changes have included modification of the stream channel, floodplain, and wetlands. Other changes are the result of the increased watershed impervious cover that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. In addition to increasing surface runoff, impervious surfaces reduce the amount of rainwater that infiltrates into the ground to recharge groundwater sources.

3.14.1 State of Illinois Reporting

Surface water quality monitoring is used by limnologists and scientists to evaluate the ecological health of water body. The overall objective for water quality sampling is to assess the existing conditions of a stream, river or lake in an attempt to restore or maintain the chemical, physical, and biological integrity of the monitored surface water. In Illinois, the Illinois EPA utilizes water quality monitoring data as its major source of information for the Illinois EPA Section 305(b) and Section 303(d) List integrated report. Section 303(b) of the Federal Clean Water Act required each state to submit to the USEPA a biannual report of the quality of the state's surface and groundwater resources. The 305(b) report includes a detailed description of the how Illinois assesses water quality and whether the assessed waters meet or do not meet "Designated Uses". When a water body is determined to be impaired, IL must list the potential reasons for the impairment in the Section 303(d) impaired waters list.

Section 303(d) of the Clean Water Act requires Illinois to submit to the USEPA a list of water bodies with impaired uses, the pollutant causing the impairment, and a priority ranking for the development of Total Maximum Daily Loads (TMDLs). The establishment of the TMDL sets the pollution reduction goal to improve the impaired waters. Historically, the 305(b) list and the 303(d) list were submitted to the USEPA as separate documents, however, since 2006, the reports have been integrated into a single report.

The surface water assessments included in the 2012 Illinois Integrated Water Quality Report and Section 303(d) List are based on data obtained through chemical, physical, and biological sampling. These assessments help protect "Designated Uses" by setting water quality standards that will protect the designated uses. In Illinois, the "designated uses" for surface waters include: aquatic life, indigenous aquatic life, fish consumption, primary contact, secondary contact, water supply and aesthetic quality. For each "designated use" it is determined if a water body is either "fully supporting" or "not supporting" the use based on the available data. Any waters that are determined to be not supporting a designated use as considered impaired. Additionally, the USEPA required that the assessed waters be placed in categories based on their attainment (Table 3-28). Category 5 waters comprise the Illinois 303 (d) list. The 303(d) listed waters are prioritized by the Illinois EPA and TMDLs are prepared for waters in the order of priority (highest to lowest).

Table 3-28: Categories of 303(d) Listed Waters

Category	Sub-Category	Description
1		All designated uses are assessed as fully supporting and no use is threatened (Note- Illinois does not assess any waters as threatened).
2		Available data and/or information indicate that some but not all designated uses are supported
3		Insufficient data and/or information to make a use support determine for any use
4		Water bodies contain at least one impaired use but TMDL is not required. Category 4 is subdivided as listed below based on the reason a TMDL is not required.
	a	TMDL has been approved or established by the USEPA.
	b	Technology based effluent limitations required by the Clean Water Act, more stringent effluent limits required by the state, local, or federal authority, or other pollution control requirements required by state, local or federal authority are stringent enough to implement applicable water quality standards within a reasonable period of time
	c	Failure to meet the applicable water quality standards is not caused but a pollutant but other types of pollution (such as aquatic life impairment due to habitat degradation)
5		Available data and/or information indicate that at least one designated use is impaired and a TMDL is required.

No waters in the Buckbee Creek watershed are assessed by the Illinois EPA and therefore, no streams in the Buckbee Creek watershed are listed on the 2012 303(d) list as impaired.

3.14.2 Available Chemical and Physical Water Quality Monitoring

Typically, chemical and physical water quality monitoring includes the collection of water quality samples that are analyzed for the following parameters:

- Temperature
- pH
- Dissolved oxygen (DO)
- Conductivity
- Total suspended solids (TSS)
- Total dissolved solids (TDS)
- Metals including cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc
- Nitrogen including nitrite, nitrate, and total nitrogen
- Phosphorus including dissolved phosphorus and total phosphorus

- Bacteria
- Chlorides

There is no known water quality data available for Buckbee Creek collected by any local, state, or Federal agency. As such as part of the stream walk conducted in the watershed on July 11, 2011, temperature, conductivity, dissolved oxygen, and pH were collected at 6 sites within the watershed. A visual description of turbidity was also noted. The data collected is summarized in Table 3-29. The monitored sites are shown in Figure 3-19.

Table 3-29: Water Quality Data for the Buckbee Creek watershed

Site	Temperature (°C)	Conductivity	Dissolved Oxygen (mg/L)	pH	Turbidity
7	20.4°C	2.42	3.11	7.65	Clear
10	23.2°C	1272	11.59	7.97	Clear
11	20.6°	1177	6.24	7.82	Clear
12	21.6°	1059	6.22	7.88	Clear
13	23.2°C	1088	7.48	8.38	Clear

Water quality data was not collected at the other sites visited on the streamwalk due to insufficient flows in Buckbee Creek at the time of the sampling.

Temperature
Water temperatures fluctuated with daily air temperatures as well as with seasonal changes, i.e., water temperatures are higher in summer and cooler in spring and fall. Maximum water temperatures over 20°C may preclude most numerous fish from using these streams for habitat.

Conductivity
Specific conductivity indirectly measures the concentration of chemical ions or dissolved salts in the water, and may be an indicator of salt as a pollutant. The more chemical ions or dissolved salts a body of water contains, the higher the conductivity will be. Conductivity levels of 200-1,000 are indicative of normal background levels. Conductivity outside of this range may not be suitable for certain species of fish or bugs. High conductivity (1000 to 10,000 µS/cm) is an indicator of saline conditions. High chloride concentrations following salt applications for snow melting in winter can led to high conductivity readings, as can the leaching of effluent from a sanitary sewer line into a stream. Low water levels tend to increase concentrations of ions in the water column, while rain events tended to temporarily flush ions out of the stream system.

Dissolved Oxygen
Algae and aquatic plants in the creek elevate dissolved oxygen (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below the Illinois Environmental Protection Agency standard of 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic conditions) can be detrimental to aquatic life.

pH
Normal pH (a measure of hydrogen ions in the water) values in streams should range from 6.5 to 8.5, good conditions for aquatic life.

Turbidity
Turbidity, a measurement of the 'cloudiness' of water, is caused by suspended particles, or TSS (total suspended solids), and may indicate erosion or sedimentation problems. Turbidity tends to increase after rain events when runoff carries particles into the stream, when high flows erode streambanks and/or the streambed, and when the increased volume of water in the channel stirs the sediment in the bottom of the channel.

3.14.3 Illinois EPA Permit Programs

The Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water regulates wastewater discharges through the implementation of the National Pollution Discharge Elimination System (NPDES) program. This program was initiated under the Clean Water Act to reduce pollution to surface waters and required permits be issued for the discharge of: 1) treated municipal effluent; 2) treated industrial effluent; and 3) stormwater from separate storm sewer systems (MS4's) and construction sites.

NPDES Point Source Discharges for Municipal and Industrial Effluent
There are no municipal wastewater treatment plants discharging to the Buckbee Creek watershed. There are 7 NPDES point source industrial permits issued by the Illinois EPA to a facility located in the Buckbee Creek watershed (Table 3-30).

Table 3-30 NPDES Point Source Discharges in the Buckbee Creek watershed

Facility Name	Facility Address	Permit Number	Permit Type	Receiving Water
Amphenol Antenna Solutions	1300 Capital Drive, Rockford, IL	ILR006164	Non-Major, General Permit	Not noted
Greenlee Textron, Inc	1222 Research Parkway, Rockford, IL	ILR004233	Non-Major, General Permit	Not noted
Hamilton Sundstrand	4747 Harrison Avenue, Rockford, IL	ILR006127	Non-Major, General Permit	Not noted
Owens Corning Foam Insulation	2710 Laude Drive, Rockford, IL	ILR001098	Non-Major, General Permit	Not noted
Rock River Reclamation District	3333 Kishwaukee Street, Rockford, IL	ILR0027201	Individual Permit	Rock River
Rockford Vehicle Maintenance	5225 Harrison Avenue, Rockford, IL	ILR003487	Non-Major, General Permit	Not noted
SA Industries 2, Inc.	999 Sandy Hollow Road, Rockford, IL	ILR004208	Non-Major, General Permit	Not noted

NPDES Stormwater Regulations
Stormwater runoff is a major source of pollution to the Buckbee Creek watershed. Stormwater runoff includes rainwater and snow melt that flows off the land into storm

sewers or directly into lakes, rivers, or streams. Stormwater runoff can carry a wide range of pollutants including sediment, nutrients, metals, chlorides, and petroleum. Additionally, as the runoff flows over land, it can lead to increased erosion of exposed soils, especially on construction sites.

In order to reduce the impacts of stormwater on our rivers, streams and lakes, Illinois has been implementing stormwater regulations since 1990 through the NPDES program. The regulations have been implemented in two phases: Phase I and Phase II. Phase I began in 1990 and required large and medium-size city with populations over 100,000 to obtain an NPDES permit coverage for their municipal separate storm sewer system (MS4). Phase I also required NPDES permits for ten industrial uses and for construction sites disturbing 5 acres or more of land.

The NPDES Phase II program began in 2003 and was an update to the 1990 Phase I program. The Phase II program expanded the program by including additional MS4 categories, providing a "no exposure" exemption to certain industrial facilities if activities are protected by a storm-resistant shelter to prevent the exposure of runoff and material from leaving the facility, and decreasing the threshold for a construction site permit to 1 acre or more of land disturbing activity.

MS4 Permits

The City of Rockford was considered an MS4 under the Phase I regulations (Illinois EPA Permit Number ILS000001). With the implementation of the Phase II regulations in 2003, the following governmental entities with the Buckbee Creek watershed were designated as MS4 communities: Cherry Valley Township; Rockford Township; and Winnebago County. The Phase II communities all operate under a General Permit for Discharges from Small MS4s (Illinois EPA Permit Number ILR40).

Both the City of Rockford and the Phase II communities are required to complete a series of Best Management Practices (BMPs) including 1) Develop a stormwater management program consisting of BMPs and measurable goals for at least 6 control measures: 1) public education and outreach on stormwater impacts; 2) public involvement; 3) illicit discharge detection and elimination; 4) construction site stormwater runoff control; 5) post-construction stormwater runoff control in new developments; and 6) pollution prevention/good housekeeping for municipal operations. In addition to the six control measures, the MS4s must also submit a Notice of Intent (NOI) and an annual report of activities related to the permit to the Illinois EPA.

As part of their MS4 program, the City of Rockford has been collecting stormwater samples from two sites within the Buckbee Creek watershed. The stormwater sampling program is called SCORE. The SCORE sites and the parameters for which the sites were sampled are detailed in Table 3-31.

Table 3-31 SCORE Stormwater Sampling Sites in the Buckbee Creek Watershed

Station	Location	Description of Tributary Area	Parameters Measured
R4	8th Street and Willis Street	780-acre commercial, industrial and residential	ph, fecal coliform, biological oxygen demand, chemical oxygen demand, TSS, TDS, hardness, ammonia-N, nitrate-N, nitrite-N, total kjeldalh nitrogen, phosphorus, cyanide, copper, cadmium, zinc, lead, and phenol
R5	Forest View Road and 28th Avenue	80-acre light industrial	ph, fecal coliform, biological oxygen demand, chemical oxygen demand, TSS, TDS, hardness, ammonia-N, nitrate-N, nitrite-N, total kjeldalh nitrogen, phosphorus, cyanide, copper, cadmium, zinc, lead, and phenol

According to the qualitative data provided by Rockford, Station R4 which receives runoff from a 780-acre industrial, commercial, and residential area had the highest mean TSS concentration and the highest concentration of nitrate-N, lead, zinc and hardness of all of the SCORE samples. A large storage yard and tool manufacturing facility adjacent to R4 was identified as a potential source of the contaminants. The report also noted that with a few exceptions, concentrations of heavy metals in the stormwater were low and suggested that runoff from the industrial and commercial areas were reasonably well managed.

Construction Permits

As discussed above, NPDES Phase II Stormwater Regulations were implemented by the Illinois EPA in 2003 to address potential erosion from construction including commercial, residential, road building, and demolition sites in the state that disturb more than one acre of land. Land disturbance is defined as exposing soil during clearing, grading, or excavation. The regulations specifically require the operator (person with operational control of the day to day construction activities) of the property to ensure compliance with the permit conditions outlined in the Illinois Construction Site General Permit (ILR10). These requirements include submitting a Notice of Intent (NOI) to begin construction, create a Stormwater Pollution Prevent Plan (SWPPP) to control erosion during construction, and submit a Notice of Termination (NOT) when the site is permanently stabilized. The regulations also require that the construction site be inspected every 7 days and after every 0.5-onch or greater rainfall event or equivalent snowfall by a qualified inspector. During the weekly inspection, the sites are existing soil erosion and sediment control (SESC) practices are inspected for needed repairs. Additionally, the inspections are used to identify additional potential sources of erosion and sedimentation and make recommendations for additional SESC control practices. If construction activities result in an off-site discharge of sediment bearing waters, the operator is required to submit a Incident of Non-compliance (ION) to the Illinois EPA and provide a plan to prevent further releases of sediment. As of January 2013, there are no active ILR10s issued for the Buckbee Creek watershed.

Winnebago County and the City of Rockford also have soil erosion and sediment control ordinances that are aimed at reducing the potential for sediment from construction activities for negatively impacting the Buckbee Creek watershed.

3.14.4 Nonpoint Source Pollution

When rain flows across the landscape, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams. This kind of pollution is called nonpoint source pollution, because it comes from the entire watershed rather than a single point, plant, or facility. These pollutants accumulate as the water flows downstream and eventually begin to degrade the quality of Buckbee Creek for aquatic life, as well as for human uses such as fishing, wading, and bird watching. In this way, every small bit of pollution adds up to a very large problem.

In addition to chemicals and other substances picked up from the landscape, non point source pollution includes other measures such as temperature, acidity, and the amount of oxygen in the water. Aquatic organism, including fish and benthic macroinvertebrates that are critical links in the food chain, need oxygen that is dissolved in the water to breathe. Low flows and nonpoint source pollution can cause the dissolved oxygen levels in the water to fall below healthy levels. When this happens, some plants and animals will die, in some cases causing fish kills, and others will leave that location to try to find cleaner water.

Water temperature can also cause problems. Many fish and other aquatic animals require cool or cold flowing water to survive. As rainwater flows across urban surfaces and through the sewer system, these surfaces warm the water causing the overall temperature of the receiving stream to be too warm for many aquatic plants and animals. This water can also be either more acidic (low pH) or more alkaline (high pH) than is healthy for these organisms to survive. Additional potential source of pollution, in addition to the list of potential sources mentioned above are the sanitary sewer system and septic systems.

Sanitary Sewer System

The Rock River Water Reclamation District (RRWRD) wastewater treatment facility discharges treated wastewater the Rock River outside of the Buckbee Creek watershed. This discharge is a point source of pollution covered by the NPDES point source permitting process discussed in Section 3.11. However, non-point source pollution also can be traced to issues (cross connections with the storm sewer system, leakage into or out of the sanitary sewer system, overflows of the sanitary sewer system due to stormwater infiltration or combined sewers) within the sanitary or sewer system. The following are known about the RRWRD's system:

- No known cross connections exist between the RRWRD sanitary system and the storm sewer system within the Buckbee Creek watershed that could result in sanitary discharge into the storm sewers.
- There are no combined sewers within these watersheds

Septic Systems

Septic systems have the potential to discharge nutrients (phosphorus and nitrogen) and bacteria and virus in to the surface and groundwater of the Buckbee Creek watershed. When properly designed and maintained, the quantity of pollution discharge from the septic systems is limited. However, failing septic systems have the potential to be a significant cause of surface water and groundwater quality degradation. Several areas in the Buckbee

Creek watershed are serviced by septic systems such as the southeast corner of the watershed. Areas not serviced by sanitary sewer are assumed to be on septic systems.

Nonpoint Point Source Pollutant Load Analysis
As a means of quantifying non-point source pollution loading in the watershed, a Pollutant Loading (PLOAD) application model for the Buckbee Creek watershed was developed. PLOAD is an extension of the comprehensive modeling tools in the Environmental Protection Agency's (EPA) Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) model. PLOAD is a GIS-based model that estimates nonpoint-source and point-source loadings on an annual average basis for small urban watersheds.

Hey has selected PLOAD as the nutrient loading modeling application that is the most appropriate for the Buckbee Creek watershed for the following reasons:

Transferability

PLOAD was designed to be utilized in a wide range of applications and uses including NPDES stormwater permitting, watershed management, watershed planning, and lake/reservoir protection projects. PLOAD is applicable for both small urban and rural watersheds of any size. The model inputs include GIS coverages of land use, subbasin boundaries, and BMP locations along with look-up tables for pollutant event mean concentrations (EMCs), imperviousness and BMP removal efficiencies.

Additionally, as PLOAD is an extension of the BASINS model, the model can be downloaded for free from the Illinois EPA on the BASINS homepage. As such it is not cost prohibitive for even the smallest watershed planning organizations.

Applicability

PLOAD has the ability to estimate the importance of pollution contributions from multiple land uses and many individual sources in a watershed. Thus, it can be used to target important areas of pollution generation and identify areas best suited for controls within a watershed. Once these "hot spots" are identified, PLOAD can then be utilized to evaluate the effectiveness that various types and locations of BMPs within the "hot spots" would have on pollutant loading.

PLOAD also has the ability to assess seasonal or inter-annual variability of nonpoint-source pollution and to assess long-term water quality trends. It can also be used to address land use patterns and landscape configurations in the watershed. This allows for the user to evaluate changes in pollutant loading that may occur as the result of future, predicted land use conditions.

Ease of Use

PLOAD has a user-friendly interface. Starting a new project within the BASINS platform involves an easy to follow step-by-step process. Once a project is started in BASINS, the gathering of background data necessary to run the PLOAD model can begin. After the initial background data is loaded into the model (land use, elevation and hydrology information, watershed boundaries, etc.) the PLOAD model plug-in can be utilized. The PLOAD model plug-in incorporates another step-by-step process where land use, precipitation, event mean concentration, BMPs, point sources, and bank erosion can either be referenced to BASINS or inserted manually where applicable for the particular project or area being analyzed. Manual insertion of the data is clearly detailed within the software instructions.

After modeling is complete, PLOAD gives its user the ability to generate out-puts as user-defined formats. This enables the user to tailor the output data they need. If so desired, the user can view the data from BASINS and PLOAD in ArcGIS if that software is installed on the computer being utilized.

Customizable

PLOAD's organization and structure facilitates modification and customization. By using look-up tables for EMCs, imperviousness terrain factor, and BMP removal efficiencies, PLOAD gives the user the opportunity to integrate site and region specific data on loading and removal rates into the model. This allows for a more refined calculation of loading and reduction rates.

Pollutants evaluated using PLOAD included

- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Phosphorus (TP)
- Total Nitrogen (TN)
- Nitrate-Nitrite (NO3-NO2)
- Total Kjeldahl Nitrogen (TKN)
- Lead
- Copper
- Cadmium
- Chromium
- Nickel
- Zinc

The model estimated pollutant loading of each pollutant from each subbasin. The modeled valued were compared to the Illinois Environmental Protection Agency (Illinois EPA) Water Quality Standards for General Use, Secondary Contact, and Aquatic Life. The Illinois EPA Water Quality Standards used for this assessment are included in Table 3-32.

Table 3-32 Illinois EPA Water Quality Standards

Pollutant	Illinois EPA Standards
TSS	750 ppm
TDS	1,500 mg/L
BOD	5.0 mg/L
COD	30 mg/L
Total Phosphorus*	0.05 mg/L
Total Nitrogen (TN)	15 mg/L
Nitrate – Nitrite (NO3-NO2)	Not applicable
Total Kjeldahl Nitrogen (TKN)	10 mg/L
Lead (Pb)	0.1 mg/L
Copper (Cu)	1.0 mg/L
Cadmium (Cd)	0.15 mg/L
Chromium (Cr)	0.3 mg/L
Nickel (Ni)	1.0 mg/L
Zinc (Zn)	1.0 mg/L

* Applicable only to lakes/reservoirs and streams at its confluence with a lake/reservoir

Four pollutants in particular (TSS, TP, COD, and BOD) are considered as pollution indicators for this watershed. TSS and TP are typical indicators of high urban pollutant loadings. TSS can lead to excessive sedimentation in stream reaches and ultimately cover and impair instream habitat. TP can lead to excessive productivity levels of aquatic plants in slow moving reaches and in wetlands. This can then lead to low DO levels as the plant material decays Low DO levels make the stream uninhabitable for some species of aquatic life. Since COD and BOD represent oxygen demanding substances they were included in the list of indicator pollutants for this watershed.

The pollutant loading results were used to identify and prioritize subbasins by their respective degree of pollutant loading. Table 4-33 details the pollution loading estimates from each subwatershed on a concentration basis (mg/L). Table 4-34 includes pollutant load calculations in pounds per acre per year.

The loading calculations were used to establish a ranking system for each of the modeled pollutants in order to identify priority watersheds. The rankings included "High" for those pollutants that exceeded the Illinois EPA standard, "Medium" for those pollutants that were under the Illinois EPA standard but at least half their value, and "Low" for those pollutants that were less than half of the Illinois EPA standard. Table 3-35 lists the Illinois EPA standards by pollutant and those subwatersheds exhibiting High, Medium, and Low levels for each pollutant.

Table 3-33 Estimated Pollutant Loading by Subwatershed in the Buckbee Creek watershed (mg/L)

Subbasin	Acres	TSS	TDS	BOD	COD	TP	TN	NO3	NO3-NO2	TKN	Pb	Cu	Cd	Cr	Ni	Zn
1	192.53	231.16	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
2	98.86	240.40	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
3	129.29	251.68	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
4	136.25	255.92	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
5	260.04	222.10	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
6	121.20	251.67	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
7	317.44	218.54	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
8	125.70	244.57	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
9	279.15	202.91	92.02	15.98	66.91	0.50	2.40	0.20	0.70	1.80	0.03294	0.036924	0.00499	0.00798	0.00798	0.134
10	299.19	234.42	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
11	108.94	265.06	92.22	15.70	65.85	0.49	2.36	0.20	0.69	1.77	0.03220	0.03604	0.00489	0.00781	0.00781	0.131
12	64.55	302.72	93.00	14.63	61.76	0.46	2.23	0.19	0.68	1.66	0.02938	0.032633	0.00450	0.00713	0.00713	0.120
13	104.62	444.42	95.41	11.31	49.10	0.37	1.80	0.16	0.61	1.33	0.02064	0.022082	0.00330	0.00502	0.00502	0.085
14	93.19	277.13	92.14	15.81	66.27	0.49	2.38	0.20	0.70	1.78	0.03250	0.036394	0.00493	0.00788	0.00788	0.132
15	34.01	299.48	92.31	15.57	65.36	0.49	2.35	0.20	0.69	1.76	0.03187	0.03563	0.00484	0.00773	0.00773	0.130
16	177.09	190.54	92.01	15.98	66.94	0.50	2.40	0.20	0.70	1.80	0.03296	0.036947	0.00499	0.00799	0.00799	0.134
17	177.96	206.03	92.16	15.78	66.17	0.49	2.37	0.20	0.70	1.78	0.03243	0.036309	0.00492	0.00786	0.00786	0.132
18	95.53	223.18	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
19	140.25	221.62	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
20	275.27	289.44	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.036998	0.00500	0.00800	0.00800	0.134
21	154.88	219.23	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
22	62.83	255.83	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
23	93.93	201.26	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
24	165.17	259.80	92.14	15.80	66.25	0.49	2.38	0.20	0.70	1.78	0.03248	0.036377	0.00493	0.00788	0.00788	0.132
25	484.98	198.25	92.04	15.94	66.78	0.50	2.39	0.20	0.70	1.79	0.03285	0.036819	0.00498	0.00796	0.00796	0.133
26	150.21	251.12	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134
27	98.66	250.49	92.00	16.00	67.00	0.50	2.40	0.20	0.70	1.80	0.03300	0.037	0.00500	0.00800	0.00800	0.134

Table 3-34 Estimated Pollutant Loading by Subwatershed in the Buckbee Creek watershed (lbs/year)

Subbasin	Acres	TSS	TDS	BOD	COD	TP	TN	NO3	NO3-NO2	TKN	Pb	Cu	Cd	Cr	Ni	Zn
1	193	148,019	58,911	10,245	42,903	320	1,537	128	448	1,153	21	24	3	5	5	86
2	99	73,484	28,122	4,891	20,480	153	734	61	214	550	10	11	2	2	2	41
3	129	92,662	33,873	5,891	24,668	184	884	74	258	663	12	14	2	3	3	49
4	136	96,422	34,662	6,028	25,243	188	904	75	264	678	12	14	2	3	3	50
5	260	207,481	85,946	14,947	62,591	467	2,242	187	654	1,682	31	35	5	7	7	125
6	121	86,867	31,755	5,523	23,126	173	828	69	242	621	11	13	2	3	3	46
7	317	257,303	108,316	18,838	78,883	589	2,826	235	824	2,119	39	44	6	9	9	158
8	126	92,133	34,657	6,027	25,240	188	904	75	264	678	12	14	2	3	3	50
9	279	245,006	111,107	19,290	80,790	603	2,894	241	845	2,171	40	45	6	10	10	162
10	299	227,196	89,163	15,507	64,934	485	2,326	194	678	1,744	32	36	5	8	8	130
11	109	75,058	26,114	4,445	18,646	139	669	56	197	501	9	10	1	2	2	37
12	65	40,744	12,517	1,969	8,312	62	300	25	91	224	4	4	1	1	1	16
13	105	55,682	11,954	1,417	6,152	47	226	20	77	167	3	3	0	1	1	11
14	93	62,350	20,730	3,557	14,911	111	535	45	157	401	7	8	1	2	2	30
15	34	21,687	6,685	1,127	4,733	35	170	14	50	127	2	3	0	1	1	9
16	177	168,095	81,171	14,100	59,050	441	2,115	176	617	1,586	29	33	4	7	7	118
17	178	153,248	68,548	11,739	49,218	367	1,765	147	518	1,323	24	27	4	6	6	98
18	96	75,868	31,275	5,439	22,776	170	816	68	238	612	11	13	2	3	3	46

19	140	112,135	46,551	8,096	33,901	253	1,214	101	354	911	17	19	3	4	4	68
20	275	179,399	57,024	9,917	41,527	310	1,488	124	434	1,116	20	23	3	5	5	83
21	155	125,269	52,569	9,143	38,284	286	1,371	114	400	1,029	19	21	3	5	5	77
22	63	44,477	15,994	2,782	11,648	87	417	35	122	313	6	6	1	1	1	23
23	94	83,251	38,056	6,618	27,714	207	993	83	290	745	14	15	2	3	3	55
24	165	115,491	40,961	7,026	29,452	220	1,056	88	310	791	14	16	2	4	4	59
25	485	437,439	203,086	35,178	147,353	1,100	5,280	440	1,542	3,959	72	81	11	18	18	294
26	150	107,831	39,504	6,870	28,769	215	1,031	86	301	773	14	16	2	3	3	58
27	99	70,968	26,066	4,533	18,983	142	680	57	198	510	9	10	1	2	2	38

Table 3-35 Estimated Annual Pollutant Load by Land Use in the Buckbee Creek subwatershed (lbs/year)

Source	TSS	TDS	BOD	COD	TP	TN	NO3	NO3-NO2	TKN	Pb	Cu	Cd	Cr	Ni	Zn
Agriculture	3,568,962	1,386,612	238,669	1,000,240	7,467	35,850	2,991	10,498	26,878	491	550	74	119	119	1,994
Commercial	4,006,216	1,556,494	267,910	1,122,785	8,382	40,243	3,357	11,784	30,171	551	617	84	134	134	2,239
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Publicly Owned Land/Parks/ Rec. Areas	4,506,485	1,750,858	301,364	1,262,990	9,429	45,268	3,777	13,256	33,938	620	694	94	150	150	2,518
Residential	42,037,289	16,332,317	2,811,180	11,781,397	87,953	422,267	35,228	123,652	316,582	5,783	6,478	877	1,402	1,402	23,492
Right-of-Way	18,177,774	7,062,424	1,215,611	5,094,514	38,032	182,597	15,233	53,470	136,896	2,501	2,801	379	606	606	10,158
Industrial	17,816,745	6,922,157	1,191,468	4,993,332	37,277	178,970	14,931	52,408	134,178	2,451	2,746	372	594	594	9,957

Table 3-36 Levels of pollutant compared to Illinois EPA standards in the Buckbee Creek watershed.

Pollutant	Illinois EPA Standard (mg/L)	High	Medium	Low
TSS	750ppm	None	None	All
TDS	1,500 mg/L	None	None	All
BOD	5.0 mg/L	**All**	None	None
COD	30 mg/L	**All**	None	
Total Phosphorus	0.05 mg/L	**All**	None	None
Total Nitrogen (TN)	15 mg/L	None	None	All
Total Kjeldahl Nitrogen (TKN)	10 mg/L	None	None	All
Lead (Pb)	0.1 mg/L	None	None	All
Copper (Cu)	1.0 mg/L	None	None	All
Cadmium (Cd)	0.15 mg/L	None	None	All
Chromium (Cr)	0.3 mg/L	None	None	All
Nickel (Ni)	1.0 mg/L	None	None	All
Zinc (Zn)	1.0 mg/L	None	None	All

3.14.5 Summary of Water Quality Assessment

The conclusions drawn and management strategies recommended in this report are the best possible, given the extremely limited water quality data in this watershed. However, typical urban watershed problems as well as site specific issues have been identified. The primary issues with respect to water quality, including those that relate to instream and riparian habitat, are discussed below.

Total Suspended Solids

Although the nutrient modeling did not identify Total Suspended Solids (TSS) as a major source of impairment, the habitat assessment and stakeholder input has identified TSS as a major issue in the watershed. The primary impact of high suspended solids concentrations in streams occurs when these solids settle in depositional areas of the stream system and cover the more desirable gravel substrates. Excessive levels of particulate material also create difficult conditions for gill breathing fish and some of their food sources, including macroinvertebrate organisms.

The sources of TSS appear to be from urban runoff over impervious surface and to a lesser degree, streambank erosion (due to hydrologic instability). Suspended solids can be transported to the streams and lakes, even from remote areas of the watershed, via storm sewers and roadside ditches.

Increases in impervious cover combined with introduction of stormwater drainage systems and loss of wetlands has lead to significant changes in watershed hydrology (flow alterations and hydromodification). This has in turn led to increased streambank and streambed erosion and degradation of instream habitat in many reaches.

As the remaining vacant land of the watershed develops, as is projected, construction site runoff will be a potential growing source of sediment if soil erosion and sediment control practices are not properly designed, installed, and maintained.

Habitat
There are very limited high quality habitat features such as instream habitat and relatively natural floodplains in the Buckbee Creek watershed. As such, biological communities are of poor quality with limited diversity. The lack of instream features, intermittent hydrologic connection with the Rock River, the flashy hydrology of the streams due to urban development within the watershed, periods of very low flow, and low dissolved oxygen conditions in the summer months all contribute to the impacts to the biological community of the creek. Additional biological sampling should be conducted in a variety of locations to establish a baseline from which improvement or degradation can be assessed.

Additionally, there has been significant encroachment by urban uses into the stream corridor and loss of riparian habitat. These encroachments can be locations of yard waste dumping as well as sheet drainage of fertilizers and pesticides into the stream. These encroachments can also disrupt wildlife corridors.

Nutrients
Urban runoff is the likely contributor of high nutrient loads, particularly phosphorous, to the stream systems. Stream or streambank dumping of yard waste, grass clippings, and leaves collected in the fall can also contribute significant nutrient loading to the stream. Pet wastes may also contribute to the nutrient loading to the stream.

Total Dissolved Solids
Dissolved solids (TDS) include substances such as salts. One of the most problematic dissolved solids in urban watersheds is sodium chloride, used as road deicing material. Road salt can occur at toxic levels in the water column at intermittent times when the weather conditions demand its use. Sodium chloride is not removed by BMPs and is conservative (does not decompose or readily change form), and can cause spikes in the water column, typically detected as increased conductivity. Salinity and chlorides were measured within the stream by collecting data on the conductivity levels in the stream, which indicated slightly elevated conductivity readings. It should be noted that these conductivity readings were taken in the summer when levels of dissolved solids are most likely at their lowest in the stream. It is expected that high concentrations would be present during the winter months due to the application of road salt.

3.15 Floodplain and Flood Hazard Areas
This section of the plan includes information on the FEMA floodplain as well as areas of known flooding within the Buckbee Creek watershed.

3.15.1 Floodplain
Floodplains along stream and river corridors provide a variety of benefits including aesthetic value, flood storage, water quality, and plant and wildlife habitat. However, the most important function is the capacity of the floodplain to hold water during significant rainfall events to minimize flooding. Flood hazard areas are identified on the Flood Insurance Rate Map (FIRMs) and are categorized as a Special Flood Hazard Areas (SFHA). SFHAs are defined as the area that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year. This 1-percent annual chance flood is commonly referred to as the base flood or 100-year flood. It should be noted that the 100-

year flood can and do occur more frequently than every 100 years. SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.

There are approximately 84.88 acres of 100-year floodplain with in Buckbee Creek watershed (Table 3-36 and Figure 3-20). The Buckbee Creek floodplain is classified as Zone A and Zone AE. Zone AE areas are subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. The Zone AE areas in Buckbee Creek are located along near its confluence with the Rock River.

Zone A Areas are subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown for Zone A areas. Mandatory flood insurance purchase requirements and floodplain management standards apply for all structures located in Zone A. The Zone A areas are located along Buckbee Creek near south of the Union Pacific and Canadian National Railway track to near its confluence with the Rock River and along Tributary #1 from the intersection of the tributary with Ohio Parkway to Tributary #1 confluence with Buckbee Creek.

Table 3-37 Floodplain in the Buckbee Creek watershed

SFHA	Acreage	% of Watershed
AE	1.55	0.03%
A	83.33	1.88%

Numerous structures are located in the mapped Zone A floodplain. These structures are primarily situated along the creek south/southwest of Harrison Road.

Records maintained by the Federal Emergency Management Agency (FEMA) indicate that one letter of map revision (LOMRs) was issued for development projects in the Buckbee Creek watershed in June 2, 2003.

3.15.2 Flooding and Drainage Problems

Over the past years the Buckbee Creek watershed has recorded some of its worst flooding to date. Five inches of rain fell on September 4, 2006 leading to damage of hundreds homes. Less than a year later on August 7, 2007, the watershed was again hit by rain when 5 to 7-inches of rain fell. Many streets, including major thoroughfares were flooded. Following the 2007 storm, the Governor of Illinois declared Rockford and Winnebago County a state disaster area. Debris removal, law enforcement, damage assessment, and other duties were offered by the governor.

In addition to these flooding events caused by significant rainfalls, the Buckbee Creek watershed experiences flood and drainage problems following much smaller rainfall events. Several different types of flooding that occurs in the watershed include:

- Overbank flooding from a waterway
- Local drainage problems (shallow flooding on roads, yards and sometimes buildings) often due to development in a drainage way, inadequately maintained drainage ditches, undersized storm sewers, and storm sewers.
- Depressional flooding in areas where water ponds in a natural depression in the landscape and there is no natural outlet for runoff. May be caused by failed or sewer or adjacent or surrounding development causing increased runoff into the depressional area.
- Sanitary sewer backups may occur, flooding basements, when stormwater infiltrates into the sanitary sewer pipes, leaky manholes, or inappropriate connections to the sanitary lines.

In 2009, the City of Rockford prepares a Citywide Stormwater Management/Flood Control Assessment of the portions of the Buckbee Creek watershed located within its city limits. The Citywide Stormwater Management/Flood Control Assessment identified three stormwater/flood control issues in the Rockford portion of the watershed. This list was presented to the Winnebago County Watershed Planning Steering Committee and other watershed stakeholders during the watershed planning process and was expanded. Table 3-37 and Figure 3-21 lists all of the flooding and drainage problems identified during the watershed planning process.

Table 3-38 Flooding and Drainage Problems in the Buckbee Creek watershed

Location	Problem Description	Over-bank Flooding	Major Surface Flooding	Localized Flooding	Roadway Overtopping	Pipe Surcharge	Culvert Scour	Water Quality Impacts	Streambank Erosion
Harmon Park Neighborhood, Rockford, Illinois	Storm sewer system is undersize and area residents report pipe surcharge. Area residents report basement flooding.		✓		✓	✓	✓		
Welworth-Wentworth Neighborhood, Rockford, Illinois	Nonexistent storm sewer or ditch infrastructure. Area residents have constructed berms to redirect flows. Area residents report basement flooding.		✓		✓				
20th Street to Cleveland Avenue	Concrete channel is severely eroded with broken concrete and exposed rebar.								
Buckbee Creek at Owens Corning access drive	Area residents report bridge overtops.		✓	✓					

Location	Problem Description	Over-bank Flooding	Major Surface Flooding	Localized Flooding	Roadway Overtopping	Pipe Surcharge	Culvert Scour	Water Quality Impacts	Streambank Erosion
Buckbee Creek west of Alpine Road, Rockford, IL	Area residents report streambank erosion and hydromodification							✓	✓
25th Street and Buckbee Creek, Rockford, IL	Area residents report undersized culvert.			✓	✓				
Ohio Parkway and Buckbee Creek, Rockford, IL	Area residents report undersized culvert.			✓	✓				
Throughout watershed	Storm sewers clog after significant rains. Area residents also report pipe surcharge.			✓	✓				

3.15.3 Constructed Drainage System

As development occurred in the Buckbee Creek watershed, the natural drainage system in the watershed was altered. Early construction of residential, commercial, industrial and roads were built without detention basins or other stormwater management practices. With the intent of removing stormwater runoff as quick as possible, this early development utilized storm sewer systems and ditches to quickly transport the water into Buckbee Creek and its tributaries. Without detention, after each rainfall stormwater was quickly delivered to the surface waters resulting in increased flows in the stream channels. These frequent, intense flows lead to channel hydromodification including streambank erosion and channel incision. See Section 3.13.4 for more information on hydromodification.

More recently city engineers and decision makes have realized the benefits of storing stormwater in detention basins that are designed to capture runoff from an impervious area and slowly releases the water over a given amount of time. Winnebago County (Article IV Surface Water Management) and the City of Rockford (Part II Chapter 109) all have stormwater management and detention requirements. Winnebago County and the City of Rockford have also adopted technical regulations/requirements in regards to surface water management.

All three stormwater management ordinances state that the maximum controlled stormwater runoff releases rate from shall not exceed the natural safe stormwater drainage capacity of the downstream system or 0.2 cubic feet per second (cfs) per area. The ordinances allow for the use of the following stormwater storage methods in order to ensure a release rate of 0.2 cfs/acre is met: dry bottom basins, wet bottom basins, paved stormwater storage areas, rooftop storage areas, automobile parking stormwater storage areas, and underground stormwater storage areas.

Detention Basins – dry bottom and wet bottom

Detention basins or detention ponds are stormwater management facilities that are constructed on or adjacent to rivers, streams, or lakes that are designed to storm rainfall in order to protect against flooding and protect downstream channels from hydromodification. Detention facilities that are constructed on a river or stream are commonly referred to as "on-line" basins. On-line basins are not recommended and are commonly prohibited under a variety of stormwater regulations. Detention basins that are not on-line and typically constructed in low areas relative to development and either discharge directly to a surface water or discharge to surface water through a stormwater sewer network. Detention basins are typically designed to be dry bottom or wet bottom.

Dry bottom basins typically hold water for short periods of time following rain events. They are commonly lined with manicured turf grass. While dry detention basins may slow water from reaching creeks and rivers, there short residence time do not promote groundwater infiltration or provide significant water quality benefits. Structures such as gazebos and storage sheds should not be located in dry bottom basins.

Wet bottom basins are designed to permanently retain some volume of water at all times. The amount of water is determined by the elevation of the outlet pipe of the basin. The sideslopes of wet bottom basins can be planted with both turf grass or native grasses. Often wet bottom basins planted with turf grass will experience bank erosion resulting in the placement of riprap near the toe of slope as a measure to slow the erosion.

Wet detention basins planted with native vegetation are commonly referred to as naturalized detention basins. Naturalized detention basins are designed to be wet bottom with side slopes and an emergent zone that is planted with native plants, flowers, and shrubs. In addition to providing stormwater management, naturalized detention basins promote groundwater infiltration and maximize the water quality benefits and wildlife habitat.

The City of Rockford has conducted a survey of detention basins within Buckbee Creek watershed. According to the survey there are 18 detention basins located within the watershed. The basins and their approximate locations are included in Table 3-38. Figure 3-22 depicts the location of the detention basins in the watershed.

Table 3-39 Detention Basins in the Buckbee Creek Watershed

Basin ID #	Location
180	Banister Dr and Carol Place
181	Balsam Ct and Balsam Ln
182	Balsam Ln and Bavarian Ln
188	Bluffside Dr and Bainburg Dr
193	By-pass 20 near 7th St
174	End of Majesty Ct
175	Off Brandies Dr
176	End of Rudeen Close
178	Sawyer Rd and 20th St
179	Hampton Ridge St and Sandy Hollow
208	Allendale and Whitmire

Basin ID #	Location
209	Whitmire
218	15TH and Reed
341	NW Manchester & Alpine
345	2003 Montana
346	2208 Colorado
N/A	NE Colorado & Louisiana
229	Log Cabin & 16th Ave.

While Rockford has compiled a list of detention basins in its jurisdiction, a detailed inventory of all detention basins in the watershed does not exist. A detailed inventory would include the location, size, type (wet bottom, dry, wetland, etc.), description of inlets and outlets, planting plan, and any issues/problems with the basin. The inventory would also include a description of any maintenance needs. While a detailed detention basin inventory was not conducted during the preparation of the watershed-based plan, a field visit to several basins was conducted. The field visits identified several problems with the existing detention basins that limit the storage capacity of the basin and prevent the basin from providing volume control. The identified problems and issues include:

- Structures such as gazebos and sheds constructed in dry basins.
- "Short circuiting" of the basin. Short circuiting occurs when the inlet and outlet are constructed immediately adjacent to each other allowing lows flows to flow directly in and out of the basin and not stored for a gradual release over time.
- Modifications made to the basin such as breeches in side slopes and removal of control structures
- The presence of trash and yard waste within the basins.
- The presence of concrete-lined trenches in the bottom of the basins.

Paved Stormwater Storage Areas

Paved stormwater storage areas are similar to detention basin except that instead of turf grass or native grasses, the basins are paved, typically with concrete. Paved stormwater storage areas prohibit groundwater infiltration and provide no water quality or habitat benefits.

Rooftop Storage Areas

Rooftop storage areas are essentially specialized detention basins used to reduce the peak discharge from rooftops. In a rooftop storage area, all rainfall that falls on a building's roof is stored on the roof and slowly released into the storm sewer system or surface waters. The water is stored on the roof through the use of small weirs located within the roof drains that capture the rainfall and slowly releases it. Rooftop storage areas are traditionally used in high density areas where traditional means of stormwater detention such as ponds are not practical. Rooftop storage areas can be installed at the time of construction or retrofitted onto existing building as long as certain design conditions such as the use of a water proof membrane and ensuring that the roof can handle the additional weight are met.

Automobile Parking Stormwater Storage Areas

Automobile parking stormwater storage areas include the temporary surface storage of stormwater in remote, used areas of parking lots. In this practice, stormwater is temporarily stored on the surface of a parking lot immediately following a storm event prior to be slowly drained into the storm sewer system or other onsite detention facility. Automobile parking stormwater storage areas do not promote groundwater infiltration or provide water quality or habitat benefits. In fact, automobile parking stormwater storage areas may increase pollution loading into a stream or river as parking lots runoff can contain metals, oils, grease, and other water quality contaminants.

<u>Underground Stormwater Storage Areas</u>

Underground stormwater storage areas are a structural practice used to control the flow of stormwater. With underground storage areas, stormwater is stored under the ground in pre-fabricated containers and discharged over time. The systems are typically installed beneath parking lots, streets and parks where there is not enough allowable space for a traditional detention basin. Unless specifically designed, underground stormwater storage areas prevent groundwater infiltration and provide no water quality or habitat benefits.

In addition to the construction of detention facilities, the installation of storm sewer systems has also changed the natural drainage pathways of the Buckbee Creek watershed. Storm sewer systems collect water from residential, commercial, and industrial areas and roads and transport the stormwater to directly to surface waters or to detention facilities prior discharging to surface waters. Storm sewer systems are not just underground pipes as constructed drainage swales are also commonly utilized in storm sewer systems. In some cases, surface waters such as creek and rivers are re-routed into storm pipes in order to accommodate development. As discussed in the Flow Path discussion above, numerous areas of the watershed have been impacted by the construction of storm sewer systems. Figure XX depicts locations where Buckbee Creek and its tributaries have been redirected into the storm sewer system.

The City of Rockford has conducted a survey of storm sewer outfalls within the Rockford portion of the Buckbee Creek watershed. According to the survey there are 164 stormwater sewer outfalls located within the watershed. The outfalls, their approximate locations, and any description supplied by the City are included in Table 3-39. Figure 3-23 depicts the location of the storm sewer outfalls in the watershed.

Table 3-40 Storm sewer Outfalls in the Buckbee Creek Watershed

Outfall ID#	Outfall Size (inch)	Material	Description of the End of Pipe
205	15	CMP	flared end section
206	15	DIP	flared end section
207	18	RCP	in bridge wall
208			buried
209	15	RCP	flared end section
210	15	RCP	flared end section
211	15	RCP	flared end section
212	15	RCP	flared end section
213	15	RCP	flared end section
214	21	RCP	flared end section
215	15	FCP	flared end section
216	15	RCP	flared end section
217	15	CMP	flared end section

Outfall ID#	Outfall Size (inch)	Material	Description of the End of Pipe
218	15	CMP	flared end section
219	15	CMP	flared end section
220	46	RCP	flared end section
221	36	RCP	flared end section
222	15	RCP	flared end section
223	15	RCP	flared end section
224	15	RCP	
225	15	RCP	
226	15	RCP	
227			flared end section, buried
228	15	RCP	flared end section
229	15	RCP	flared end section
230	36	RCP	flared end section
231	15	RCP	flared end section
232	15	RCP	flared end section
233	15	RCP	flared end section
234			flared end section, buried
235	15	RRCP	flared end section
236	18	RCP	
237	15	RCP	box culvert
238	15	RCP	box culvert
239	18	RCP	flared end section
240	18	RCP	flared end section
241	12	PVC	
242	12	RCP	flared end section
243	12	CMP	flared end section
244	18	RCP	box culvert
245	12	RCP	box culvert
246	12	CMP	elevation above ditch
247	15	RCP	flared end section
248	18	RCP	box culvert
249	18	RCP	box culvert
250	15	RCP	flared end section
251	15	RCP	box culvert
252	15	RCP	box culvert
253	24	RCP	flared end section
254	15	RCP	flared end section
255	15	RCP	flared end section
256	15	DIP	Into Ditch
257	15	RCP	box culvert
258	15	CMP	ditch wall
259	36	RCP	flared end section
260	15	RCP	flared end section
261	15	RCP	flared end section
262	36	RCP	flared end section
263	15	RCP	flared end section
264	6	PVC	flared end section, water pumping constantly
265		RCP	flared end section
266	15	RCP	box culvert
267	15	RCP	box culvert
268	12	CMP	built into wall
269	15	RCP	box culvert
270	2' x 3.5'	Conc.	in wall

Outfall ID#	Outfall Size (inch)	Material	Description of the End of Pipe
271	15	RCP	flared end section
272	24	CMP	into wall
273	12	RCP	flared end section
274	24	CMP	into flare wall
275	12	CPP	6" orifice
276	12	CPP	6" orifice
277	12	CPP	6" orifice
278	8	DIP	
279	12	CPP	6" orifice
280	12	RCP	flared end section
281	21	RCP	box culvert
282	6	DIP	74' from retaining wall
283	6	DIP	Into culvert box
284	6	DIP	into culvert box
286	6		
287	6		
288	6		
289	6		
290	6		
291	6		
292	6		
293	6		
294	6		
295	6		
296	15	RCP	flared end section
297	15	RCP	flared end section
298	78	RCP	triple barrel
301	21	RCP	flared end section
302	18	RCP	flared end section
303	18	RCP	box culvert
304	15	RCP	box culvert
305	15	PVC	drains directly into ditch
306	24	RCP	flared end section
307	24	RCP	box culvert
308	18	RCP	box culvert
309	20	RCP	flared end section
310	20	RCP	flared end section
311	15	RCP	flared end section
312	18	RCP	flared end section
313	27	RCP	flared end section
314	18	RCP	flared end section
315	24	RCP	flared end section
316	24	RCP	box culvert
317	20	CMP	flared end section
318	18	RCP	flared end section
319	36	RCP	box culvert
320	15	CMP	flared end section
321	18	CMP	flared end section
322	15	CMP	flared end section
323	29	RCP	flared end section
324	15	CMP	flared end section
325	48	RCP	flared end section
326	36	RCP	flared end section
327	24	CMP	flared end section

Outfall ID#	Outfall Size (inch)	Material	Description of the End of Pipe
328	24	CMP	flared end section
329	24	CMP	flared end section
330	30	RCP	flared end section
331	24	CMP	flared end section
332	24	RCP	culvert box
333	30	RCP	box culvert
334	21	RCP	box culvert
335	12	RCP	box culvert
336	12	RCP	flared end section, extends out into ditch
337	15	RCP	
338	36	RCP	flared end section
339	6	PVC	
340	6	PVC	
341	6	PVC	
342	6	PVC	
343	6	PVC	
344	6	PVC	
345	6	PVC	
346	6	PVC	
347	6	PVC	
348	6	PVC	
349	8	CMP	
350	8	CMP	
351	18	CMP	
352	24	CMP	
353	15	RCP	box culvert
356	15	RCP	
357	24	RCP	flared end section
358	21	RCP	
359	21	RCP	
360	24	RCP	
361	12	RCP	
362	28	RCP	
363	24	RCP	
364	18	RCP	
365	15	RCP	
367	15	CMP	
368	15	CMP	
369	30	CMP	
370	30	CMP	
371	15	CMP	
372	36	RCP	
373	36	RCP	
374	48	RCP	

3.15.4 Regional Compensatory Storage Facilities
There are no regional compensatory storage facilities in the Buckbee Creek watershed.

3.16 Impervious Area Analysis

An Impervious Area Analysis was used to help understand how stream quality relates to the subwatershed area that drains to a particular stream reach. This analysis uses the subbasins described in Section 3.14.2 and illustrated in Figure 3-25. The Impervious Area Analysis utilized based on the well-established belief that as the percentage of watershed imperviousness increases with increasing urbanization, the quality of physical, chemical, and biological conditions of streams within the watershed decreases.

Table 3-41 Impervious Area Analysis Results by Subbasin

Subbasin	Acres	Percent Impervious
1	192.53	51.26
2	98.86	48.97
3	129.29	44.20
4	136.25	41.70
5	260.04	53.38
6	121.20	43.31
7	317.44	56.70
8	125.70	47.13
9	279.15	65.36
10	299.19	49.62
11	108.94	39.35
12	64.55	30.33
13	104.62	13.48
14	93.19	32.60
15	34.01	27.35
16	177.09	73.04
17	177.96	61.51
18	95.53	54.58
19	140.25	55.86
20	275.27	28.29
21	154.88	61.27
22	62.83	39.55
23	93.93	65.21
24	165.17	41.23
25	484.98	71.75
26	150.21	43.97
27	98.66	44.44

Of the 27 subwatershed in Buckbee Creek, 26 subwatersheds have impervious areas greater than 25% (Table 3-41). According to research conducted by the Center for Watershed Protection, impervious coverage of greater than 25% is indicative of severely degraded stream channels, poor water quality, poor channel condition, & poor biological communities. The remaining watersheds have impervious coverage of 13.48%. As the majority of the subwatersheds appear to have a high percentage of impervious area, the use of impervious cover to determine "hot spots" or critical area may not be an appropriate tool. It may be more useful to select subwatersheds as critical areas where there are willing partners for project implementation and/or where BMP implementation is the most cost effective. These Critical Areas are discussed in the next section, and recommendations for improving conditions within these areas are detailed in Chapter 5.

As part of the watershed planning process eight cross sections were taken at various locations within Buckbee Creek (Figure 3-25). Using the locations of these cross sections, the percent of impervious for the contributing watershed was calculated (Table 3-41). In general, the percent of impervious of the tributary watershed at each cross section is greater than 25%.

Table 3-42 Impervious Area Analysis Results by Cross Section

Cross Section	Tributary Area (acres)	% of Watershed	% Impervious
BCR XS1	389.80	8.78%	44.54%
BCR XS2	540.36	12.17%	51.38%
BCR XS3	958.01	21.57%	56.17%
BCR XS4	1168.93	26.32%	50.90%
BCR XS5	1539.71	34.66%	50.68%
BCR XS6	2805.25	63.16%	50.10%
BCR XS7	3204.66	72.15%	50.49%
BCR XS8	4441.73	100.00%	51.62%

3.17 Critical Areas

The intent of identifying Critical Areas is to focus watershed improvement efforts on areas where impairments are concentrated or relatively worse than in other areas of the watershed. Restoration, prevention, and remediation efforts in these Critical Areas are expected to achieve a greater impact than in less critical parts of the watersheds. The Critical Area analysis identified two different types of Critical Areas: Critical Subbasins and Critical Reaches, as described below. These results, and recommendations for watershed improvement, have been incorporated into the watershed Action Plan.

3.17.1 Critical Subbasins

Critical subbasins are those that have particularly strong impact on watershed resources and water quality due to the type and extent of current and planned development. These subbasins will require action to reduce the impact of existing impervious surfaces. Critical Subbasins are listed in Table 3-42 and shown on Figure 3-25 and include the following:

- Subbasins with the potential conversion of land to higher impervious land uses that would lead to the future degradation of water quality and natural resources.
- Subbasins with the highest number of water quality and flooding concerns reported by stakeholders.

Table 3-43 Critical Subbasins

Subbasin	Acres	Rationale
1	192.53	Significant water quality and flooding concerns reported by stakeholders
3	129.29	Significant water quality and flooding concerns reported by stakeholders

Subbasin	Acres	Rationale
6	121.20	Significant water quality and flooding concerns reported by stakeholders
7	317.44	Significant water quality and flooding concerns reported by stakeholders
13	104.62	Identified as supported in impervious analysis
14	93.19	Significant water quality and flooding concerns reported by stakeholders
27	98.66	Significant water quality and flooding concerns reported by stakeholders

3.17.2 Critical Reaches

Critical Reaches are those that have been impacted due to significant streambank erosion problems and to low habitat quality. These reaches will require restoration of the channel and riparian areas, which will help improve water quality. Critical Reaches are shown on Figure 3-26 include the following:

- Buckbee Creek between Yale Drive and the railroad tracks (streambank erosion)
- Buckbee Creek between Upland Drive and Harrison Avenue (channelization, concrete lined channel)
- Tributary #1 east of Ohio Parkway (channelization, concrete lined channel)

3.18 Summary and Conclusions

The Buckbee Creek watershed resource inventory and assessment provides important insight into the issues and problems in the watershed and the opportunities available for preserving and improving watershed resources. The vast majority of the impacts and impairments to watershed resources identified are the direct result of years of modification of the stream and surrounding lands as land use in the watershed changed from undeveloped to agriculture to urban. The impacts of this changing landscape on watershed resources are summarized here and actions for addressing these impacts are included in the Action Plan in Chapter 5.

It is important to identify potential causes and sources of impairment in the watershed so that preventive and restorative measures can be planned and implemented. The issues, causes and sources identified below and in Table 3-43 are based on the best professional judgment based on the watershed inventory assessment and input from the watershed stakeholders. Thus, they should be considered as potential rather than confirmed until additional sampling and surveying can be done. Table 3-43 includes those impairments, causes, and sources that are most relevant to the Watershed-Based Plan nine element requirements of the US EPA. Nonetheless, although the table does not include all of the issues and problems identified below, they all have been addressed within the Action Plan included in Chapter 5.

Water Quality
The most important water quality issues that need to be addressed include the following:

- low dissolved oxygen concentrations due to low flow and the lack of adequate stream habitat features to help oxygenate the water;
- sedimentation of stream channels within low gradient reaches, that is the result of streambank erosion and runoff from the urban landscape; and
- elevated chloride levels resulting from application of salt for snow and ice control on roads, as well as other toxic substances in the water column from urban runoff form impervious surfaces including roads and highway

Watershed Hydrology
The most important issues related to watershed hydrology that need to be addressed include the following.

- flashy hydrology (higher high flows and lower low flows), which impact a number of other watershed resources;
- poor performing detention basins;
- unmaintained, undersize and/or damaged culverts and roadside conveyance systems restricting flow in the stream channels; and
- unmaintained, undersize and/or damaged storm sewers restricting flow and causing localized flooding.

Stream Channels
The most important issues related to stream channels that need to be addressed include the following:

- streambank erosion resulting from flashy hydrology, unstable streambanks, and stormwater discharges;
- stormwater discharges from residential and municipal stormwater management systems that cause erosion of the streambanks and stream channel;
- debris buildup and obstruction within the stream channel that is the result of streambank erosion and dislodged trees and vegetation;
- improperly designed, installed or maintained streambank and stream channel armoring (gabions, riprap, etc.) that is intended to control erosion but is contributing to erosion problems; and
- channelized, concrete-lined, and incised stream channels.

Riparian Corridors
The most important riparian corridor issues that need to be addressed include the following:

- lack of riparian vegetation as the existing turf grass that is present to the water or stream bank edge destabilizes streambanks and provides no water quality or riparian habitat benefits; and
- dumping of yard waste along the stream banks and in stream channels, which smothers ground level vegetation and adds organic matter and nutrients to the water.

Natural Areas and Wetlands
The most important issues related to watershed wetlands include the following:

- lack of management and restoration plans and action to preserve and restore native habitat;
- invasive species infestations that degrade natural habitat;

- lost wetland acreage; and
- impairment of natural hydrologic patterns that support healthy wetlands resulting from stormwater discharge.

Flooding

The most important flooding issues that need to be addressed include the following:

- risk of flood damage to structures located along the waterways;
- hydrologic modification causing high flows; and
- creation of detention and retention areas including wetlands and depressional storage.

Land Use

The most important land use issues that need to be addressed include the following:

- conversion of vacant, agricultural, or open land to urban uses, which increases impervious surface area and impacts water quality and runoff volume; and
- redevelopment of existing developed land to other land uses with greater impervious surface area and/or higher pollutant loading rates;

Table 3-44 Watershed Impairments, Causes and Sources

Impairment	Causes	Sources
Water Quality	Total suspended solids/sedimentation and siltation	In channel erosion caused by streambank modification and destabilization
		Urban runoff/storm sewers
		Construction sites
		Streets, highway and bridge runoff
Water Quality	Nutrients – phosphorus and nitrogen	Urban runoff/storm sewers
		Soil erosion
		Agricultural activities/golf courses
		Improper disposal of wastes (yard waste, pet waste, etc)
		Leaking septic systems
Water Quality	Low dissolved oxygen (elevated biological oxygen demand & chemical oxygen demand)	Flow alteration (low flow)
		Habitat modifications
		Urban runoff/storm sewers
		Improper disposal of wastes (yard waste, pet waste, etc)
Water Quality	Salinity/chlorides/total dissolved solids	Urban runoff/storm sewers
		Road salt storage and use
Habitat degradation	Hydromodification and flow alterations	Urban runoff/storm sewers
		Loss of riparian buffer
		Loss of floodplain, wetlands, and depressional storage
		Modification to stream flow regime
		Development
		Habitat modifications
Habitat degradation	Lack of instream habitat	Unstable streambanks
		Channelization
		Habitat modifications
Habitat degradation	Loss of riparian buffer	Development
		Inappropriate land management
		Unstable streambanks

Impairment	Causes	Sources
		Habitat modifications
Increased stream flows	Increased rate and volume or runoff	Development
		Loss of floodplain, wetlands, and depressional storage
		Poorly functioning/undersized detention
Increased stream flows	Loss of floodplain, wetlands, and depressional storage	Draining/filing of floodplain, wetlands, and depressional storage
		Development
Flood damage	Past encroachment on floodplain	Past floodplain development
Flood damage	Undersize/improperly maintained infrastructure (storm sewers, culverts, detention, etc)	Development
		Lack of infrastructure maintenance

0 8,500 17,000
Feet

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Legend

Buckbee Creek Watershed
Streams & Flowlines
Winnebago County

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Winnebago County
Watershed Planning

Buckbee Creek -
General Location of Watershed

PROJECT NO: 11-0174		SHEET NO:
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CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

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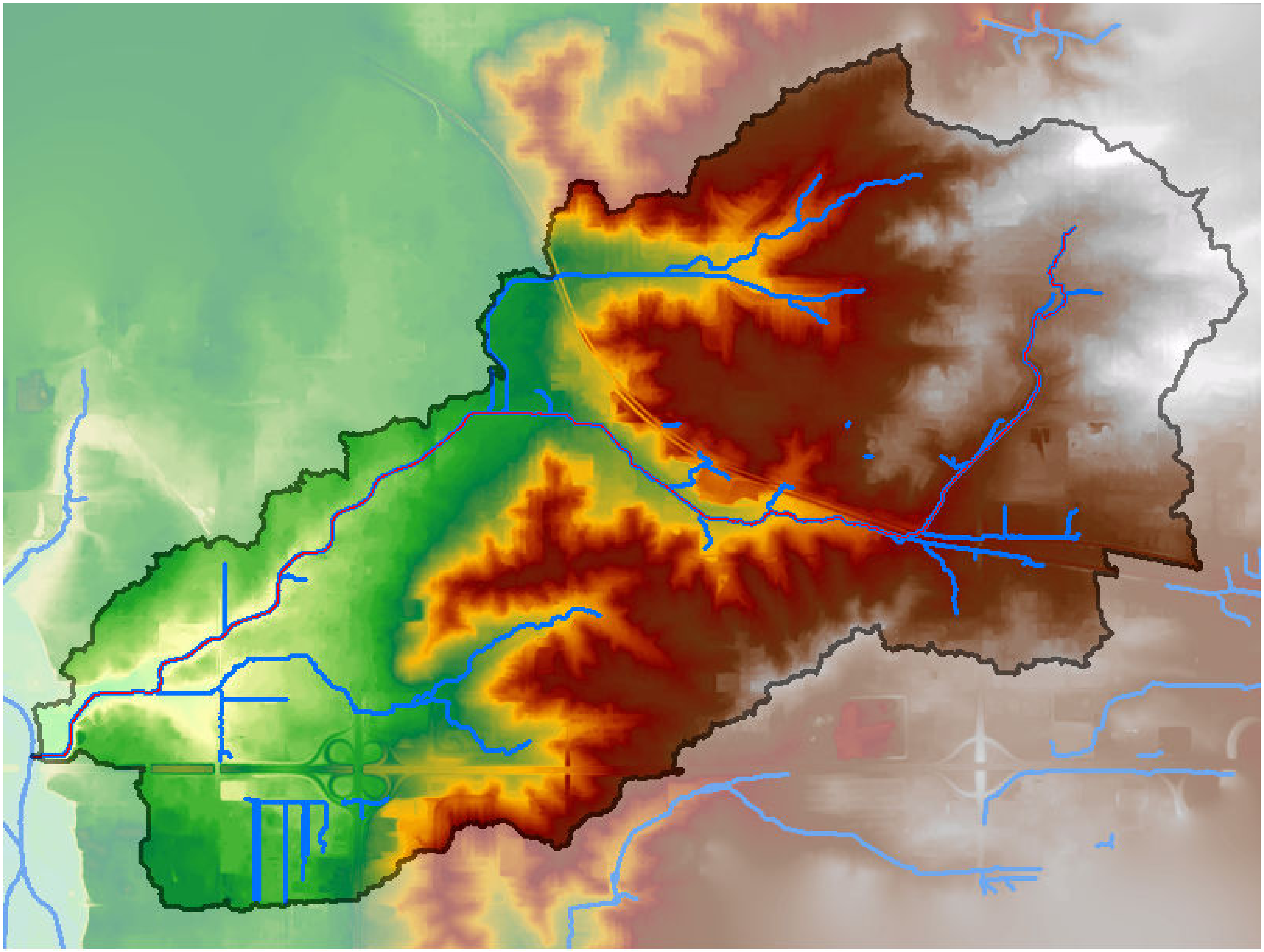

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Feet

Legend

Streams & Flowlines

Buckbee Creek Mainstem

DEM

High : 912.121

Low : 682.277

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Winnebago County Watershed Planning

Buckbee Creek - Digital Elevation Model (DEM)

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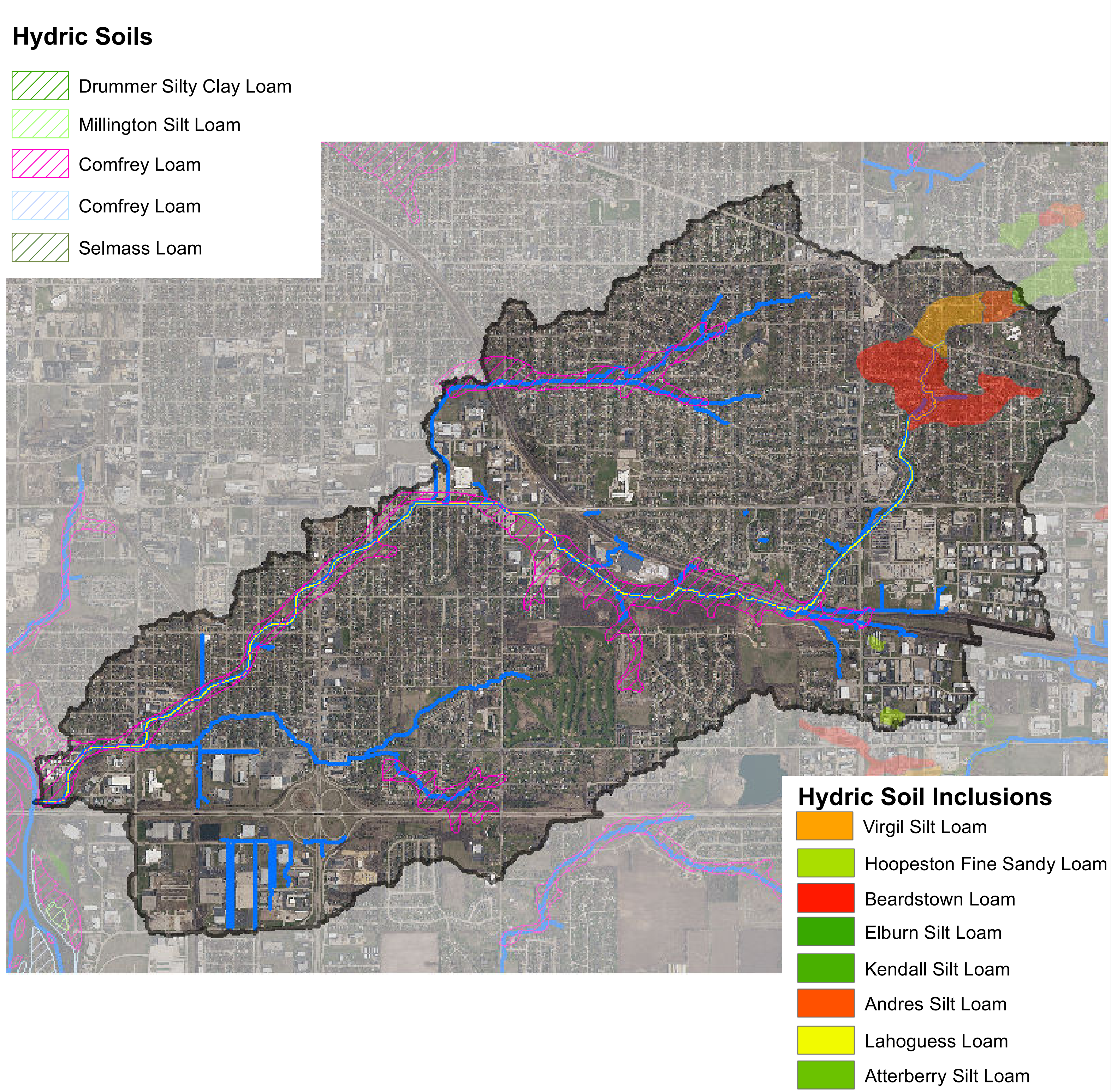

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Feet

Legend

Buckbee Creek Mainstem

Streams & Flowlines

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Buckbee Creek -
Hydric Soils &
Hydric Soil Inclusions

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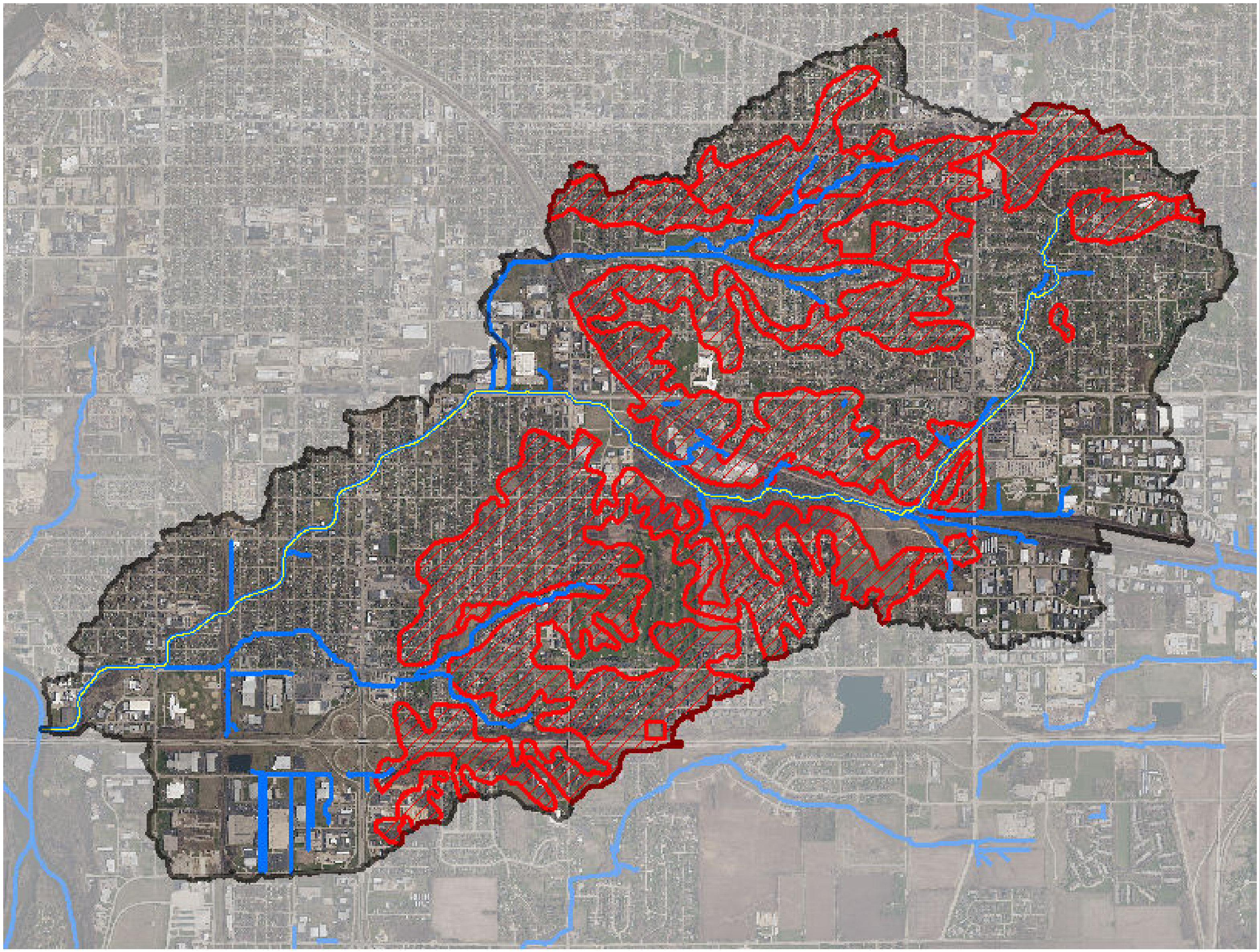

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Legend

Buckbee Creek Mainstem

Streams & Flowlines

Highly Erodible Soils

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Winnebago County Watershed Planning

Buckbee Creek - Highly Erodible Soils

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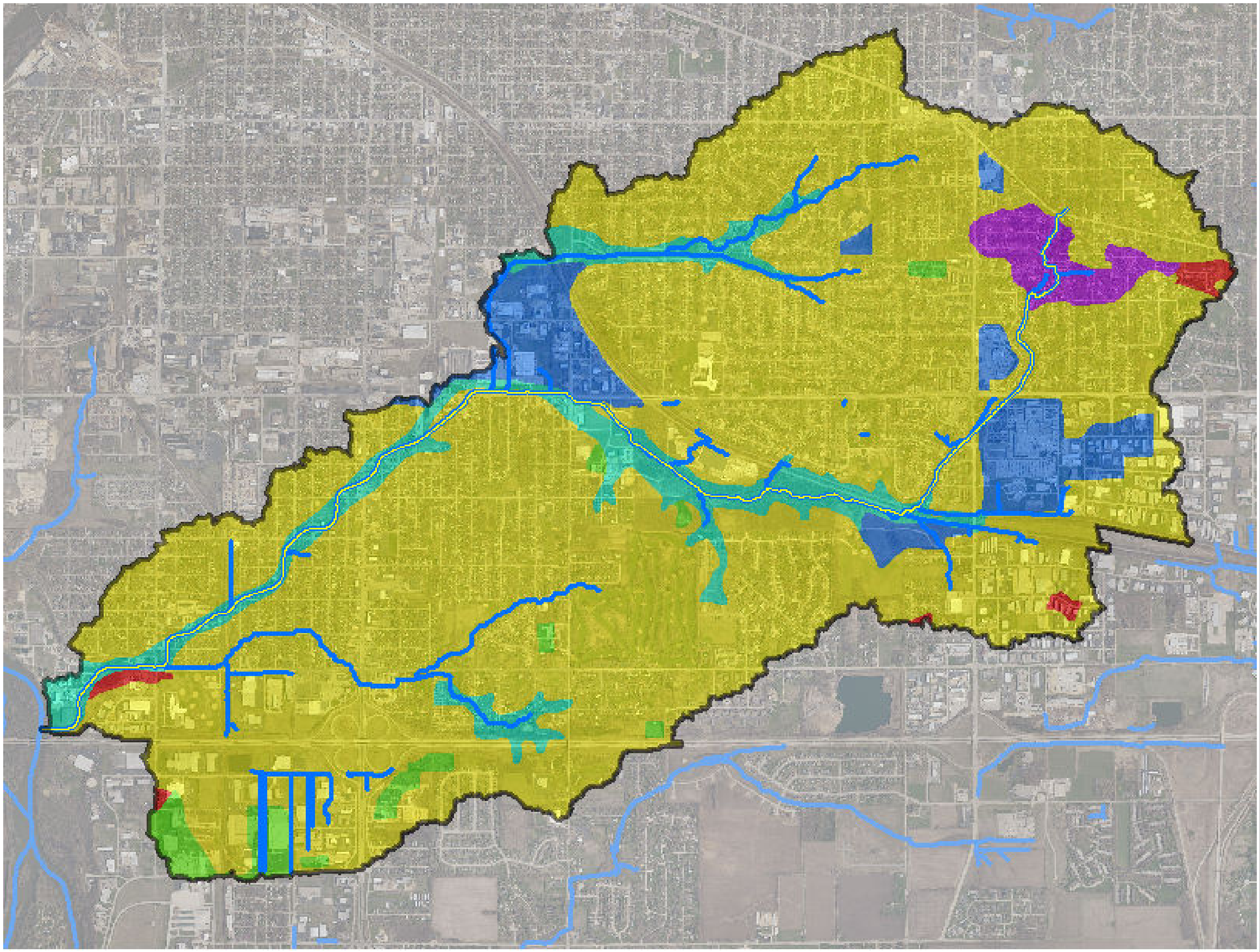

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Feet

Legend
Buckbee Creek Mainstem
Streams & Flowlines

Hydrologic Soil Groups
A
B
B/D
C
C/D
Water/ Gravel/ Quarry/ Urban Land

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Winnebago County Watershed Planning

Buckbee Creek - Hydrologic Soil Groups

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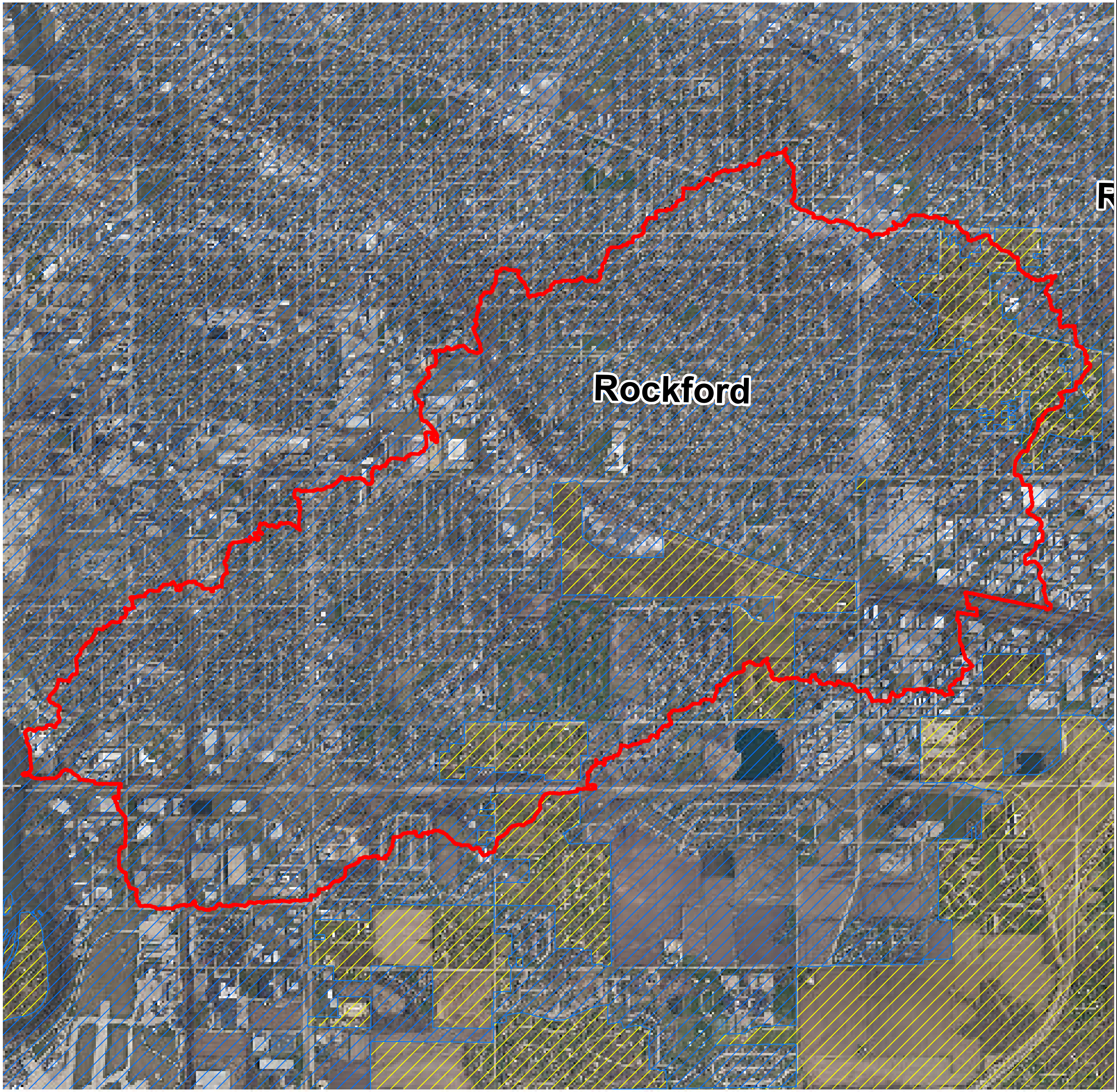

0 1,500 3,000

Feet

N S E W

Legend

- Cherry Valley
- Rockford
- Unincorporated Winnebago County
- Buckbee Creek

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Winnebago County Watershed Planning

Buckbee Creek - Jurisdictions

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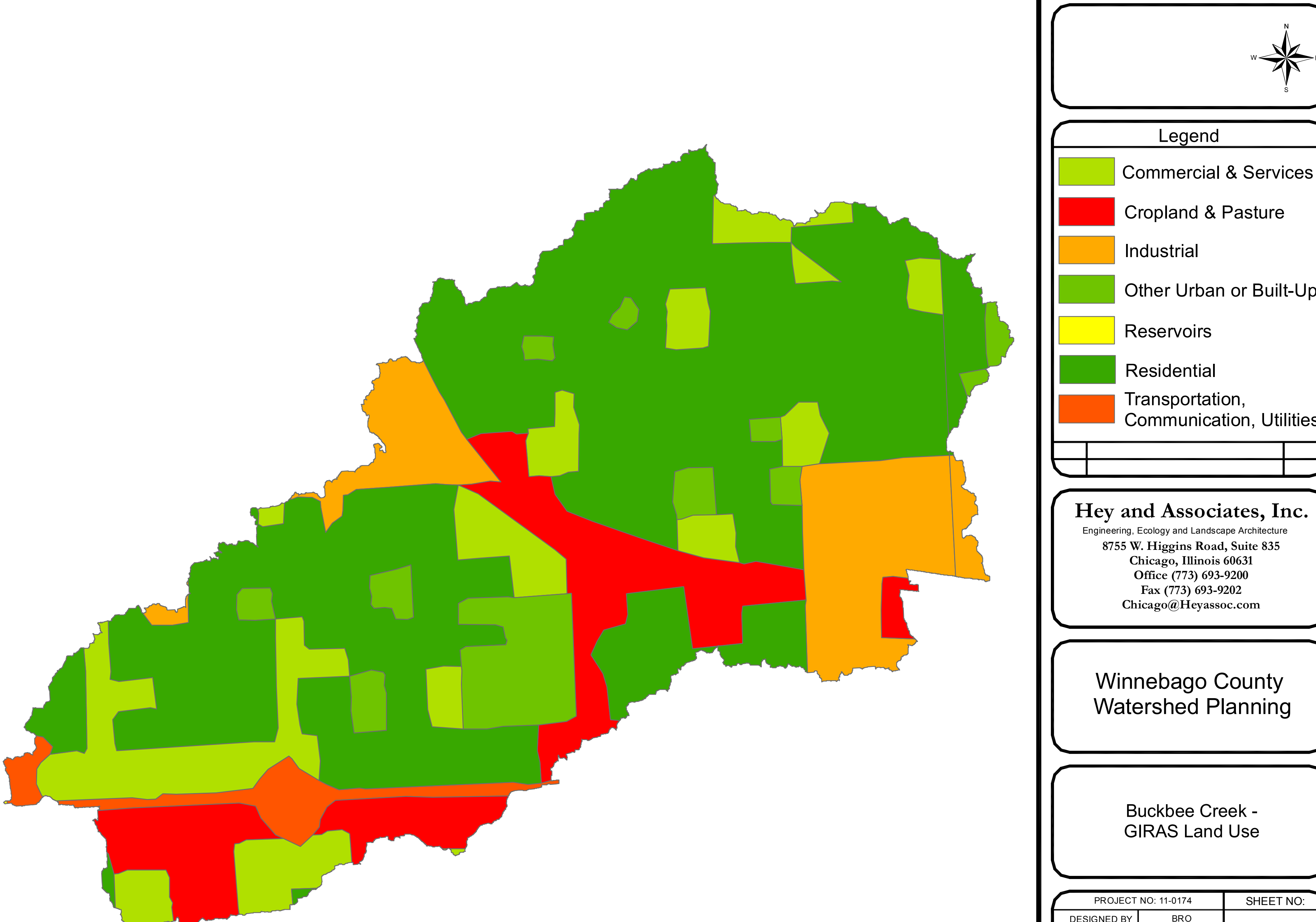

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Winnebago County Watershed Planning

Buckbee Creek - GIRAS Land Use

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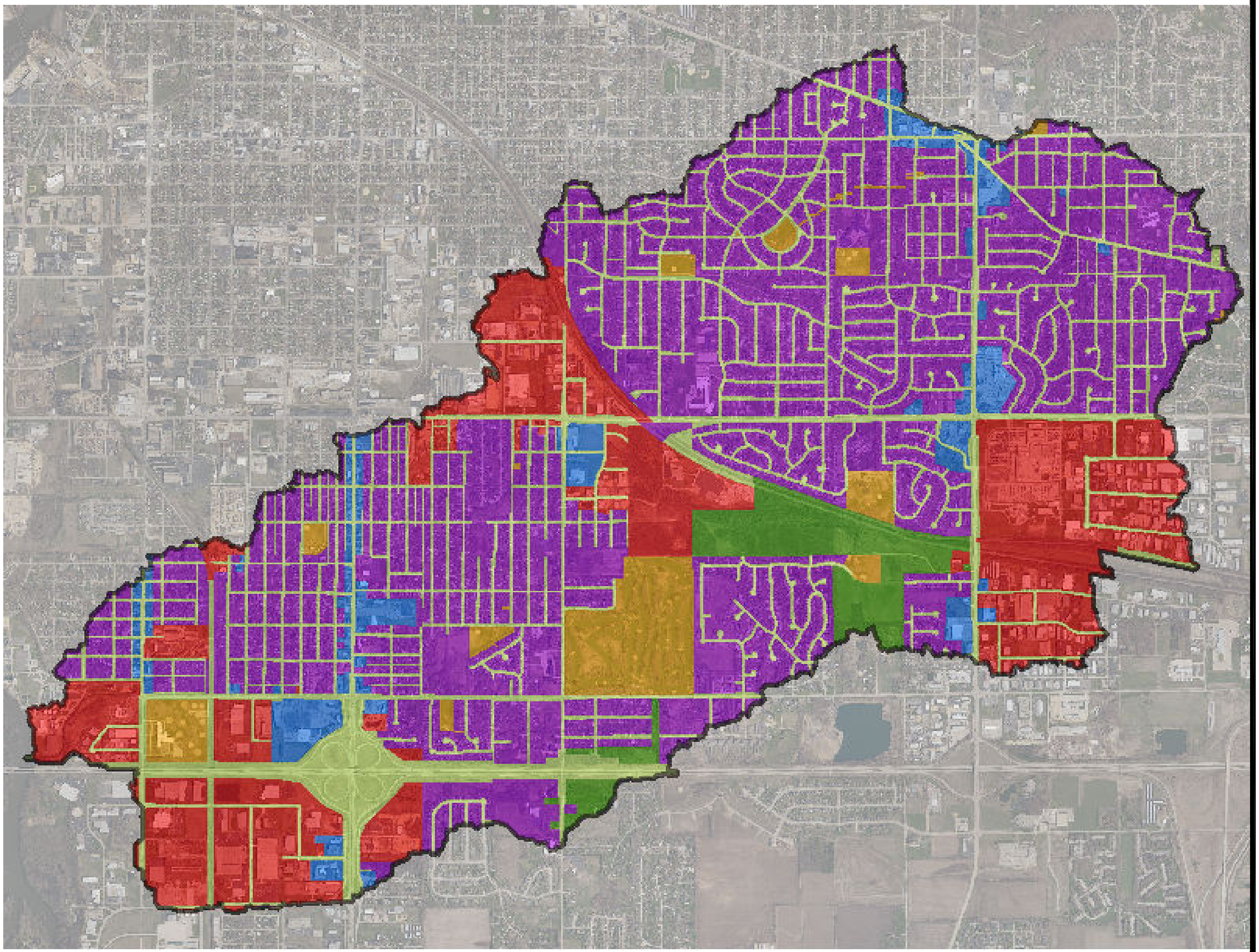

0 1,500 3,000
Feet

N S E W

Legend

- Agriculture
- Commercial
- Industrial
- Publicly Owned Land/ Parks/Rec. Areas
- ROW
- Residential

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Winnebago County Watershed Planning

Buckbee Creek - Existing Land Use

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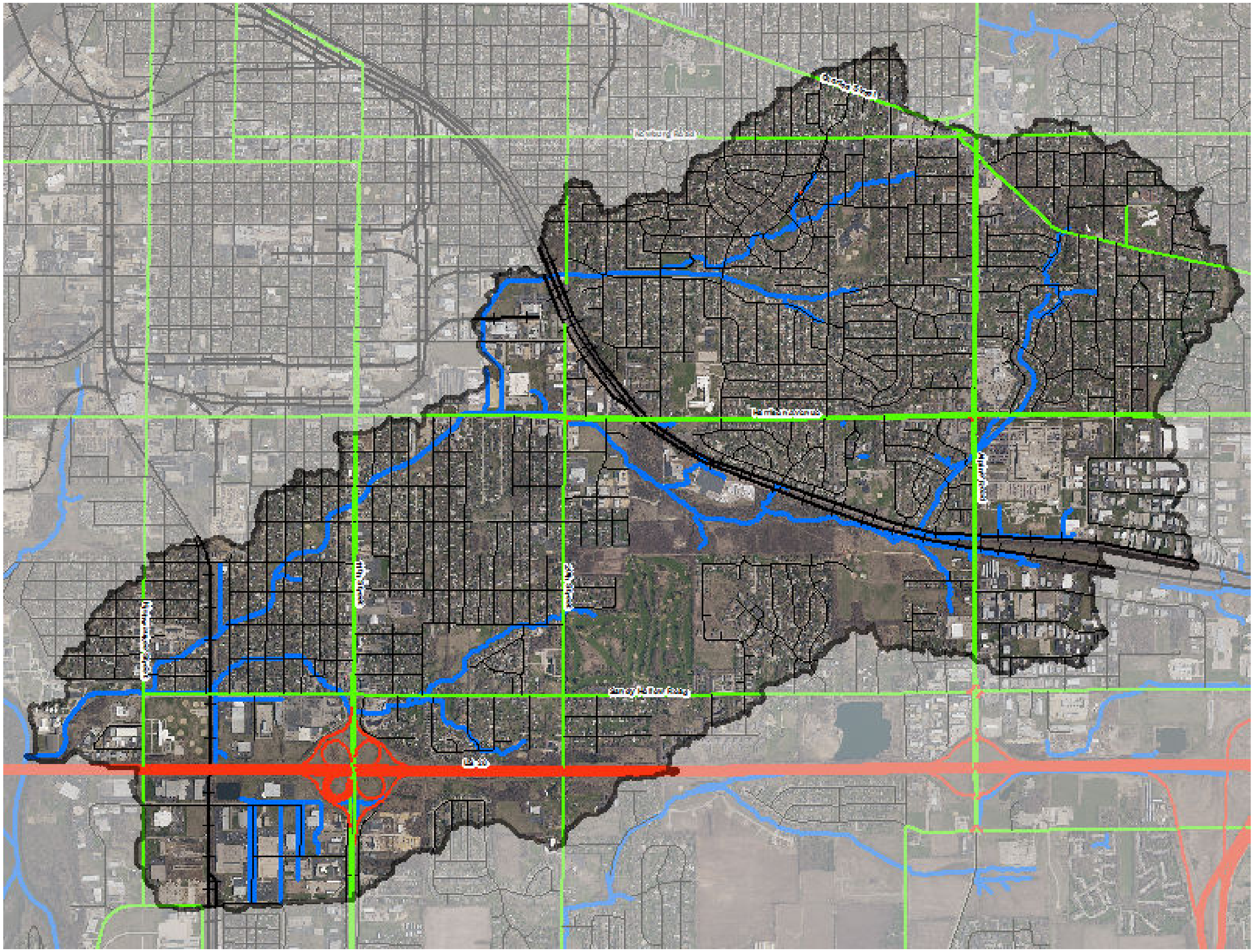

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Feet

N
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Legend

- Streams & Flowlines
- Local Road
- Secondary or Minor Highway
- Primary or Major Highway
- Railroad

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Buckbee Creek - Transportation Network

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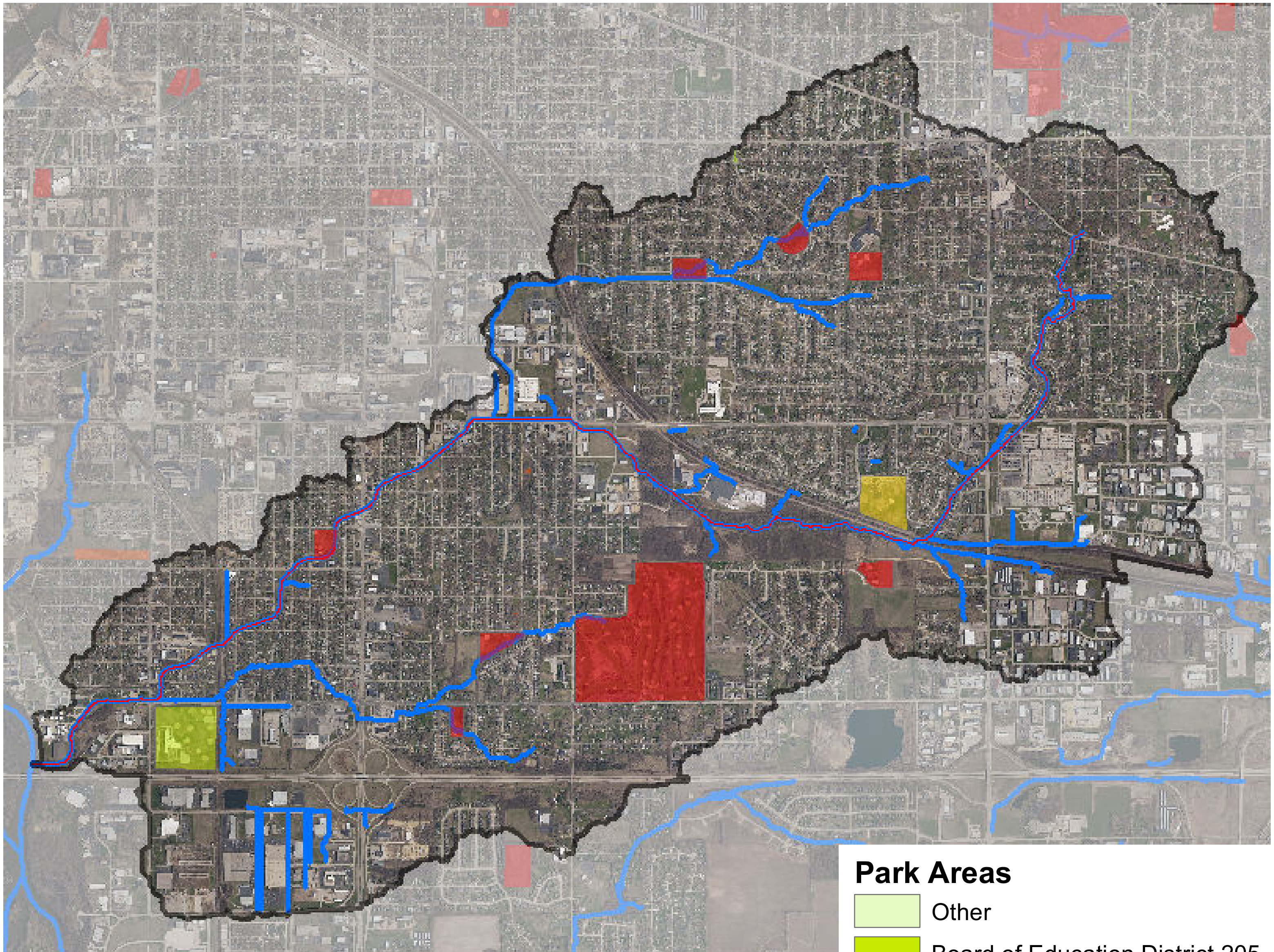

Park Areas

- Other
- Board of Education District 205
- City of Rockford
- Rockford Park District
- School District

0 1,500 3,000
Feet

N W E S

Legend

- Buckbee Creek Mainstem
- Streams & Flowlines

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Winnebago County Watershed Planning

Buckbee Creek - Rockford Park District Lands

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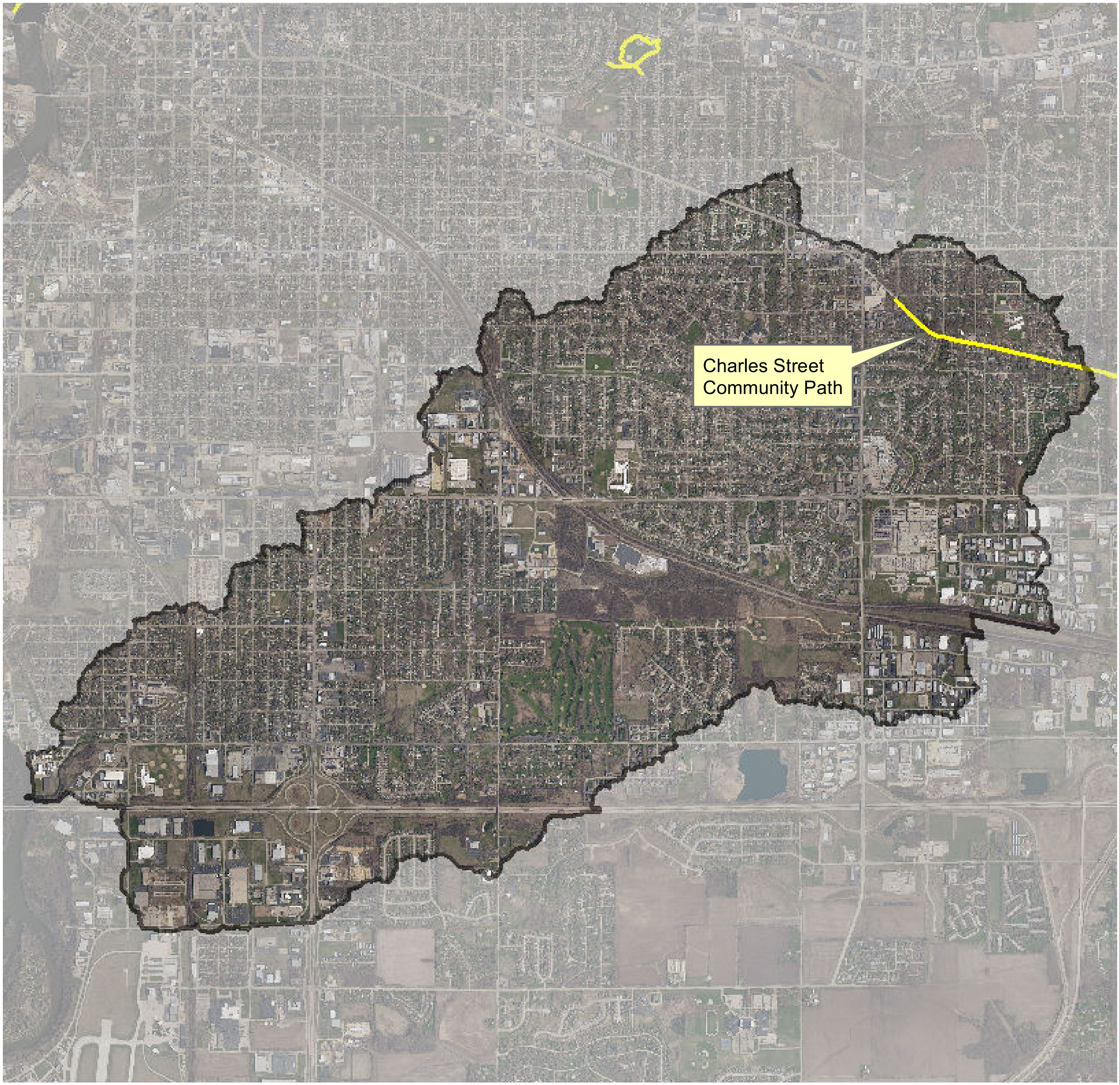

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Feet

N W E S

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Winnebago County
Watershed Planning

Buckbee Creek - Trails

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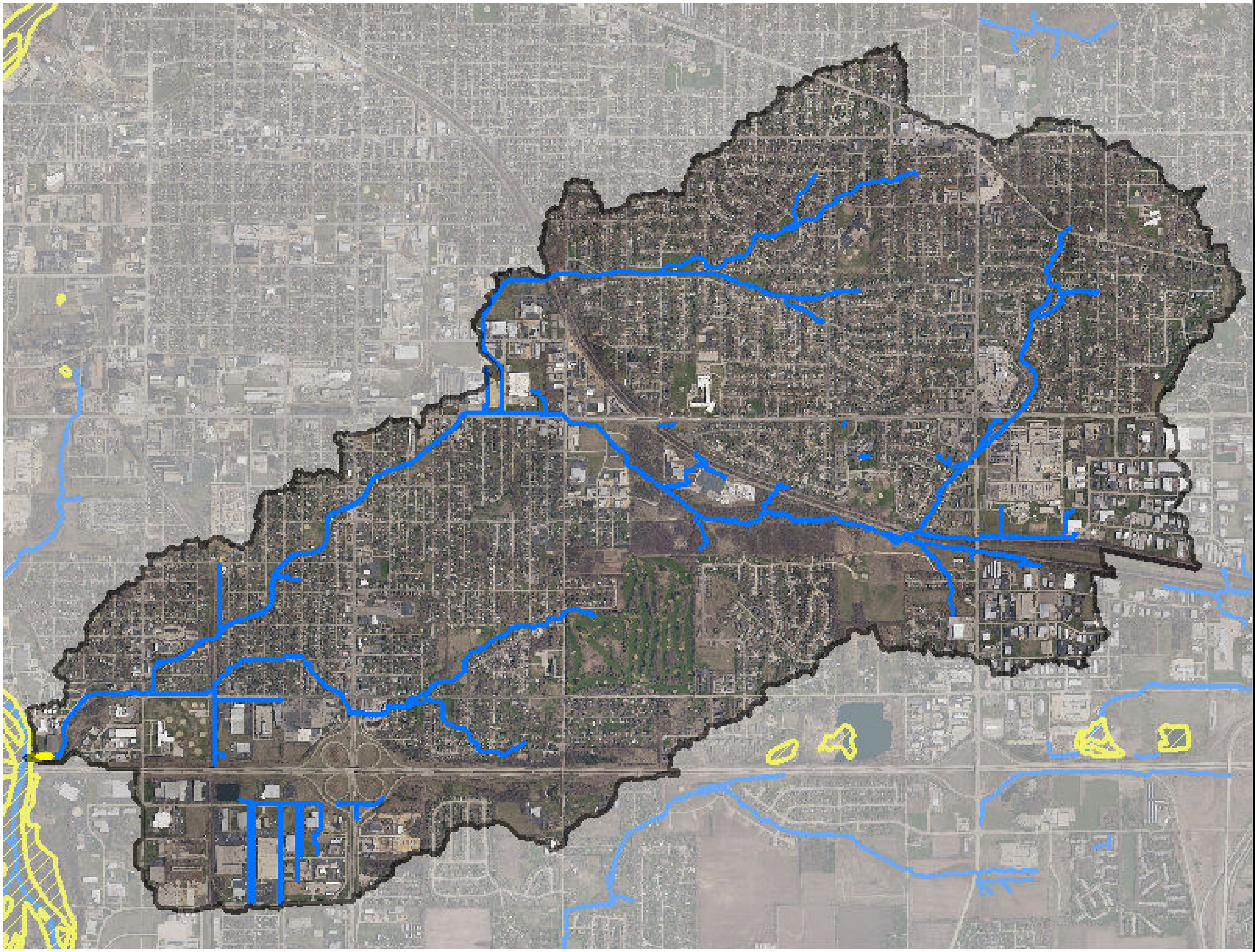

Legend

Streams & Flowlines

NWI Wetlands

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Buckbee Creek - NWI Wetlands

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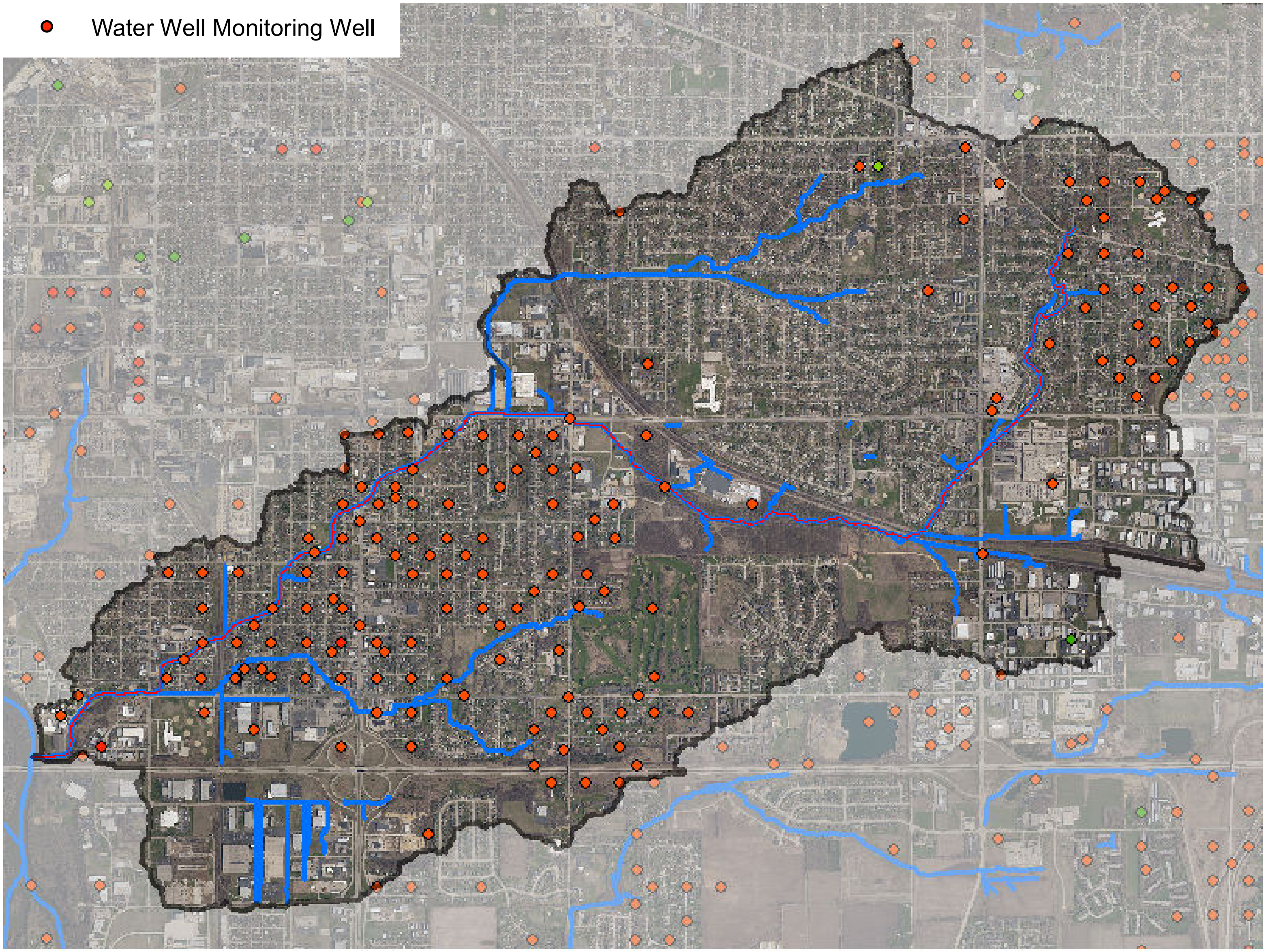
ISGS Wells

- Other
- Engineering Test
- Water Well
- Water Well Monitoring Well



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Feet

Legend
Buckbee Creek Mainstem
Streams & Flowlines

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Winnebago County Watershed Planning

Buckbee Creek - Illinois State Geological Survey Wells

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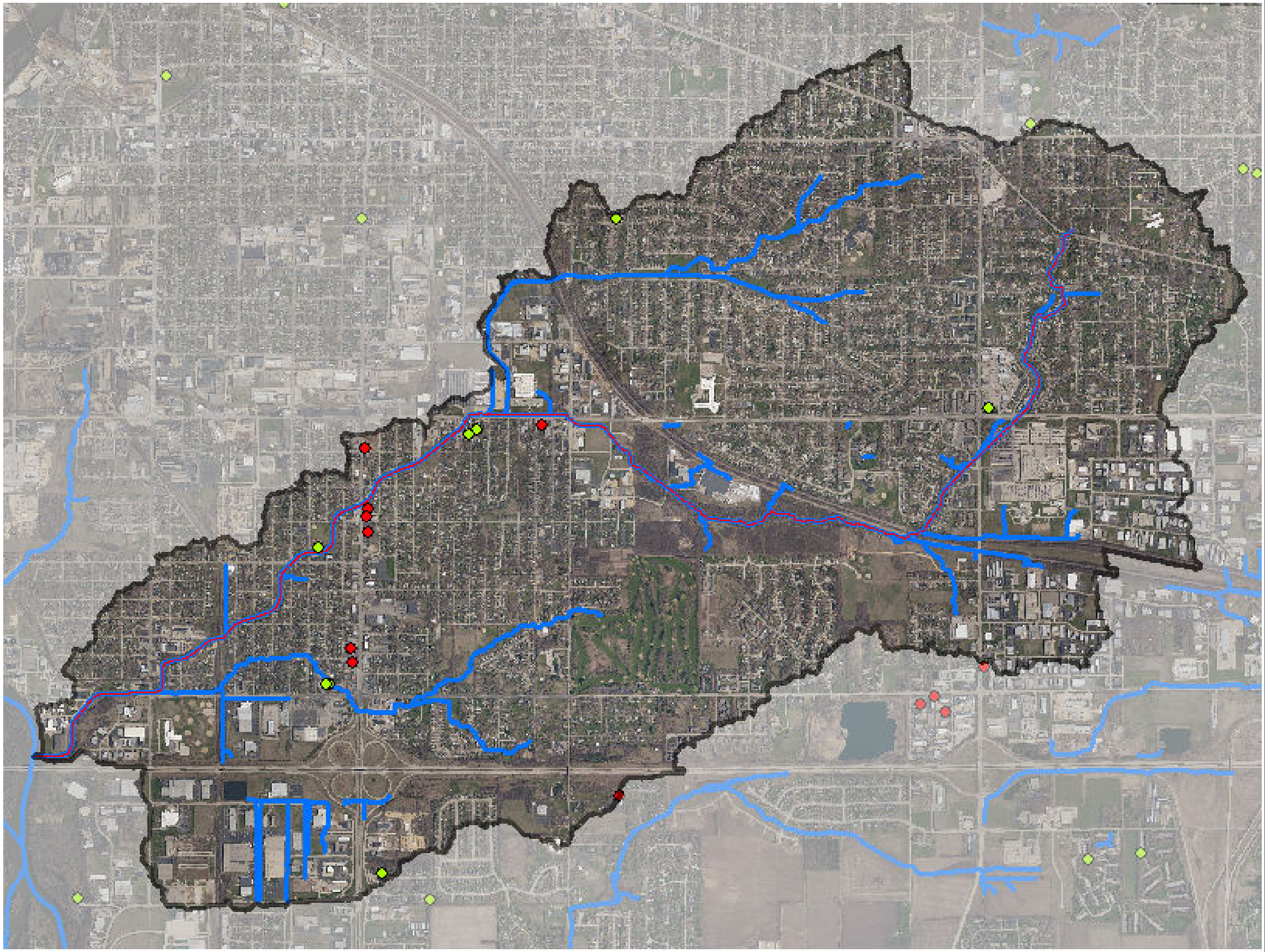

Legend

- Community Water Wells
- Non-Community Water Wells
- Buckbee Creek Mainstem
- Streams & Flowlines

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Winnebago County Watershed Planning

Buckbee Creek - IDH Community Wells

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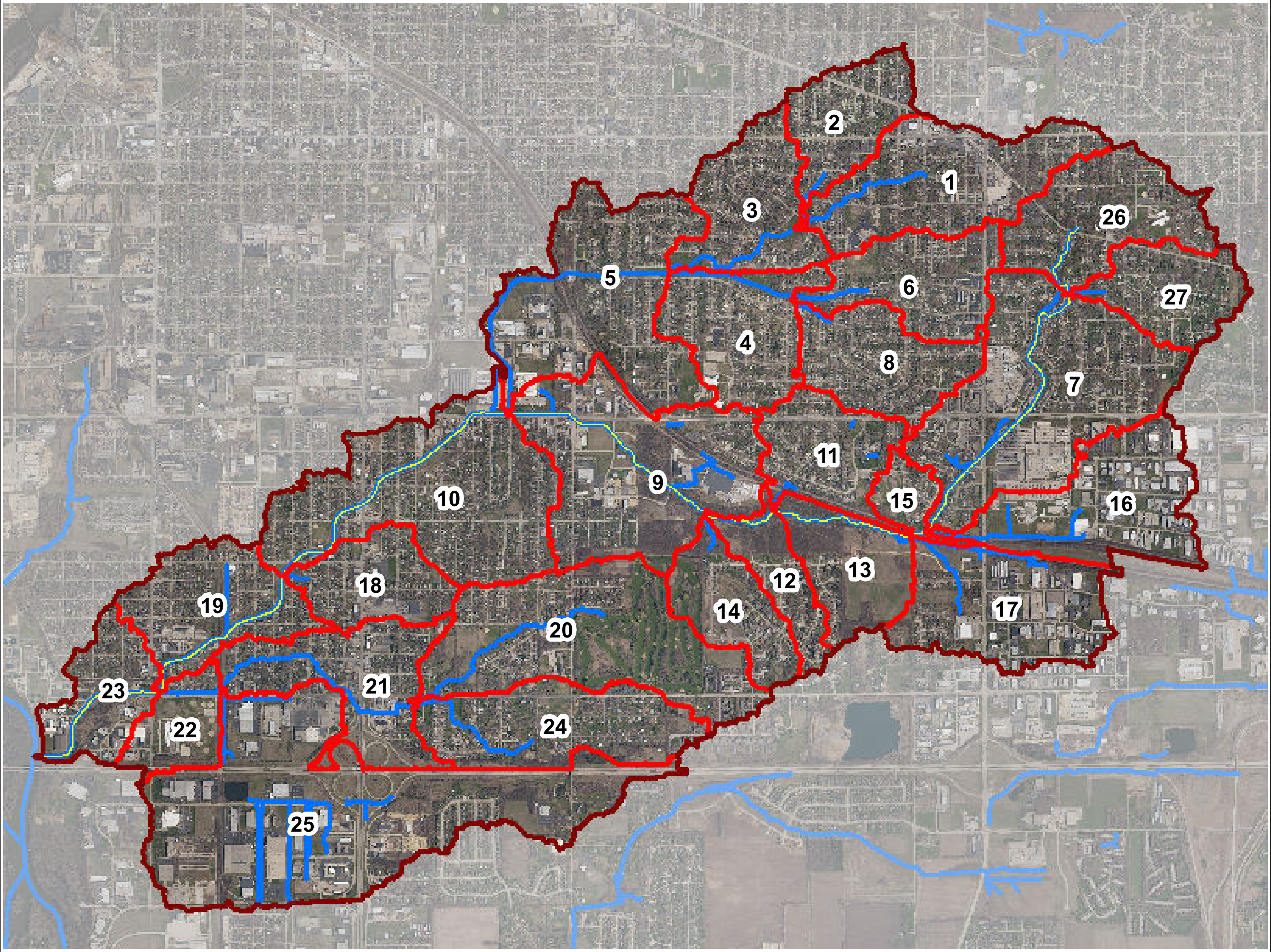

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Legend

Subbasins
Buckbee Creek Mainstem
Streams & Flowlines

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Winnebago County Watershed Planning

Buckbee Creek - Subbasins

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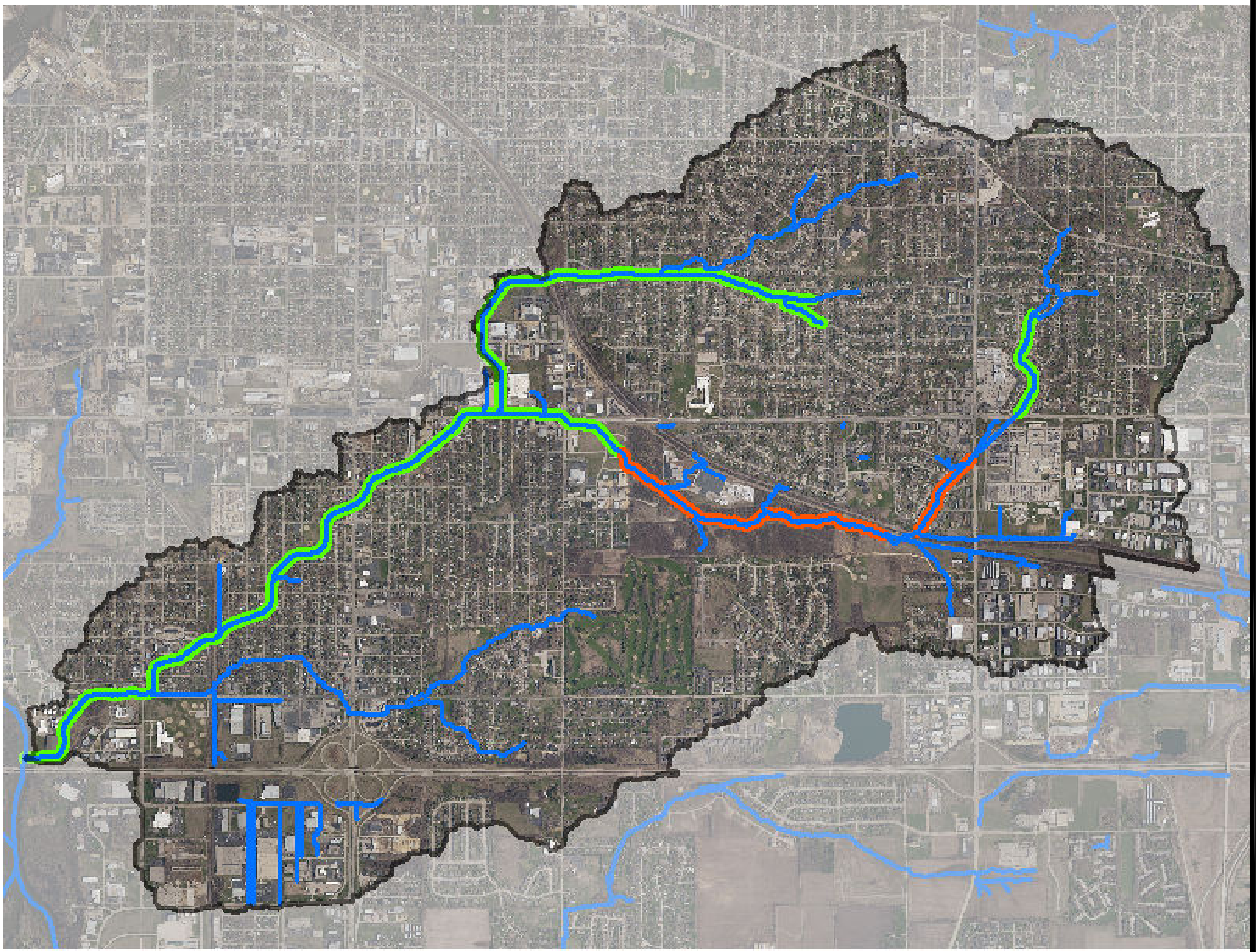

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Winnebago County Watershed Planning

Buckbee Creek - Areas with Significant Channelization

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	3-16
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

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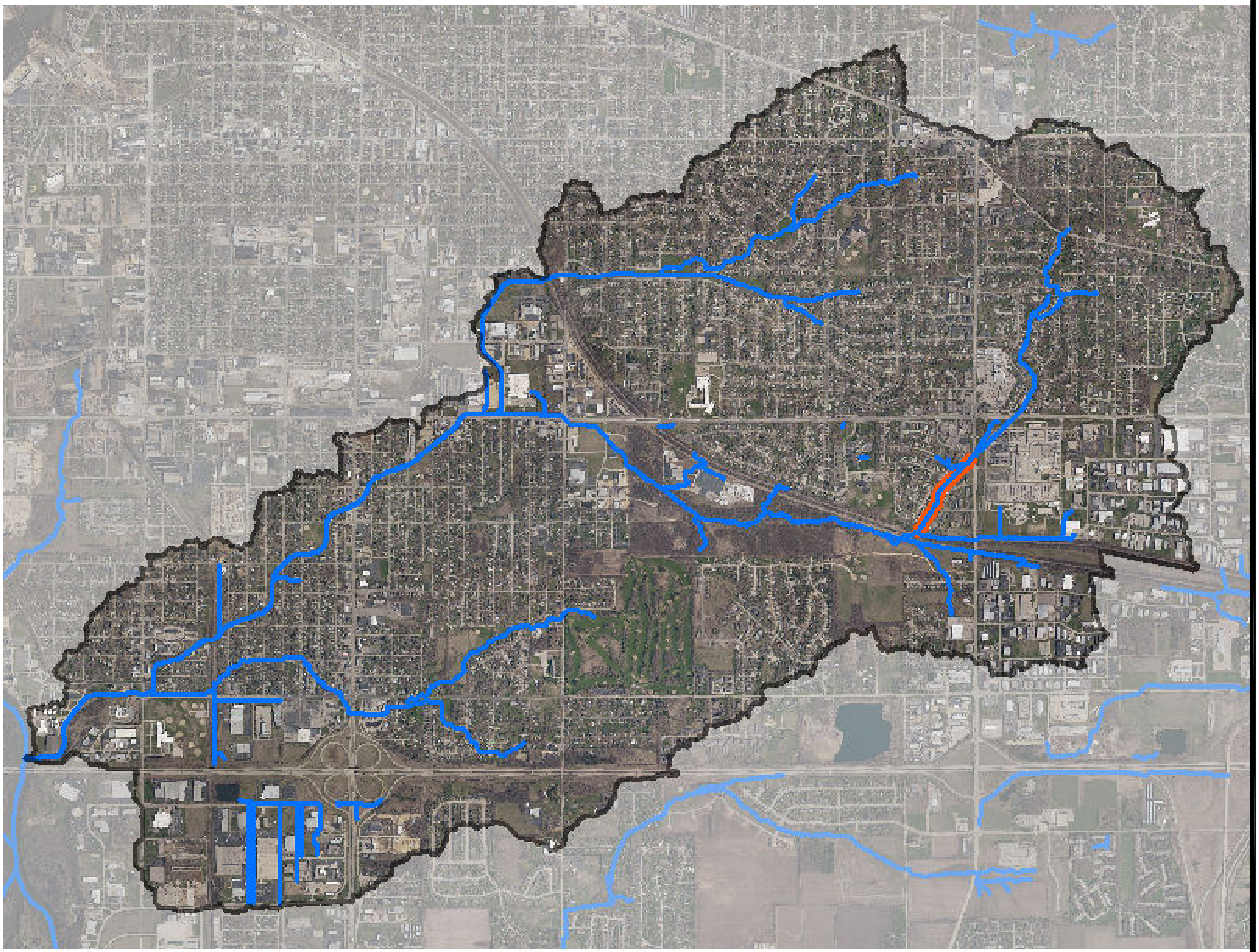

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Legend

- Streams & Flowlines
- Hydromodification

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Winnebago County Watershed Planning

Buckbee Creek - Areas with Significant Hydromodification

PROJECT NO: 11-0174		SHEET NO:
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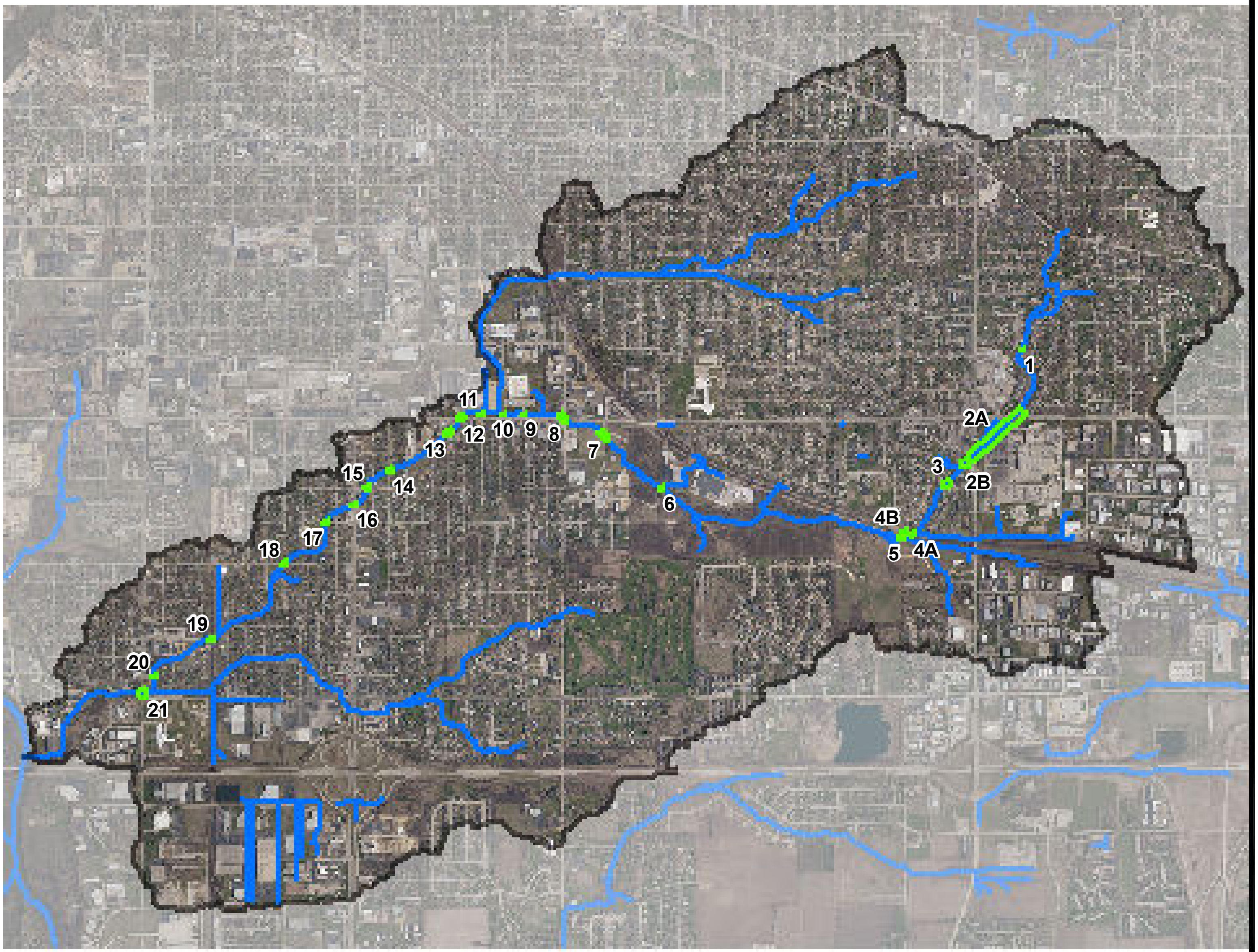

Legend

- Streams & Flowlines
- Surveyed Structures

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Winnebago County Watershed Planning

Buckbee Creek - Surveyed Hydraulic Structures

PROJECT NO: 11-0174		SHEET NO:
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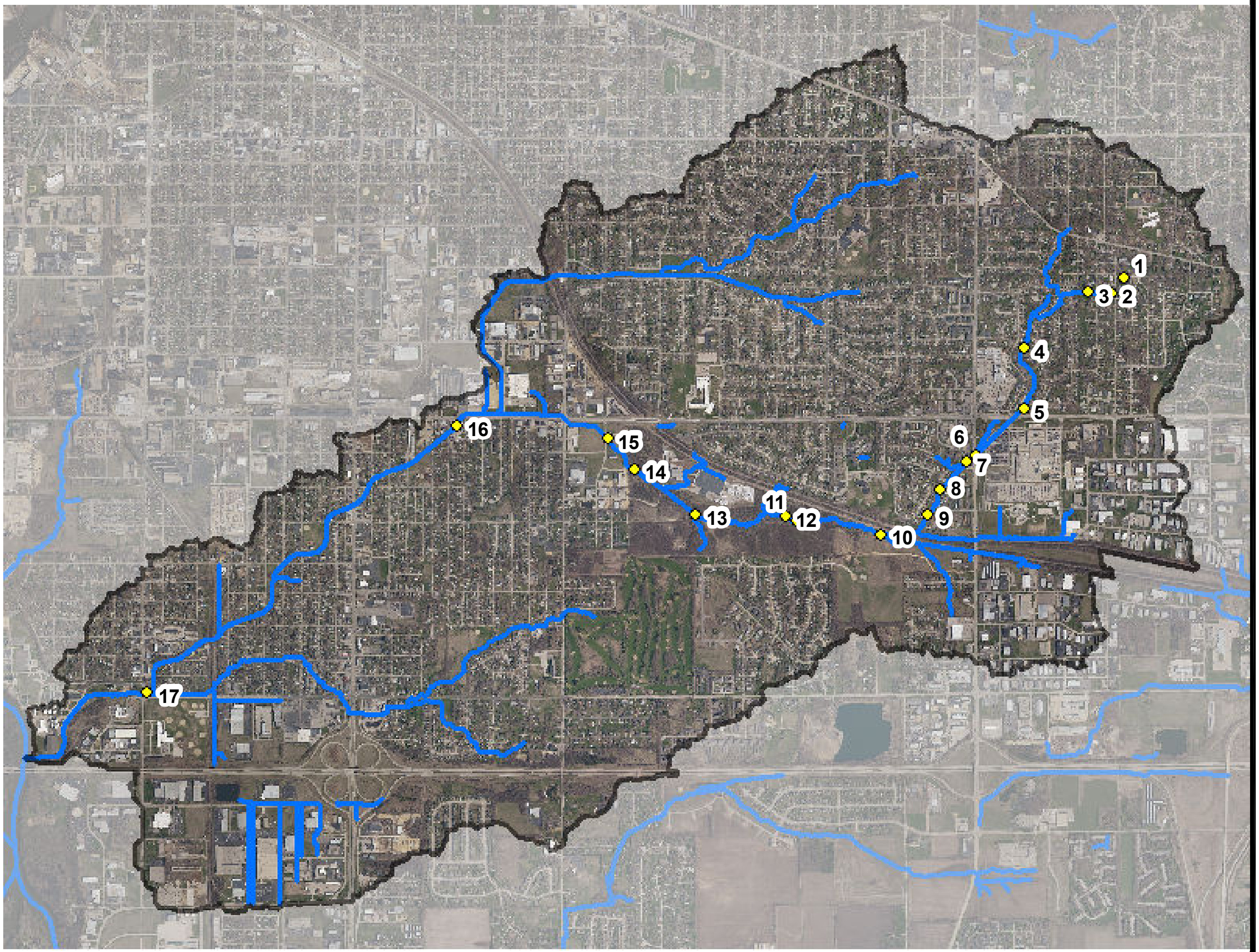

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Streams & Flowlines

RBP Sites w/ Station Number

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Winnebago County Watershed Planning

Buckbee Creek - Instream and Riparian Habitat Assessment Sites

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	3-19
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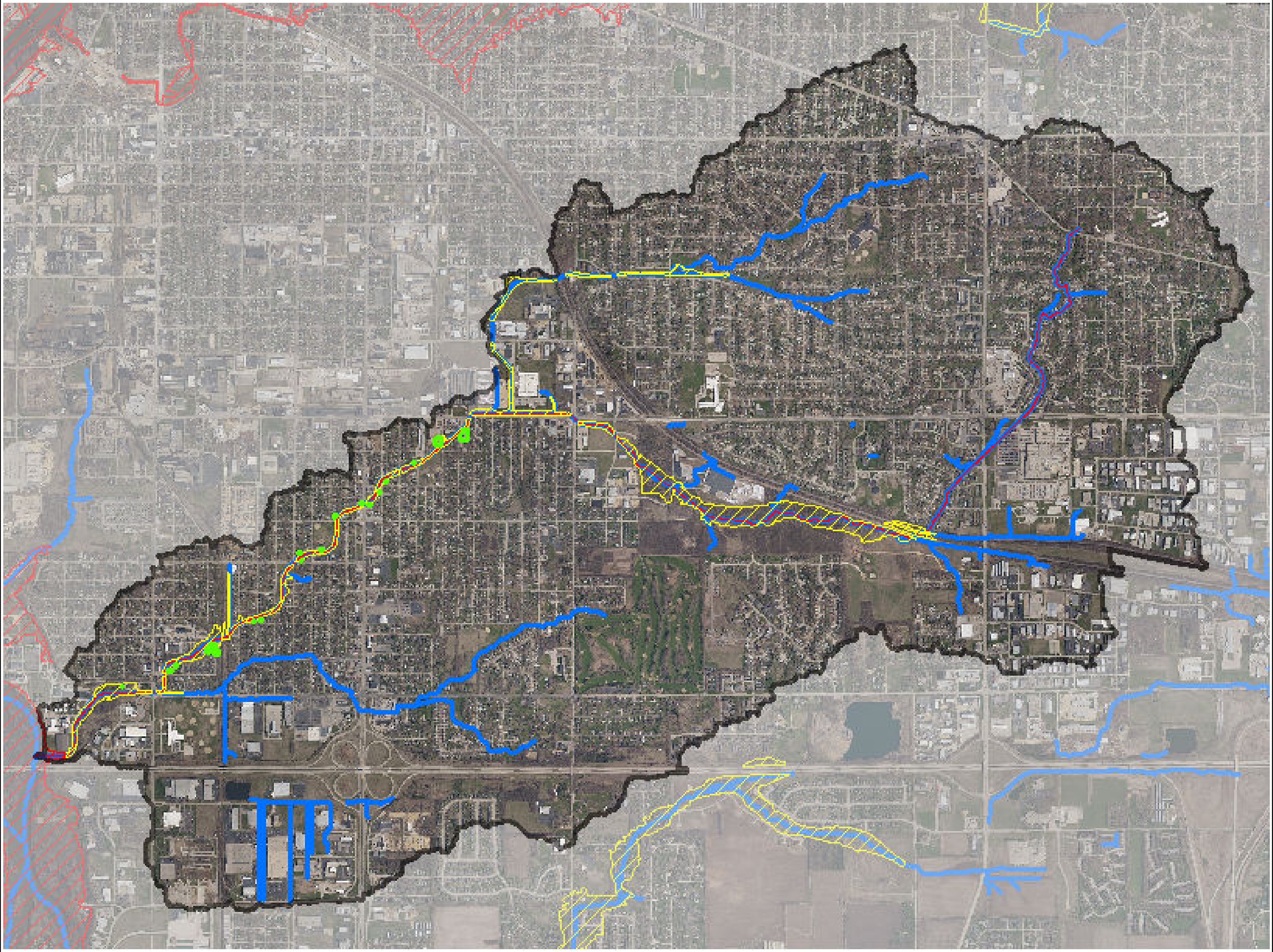

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- Zone AE Floodplain
- Zone A Floodplain
- Buckbee Creek Mainstem
- Streams & Flowlines
- Inundated Structures

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Winnebago County Watershed Planning

Buckbee Creek - FEMA Floodplain

PROJECT NO: 11-0174		SHEET NO:
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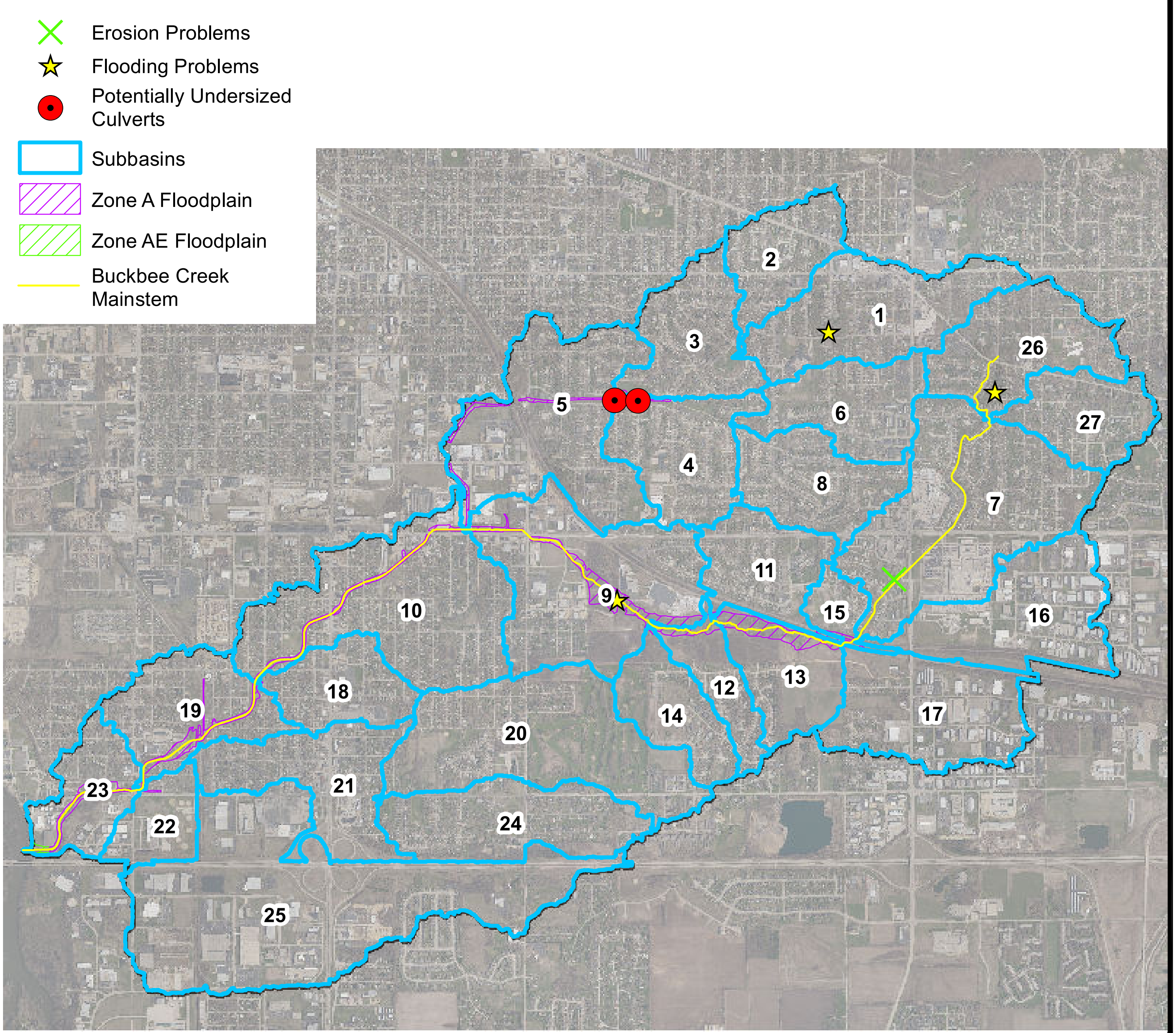

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Winnebago County
Watershed Planning

Buckbee Creek -
Flooding and Drainage Problems

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	3-21
DRAWN BY	BRO	
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APPROVED BY	JAW	
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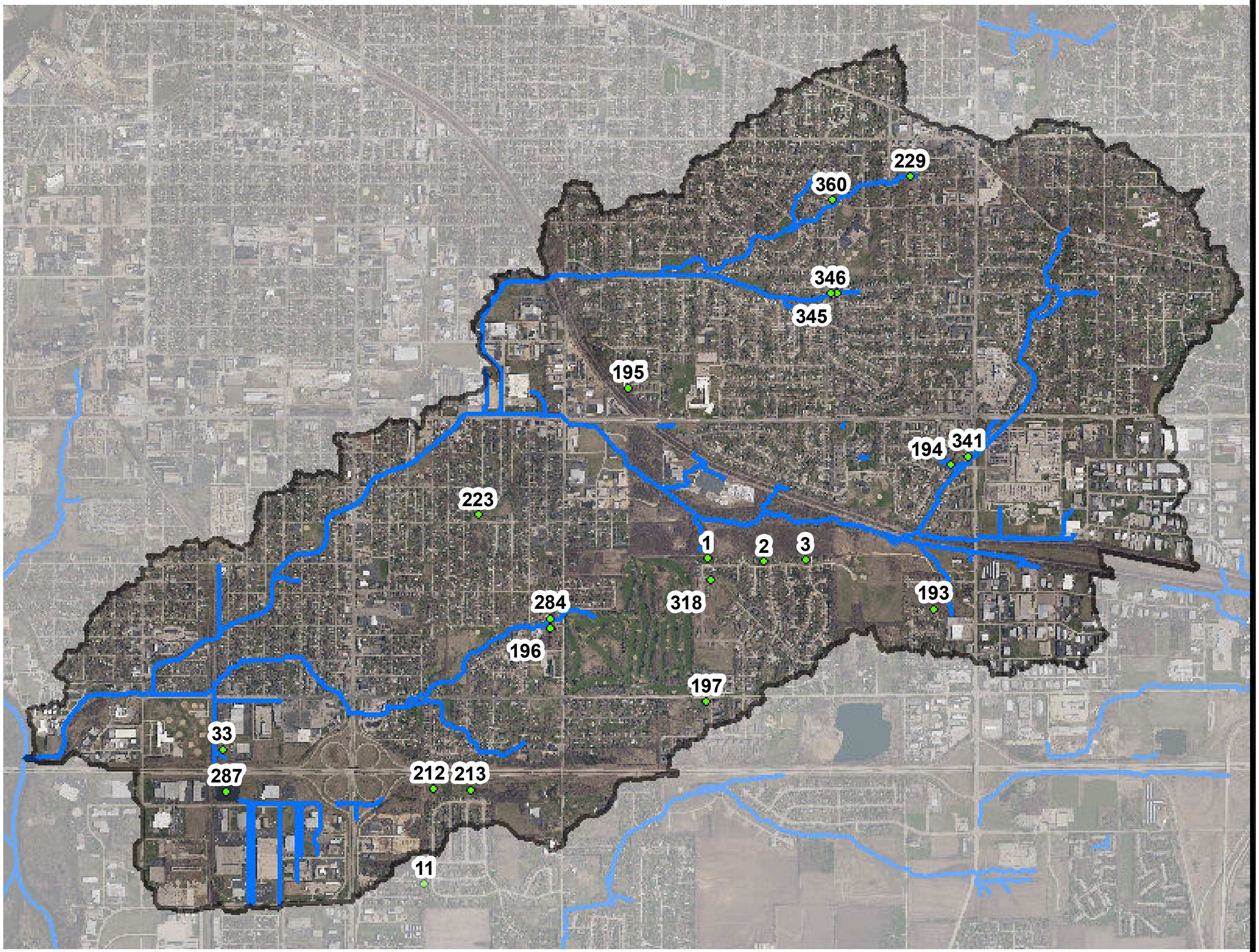

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Streams & Flowlines

Basins w/ ID Number

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Winnebago County
Watershed Planning

Buckbee Creek -
Existing Detention
Facilities (Rockford)

PROJECT NO: 11-0174		SHEET NO:
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APPROVED BY	JAW	
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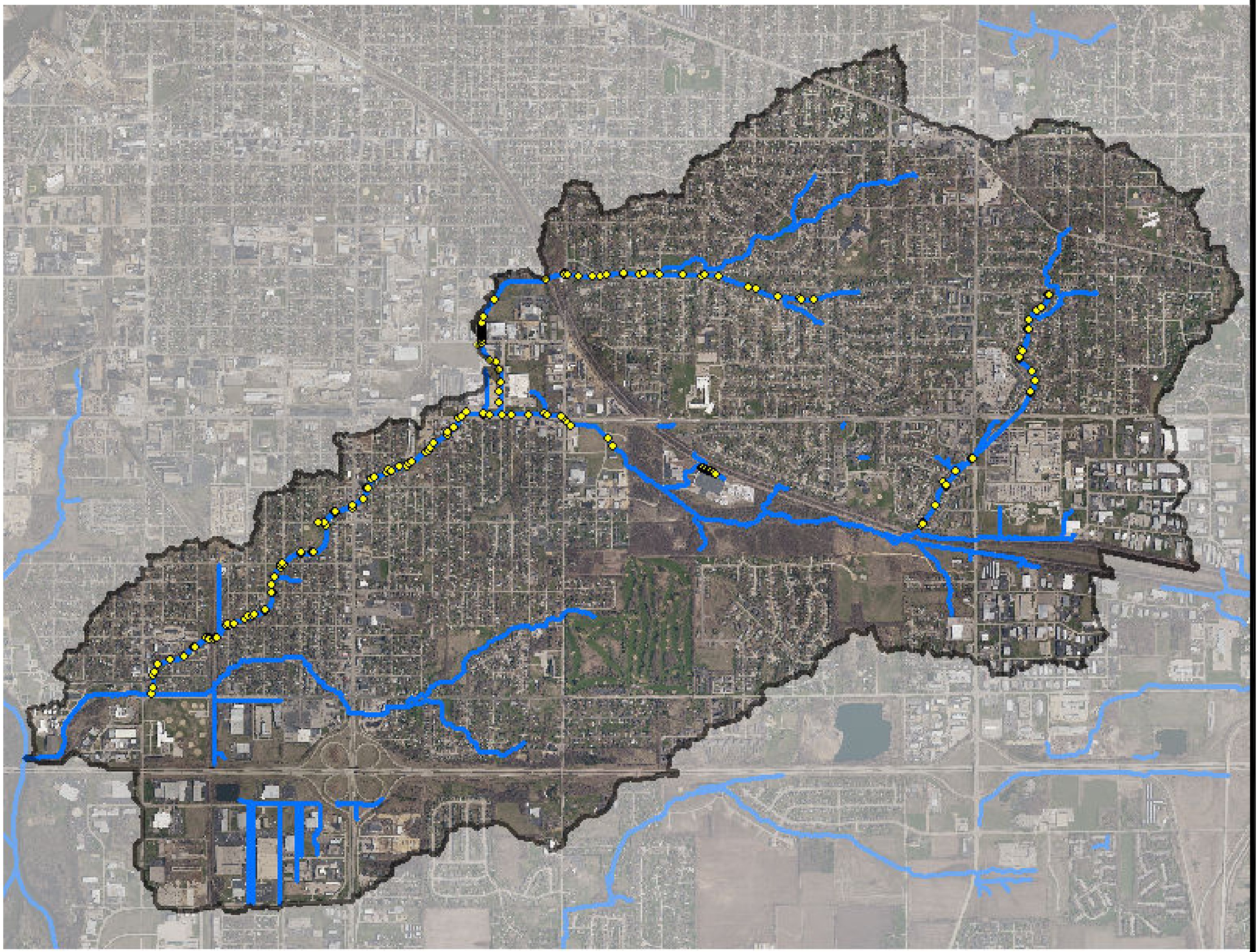

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Streams & Flowlines

Outfalls

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Winnebago County Watershed Planning

Buckbee Creek - Stormsewer Outfalls (Rockford)

PROJECT NO: 11-0174		SHEET NO:
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APPROVED BY	JAW	
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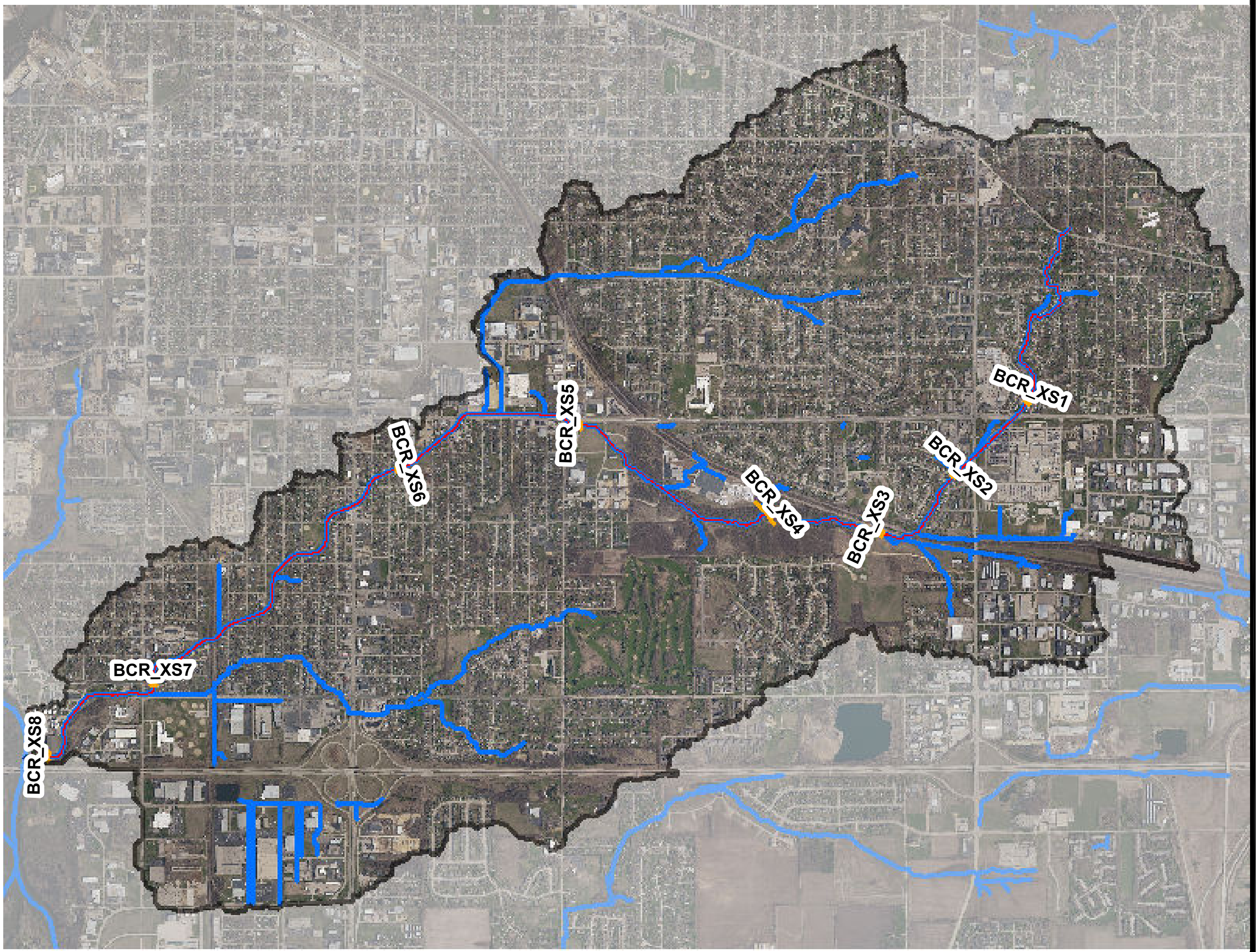

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Legend

- Streams & Flowlines
- Buckbee Creek Mainstem
- Cross Section Locations

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Winnebago County
Watershed Planning

Buckbee Creek - Surveyed
Cross Section Locations

PROJECT NO: 11-0174		SHEET NO:
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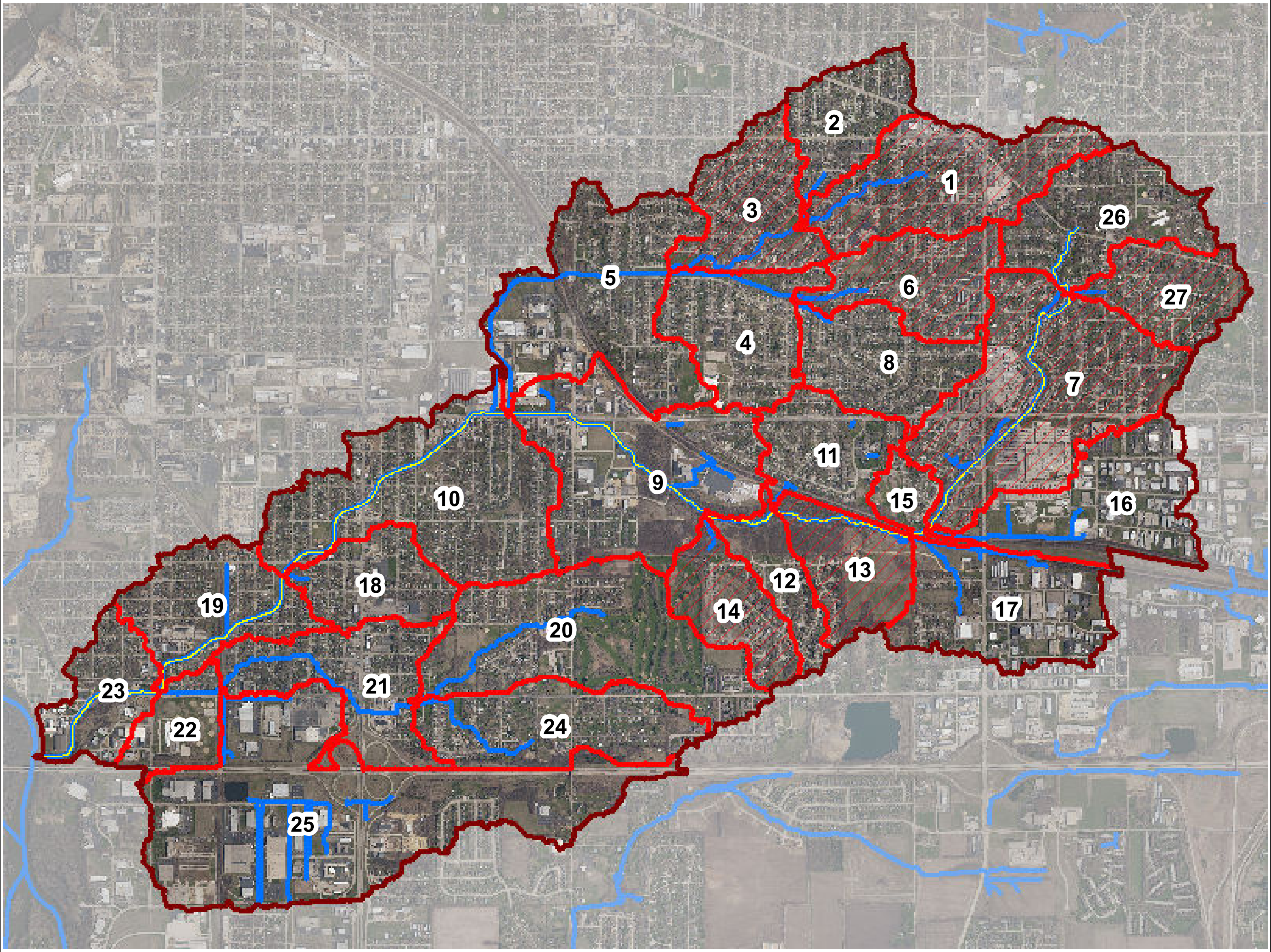

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Subbasins

Buckbee Creek Mainstem

Streams & Flowlines

Critical Subbasins

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Winnebago County Watershed Planning

Buckbee Creek - Critical Subbasins

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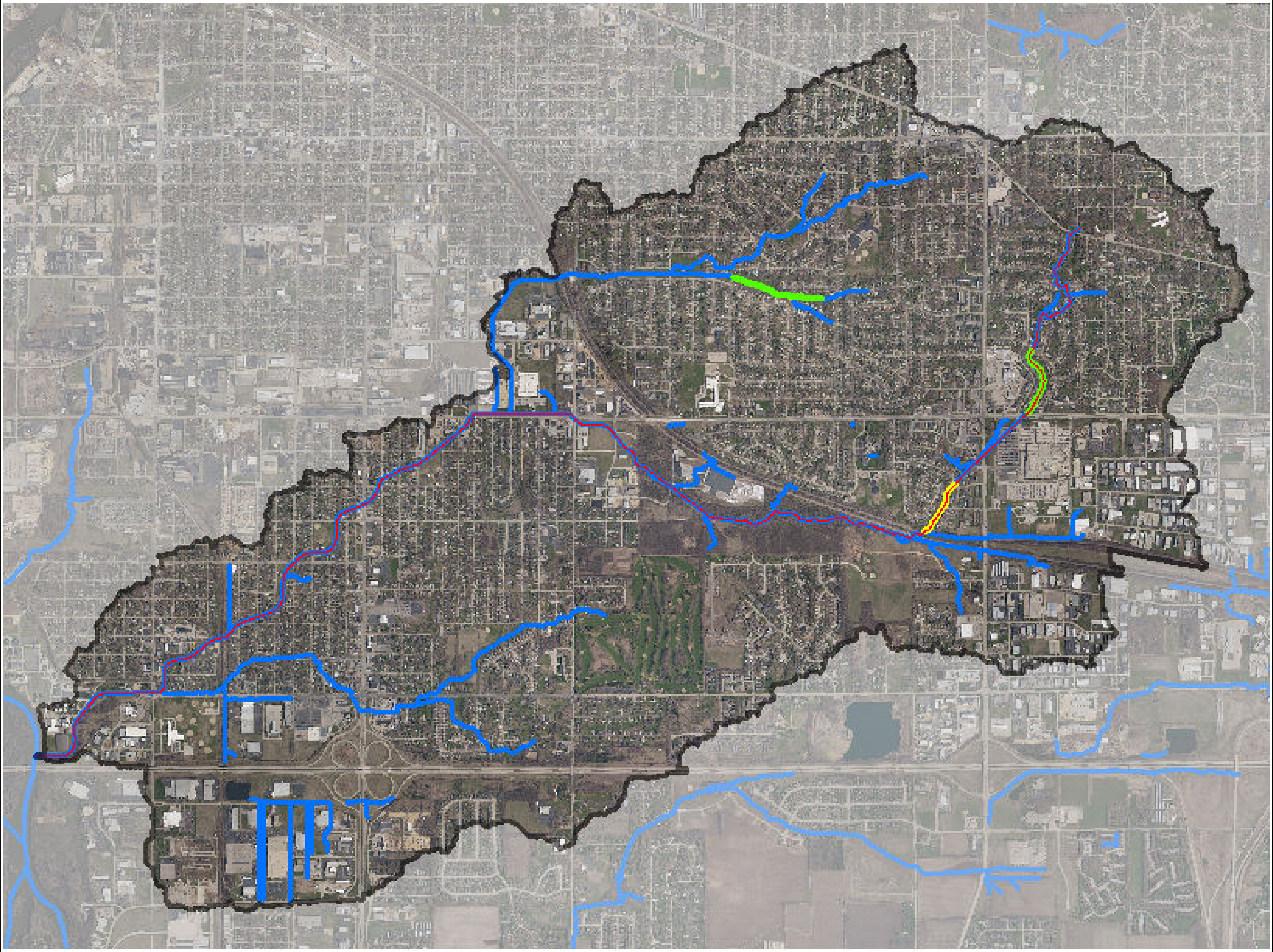

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Legend

Buckbee Creek Mainstem

Streams & Flowlines

Critical Reaches

Channelization, Concrete-Lined Channel

Streambank Erosion

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Winnebago County Watershed Planning

Buckbee Creek - Critical Reaches

PROJECT NO: 11-0174		SHEET NO:
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Chapter 4.0 Watershed Best Management Practice (BMP) and Solutions Toolbox

This section presents a brief illustrated overview of a variety of site planning and stormwater and landscaping best management practices (BMPs). The BMPs are integrated into the Buckbee Creek Watershed-Based Plan action items and recommendations presented in Chapter 5. Following the brief descriptions, more detailed information including guidance on applicable scale and land use, benefits and effectiveness, and design considerations are included on BMP Fact Sheets.

4.1 Planning Process BMPs

Planning process BMPs are policy goals used to maintain high environmental quality as a watershed develops and/or restore environmental quality during redevelopment. Significant natural features can be created and/or preserved by open space requirements and other standards. Open space preservation/restoration and riparian buffer standards are tools used to preserve natural resources during development and/or restore natural resources during redevelopment. Impervious area reduction is a critical site-level planning and design strategy use to achieve stormwater management and water quality goals.

Impervious Area Reduction: Impervious area reduction can be achieved in a variety of ways including adding rain garden "bump outs" to neighborhood streets, increasing pervious areas in large parking lots by installing depressed parking lot islands and use of permeable pavement.

Open Space: Protection or re-establishment of open space and/or natural areas as greenways, in order to preserve and connect significant water quality and habitat features and improve aesthetic, recreational and/or alternative transportation uses.

Riparian Buffer: A riparian buffer is a vegetated area next to a stream or wetland that protects water resources from pollution, stabilizes the stream bank, and offers aquatic and wildlife habitat.

4.2 Stormwater BMPs

Stormwater BMPs are site-specific practices are techniques, methods, or structural controls that are designed to manage the quantity and improve the quality of stormwater runoff in a cost-effective manner. Commonly, stormwater BMPs minimize onsite and offsite hydrologic and water quality impacts from stormwater runoff by incorporating and re-establishing natural hydrologic processes into an urbanized area. Stormwater BMPs can be both integrated into new development or retrofitted into existing developments.

Bioswales: Bioswale are filtration and infiltration systems planted with grasses, shrubs, and wetland plants designed to filter, retain, evapotranspirate, and infiltrate stormwater. Typically, bioswales are constructed with an underdrain and infiltration trench comprised of engineered soil and gravel. The infiltration trench provides additional stormwater storage and facilitates infiltration of water into the surrounding soils and groundwater.

Naturalized Detention: Naturalized detention basins are used to temporarily store stormwater runoff and release it at a rate designed to protect stream health and provide water quality treatment. Naturalized detention basins are planted with native wetland and prairie vegetation to provide additional water quality benefits and provide habitat for aquatic and terrestrial species. The naturalized detention basins can be designed both as shallow wetland systems with little to no open water or as open water wetland ponds with a wetland fringe and prairie sideslopes.

Permeable Pavement: Permeable pavement is pavement that is designed to allow for the infiltration of rain and snowfall. Permeable pavement is constructed with an underdrain and infiltration trench bed comprised of gravel underneath the permeable pavement. Rain that falls on the permeable pavement infiltrates into the gravel and then into the soil and/or groundwater below. Runoff that is not infiltrated can is slowly released from the trench into a second BMP as part of a stormwater BMP "treatment train" or into the storm sewer system.

Rain Barrels/Cisterns: Rain barrels and cisterns are storage vessels uses to capture and temporarily store rainfall for landscape irrigation.

Rain Gardens: Rain gardens are landscaped gardens designed to filter, retain, evapotranspirate, and infiltrate stormwater from roofs, driveways, or lots.

Vegetated Swales: Vegetated swales are stormwater features that convey, retain, and infiltrate stormwater. Water quality benefits of vegetated swales are enhances by the planting of native vegetation in the swale.

4.3 Landscaping BMPs

Landscaping has many properties that make it an important BMP to integrate into watershed planning action plans. Landscaping improves biodiversity, aesthetics, and habitat and cools ambient air. Native landscaping can also improve water quality through increasing infiltration and filtration of stormwater runoff.

Native Landscaping: Native vegetation uses the plants that were endemic to a specific geographical region prior to settlement for a variety of purposes including habitat improvement and increasing stormwater infiltration and water quality treatment.

Stream/Wetland Management and Restoration: Landscape restoration practices designed to maintain existing remnant landscapes and/or restore streams and wetlands to their nature state.

Streambank Stabilization: Streambank stabilization includes the use of bioengineering techniques to address streambank erosion and protect private property, roadways, and utilities from damage caused by streambank erosion.

Stormwater Trees: Trees can reduce stormwater runoff from impervious area such as parking lots, roads, and buildings. Trees have an effect on stormwater above the ground surface, at the ground surface, and below the ground surface by slowing, storing, and infiltrating runoff..

4.4 Flood Reduction BMPs

Structural Flood Control: Structural flood control measures include reservoirs, levees, floodwalls, diversions, stream channel conveyance improvements, and stormsewer improvements. These measures are generally designed to reduce the risk of flood damage in urbanized areas. Structural flood control projects are frequently cost prohibitive for munipalities to implement without some type of financial assistance through cost sharing or grants.

Non-Structural Flood Control: Non-structural flood control measures include floodproofing, acquisition and demolition of flood damaged building, and elevating or relocating buildings out of the floodplain.

The following Fact Sheets include guidance on applicable scale and land use, benefits and effectiveness, and design considerations of stormwater BMPs and solutions that are recommended as Action Items in Chapter 5 of this watershed-based plan. The general layout of the Fact Sheets is described below.

BMP Description: Provides a description of the BMP, how it works, and water quality and stormwater management benefits provided by the BMPs.

Applicability: Where and how each BMP is applicable addressed by scale, application, and effectiveness:

Scale

- **Watershed/County:** Applied at a regional scale in the watershed or county-wide.
- **Town/Village:** Applied at a municipal level.
- **Neighborhood:** Applies at development or other sub-municipal level.
- **Lot:** Applied on individual residential, commercial, or industrial lots.

Application

- **Retrofit:** Applied to existing development, infill, and redevelopment.
- **New:** Applied to new development.
- **Roofs:** Applied on roofs or to treat roof runoff.
- **Streets:** Applied on or used to treat runoff from streets and roads.
- **Driveways:** Applied on or used to treat runoff from driveways.
- **Parking Lots:** Applied on or used to treat runoff from parking lots.
- **Lawns:** Applied on or used to treat runoff from lawns that are planted with turf grass.
- **Sensitive Areas:** Applied to ecological important areas such as floodplains, wetlands, and highly erodible soils.

Effectiveness

- **Runoff Rate Control:** BMPs that control or reduce runoff rates.
- **Runoff Volume Control:** BMPs that control or reduce runoff volumes.
- **Physical Habitat Preservation/Creation:** BMPs that preserve, restore, or provide wildlife habitat.
- **Sediment Pollution Control:** BMPs that reduce the amount of suspended sediment in runoff.
- **Nutrient Control:** BMPs that reduce the amount of nutrients in runoff.
- **BOD Control:** BMPs that remove constituents that cause BOD in runoff.
- **Other Pollutant Control:** BMPs that reduce the amount of metals, petroleum-based compounds, and other pollutants in runoff.

Design Consideration: Design recommendation that should be considered when designing and implementing the BMP.

Additional Benefits: Other positive effects that the BMP provides beyond its stormwater and water quality benefits.

Maintenance: Recommendation on maintenance practices necessary to keep the BMP functioning as designed.

Bioinfiltration Basins

How Do Bioinfiltration Basins Help Manage Stormwater?

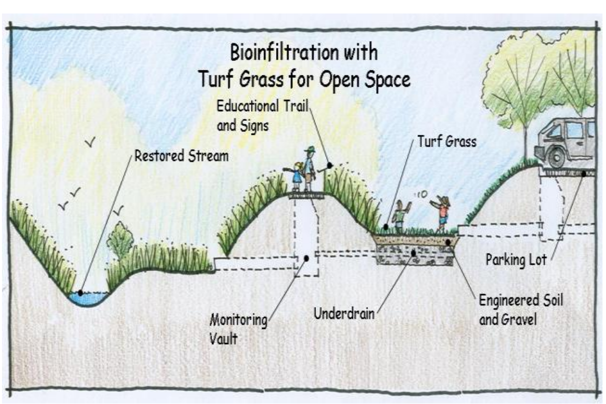
Bioinfiltration basins are shallow, vegetated depressions designed to capture and hold a volume of stormwater runoff and allow it to infiltrate into the underlying soils over several days. The design of bioinfiltration basins is simple and they are used as an "end of pipe" method to catch stormwater from swales or storm sewer systems. Bioinfiltration basins allow the stormwater to infiltrate into the soil and recharge groundwater rather than discharging directly into sewers and rivers.

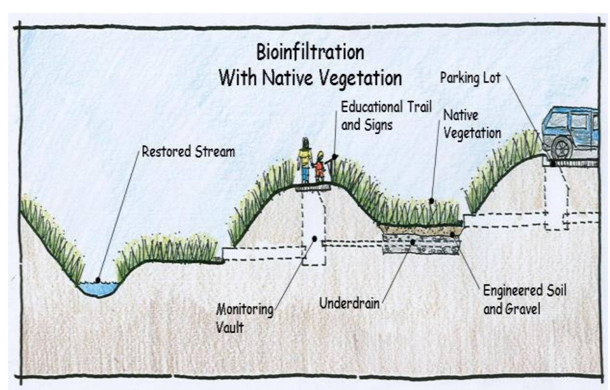
Bioinfiltration basins are very effective at removing pollutants and reducing the volume of runoff from impervious surfaces such as parking lots. Based on published pollutant removal efficiencies, bioinfiltration basins can remove approximately 65% of the total phosphorous, 60% of the total nitrogen, 75% of total suspended solids, and 65% of metals.

Where and How can Bioinfiltration Basins be Located?

Scale ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot

Applications	☒ Retrofit	☒ New	
	☒ Preventative	☒ Remedial	☒ Ongoing/Maintenance
	☒ Parking lots	☒ Streets	☒ Driveways
	☐ Roofs	☐ Lawns	☐ Sensitive Areas
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Habitat Preservation/ Restoration
	☒ Sediment Control	☒ Nutrient Control	☒ BOD/COD Control
	☒ Other Pollutant Control		





Design Considerations

- Bioinfiltration basins must be sized and designed to account for drainage area and soils.
- Infiltration storage should be designed to drain in 24-72 hours.
- Filtration benefits can be improved by planting native-deep rooted vegetation.
- Topsoil should be amended with compost and/or sand as a means of improving organic content for filtering and to achieve adequate infiltration.

Additional Benefits of Bioinfiltration Cells

Bioinfiltration cells provide much more than just stormwater management. They also:

- Enhance the aesthetics of the local landscape
- Provide habitat for wildlife
- Provide open space

Maintenance

The maintenance on bioinfiltration cells includes the periodic inspection and cleaning in order to ensure that the system is operating properly. The system should be inspected for clogging of the discharge pipe and sediment accumulation on the basin surface. If a clog is found, rehabilitative maintenance should be conducted immediately to restore its proper operation. In addition, to preventing and repairing clogs, management of the vegetation including mowing, weeding, and replanting sparse areas should also be conducted.

This Fact Sheet was prepared by the Winnebago County Highway Department using funding provided in part through the USEPA Section 319 of the Clean Water Act and administrated through Illinois Environmental Protection Agency.

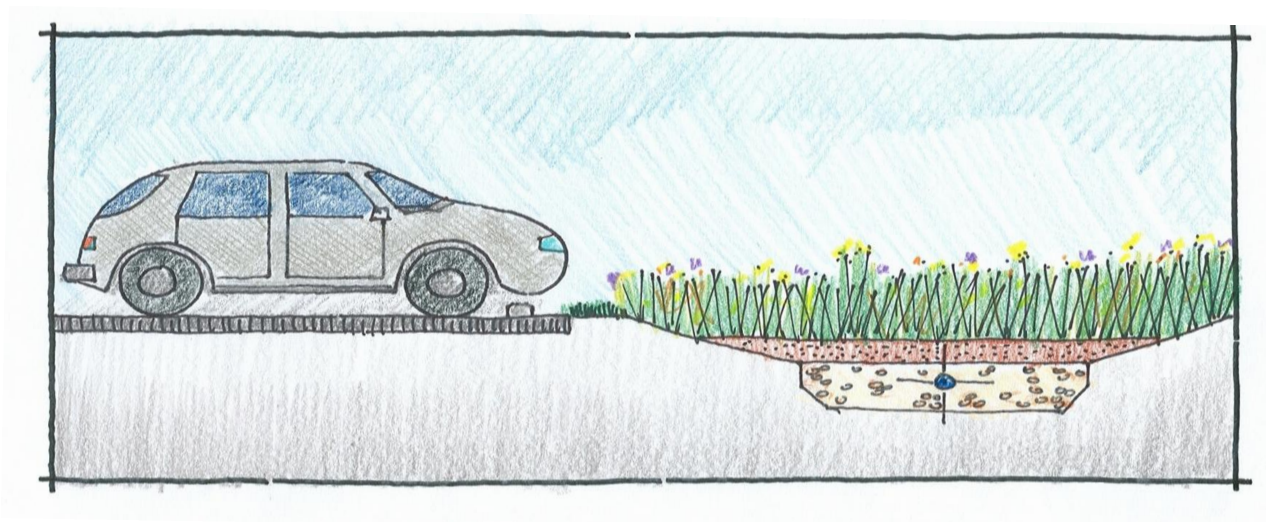
Bioswales

How Do Bioswales Help Manage Stormwater?

Bioswales are stormwater treatment systems that provide an alternative to traditional curb-and-gutter and storm sewers. Bioswales are broad, vegetated channels that reduce the rate and volume of runoff from a site. They are commonly planted with wet-tolerant species and may remain wet for a few days following a storm.

Bioswales differ from traditional vegetated swales in that the bioswales are primarily used for storage of stormwater while vegetated swale is utilized for conveying water. In order to increase the storage capacity of the bioswale, the bioswale can be constructed with an underdrain and infiltration trench comprised of engineered soil and gravel, while a traditional vegetated swale is constructed on native soils. The infiltration trench provides additional stormwater storage and facilitates infiltration of water into the surrounding soils and groundwater. Once the storage capacity of the infiltration trench has been reached, the underdrain will convey the water into the storm sewer system.

Bioswales remove suspended solids through settling and filtration. Dissolved pollutants such as nutrients and metals are removed and/or transformed as runoff infiltrates into the soil. Based on published pollutant removal efficiencies, bioswales can remove approximately 100% of the total phosphorous, 94% of total suspended solids, and 83% of biochemical oxygen demand (the degree of organic pollution in water leading to the depletion of oxygen).



Where and How Can Bioswales Be Located?

Scale ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot

Applications
☒ Retrofit ☒ New
☒ Preventative ☒ Remedial ☒ Ongoing/Maintenance
☒ Parking lots ☒ Streets ☒ Driveways
☐ Roofs ☐ Lawns ☐ Sensitive Areas

Effectiveness
☒ Runoff Rate Control ☒ Runoff Volume Control ☐ Habitat Preservation/ Restoration
☒ Sediment Control ☒ Nutrient Control ☒ BOD/COD Control
☒ Other Pollutant Control

Design Considerations

- Bioswales must be sized and designed to account for drainage area and soils.
- Infiltration storage should be designed to drain in 24-72 hours.
- Filtration benefits can be improved by planting native-deep rooted vegetation.
- Salt tolerant species should be used in the swale is to receive runoff from parking lots and roads.
- Topsoil should be amended with compost and/or sand as a means of improving organic content for filtering and to achieve adequate infiltration.

Additional Benefits of Bioswales

Bioswales provide more than just stormwater management. They also:

- Enhance the aesthetics of the local landscape
- Provide habitat for wildlife
- Can be used for snow storage during winter months

Maintenance

The maintenance requirements for bioswales are minimal. The bioswales should be inspected periodically to remove litter and blockages. Sparse areas may need to be reseeded or replanted.

This Fact Sheet was prepared by the Winnebago County Highway Department using funding provided in part through the USEPA Section 319 of the Clean Water Act and administrated through Illinois Environmental Protection Agency.

Permeable Pavement

How Does Permeable Pavement Help Manage Stormwater?

Permeable pavements refer to paving materials that promote the absorption of rainfall and snowmelt. There are four main types of permeable pavements: porous concrete, porous asphalt, permeable grid pavers, and permeable pavers. See the table below for a detailed description of each paving system.

Types Of Permeable Paving Systems	
Type of Paving System	**General Description**
Porous concrete	Porous concrete looks very similar to regular concrete. Porous concrete typically consists of specialty formulated mixtures of Portland cement, course aggregate and water that has been manufactured to have gaps through which water can flow into an infiltration bed of uniformly graded gravel below the pavement.
Porous asphalt	Porous asphalt looks very similar to regular asphalt. Porous asphalt consisted of course aggregate bonded together by asphalt cement with sufficient gaps through which water can flow into an infiltration bed of uniformly graded gravel below the pavement.
Permeable grid pavers	Permeable grid pavers are manufactured rigid plastic subsurface reinforcement systems that are backfilled with permeable gravel or soil. The permeable grid pavers are most often installed over an infiltration bed of gravel. This system is most commonly used for fire lanes, overflow parking, or other low-traffic areas.
Permeable pavers	Permeable pavers are modular concrete pavers manufactured with internal void spaces or gaps between pavers to allow stormwater to percolate into an infiltration bed of uniformly graded gravel below the pavers. Course sand is most often used to fill voids, creating a durable smooth surface.

Rain that falls onto the permeable pavement systems described above percolates through the pavement surface and into the gravel bed below. An underdrain is often incorporated into the design to convey excess stormwater to a storm sewer if the infiltration capacity of the underlying soil is exceeded. By infiltrating most of the stormwater that falls onto the permeable pavement, the rate and volume of runoff flowing into storm sewers is reduced, along with pollutants being carried by the stormwater. Thus, permeable pavement helps maintain more stable base flows in streams, reduces flood peaks, and reduces streambank erosion caused by stormwater runoff.

Permeable pavement removes suspended solids through filtration. Dissolved pollutants such as nutrients and metals are removed and/or transformed as runoff infiltrates into the soil. Utilizing the Illinois EPA's Estimating Pollutant Load Reductions for Nonpoint Source Pollution Control BMPs worksheets, the permeable pavement can remove approximately 65% of the total phosphorous, 85% of total nitrogen, and 90% of total suspended solids.

Where And How Can Permeable Pavement Be Located?

Scale ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot

Applications
☒ Retrofit ☒ New
☒ Preventative ☒ Remedial ☐ Ongoing/Maintenance
☒ Parking lots ☒ Streets ☒ Driveways
☐ Roofs ☐ Lawns ☐ Sensitive Areas

Effectiveness
☒ Runoff Rate Control ☒ Runoff Volume Control ☐ Habitat Preservation/ Restoration
☒ Sediment Control ☒ Nutrient Control ☒ BOD/COD Control
☒ Other Pollutant Control

Additional Benefits of Permeable Pavement

Permeable pavers provide much more than just stormwater management. They also:

- ❖ Permeable pavements can be engineered to be just as stable as conventional methods and provide the same functionality of traditional concrete and asphalt.
- ❖ Snow melts faster on permeable pavements because of the improved drainage
- ❖ Permeable pavements are also effective in reducing the "urban heat island" effect.
- ❖ The use of pavers improves the aesthetic appeal of paved areas.

Maintenance

Permeable pavements should be inspected annually and after large storms to assure the pavements are still fully functioning. Permeable pavements should also be vacuumed periodically to remove any accumulated sediment and leaves. Vacuum-type street sweeping equipment is the most effect method of vacuuming permeable pavement systems. Snow and ice should be removed via scrapping and shoveling. Avoid the use of de-icing chemicals and sand on permeable pavement. Polymeric jointing sand, commonly used with traditional pavers, should never be used with permeable pavers as it will prevent infiltration.

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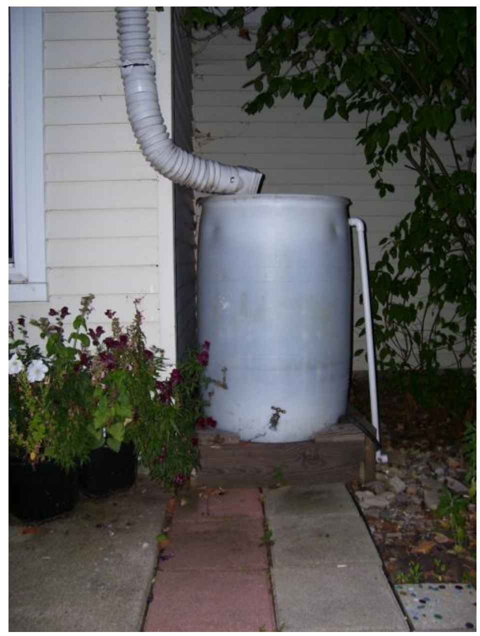
Rain Barrels

How Do Rain Barrels Help Manage Stormwater?

In many urban locations roof runoff is routed directly into the sewer system or adjacent areas that are designed to carry the flow away as swiftly as possible. By installing a rain barrel, it is possible to disconnect these downspouts from the sewer system or capture the runoff that would otherwise be lost and save the rain water for other uses. A rain barrel is a temporary storage system for stormwater. The water captured by the barrel can then be used to irrigate your lawn, flower beds and garden or wash your car. By using a rain barrel you will save money and water by having an ample supply of free 'soft water'.

How Do I Install A Rain Barrel For My Home?



Rain barrels are designed to accumulate and store runoff from your rooftop. A rain barrel is composed of a large drum, hose, pipe and hose couplings, a screen grate and other off the shelf items. Rain barrels can be purchased from garden supply stores or they can be easily built with supplies purchased from a hardware store. Information on where to purchase a rain barrel or assembling one yourself can easily be found online.

The first step in installing a rain barrel at your home is to decide where to place the rain barrel. Many people place their rain barrels near an existing downspout as it simplifies installation. But also be sure you consider how far the location of the barrel is from your plants, gardens, and flowerbeds. You want to be sure you can easily utilize the water that is captured in the rain barrel.

Once you have selected the location for your rain barrel, make sure the area is level and free from any rocks, roots, or debris that would cause your barrel to rock from side to side. Also be sure to rake the area in order to remove any leaves that could cause the ground to be soft and unsecure. It is also recommended that prior to placing your rain barrel in its selected location, construct a platform out of cinder blocks, wood, or flat landscape/paver type stones. Raising your rain barrel a few inches off the ground will give you more water pressure when using a hose and make it easier for you to reach the faucet or fill a watering can.

Now that your platform is constructed, place the rain barrel in its location and measure where you need to cut or disassemble your downspout. Often times you can disassemble the downspout at the gutter by removing the bolts. Replace the portion of the metal downspout removed with a flexible downspout extender. Once securely attached to the gutter, place the downspout extender in the barrel.

Where and How Can Rain Gardens Be Located?

Scale ☐ Watershed/County ☐ Town/Village ☐ Neighborhood ☒ Lot

Applications	☒ Retrofit	☒ New	
	☒ Preventative	☐ Remedial	☐ Ongoing/Maintenance
	☐ Parking lots	☐ Streets	☐ Driveways
	☒ Roofs	☐ Lawns	☐ Sensitive Areas
Effectiveness	☐ Runoff Rate Control	☒ Runoff Volume Control	☐ Habitat Preservation/ Restoration
	☐ Sediment Control	☐ Nutrient Control	☐ BOD/COD Control
	☐ Other Pollutant Control		

Costs

Rain barrels vary in cost based on size, material and expected lifetime. You can expect to pay between $40 and $150. Purchasing materials and assembling your own rain barrel instead of buying an already assembled rain barrel can reduce this cost.

Maintenance

There are several easy ways to routinely maintain your rain barrel in order to ensure its usefulness for a long period of time. Use a screen on the lid of the rain barrel to prevent insects and debris such as leaves or twigs from getting into the barrel. Rain barrels should also be disconnect over the winter to prevent ice-damming and minimize the potential for damage to gutters, downspout, and house.

This Fact Sheet was prepared by the Winnebago County Highway Department using funding provided in part through the USEPA Section 319 of the Clean Water Act and administrated through Illinois Environmental Protection Agency.

Rain Gardens

How Do Rain Gardens Help Manage Stormwater?

Rain gardens are one of the many BMPs that you can implement at home to reduce the impacts of stormwater in your watershed. Building a rain garden is one of the simplest, easiest and most cost effective ways you can protect water quality at home. The purpose of a rain garden at home is to store and promote the infiltration of rainfall into the groundwater. Without the rain garden, the majority of the rain that falls onto the impervious surfaces around your home such as driveways, sidewalks, and roofs will flow directly into the sewer system or nearby lakes or streams. When properly constructed a rain garden will reduce the amount of runoff from your property. In addition, the plants in the rain garden will also reduce the amount of pollutants in stormwater runoff. Suspended sediments and attached pollutants such as phosphorus and metals are settled out of the stormwater and captured in the basin. Dissolved pollutants such as nitrogen and organic matter are filtered out and/or transformed by the vegetation and as the runoff infiltrates into the underlying soils.

How Do I Design A Rain Garden For My Home?

You should consider location, size/shape, and plant selection when designing a rain garden for home. Each of these critical design elements are discussed in detail below.

Location: When deciding where to place a rain garden it is important to decide where the runoff water will be coming from. Runoff water can collect near a driveway, roof downspout or a low point in your yard. After you pick a location, the first step is to dig a shallow depression of the shape and depth you want your garden to be. Be sure to remember to locate the garden a minimum of 10 feet from your house to keep the water away from the foundation. The overflow should be directed away from the house.

Size and Shape: Typically a rain garden will be 2-6 inches deep and about 70 square feet. The most important factor in determining the depth of your rain garden is to make sure the rain garden will drain in approximately 24 hours after it rains. You can easily determine the proper depth by conducting an infiltration test in the area where you have selected to construction your rain garden. The first step in the infiltration test is to dig a hole approximately 12-inches deep and write down the depth of the hole. Next, fill the hole completely with water and wait approximately 24-hours. The next day, measure the amount of water still remaining in the hole. The amount of water that drained from the hole is a great estimation on how deep your rain garden should be. For example, if 6-inches of water drained, the garden should be about 6-inches deep. Gardens that only hold water for a day will not promote mosquito breeding. The shape of the garden can vary depending on the drainage of the landscape but generally rain gardens are in the shape of a teardrop, oval or a kidney bean. Be sure to consider where the water will enter the garden and where it overflows during large events. You want the overflow to be directed away from your house.

Plant Selection: Your garden can include, but is not limited to native wetland and prairie grasses, wildflowers, shrubs or grasses.

Suggested Species:

Black-eyed Susan
Butterflyweed
Golden Alexander
Obedient Plant
Purple Coneflower
Spiderwort
Wild Columbine
Wild Geranium

Special Considerations:

- Make sure to have utilities marked before digging
- Avoid building your rain garden over or near septic drain fields
- Use of fertilization and exposure to pesticides is typically not necessary
- Make sure to pick plants that you like but also are able to survive with the amount of sunlight/shade in your yard
- Plants should be tolerant to both wet and dry conditions

Costs

Rain gardens are estimated to cost between $3 and $20 per square foot. These costs will very greatly depending on how much of the planning, design, and installation is done by you. Rain gardens can even be free if you use plants that you already own.

Maintenance

Just like any garden, your rain garden needs to be properly maintained in order for it to function properly. After your garden is first built, the plants will need to be watered through the first growing season. After the first season you will only need to water the rain garden during a drought. In addition, your rain garden should be mulched annually in order to keep weeds out. If any weeds to persist they should be pulled. Finally the garden should be inspected periodically for any kind of debris, trash or pet waste, which should be removed

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Stormwater Trees

How Do Trees Help Manage Stormwater?

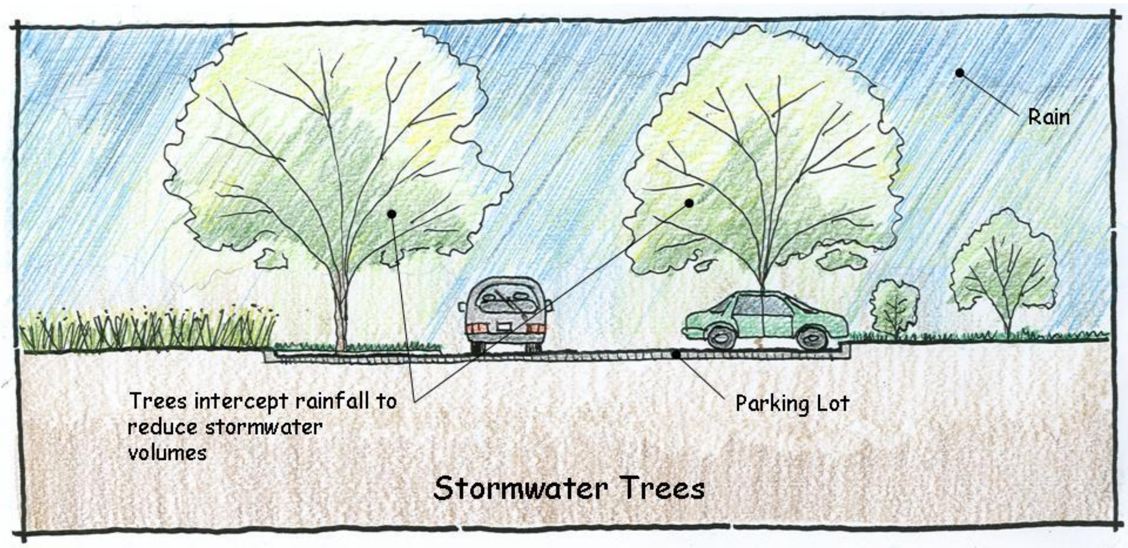
Trees are one of the simplest and most cost effective ways of reducing stormwater runoff from impervious area such as parking lots, roads, and buildings. Trees have an effect on stormwater above the ground surface, at the ground surface, and below the ground surface.

First, rain is caught on the trees' leaves, branches, and trunk slowing the movement of the stormwater. A portion of this rainfall is evaporated from the foliage and released back into the atmosphere as vapor. In addition to being evaporated, some of the rainfall caught by the trees is absorbed into the trees' leaves and stems where it is used for growth.

Not all rainfall that falls on a tree is absorbed or evaporated: some raindrops fall through the trees without landing on leaves or branches and other raindrops drip from the tree before they can be absorbed or evaporated. The rainfall that reaches the ground beneath the trees may still be affected by the tree.

The leaf litter and other organic matter commonly located underneath trees hold the precipitation in temporary surface ponds that reduce the amount and peak rates of stormwater runoff from the area. In addition, roots and the trunks of mature trees create hollows and hummocks on the ground that also provides areas for temporary water storage and ponding.

A small portion of the ponded water is evaporated from the surface while the majority is infiltrated into the soil. The presence of organic matter from leaf litter and other tree detritus and macropores, which are large interconnected pores in the soil created by roots, increases the infiltration rate and the moisture holding capacity of the soils. Once below ground, the stormwater can be taken up by the trees through their roots or percolated into the groundwater. The roots of the trees also act as natural pollution filters removing nitrogen, phosphorus, and potassium from the stormwater before it is able to percolate into the groundwater.



Where and How Can Stormwater Trees Be Located?

Scale ☒ Watershed/County ☒ Town/Village ☒ Neighborhood ☒ Lot

Applications	☒ Retrofit	☒ New	
	☒ Preventative	☒ Remedial	☐ Ongoing/Maintenance
	☒ Parking lots	☒ Streets	☒ Driveways
	☐ Roofs	☒ Lawns	☒ Sensitive Areas
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☒ Habitat Preservation/ Restoration
	☒ Sediment Control	☒ Nutrient Control	☒ BOD/COD Control
	☒ Other Pollutant Control		

Additional Benefits of Stormwater Trees

Trees provide more than just stormwater management.
They also:

- Reduce air pollution
- Provide shade
- Lower energy costs
- Prevent soil erosion
- Reduce noise level
- Enhance aesthetics and increase property values

Maintenance

Maintenance needs for trees planted for stormwater management is the same for all other trees. Basic tree care should be preformed regularly to ensure healthy trees and minimize the risk of damage to people and property.

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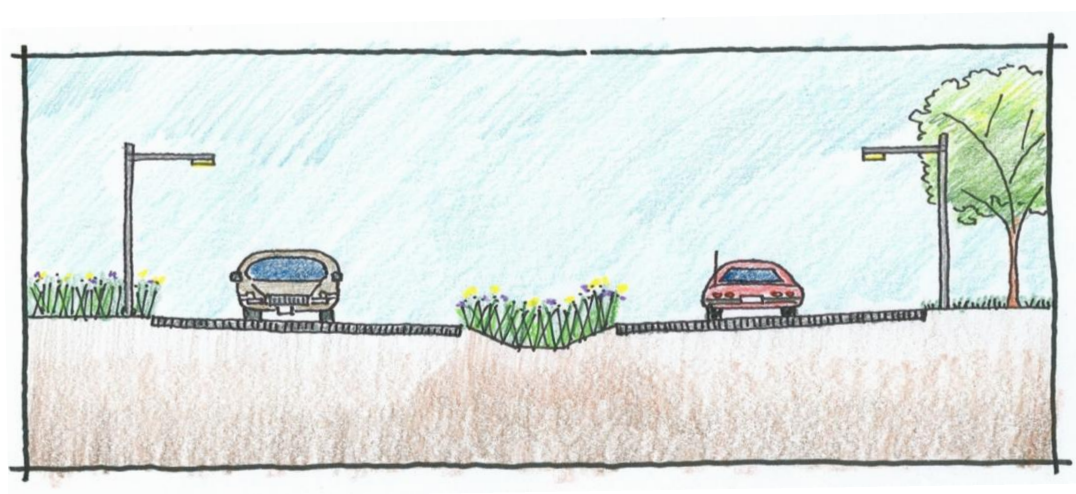
Vegetated Swales

How Do Vegetated Swales Help Manage Stormwater?

The vegetated swale is a common stormwater treatment system. Vegetated swales are vegetated areas used to convey and treat stormwater runoff by acting as a buffer between impervious areas such as roads, parking lots, and driveways and storm sewer systems or streams. While a roadside ditch is technically a vegetated swale, these are typically referred to as "grassed swales". The term vegetated swale most typically refers to swales that are densely vegetated. Vegetated swales function best when constructed with gentle slopes to minimize flow velocities and maximize opportunities for the absorption of runoff and the filtering of pollutants.

Vegetated swales will improve the water quality of stormwater by slowing runoff speed, trapping sediment and other pollutants, and providing some absorption. The swales will also reduce both the rate and volume of stormwater. Choosing to plant swales with native vegetation is more effective in managing runoff than if it was planted with short turf grass.

Vegetated swale removes suspended solids through settling and filtration. Dissolved pollutants such as nutrients and metals are removed and/or transformed as runoff infiltrates into the soil. Utilizing the Illinois Environmental Protection Agency's Estimating Pollutant Load Reductions for Nonpoint Source Pollution Control Best Management Practices (BMPs) worksheets, the vegetated swale will remove approximately 20% of the total phosphorous, 65% of total suspended solids, and 50-71% of metals.



Where And How Can Vegetated Swales Be Located?

Scale ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot

Applications

- ☒ Retrofit
- ☒ New
- ☒ Preventative
- ☒ Remedial
- ☐ Ongoing/Maintenance
- ☒ Parking lots
- ☒ Streets
- ☒ Driveways
- ☒ Roofs
- ☒ Lawns
- ☐ Sensitive Areas

Effectiveness

- ☒ Runoff Rate Control
- ☒ Runoff Volume Control
- ☐ Habitat Preservation/ Restoration
- ☒ Sediment Control
- ☒ Nutrient Control
- ☒ BOD/COD Control
- ☒ Other Pollutant Control

Design Considerations

- ❖ Vegetated swales must be sized to convey design runoff rate.
- ❖ Filtration benefits can be improved by planting native-deep rooted vegetation.
- ❖ Salt tolerant species should be used in the swale is to receive runoff from parking lots and roads.
- ❖ Topsoil should be amended with compost and/or sand as a means of improving organic content for filtering and to achieve adequate infiltration.

Additional Benefits of Vegetated Swales

Vegetated Swales provide more than just stormwater management. They also:

- ❖ Enhance the aesthetics of the local landscape
- ❖ Provide habitat for wildlife
- ❖ Can be used for snow storage during winter months

Maintenance

The maintenance requirements for vegetated swales are minimal. The swales just need to be inspected periodically to remove litter and blockages. Sparse areas may need to be reseeded or replanted.

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Chapter 5.0 Prioritized Action Plan

5.1 Introduction

A Prioritized Action Plan has been developed for the Buckbee Creek watershed to provide stakeholders guidance on action items for watershed improvement practices. The Prioritized Action Plan serves as a "roadmap" for the implementation of the watershed-based plan and includes recommended watershed-wide and site specific best management practices (BMPs), a prioritized schedule for the implementation of the BMPs, recommendations on agencies and organizations responsible for plan implementation, and estimated BMPs costs.

The Prioritized Action Plan is divided into four subsections:

- Programmatic Action Plan
- Site Specific Action Plan
- Water Quality Monitoring Plan
- Education and Outreach Plan

The Programmatic Action Plan (Section 5.3) is focused on watershed-wide action items that are not site specific while the Site Specific Action Plan (Section 5.4) identifies specific and actual locations where water quality, hydrological modification, and/or flood reduction/prevention projects can be implemented. The Action Items were selected based on their ability to reach the goals and objectives identified by the WCWIPSC for the Buckbee Creek watershed (see Chapter 2.0). For each Watershed-wide and Site Specific recommendation a priority ranking was assigned. Additionally, estimated costs and responsible entities for project implementation are also provided.

Section 5.5 includes the Water Quality Monitoring Plan. The Action Items identified in this plan have not been prioritized. However, recommendations on who, what and where the recommendations should be implemented are included.

Section 5.6 includes the Education and Outreach Plan. The Education and Outreach Plan highlights recommended actions that will need additional outreach and educations in order to be implemented.

The eight most important recommendations are summarized as follows:

1. Manage, retrofit, and stabilize the stormwater management system including detention basins and culverts, with focused attention on detention basins, to reduce runoff rate and volume and to improve water quality in the watershed.
2. Stabilize streambanks to reduce erosion, protect property and infrastructure, improve water quality, and improve habitat.
3. Remediate existing flood problems and prevent future flooding by reducing stormwater runoff and restoring areas for surface water storage and absorption such as floodplains, depressional storage areas, and wetlands, which also provide water quality improvement benefits.

4. Restore and manage stream corridors by restoring native riparian buffers, removing excessive debris, and stabilizing the streambed and streambanks with practices that also enhance habitat.
5. Use better stormwater management and low impact development practices for new and existing development that slow, filter, infiltrate, cool, and cleanse stormwater runoff.
6. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality.
7. Provide public education and outreach to enhance understanding and appreciation of watershed resources and problems and to provide opportunities for people to get involved in watershed improvement activities.
8. Monitor and evaluate watershed plan implementation and physical watershed conditions to gauge progress towards watershed goals.

5.2 Implementation Partners

Implementation of the Prioritized Action Plan cannot be the responsibility of one watershed stakeholder. Successful plan implementation will require coordination and partnerships between numerous stakeholders in the watershed. Key stakeholders in the Buckbee Creek watershed are listed in Table 5-1. A brief description of each stakeholder's role in watershed-plan implementation is also included.

Table 5-1 Key Watershed Stakeholders

Watershed Stakeholders	Abbreviation
Cherry Valley Township	CVT
Corporate and Business Landowners	CBL
Developers and Builders	DB
Federal Emergency Management Agency	FEMA
Golf Courses	GC
Illinois Department of Natural Resources	IDNR
Illinois Department of Transportation	IDOT
Illinois Emergency Management Agency	IEMA
Illinois Environmental Protection Agency	Illinois EPA
Residents/Owners	RO
Rock River Water Reclamation District	RRWRD
Rockford, City of	ROCK
Rockford Park District	RPD
Rockford Metropolitan Agency for Planning	RMAP
Rockford Township	RT
Winnebago County Soil Water Conservation District	WCSWCD
Winnebago County	WC
Winnebago County Watershed Improvement Plan Steering Committee	WCWIPSC
Upper Rock River Ecosystem Partnerships	URREP
US Army Corps of Engineers	USACE

Corporate and Business Landowners (CBL)

The active participation of CBLs in the planning process can lead to positive impacts on the quality of the Buckbee Creek watershed. Businesses and commercial properties can become involved by retrofitting existing detention basins and swales, managing their grounds, roof runoff, and parking lots to reduce stormwater runoff volume and pollutant loadings, and sponsoring watershed events. Coordination with the CBL community can also lead to new development being designed to minimize runoff and pollutant loadings.

Developers & Builders (DB)
As discussed previously in the watershed-based plan, the design and construction of properties can significantly impact a watershed. Developers should be encouraged or required to utilize development techniques that protect water quality and stream health. Builders should properly install and maintain BMPs during the construction phase in order to reduce the potential for sediment-bearing water to be discharged to creek and natural areas.

Federal Emergency Management Agency (FEMA)
FEMA is the principal federal agency involved in flood mitigation and flood disaster response. FEMA is responsible for the National Flood Insurance Program, helps municipalities develop and enforce floodplain ordinances, develops floodplain maps, and administers funding for flood mitigation plans and projects.

Golf Courses (GC)
Golf courses can help reduce pollutant loadings, especially nutrients, as well as runoff volume by incorporating BMPs into their golf course management programs.

Illinois Department of Natural Resources (IDNR)
Several offices within IDNR provide services that will be key to the implementation of the Buckbee Creek watershed plan for issues related to water resource management, habitat protection and management, wildlife management, invasive species control, and wetland management.

- The Office of Water Resources (OWR) is responsible for the regulation of floodplain development as well as for the implementation and funding of structural flood control and mitigation.
- The Office of Realty and Environmental Planning (OREP) is responsible for natural resource and outdoor recreation planning. It also administers the Conservation 2000 Ecosystems Program, which provides technical and financial assistance through a grant program to natural resource protection.
- The Office of Resource Conservation (ORC) reviews Clean Water Act Section 404 wetland permits for impacts on fish and wildlife resources; it manages threatened and endangered species issues; it also protects fisheries and other aquatic resources through regulation, ecological management and public education.

Illinois Department of Transportation (IDOT)
IDOT Region 2 is responsible for the planning, construction, and maintenance of portions of the transportation network that covers the Buckbee Creek watershed. Incorporation of BMPs into IDOT projects can help lead to improvements in the environmental quality of the watershed.

Illinois Emergency Management Agency (IEMA)
IEMA is responsible for flood and disaster planning, emergency response, and hazard mitigation. IEMA works with local governments on flood mitigation plans and provides operational support during floods. IEMA also administers FEMA-funded programs in the state, including flood mitigation grant programs.

Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water
As discussed in Chapter 3, Under the Illinois EPA is responsible for the protection of the state's water resources and ensuring that Illinois' rivers, streams and lakes will support all uses for which they are designated including protection of aquatic life, recreation and drinking water supplies. The Illinois EPA also provides technical assistance and administers several state and federal grant programs, including Section 319 funding, which helps local governments, not-for-profits, and other stakeholders to complete projects that are aimed at reducing nonpoint source pollution.

Municipalities (all departments) including Rockford (ROCK)
Municipalities (i.e., local elected officials and local agency staff) have the principal responsibility for land use and development planning, establishing legislative and administrative policies, adopting ordinances and resolutions, setting zoning standards, establishing the annual budget, appropriating funds, and setting tax rates. Municipalities are a critical stakeholder in watershed protection efforts because they are responsible for the enforcement of local land use and development ordinances.

Residents and Owners (RO)
The activities of residential landowners, often unknowingly, can have a significant impact of the quality of a watershed. Practices such as excessive lawn fertilization application, disposal of trash and yard waste in waterways or encroachment riparian buffers can be significant sources of nonpoint pollution. Recommendations of the watershed-based plan should include education and outreach programs aimed at informing residents on consequences of their actions and presenting alternative actions. Additionally, political pressure from local residents on municipal or county officials can lead to increased efforts focused on water quality protection and flood remediation.

Rock River Water Reclamation District (RRWRD)
The RRWRD provides wastewater treatment service for watershed communities. The RRWRD maintains the sanitary sewer system in the watershed.

Rockford Parks Districts (RPD)
RPD maintains numerous recreational facilities and parks in the watershed. Partnerships with local park districts can help ensure the preservation of open space while also facilitating recreational and other community opportunities that can help increase support for watershed protection efforts.

Rockford Metropolitan Agency for Planning (RMAP)
The Rockford Metropolitan Agency for Planning (RMAP) is the transportation Metropolitan Planning Organization (MPO) for the Rockford region. Over the past several decades as the MPO process has advanced, the traditional ways that planning for transportation, land use and environmental issues were undertaken by different agencies is now taking a more

integrated approach to civic planning. Since the RMAP MPO was reorganized in 2008, the planning horizons have expanded to become more active in other planning issues that alter the overall transportation planning process. RMAP's involvement in broader community collaborative activities that amalgamates overall regional issues with environmental sustainability is one our principal goals. Because of RMAP's involvement with the development of the regional Greenway Plan and its overall purpose of improving environmental quality, RMAP's technical assistance with the Winnebago County Watershed Improvement Plan Steering Committee matches into the strategy of protecting and restoring the region's natural resources.

Townships including Cherry Valley (CVT) and Rockford (RT)
While unincorporated townships generally play a secondary role in watershed protection, they often have responsibility for road upkeep and occasionally sponsor drainage system improvement projects. The use of BMPs by townships, especially for road maintenance, can help improve water quality and stream habitat within the watershed.

Winnebago County Soil and Water Conservation District (WCSWCD)
The Winnebago County Soil & Water Conservation District is a locally operated unit of government functioning under Illinois law. WCSWCD's mission is to promote the protection, restoration, and wise use of the soil, water, and related resources within the district. They provide technical and educational resources in the areas of soils and land use, water quality, soil erosion in both urban and agricultural land uses, conservation program needs, wildlife habitat, and native ecosystem restoration and management.

Winnebago County (WC)
Winnebago County is responsible for land use planning, development, natural resource protection, and drainage system management in the unincorporated areas of the Buckbee Creek watershed. Working with the County and its public works, health, and transportation departments, can help ensure responsible, sustainable land use planning, road and sewer maintenance, and public health policies for the watershed.

Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC)
The Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC) is a consortium of municipalities in the watershed, resource agency professionals, environmental advocates, and local residents that established itself in April 2010 to guide the development of strategies to protect and restore Buckbee Creek and its tributaries. It is likely that WCWIPSC will be the primary lead for the implementation of the watershed-based plan.

Upper Rock River Ecosystem Partnership (URREP)
The Rock River Partnership was formed in January of 2000 and lies in Boone and Winnebago Counties. The Partnership's Mission; "The Partnership promotes collaboration among the diverse organizations and private landowners who share an interest in improving the quality of life within the watershed by; by protecting, preserving and enhancing its natural, cultural, scenic, scientific, and recreational values."

Resource Concerns in the watershed are:

- Water Quality
- Water Hydrology
- Education and Public Relations
- Urban Growth
- Erosion
- Wildlife and Plant Biodiversity

U.S. Army Corps of Engineers (USACE)
USACE plays a major role in wetland protection and regulation through Section 404 of the Clean Water Act, which requires USACE to administer permit applications for alterations to wetlands that are considered Waters of the United States.

5.3 Programmatic Action Plan

The Programmatic Action Plan includes recommended BMPs that are applicable watershed-wide and has been divided into two sections. The first section is focused on recommendations that are applicable across the watershed to meet the goals identified by the WCWIPSC. The second section provides a review of the existing stormwater and development ordinances applicable in the watershed and provides recommendations for changes aimed at improving water quality and stream health and the reduction of flooding in the watershed.

Section 5.3.1 Programmatic Action Plan by Goal

As discussed in Chapter 2, the watershed-wide goals identified by the WCWIPSC include:

A. Protect and enhance overall surface and groundwater quality in the Buckbee Creek watershed
B. Reduce existing flood damage in the watershed and prevent flooding from worsening
C. Improve aquatic and wildlife habitat in the Buckbee Creek watershed
D. Develop open space in the Buckbee Creek watershed and provide recreational opportunities
E. Increase coordination between decision makers and other stakeholders in the watershed.
F. Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship

The Programmatic Action Plan including measures related to each goal. This Programmatic Action Plan includes remedial, preventative, regulatory, and maintenance action items that are applicable throughout the watershed. This Programmatic Action Plan should be considered as general guidance for all watershed stakeholders and plan implementers.

The Programmatic Action Plan is presented in table format (Tables 5-2 to 5-7). The tables include the recommended action item/BMP, priority, cost, responsible lead agencies or organization with greatest potential to implement the recommendation, and support agencies or agencies who could assist with technical, financial, or regulatory assistance or whose programs may be impacted by the recommendations. Each recommendation is given a unique ID number (ID#). As some recommendations appear in multiple tables, the ID number will link these recommendations.

Cost estimates are only provided for best management practices that involve construction or engineering costs such as streambank stabilization, native plantings, and feasibility studies. Costs are not included for preventative measures such as outreach and educational programs or regulatory actions. The cost estimates are included for advisory purposes only. The cost estimates are concept level and are most useful to compare the relative costs of the recommended BMPs. More detailed costs can be developed when site constraints are more fully investigated and preliminary engineering is conducted.

Each of the BMPs was assigned a priority status and classified as high (H), medium (M), or low (L). Priority status was assigned based on need, cost, potential funding opportunities, and technical needs. High priority action items should be considered short-term goals (1-5 years) while medium and low priority action items are considered long-term goals (greater than 5 years).

Goal A: Protect and enhance overall surface and groundwater quality

Objectives

1) Identify design alternatives to the concrete channel that will provide water quality and groundwater benefits.
2) Reduce sediment loading in streams by stabilizing stream banks.
3) Implement stormwater best management practices (BMPs) throughout the watershed to improve water quality and reduce runoff.
4) Retrofit existing stormwater management facilities and design new facilities within urbanized areas to reduce nutrient and sediment loading.
5) Restore riparian buffers along Buckbee Creek and its tributaries.
6) Implement infiltration BMPs throughout the watershed to encourage groundwater infiltration.
7) Educate the public about the need for groundwater protection.

As discussed in Chapter 3, stormwater runoff is one of the primary sources of water quality impairment in the watershed. The causes and sources of water quality impairment in the Buckbee Creek watershed are directly related to the urban nature of the watershed. As the land use in the watershed moved from natural to agriculture to urban, corresponding modifications of the steam channel, floodplain, wetlands, and riparian corridor have occurred. The most significant modification includes the placement of Buckbee Creek within a concrete channel for the majority of its length. Additionally, construction associated with the urbanization has lead to increase of impervious areas (roads, rooftops, parking lots, etc) that has directly caused an increase in the volume and rate of runoff in the watershed. In the naturalized portions of the creek, this increase in runoff volume has lead to problems including streambank erosion and the deepening of the stream channel (channel incision). This increased erosion is leads to increased levels of total suspended solids (TSS) in the waterways. The urbanization has also lead to a flashy stream regime in both the naturalized creek and concrete channels where there are long periods of little to no flows during dry times and high velocity flows during and immediately after rain events. This flashiness is caused by efficient storm sewer systems that transport precipitation directly to the creeks during storm events. The impervious areas reduce infiltration to groundwater, which then reduces baseflow to the creeks. These low flows result in low dissolved oxygen levels that can impair aquatic habitat.

As of means of improving water quality, the use of stormwater best management practices (BMPs) and the preservation and restoration of the natural drainage system (overland flow paths, streams, and floodplain) should be required in all new development and encourages in areas that have been previously developed. Drainage and detention in existing areas should be retrofitted or repaired to better control runoff rates and volume as well as to improve water quality. Natural and existing drainageways should also be preserved and/or restored to the extent practicable to reduce the impacts of hydrologic modification within the watershed.

All landowners and stakeholders within the watershed have the ability to improve water quality by managing land and property to prevent or remove pollutants in runoff before they are washed into the stream. The implementation of stormwater BMP is the responsibility of all landowners (for existing development) and developers and builders (for new development). However, municipalities must require or encourage these practices to be installed. Preservation of remaining natural drainage and storage features of the landscape is the responsibility of the private and public land owners. Additionally, the management and maintenance of the stormwater management system (detention basins, storm sewer pipes, drainage swales, etc) is primarily the responsibility of municipalities, unless management of these features has been assumed by a homeowners association or other party.

Programmatic actions aimed at the protection and enhancements of surface and groundwater quality are listed in Table 5-2.

Table 5-2 Water Quality and Groundwater Programmatic Actions

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
1	Watershed-wide	Implement a comprehensive water quality monitoring program aimed at assessing the current condition of the Buckbee Creek watershed and to assess changes in water quality associated with the implementation of the watershed-based plan.	A2, C1	H	WCWIPSC; Illinois EPA; IDNR	RRRD	S	n/a	
2	Watershed-wide	Develop a Riparian Landowner Handbook to educate riparian landowners on their responsibilities and easement requirements.	A2, A4, C2	H	ROCK; WC	CVT; RT	S	n/a	
3	Watershed-wide	Implement a waterside-wide stream maintenance program to remove debris and repair problem hydraulic structures. Remove damaged concrete and replace with a restore stream channel where feasible.	A1, A2, A3, A5, B2, C1	H	ROCK; WC; RO	CVT; RT; IDOT	S	$20 per linear foot	
4	Watershed-wide	Conduct a detailed inventory of all detention and retention basins in the watershed to document storage capacity, vegetation, maintenance needs, etc to identify potential retrofit opportunities.	A2, A3, A4, B5	H	ROCK; WC; RO	CVT; RT; IDOT	S		
5	Watershed-wide	Develop a maintenance plan for all detention and retention basins in the watershed to ensure effective operation and provide maximum detention, water quality benefit, and habitat. The plan should identify who is responsible, a maintenance schedule, budget and funding source.	A2, A3, A4, B5	M	ROCK; WC; RO	CVT; RT; IDOT	M	n/a	
6	Watershed-wide	Utilize naturalized detention basins in new development and retrofit existing single function dry bottom detention basins to provide multiple benefits including reducing pollutant loads and proving habitat. Upgrade and maintain existing basins to provide water quality benefits and slower release rates.	A2, A3, A4, A6, B5	M	ROCK; WC; RO; CBL; DB	IDOT	M	varies	
7	Watershed-wide	Stabilize eroding shorelines and replace riprap, concrete and turf pond edges with native vegetation.	A1, A2, A3, A4, C2	L	ROCK; WC; RO; CBL; DB	IDOT	L	$100 per linear foot	

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
8	Watershed-wide	Develop stream restoration guidelines to provide guidance to riparian landowners on methods of streambank stabilization, riparian buffer restoration, and other bioengineering techniques.	A2, A3, A5, C2	M	WCWIPSC	Illinois EPA; IDR; WCSWCD	M	n/a	
9	Watershed-wide	Review and updated local landscaping and stormwater requirements to promote the use of native vegetation in water quality BMPs.	A2, A3, A5, C2, D1	M	ROCK, CVT, RT; WC	WCWIPSC	M	n/a	
10	Watershed-wide	Develop stormwater BMPs for handling residential stormwater including downspouts and sump pumps. Flow should be directed onto a lawn or areas landscaped with native vegetation.	A3, A6, B5	M	RO	WCWIPSC; WCSWCD	M		
11	Watershed-wide	Encourage septic system owners to properly maintain their septic systems. Provide information on routine maintenance evaluations.	A3, A8	L	RO	WC; ROCK	L	n/a	
12	Watershed-wide	Develop recommendations for outreach regarding the importance of groundwater quality and quantity.	A7, A8	L	WCWIPSC; URREP	WCSWCD	L	n/a	
13	Watershed-wide	When replacing pavement or rebuilding roads, use pervious or porous pavement or permeable pavers where appropriate to increase infiltration and reduce runoff volumes.	A2, A3, A4, A6, B5	L	IDOT; CBL; DH	WC; ROCK	L	$2 to $6 per square foot	
14	Watershed-wide	Retrofit roadways and parking lots to allow stormwater to enter infiltration BMPs (rain gardens, swales, etc)	A2, A3, A4, A6, B5	M	CBL; DH; IDOT	WC; ROCK	M	$1 per linear foot to $650 per acre	
15	Watershed-wide	Where feasible, convert existing swales and open drainageways to infiltration BMPs with native landscaping.	A2, A3, A4, A6, B5	M	ROCK; WC	IDOT	M	$1 per linear foot to $650 per acre	
16	Watershed-wide	Encourage the implementation of stormwater BMPs in new developments and in redevelopment projects.	A2, A3, A4, A6, B5	M	ROCK; WC; DB, CBL	Illinois EPA; RO	M	varies	

Goal B: Reduce existing flood damage in the watershed and prevent flooding from worsening

Objectives

1) Encourage decision makers to coordinate the completion of a detailed hydraulic and hydrology study of the watershed.
2) Mitigate for existing flood damage by identifying parcels suitable for flood mitigation projects such as compensatory storage basins.
3) Identify design alternatives to the concrete channel in order to reconnect the channel to the floodplain.
4) Reconnect channelized stream segments to the floodplain where feasible.
5) Implement stormwater best management practices (BMPs) throughout the watershed designed to reduce runoff and encourage infiltration.
6) Protect undeveloped floodplain from development.

Flooding and risk of flooding is common throughout the Buckbee Creek watershed. The flooding and increased flood risk is directly related to the impact of urban development which leads to increased impervious surfaces, increased rate and volume of stormwater runoff, and modifications to the floodplain and wetland areas. While the flooding noted in the watershed is not extensive in terms of area affected, the flooding is extremely destructive and disruptive to those suffering from the flood damage. As such, addressing the current and future flood problem areas is important for those affected for the overall impact of flood damage in the watershed. Current flooding that occurs in the watershed includes:

- Overbank flooding from a waterway
- Local drainage problems (shallow flooding on roads, yards and sometimes buildings) often due to development in a drainage way, inadequately maintained drainage ditches, undersized storm sewers, and storm sewers.
- Depressional flooding in areas where water ponds in a natural depression in the landscape and there is no natural outlet for runoff. May be caused by failed or sewer or adjacent or surrounding development causing increased runoff into the depressional area.
- Sanitary sewer backups may occur, flooding basements, when stormwater infiltrates into the sanitary sewer pipes, leaky manholes, or inappropriate connections to the sanitary lines.

Increasing drainage capacity for the flooded areas will likely require the installation of new or larger sewer pipes, larger culverts, or improving the capacity of drainageways and ditches. Additionally, the flood storage capacity of the areas could be increased through the construction new detention facilities or the retrofitting of existing facilities to increase storage capacity. Flood proofing options, such as raising structures or the low water entry points above the level of flooding are also available but are not typically preferred solutions as they don't address the source or cause of flooding.

Programmatic actions aimed at reducing existing flood damage and preventing the flooding from worsening are listed in Table 5-3.

Table 5-3 Flood Mitigation Programmatic Actions

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
3	Watershed-wide	Implement a waterside-wide stream maintenance program to remove debris and repair problem hydraulic structures. Remove damaged concrete and replace with a restore stream channel where feasible.	A1, A2, A3, A5, B2, B3	H	ROCK; WC; RO	CVT; RT; IDOT	S	$20 per linear foot	
4	Watershed-wide	Conduct a detailed inventory of all detention and retention basins in the watershed to document storage capacity, vegetation, maintenance needs, etc to identify potential retrofit opportunities.	A2, A3, A4, B5	H	ROCK; WC; RO	CVT; RT; IDOT	S		
5	Watershed-wide	Develop a maintenance plan for all detention and retention basins in the watershed to ensure effective operation and provide maximum detention, water quality benefit, and habitat. The plan should identify who is responsible, a maintenance schedule, budget and funding source.	A2, A3, A4, B5	M	ROCK; WC; RO	CVT; RT; IDOT	M	n/a	
6	Watershed-wide	Utilize naturalized detention basins in new development and retrofit existing single function dry bottom detention basins to provide multiple benefits including reducing pollutant loads and proving habitat. Upgrade and maintain existing basins to provide water quality benefits and slower release rates.	A2, A3, A4, A6, B5	M	ROCK; WC; RO; CBL; DB	IDOT	M	varies	
13	Watershed-wide	When replacing pavement or rebuilding roads, use pervious or porous pavement or permeable pavers where appropriate to increase infiltration and reduce runoff volumes.	A2, A3, A3, A6, B5	L	IDOT; CBL; DH	WC; ROCK	L	$2 to $6 per square foot	
14	Watershed-wide	Retrofit roadways and parking lots to allow stormwater to enter infiltration BMPs (rain gardens, swales, etc)	A2, A3, A3, A6, B5	M	CBL; DH; IDOT	WC; ROCK	M	$1 per linear foot to $650 per acre	

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
15	Watershed-wide	Where feasible, convert existing swales and open drainageways to infiltration BMPs with native landscaping.	A2, A3, A3, A6, B5	M	ROCK; WC	IDOT	M	$1 per linear foot to $650 per acre	1
16	Watershed-wide	Encourage the implementation of stormwater BMPs in new developments and in redevelopment projects.	A2, A3, A3, A6, B5	M	ROCK; WC; DB, CBL	Illinois EPA; RO	M	varies	
17	Watershed-wide	Conduct a detailed H&H model of the watershed to identify all flood problem areas	B1, B2, B3, B4, B5, B6	H	WC	ROCK	S		
18	Watershed-wide	Identify flood mitigation opportunities in the watershed by additional storage and/or maintaining/improving the local drainage through the installation of new or larger sewer pipes, larger culverts, or improving or increasing the capacity of drainageways.	B2, B4, B5, B6	H	WC; ROCK, RO	FEMA; CVT; RT; IDOT	S	varies	
19	Watershed-wide	Identify locations for and construction regional compensatory storage basins within the watershed	B2, B5	M	WC; ROCK, RO	DH; CBL; USACE	M	varies	
20	Watershed-wide	Create/restore wetlands and depressional areas within the watershed	B2, B4	H	WCWIPSC; RPD	USACE	S	varies	
21	Watershed-wide	Identify locations where the incised stream and concrete lined channel can be reconnected to the floodplain	B1, B3	H	WCWIPSC	ROCK; WC; WCSWCD	S	varies	
22	Watershed-wide	Provide information to residents living within and along the 100-year floodplain on the benefits of a functional floodplain.	B6	L	WCWIPSC	FEMA	M	n/a	
23	Watershed-wide	Provide information to residents living within and along the 100-year floodplain on flood proofing.	B6	L	WCWIPSC	FEMA	L	n/a	

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
24	Watershed-wide	Develop stormwater BMPs for handling residential stormwater including downspouts and sump pumps. Flow should be directed onto a lawn or in areas landscaped with native vegetation.	A3, A5, B5	M	RO; URREP	WCWIPSC; WCSWCD	M	varies	
25	Watershed-wide	Mitigate flood damages through flood proofing at-risk structures.	B5	L	RO; DB; CBL	FEMA	L	varies	

Goal C: Improve aquatic and wildlife habitat in the Buckbee Creek watershed

Objectives

1) Identify opportunities for improving habitat along degraded stream channels using a natural channel design.
2) Restore riparian buffers along Buckbee Creek and its tributaries.
3) Encourage local residents to utilize native species in their landscapes.
4) Identify opportunities for habitat improvements at parks and natural areas.

Streambank erosion is threatening property, damaging infrastructure, and degrading water quality and riparian habitat. Stabilization, restoration and management of the stream channel, streambank and riparian corridor are needed throughout the watershed to improve water quality, maintain floodplain functions, and improve aquatic and wildlife habitat both within and near the streams. Practices that are needed include restoring instream habitat such as pools and riffles, removing excessive debris from the stream channel, establishing naturalized streambanks with native plants, establishing natural stream channels by removing concrete, and managing stream corridors by restoring native riparian buffers.

Through easement agreements, most private landowners are responsible for maintaining the stream and riparian zone as it crosses their property or flows along a property line. This includes all aspects of management and maintenance including debris removal, stabilization of streambanks, and management of private stormwater outfall pipes such as sump pumps and downspouts. Exceptions to the private landowner responsibility exist where the stream flows through publically owned lands such as parks and within right-of-way easements. As problems within the stream and riparian corridor are directly related to land use and other activities upstream in the watershed, it is important that all landowners living within the watershed (not just those living adjacent to the creek) work together on implementing the watershed-based plan.

Programmatic actions for the improvement of aquatic and wildlife habitat are detailed in Table 5-4.

Table 5-4 Programmatic actions for the improvement of aquatic and wildlife habitat

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
2	Watershed-wide	Develop a Riparian Landowner Handbook to educate riparian landowners on their responsibilities and easement requirements.	A2, A5, C2	H	ROCK; WC	CVT; RT	S	n/a	
3	Watershed-wide	Implement a waterside-wide stream maintenance program to remove debris and repair problem hydraulic structures. Remove damaged concrete and replace with a restore stream channel where feasible.	A1, A2, A3, A5, B2, C1	H	ROCK; WC; RO	CVT; RT; IDOT	S	$20 per linear foot	Watershed-wide
7	Watershed-wide	Stabilize eroding shorelines and replace riprap, concrete and turf pond edges with native vegetation.	A2, A3, A4, C2	L	ROCK; WC; RO; CBL; DB	IDOT	L	$100 per linear foot	
8	Watershed-wide	Develop stream restoration guidelines to provide guidance to riparian landowners on methods of streambank stabilization, riparian buffer restoration, and other bioengineering techniques.	A2, A3, A5, C2	M	WCWIPSC	Illinois EPA; IDR; WCSWCD	M	n/a	
9	Watershed-wide	Review and updated local landscaping and stormwater requirements to promote the use of native vegetation in water quality BMPs.	A2, A3, A5, C2, D1	M	ROCK; CVT; RT; WC	WCWIPSC	M	n/a	
26	Watershed-wide	Use bioengineering techniques in sections of hierologically modified channel to improve instream and streamside habitat.	C1,C 2	H	RO	USACE; IDNR	S	$50-$150 per linear foot	
27	Watershed-wide	Restore instream and riparian habitat in conjunction with road and bridge improvement projects.	C1,C2	M	IDOT; WC; ROCK	USACE	M	Varies	
28	Watershed-wide	Provide information to residents and business owners on the benefits of native landscaping.	C3	L	WCSWCD	IDNR	L	n/a	
29	Watershed-wide	Promote native plant and native seed exchanges and/or sales.	C3	L	WCSWCD	IDNR	L	n/a	

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
30	Watershed-wide	Where feasible, replace failing or crude armoring and concrete line channels with more naturalized and habitat focused measures.	C1, C2	M	ROCK; WC	RO	M	$250 per linear foot	
31	Watershed-wide	Where feasible, daylight and re-meander streams that have been contained in ditches or moved underground into culverts and pipes.	C1, C2	L	RO; ROCK; WC	IDNR	L	$575 per linear foot	
32	Watershed-wide	For moderately and severely eroded stream reaches, develop a stream restoration plan and cost estimate.	C1	M	WCWIPSC	IDNR; Illinois EPA	M		
33	Watershed-wide	Establish native riparian buffers along all unbuffered or inadequately buffered stream reaches.	C2, C3, D1, D2	M	RO	ROCK; WC	M	$25 per linear foot	
34	Watershed-wide	Restore streams and aquatic habitat to a health stream condition by installing habitat features such as natural channel substrates and pools and riffles.	C1	M	RO	ROCK; WC; IDNR	M	$250-$500 per linear foot	
35	Watershed-wide	Prepare a Natural Areas Management Plan for all public lands in the watershed as a means of identifying opportunities for habitat improvement projects.	C4, D1, D2	L	RPD	ROCK; WC	L		
36	Watershed-wide	Prevent the spread and control existing populations of invasive plant species.	C4, D2	M	RPD	IDNR	M	Varies	

D. Develop open space in the Buckbee Creek watershed and provide recreational opportunities

Objectives

1. Identify open space along the waterways that would provide access to the waterway.
2. Identify open space that provide natural resources protection and provide passive recreational opportunities.

With the exception of central portion of the watershed, very few areas in natural condition are found in the watershed. Open space and natural areas such as stream and riparian corridors, wetlands, and parks that remain undeveloped provide storm and flood water protection, serve as natural buffers for streams, and serve as passive and active recreational spaces for residents and visitors to the watershed. As such it is important for the watershed-based plan to identify ways of restoring/creating naturalized open space and improving access to creeks for recreational activities.

Programmatic actions for the development of open space and recreational opportunities are presented in Table 5-5.

Table 5-5 Programmatic actions for the development of open space and recreational opportunities

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
36	Watershed-wide	Prevent the spread and control existing populations of invasive plant species.	C4, D2	L	RPD	IDNR	L	varies	
37	Watershed-wide	Form partnerships to develop grant applications for the protection of open space and the expansion of trails and greenways.	D1, D2	H	WCWIPSC	ROCK; RPD; WC	S	n/a	
38	Watershed-wide	Establish native riparian buffers along all unbuffered or inadequately buffered stream reaches.	C2, C3, D1, D2	M	RO	ROCK; WC	M	$25 per linear foot	
39	Watershed-wide	Identify opportunities for municipalities to encourage the use of green infrastructure and open space preservation in new developments.	D1, D2	L	WCWIPSC	ROCK; WC	L	n/a	
40	Watershed-wide	Prepare a Natural Areas Management Plan for all public lands in the watershed as a means of identifying opportunities for habitat improvement projects.	C4, D1, D2	L	RPD	ROCK; WC	L	varies	
53	Watershed-wide	Encourage all municipalities to incorporate the recommendation of the Boone and Winnebago County Greenway Plan into their comprehensive plan.	D2	H	WCWIPSC; URREP	RMAP; RO	S	n/a	

D. Increase coordination between decision makers and other stakeholders in the watershed.

Objectives

1. Ensure communities adopt the Buckbee Creek Watershed-Based Plan.
2. Encourage the adoption and/or revision of comprehensive plans and ordinances that support the watershed plan's goals and objectives.
3. Encourage communities to continue to be an active member of the WCWIPSC following plan development.

Due to the nature of watershed, activities in one area of the watershed can impact water resources in another part of the watershed even when those areas seem distant and unconnected. And subsequently, the actions of all those living within the watershed have impacts, whether negative or positive, on the health of Buckbee Creek and its tributaries. As such, the participation and coordination of all watershed stakeholders is necessary for water quality and habitat improvements and flood reduction in the watershed. No single person, municipality or entity can effectively implement with the watershed-based plan alone.

Many of the recommendations in the plan require technical expertise and require significant funding to implement. As such, coordination across property and jurisdictional lines is vital for the success implementation in plan. By working together, stakeholders can share expertise and equipment making projects that one entity could not do alone feasible. Additionally, available monies can be combined and leveraged for maximum benefits.

Programmatic actions for the development of coordination between decision makers and watershed stakeholders are presented in Table 5-6.

Table 5-6 Programmatic actions for the development of coordination between decision makers and watershed stakeholders

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
41	Watershed-wide	Encourage the adoption of the Watershed-Based Plan by all jurisdictions located in the watershed.	D1, D2	H	WCWIPSC	ROCK; WC	S	n/a	
42	Watershed-wide	Continue to meet as the WCWIPSC in order to facilitate plan implementation and conduct progress evaluations.	D1, D3	H	WCWIPSC	All stakeholders	S	n/a	
43	Watershed-wide	Members of the WCWIPSC should work together to prepare grant applications and develop funding packages for the implementation of the plan's recommendations.	D3	H	WCWIPSC	RMAP; ROCK: RPD; WC	S	n/a	
44	Watershed-wide	Incorporate the watershed-based plan's goals, objectives, and recommendations in to municipal codes, regulations and comprehensive plans.	D1, D2, D3	M	WCWIPSC	ROCK; WC	M	n/a	
45	Watershed-wide	Hire a watershed coordination to assist the WCWIPSC with plan implementation.	D3	M	WCWIPSC	ROCK; WC	M	n/a	
46	Watershed-wide	Provide training and educational outreach to municipal officials and engineers on the goals, objectives, recommendations, and implementation of the watershed-based plan.	D1, D2	M	WCWIPSC	URREP	M	n/a	

E. Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship

Objectives

1. Encourage stakeholder to join the Upper Rock River Ecosystem Partnership.
2. Encourage stakeholders to participate in WCWIPSC activities and educational workshops.
3. Provide watershed stakeholders with an education plan that gives them the skills needed to implement the watershed plan.

Even the best plan for managing watersheds and controlling nonpoint source pollution cannot succeed without community participation and cooperation. An aggressive public outreach and education program, therefore, is essential and must be nurtured. Because many water quality problems result from individual actions and the solutions are often voluntary practices, effective public involvement and participation to promote the adoption of management practices is necessary. The needed public buy-in and support is impossible unless stakeholders understand their role in watershed protection and restoration and are willing to make changes in their behavior that will help achieve overall watershed goals. A well designed and implemented education and outreach plan is necessary to facilitate changes in stakeholder's opinions and actions.

Programmatic actions for education and outreach are presented in Table 5-7.

Table 5-7 Programmatic actions for education and outreach

ID#	Location	Recommendation/BMP	Goals + Objective	Priority	Lead Agency	Supporting Agency	Timeframe	Project Cost	Status
46	Watershed-wide	Provide training and educational outreach to municipal officials and engineers on the goals, objectives, recommendations, and implementation of the watershed-based plan.	D1, D2, E3	M	WCWIPSC	URREP	M	n/a	
47	Watershed-wide	Offer workshops to homeowners on native landscaping and other stormwater BMPs.	E2, E3	M	WCWIPSC; URREP	IDNR; WCSWCD	M	n/a	
48	Watershed-wide	Encourage interested watershed residents to join the Upper Rock Ecosystem Partnership.	E1	H	WCWIPSC		S	n/a	
49	Watershed-wide	Maintain the watershed planning website to keep the public informed on plan implementation activities.	E2, E3	H	URREP	WCWIPSC	S	n/a	
50	Watershed-wide	Hold watershed workshops in parks and other open spaces.	E2, E3	L	WCWIPSC;	WCSWCD; URREP; RPD	L	n/a	
51	Watershed-wide	Educate riparian property owners on ways to improve riparian conditions for water quality and habitat.	E3	L	URREP	WCSWCD	L	n/a	
52	Watershed-wide	Educate homeowners associations, developers, and municipalities about the importance of protecting open space, incorporating stormwater BMPs, and maintenance strategies for existing BMPs.	E2, E3	M	WCWIPSC	URREP	M	n/a	

Section 5.3.2 Regulatory Ordinance Review and Recommendations
A review of the existing regulations related to stormwater management was conducted. The stormwater management regulations govern strategies and stormwater management controls to improve water quality of runoff. They also play a primary role in addressing hydromodification, which has been identified as a primary cause of impairments in the waterway.

Regulations in the Madigan Creek watershed fall under two jurisdictions, Rockford and Winnebago County. Both jurisdictions have very similar regulations regarding stormwater management. There are additional regulations and codes governing the prevention of water pollution through non-stormwater discharges, but the most applicable regulations related to active managment of stormwater are listed below:

- Rockford, Illinois Code of Ordinances; Part II – Land Development Regulations; Chapter 109 – Flood Hazard Reduction; Article I. Surface Water Management; and Technical Requirements.
- Winnebago County Code, Article IV. Surface Water Management; and Technical Regulations.

The comments that follow apply to both jurisdictions (except as noted).

Regulated Development – The definition of developments subject to detention requirements is quite broad with only several reasonable exclusions (notably agriculture and existing single family dwellings). However the trigger of "developments which increase the amount of impermeable area" limits the ability to require detention as part of redevelopment activities. This language could be modified to require detention under a broader range of proposed development scenarios. One such modification would be to require detention for developments that propose "redeveloped impervious area," which can be defined as follows:

> ***Redeveloped Impervious Area.*** Redeveloped impervious area includes all of the impervious areas associated with a proposed development on a previously developed parcel. This includes new buildings, building additions, new parking lots, and reconfigured parking lots that will have revised drainage patterns and or new drainage structures. It does not include work such as sealcoating, restriping, patch repairs or resurfacing of existing pavement with no change in the drainage patterns or drainage structures serving that pavement.

Release Rate – The required release rate is 0.2 cfs per acre for the 100-year event, which is identified as the natural safe stormwater drainage capacity of the downstream system. The basis for this release should be revisited if a detailed stormwater management plan is conducted for the watershed. In addition, many communities have developed a dual release rate requirement to provide additional stream protection due to higher peak flows and volumes in smaller storm events. A release rate of 0.04 cfs per acre in the 2-year event has been shown to offer enhance protection from the damaging effects of hydromodification.

Design Storm – While detention is required for the 100-year event, the technical source for rainfall depth (i.e. – Illinois Bulletin 70), and a rainfall duration are not specified in the regulations. These should be clarified.

Low flow conduits – Low flow conduits are required in dry detention basins. These conduits reduce any potential benefits that can be derived from a dry detention in small storm events. With proper inlet and outlet protection, dry detention basins do not require these conduits to maintain an acceptable appearance. The low flow conduits convey water across the basin bottom and limit any chance for infiltration or water quality benefits. The requirement for these low flow conduits should be removed from the regulations.

Automobile parking stormwater storage areas – By allowing storage of stormwater on parking lots, there is no opportunity to require other more beneficial types of storage that would allow for some infiltration and water quality improvements. In addition, most vehicles will sustain damage if flooded to the allowable depth of 1.5 feet. Consider removing this allowance altogether; allowing it for only a portion of the required detention, and/or lowering the depth of allowable storage.

Off-site tributary areas – It is encouraged that detention be provided to limit the release rate to 0.2 cfs per acre for the total acreage of the tributary watershed. However, a larger outlet may be permitted where large tributary areas are developed without detention. Then the regulations state that if the orderly management of stormwate runoff cannot be achieved by passing the entire tributary area through the stormwater storage area, the storage area shall be constructed to exclude the runoff from the tributary area outside of the area to be developed.

This sequence of rules starts with the requirement to provide storage for the entire tributary area. While this would be good for the watershed, it is doubtful that any developer would willingly construct detention for upstream non-detained areas if they are not required to do so. The second rule suggests that a release rate to account for bypass flow may be granted. This typically creates a de facto on-line detention basin. Depending on the ratio of upstream area and the allowable bypass release rate, online detention basins typically underperform and do not provide the anticipated hydrologic benefits. The final requirement to bypass upstream flow, which seems to be presented as a last resort, is the hydrologically preferred solution. Consider eliminating the possibility of flow-through detention basins and require upstream drainage to be routed around new detention basins.

Detention basins less than 0.3 acre feet – Requirements for detention basins less than 0.3 acre-feet may be waived. This is a missed opportunity to implement detention. If the communities feel strongly that detention basins of this size are undesirable, then consider converting this allowance to a fee-in-lieu of detention. Monies could then be collected and used for other watershed improvements to offset the impacts of new development.

Post construction runoff controls - The technical reference documents for Rockford and Winnebago County discuss both post construction runoff quantity and quality controls. For post construction runoff quantity control, detention volume reduction credit is offered to facilities that can be shown to infiltrate stormwater runoff. This may be a good way to incentivize best management practices and green infrastructure to reduce the volume of stormwater runoff discharged to surface waterways. Future revisions to regulations may wish to consider requiring these measures outright with no detention credit. The section on post construction runoff quality controls are quite brief and acknowledge that at this time these measures are simply encouraged. The local jurisdictions are aware that this section will require modification to maintain compliance with their community MS4 permits.

Section 5.4 Site Specific Action Plan

In addition to the programmatic recommendations, which generally apply watershed wide, site specific action items and recommendations are tied to a particular location in the watershed. As with the programmatic actions, these site specific recommendations were developed to address watershed problems, to improve watershed resources, and to achieve the watershed goals and objectives.

The process of identifying specific sites that are in need of, or suited to, watershed improvement projects has been ongoing during the planning process and will continue throughout plan implementation. Watershed improvement projects in the site specific plan range from small maintenance and repair tasks, to mid-size projects such as detention basin retrofits to the construction of large regional storage facilities.

During development of the watershed-based plan, several methods were used to identify project sites.

1) Members of the WCWIPSC provided site and project recommendations during meetings.
2) Watershed stakeholders provided site and project recommendations during public meetings.
3) Sites were identified based on results of previous watershed studies.
4) New data was collected during the field assessments conducted as part of the watershed planning process.
5) Extensive map analysis using existing data including land use, wetlands, soil, floodplain, etc.

The Site Specific Plan is presented in table format (Tables 5-9). The tables include the recommended BMP, priority, cost, responsible lead agencies or organization with greatest potential to implement the recommendation, and support agencies or agencies who could assist with technical, financial, or regulatory assistance or whose programs may be impacted by the recommendations. Each recommendation is given a BMP ID number (ID#).

The provide cost estimates are included for advisory purposes only. The cost estimates should not be interpreted as concept costs and are best used to compare the relative costs of the recommended BMPs. More detailed costs can be developed once site constraints and some preliminary engineering activities are conducted.

Each of the BMPs was assigned a priority status and classified as high (H), medium (M), or low (L). Priority status was assigned based on need, cost, potential funding opportunities, and technical needs. High priority action items should be considered short-term goals (1-5 years) while medium and low priority action items are considered long-term goals (greater than 5 years).

Table 5-8 Buckbee Creek Watershed Site Specific Action Plan

BMP ID#	Location	Approximate Size	Recommendation/BMP	Priority	Lead Agency	Supporting Agency	Timeframe	Approximate Cost	Status
14	See Exhibit 5-4	6.4 acres (Harmon Park)	Complete Rockford's plan to build the Harmon Park Drainage Basin project.	H	ROCK		S	$7,500,000	
15	See Exhibit 5-3	2,145 feet	Remove concrete channel and restore channel by using a combination of soft- and hard-scape methods.	L	ROCK	WCWIPSC	L	$600/foot	
16	See Exhibit 5-1	98.66 acres	Complete a feasibility study to determine the best way to increase storage and improve conveyance out of this sub-basin to Buckbee Creek.	H	WC; ROCK		S	Conduct detailed study to determine cost.	
17	See Exhibit 5-3	2,600 feet	Remove concrete channel and restore channel by using soft-scape methods.	H	ROCK	WCWIPSC	S	$350/foot	
18	See Exhibit 5-2	4 acres	Remove pavement in select parking stall areas and install permeable pavers. Underdrains are not accounted for in the cost estimate.	M	CBL	WCWIPSC	M	$15/sq-ft	
19	See Exhibit 5-3	1,150 feet	Complete channel stabilization using soft-stabilization methods. Re-grade channel and plant native vegetation.	M	WC; ROCK	WCWIPSC	M	$100/foot	
20	See Exhibit 5-4	0.90 acres	Re-grade and plant native vegetation in the detention basin. Cost estimate includes dumped rock/rip rap in the drainage swales leading to the basin from adjacent impervious areas.	L	RO	ROCK	L	$25/sq-yd	

BMP ID#	Location	Approximate Size	Recommendation/BMP	Priority	Lead Agency	Supporting Agency	Timeframe	Approximate Cost	Status
21	See Exhibit 5-4	43 acres	Lower and expand existing floodplain to increase storage and construct several detention basins in upland areas. Conduct a detailed hydrologic/ hydraulic study to support further concept development and preliminary engineering. Potential environmental hazards not considered in the cost estimate.	H	WC; ROCK	DB	S	$130,000/acre	
22	See Exhibit 5-3	2.2 miles	Conduct a detailed hydrologic/ hydraulic study to determine the feasibility and ultimate design of any channel improvements and storage opportunities in this reach. Cost estimate includes concrete removal with the planting of native vegetation only for the concrete channel portion of this segment. Final cost is contingent on the type of channel restoration and overall complexity.	L	ROCK		L	$400/foot	
23	See Exhibit 5-2	1.28 acres	Remove pavement in select parking stall areas and install permeable pavers. Underdrains are not accounted for in the cost estimate.	L	CBL	WCWIPSC	L	$15/sq-ft	
24	See Exhibit 5-4	6 acres, 23 Ac-ft	Create a detention basin upstream of the Creek. Will require some additional sewer routing to deliver flow to and from the basin. Eventual cost would contingent on the size of the basin and overall complexity.	L	ROCK		L	$150,000/Ac-ft of storage	
25a	See Exhibit 5-1	200-feet x 15-feet	Complete outfall separation and install a rain garden at the outfall to the Creek.	H	ROCK	WCWIPSC	S	$10/sq-ft	

BMP ID#	Location	Approximate Size	Recommendation/BMP	Priority	Lead Agency	Supporting Agency	Timeframe	Approximate Cost	Status
25b	See Exhibit 5-1	30-feet x 30-feet	Complete outfall separation and install infiltration basins at select outfalls to the Creek.	M	ROCK	WCWIPSC	M	$19,450/infiltration basin	

5.5 Water Quality Monitoring Plan

As detailed in Section 3.14, limited water quality monitoring data is available for the Buckbee Creek watershed. A comprehensive water quality monitoring program should be implemented in the Buckbee Creek watershed aimed at assessing the current condition of the Buckbee Creek watershed and to assess changes in water quality associated with the implementation of the watershed-based plan. A quality assurance project plan (QAPP) should be developed for the comprehensive water quality monitoring plan proposed for the watershed.

Chemical and Physical Water Quality Monitoring

Baseline Sampling

Baseline sampling is regularly scheduled water quality sampling designed to obtain a long term record of water quality in the watershed. Sampling is typically conducted on a weekly, monthly, or yearly basis. Baseline chemical and physical water quality monitoring typically includes monitoring for nutrients, suspended solids, water clarity, dissolved oxygen, temperatures, conductivity, and pH. Due to the frequency of sampling, a baseline program can be expensive so budget is a significant consideration in determining the number of sampling sites and the frequency of the sampling.

It is recommended that two types of baseline stream sampling be conducted in the Buckbee Creek watershed: 1) sampling of the main stem of Buckbee Creek near its confluence with the Upper Rock River and 2) sampling of the major tributaries near their confluence with Buckbee Creek. Baseline sampling of the main stem of Buckbee Creek will give an overall picture of stream health of the entire watershed. Sampling of the tributaries will provide data on the pollutant loading from each of the major tributaries. The site along the main stem should be sampled on an annual basis with sampling conducted every 3-5 years on the tributaries. See Table 5-9 and Figure 5-5 for details and the locations of the recommended baseline sampling sites. The table also includes recommendation of potential responsible parties for the sampling.

At each sampling site, it is recommended the following parameters being analyzed as part of the baseline sampling program:

- Temperature
- Conductivity
- pH
- Dissolved Oxygen
- Total Suspended Solids (TSS)
- Total Nitrogen (TN)
- Total Phosphorus (TP)

It is recommended that the water quality samples for TSS, TN, and TP be collected using grab sampling methods. Samples should be collected using careful collection and handling procedures to ensure that the samples are representative and uncontaminated. The collected samples should be submitted for analysis at an Illinois Environmental Protection Agency (Illinois EPA) accredited lab. Temperature, conductivity, pH, and dissolved oxygen measurements should be collected in the field using portable instruments. To ensure the proper collection and handling, a Quality Assurance Project Plan (QAPP) should be developed for the baseline sampling program.

Table 5-9 Recommended Water Quality Monitoring Sites in the Buckbee Creek Watershed

Sampling Program	Site Location (see Figure XX)	Sampling Frequency	Indicators Tested	Recommended or Existing Sampling Parties
Baseline Sampling	Buckbee Creek at confluence with Upper Rock River	Annually	Physical and Chemical	
Baseline Sampling	2 tributaries at confluence of Buckbee Creek	Every 3-5 years	Physical and Chemical	
Stormwater Sampling	Baseline Sampling sites	Every 3-5 years	Physical and Chemical	
Macroinvertebrates	Buckbee Creek at confluence with Upper Rock River	Every year	Biological	RiverWatch
Fish	Buckbee Creek at confluence with Upper Rock River	Every 5 years	Biological	IDNR and Illinois EPA
Hydrologic Sampling	Throughout watershed	Every 3-5 years	Flow, water, level, erosion and deposition	
Project Implementation	Varies	Pre and post project construction	Physical, Chemical, Biological, and Habitat	Varies

<u>Stormwater Sampling</u>
Stormwater sampling is water quality sampling immediately following storm events designed to quantify pollutant loading to the creek from runoff events. This information is useful in refining the pollutant loading calculations generated by the PLOAD model to better reflect watershed conditions. It is recommended that stormwater sampling be conducted at each of the 3 baseline sampling sites at a frequency of every 3-5 years, depending on budget constraints. Stormwater samples should be collected within 12 hours of a significant rainfall event (>1.0 inches) and all three stormwater samples should be collected on the same day. The stormwater sampling program should mirror the baseline sampling program in regards to analyzed parameters, sampling methods, and quality assurance/quality control.

Table 5-9 and Figure 5-5 includes the details and the locations of the recommended stormwater sampling sites. The table also includes recommendation of potential responsible parties for the sampling.

<u>*Biological Monitoring*</u>
Monitoring the biological communities including macroinverterbrates and fish are extremely useful for assessing the health of a stream system. As both fish and macroinvertebrates live in water for all or part of their lives, their survival is related to water quality. These animals

are sensitive to different chemical and physical conditions in the water such as increased water pollution or changes in water flow. As such, the richness of fish and macroinvertebrate community composition in a stream or river can be used to provide an estimate of stream health.

Macroinvertebrate Sampling

It is recommended that RiverWatch continue to conduct benthic macroinvertebrate sampling on Buckbee Creek near its confluence with the Upper Rock River. As discussed in Section 3.11, a RiverWatch sampling site was established at this location during the development of the watershed plan. This site should be sampled on a yearly basis to provide a baseline on the overall health of the Buckbee Creek stream system. Baseline sampling at this location will also provide information on water quality changes resulting from the implementation of the watershed plan.

Macroinvertebrate sampling should also be conducted in stream segments immediately preceding and following the completion of stream restoration and stream habitat enhancement project completed during the implementation phase of the watershed plan. Macroinvertebrate sampling should be conducted prior to the construction of the project and 1-3 years following the completion of the project in order to quantify the success of the project on improving water quality and instream habitat conditions.

Fish Sampling

It is also recommended that watershed stakeholders work with the Illinois Department of Natural Resources (IDNR) and the Illinois Environmental Protection Agency (Illinois EPA) to establish a fish sampling site along Buckbee Creek near its confluence with the Upper Rock River.

Table 5-9 and Figure 5-5 includes the details and the locations of the recommended biological sampling sites. The table also includes recommendation of potential responsible parties for the sampling.

Habitat Assessment

The *Rapid Bioassement Protocol (RPB) for Stream and Rivers* provides a cost effective, straightforward and accurate means for evaluating and assessing instream and riparian habitat condition. It is recommended that the RBP for habitat be conducted in stream segments immediately preceding and following the completion of stream restoration and stream habitat enhancement project completed during the implementation phase of the watershed plan. The RBP evaluation should be conducted prior to the construction of the project and 1-3 years following the completion of the project in order to quantify the success of the project on improving instream and riparian habitat conditions. Details on the RBP for Habitat are included in Section 3.11.

Hydraulic and Hydrological Sampling

To supplement the water quality and habitat monitoring conducted in the Buckbee Creek watershed, it is important to also assess hydraulic and hydrological conditions of the watershed. As described in the previous sections of the watershed plan, a significant portion of the watershed has been developed with no or inadequate stormwater control. This has lead to increases in the total volume and rate of stormwater entering the stream system causing high fluctuations in the water levels and flows in the watershed. These rapidly changing fluctuations are the predominate cause of the hydromodification that is prevalent throughout the watershed. In order to understand and define these hydrological impacts, it is recommended that stream flow and stage monitoring be collected in the Madigan Creek watershed. When combined with the water quality data, the collected stream flow and stage monitoring data will also be useful in refining pollutant load calculations in the watershed.

Flow and water level monitoring

Three sites in the Buckbee Creek watershed have been identified for stream flow and stage monitoring. It is recommended that stream flow and water level measurements be based on the methodology outlined in *Discharge measurements at Gaging Stations, U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 3, Chapter A8* by T.J. Buchanan and W.P. Somers. It is recommended that the stream flow and water level be integrated into the baseline and stormwater sampling monitoring program of the 3 sites located on Buckbee Creek and its 2 major tributaries. The 3 sites should be monitored every 3-5 years within 12 hours of a significant rainfall event (>1.0 inches). All 3 sites should be monitored on the same day.

Additional sites for stream flow and stage monitoring may be identified during future Hydraulic and Hydrologic efforts and should be added as necessary.

Stream Bank and Bed Erosion and Deposition Measurements

Stream bank and bed erosion and deposition measurements should be collected at three locations in the Buckbee Creek River watershed at locations that represent typical conditions for the stream network. It is recommended that stream bank and bed erosion and deposition be quantified using the following methods:

- Erosion pins
- Erosion chains
- Stream cross-sections

An erosion pin, a steel rod 48-inch long, should driven into the stream bank. Approximately 4-inches of the pins are exposure at the soil surface. The head of the erosion pin is considered as a fixed reference and changes in its height are interpreted as changes in the elevation of the surrounding ground surface. Measured over time the erosion pins provide a measurement of recession or deposition rates. The stream banks on Buckbee Creek are relatively high due to hydromodification and channelization of much of the stream; therefore, it is recommended that the pins be placed at the following locations on the bank:

- Upper Level
- Mid Level
- Water Level
- Lower bank underwater

Measuring at the various locations on the bank provide the investigators an understanding of which portions of the banks are providing different amounts of soil. Erosion rates for each study reaches are based on an average of the pin erosion rates and measurements of the lineal and vertical extent of exposed bank representative of the reach.

To measure streambed scour, scour chains should be used. Scour chains are steel chains implanted vertically in streambeds to measure scour and fill of sediments over a period of time. The technique is based on the concept that bed load movements in streams occurs as discrete scour and fill events along the stream channel. During high flows, the streambed is scoured and the exposed portion of the scour chain lies over to the depth of scour. The portion of the chain now parallel to the streambed records the depth of the scour. As peak flows recede, deposition occurs, and the scour chain is buried. The depth of burial indicates the depth of deposition.

To confirm the rates of erosion and deposition at each study reach, stream-cross-sections should also be surveyed.

Table 5-9 and Figure 5-5 includes the details and the locations of the four recommended hydraulic and hydrology sampling sites. The table also includes recommendation of potential responsible parties for the sampling.

5.6 Education and Outreach Plan

The cumulative actions of thousands of individuals can either improve water quality, flooding, and natural resources or further degrade them. As such a watershed-based plan must include a strategy to educate and inform watershed stakeholders about watershed issues and encourage them to take an active role in implementing the watershed-based plan. Because many watershed problems are caused by individual actions and their solutions are often voluntary practices, effective public involvement and participated are necessary for the successful implementation of the plan. Furthermore, the general public is often unaware of the environmental impact their day to day activities have on the watershed's resources. With an understanding of watershed issues, watershed stakeholders can play a critical role in protecting and restoring water quality.

This section of the Action Plan includes:

- Primary goals addressed by each action;
- Targeted audiences and partner organizations;
- Best package (vehicle) for the action message for delivery to the targeted audience;
- Lead and supporting organizations; and
- Potential outcomes

The WCWIPSC Education Committee will lead the efforts to build and implement the education and outreach campaign.

5.6.1 Education and Outreach Strategy for the Buckbee Creek watershed

Development of an effective Education and Outreach Plan begins by defining E&O goals and objectives. WCWIPSC specifically addressed watershed information and education issues by developing an education goal. The education goal for the plan reads:

F. Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship

The E&O Plan includes program needs related to each of the watershed goals outlined in Chapter 2. Table 5-10 includes the E&O Plan for the Buckbee Creek watershed.

5.6.2 Target Audience

The primary target audiences for the Education and Outreach (E&O Plan are 1) residents and other landowners, 2) Land and resource managers and organizations, 3) Government officials and agencies, and 4) Developers and contractors. Each of these targeted audiences can be broken down into more specific sub-groups as detailed below:

1. Residents, other landowners, and visitors
    a. Riparian landowners and residents (RR)
    b. Non-riparian landowners and residents (NR)
    c. Homeowner Associations (HOA)
    d. General public and visitors (GP)
    e. Businesses and industrial properties (BI)
2. Land and resource managers and organizations
    a. Land and resource managers including golf courses and farmers (LM)
    b. Organizations, committees, and special interest groups involved in water resource management (OG)
3. Government officials and agencies
    a. Local governments including municipalities, townships, park districts, health departments, transportation departments, and other departments that manage land within the watershed (LG)
    b. Schools (S)
4. Developers and contractors
    a. Developers and home builders (DH)
    b. Consultants and contractors including civil engineers, planners, and landscapers (CC)

The abbreviations are keyed to the Education and Outreach Plan in Table 5-10.

To determine programming needs for each audience, WCWIPSC Education Committee should reach out and speak with representatives from each group to determine their level of understanding of watershed issues. The intent of this plan is to include both existing partners, as well as stakeholders that have previously not been participants in the watershed planning process. It is critical that the E&O Plan address the needs of both groups.

5.6.3 Partner Organizations

Organizations that can assist with the implementation of the Education and Outreach Plan are the same as those charged with implementing the Programmatic and Site Specific Action Plans. These same organizations may also serve as targeted audiences for programs. These organizations are listed in Section 2 of this chapter.

5.6.4 Evaluating the Education and Outreach Plan

Actual reduction in water quality and habitat degradation in the watershed is perhaps the best indication that the Education and Outreach Plan is successful. Although it is extremely difficult to attribute water quality and habitat improvement to a specific action item in the Education and Outreach Plan, there is little doubt that increased knowledge and understanding of watershed issues and solutions is essential to improving water quality and stream health and reducing flooding in the watershed. As such, it is extremely important to regularly evaluate the E&O plan to ensure the programs are being effective.

Evaluation conducted early in the process will help determine which programs are meeting their goals and which are not. This will allow for timely refinements to the E&O program to maximize efforts and facilitate plan implementation. Chapter 6, Section 6.5.1 contains "Report Cards" with milestone related to watershed education that can be used to access the E&O efforts.

Table 5-10 Education and Outreach Action Plan

Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Educate the public about general watershed issues.	All Goals	GP	• Signs at stream crossings and watershed boundaries. • Messages in community newsletters. • Post watershed maps in public buildings.	WC; ROCK; WCWIPSC; KREP	• General public participate in watershed events and activities. • General public requests additional information on watershed activities.
Educate the public that a watershed-based plan has been developed for the watershed to gain interest for implementing Action Items.	All Goals	GP	• Website. • Public interest message on radio. • Articles in newspaper.	WCWIPSC; KREP	• General public requests additional information on watershed-based plan. • Majority of watershed residents have a working knowledge of watershed conditions and know how to get involved in plan implementation. • Public begins to make small changes in day to day behaviors aimed at improving water quality and habitat in the watershed.
Maintain the watershed planning website	All goals	All stakeholders	• Maintain the website to keep the public informed on plan implementation activities.	WCWIPSC; KREP	• Increase in the number of visitors to the website. • Website users have information related to the watershed including potential and ongoing projects, watershed problems, and a calendar of upcoming events.
Provide training and educational outreach to municipal officials and engineers on the goals, objectives, recommendations, and implementation of the watershed-based plan.	All goals	CC; WC; ROCK	• Meet with elected boards to promote the Watershed-Based Plan. • Meet with consulting engineers to promote the Watershed-Based Plan.	WCWIPSC	• All elected officials are familiar with the Watershed-Based Plan. • Local governments adopt the Watershed-Based Plan.

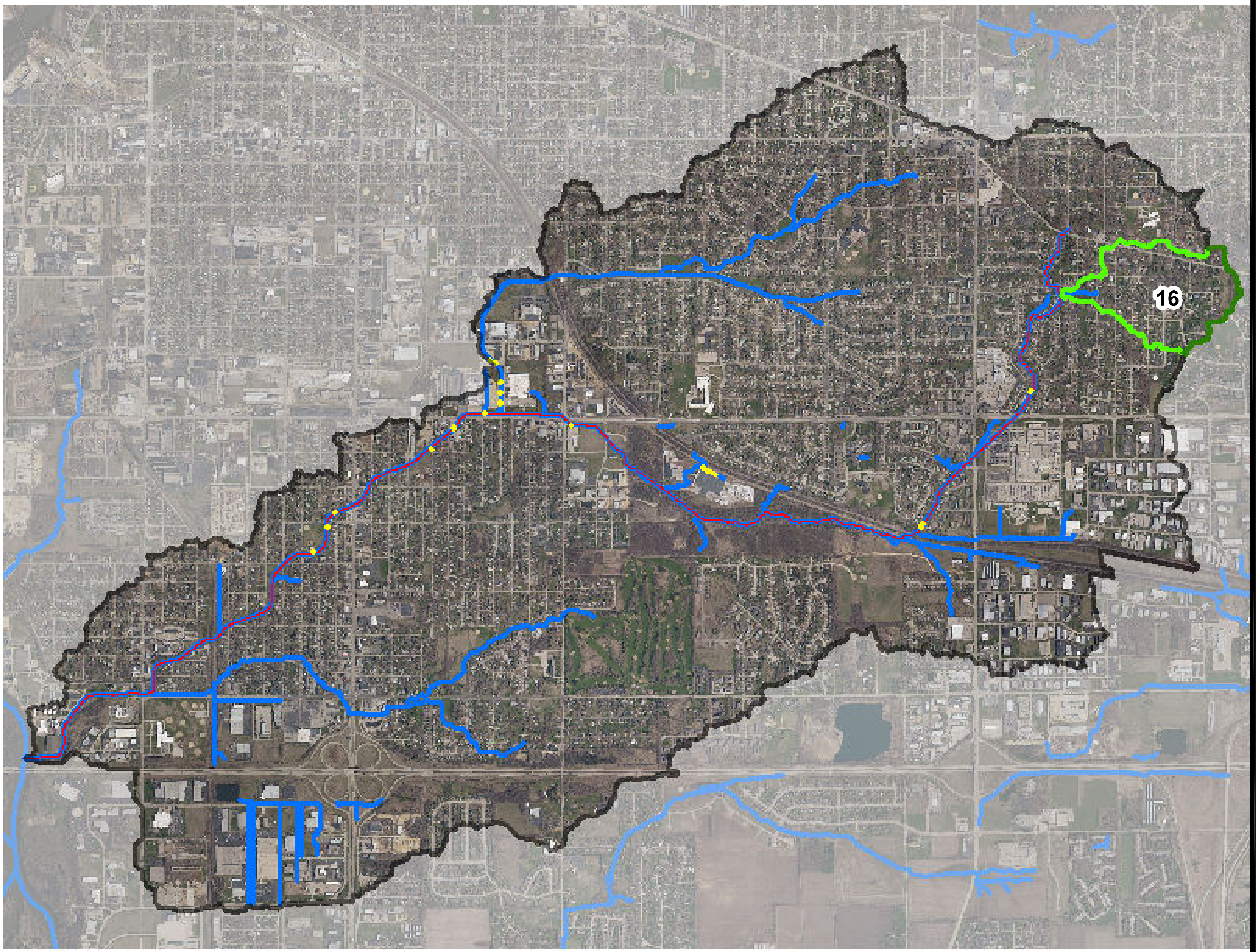
Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Educate riparian landowners on their responsibilities and easement requirements.	A & C	RL	• Hold riparian owner training workshops. • Develop and distribute an information booklet/pamphlet.	WC; ROCK; WCWIPSC; KREP	• Number of reported debris blocks decrease. • Problems are reported to the proper authorities.
Educate homeowners on how to best maintain septic systems	A	RR, NR	• Distribute educational letters to all residents with septic systems.	WC	• Owners act quickly to mitigate and repair problems with their septic system. • Owners understand the impact poorly maintained and broken septic systems have on water quality.
Educate the general public on the importance of groundwater quality and quantity.	A	GP	• Hold education workshops to educate the general public on groundwater related issues. • Hold field trips to educate the general public on the importance of groundwater recharge.	WC; WCWIPSC	• Attendees gain a better understanding of groundwater related issues. • Attendees inform their neighbors of information they learned at the workshops and field trips.
Educate owners/developers of existing and new developments on ways to reduce volume and rate of stormwater runoff.	A & B	HOA, BI, DH, CC, WC, ROCK	• Meet on a case-by-case basis to develop strategies and incentives for reducing impervious areas. • Distribute fliers to existing HOAs and businesses that highlight the benefits and funding sources for retrofitting existing stormwater management facilities. • Hold training seminars on stormwater BMPs. • Install stormwater BMP demonstration projects.	WCWIPSC; KREP	• Municipalities, businesses, and HOAs realize the potential that naturalized detention basins have to improve water quality and reduce flooding. • Municipalities, businesses, and HOAs implement maintenance programs for all existing stormwater management facilities.

Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Educate municipalities, HOAs, and businesses on importance of and how to maintain naturalized detention basins.	A, B, C, & D	RR, HOA, BI, WC, ROCK	• Meet with landowners, municipalities, and others who manage these facilities. • Develop and distribute an information booklet/pamphlet. • Hold technical workshops that provide information on detention basin retrofits and stress maintenance needs for existing facilities.	WCWIPSC	• Number of retrofit projects increase. • Detention basins are monitored, maintained, and repaired on a regular basis.
Educate HOA, developers, and municipalities about the importance of protecting open space.	A, C & D	DH, CC, HOA, WC, ROCK	• Meet on a case-by-case basis to develop strategies and incentives for developing and preserving open space. • Municipalities use zoning to protect open space and natural areas. • HOAs and developers allocate funding to the protection and restoration of open space. • Distribute copies of the Winnebago and Boone County Green Infrastructure Plan. • Presentations on open space at community and board meetings.	WCWIPSC; WCSWCD	• Voluntary preservation and restoration of open space. • Linear feet of trail in the watershed increases. • Number of municipalities adopting the Winnebago and Boone County Green Infrastructure Plan increase. • Number of government officials and board members reached at community meetings.
Educate municipalities and landowners on stream maintenance strategies aimed at removing debris and repairing problem hydraulic structures.	A & B	RR, HOA, WC, ROCK	• Meet with landowners, municipalities, and others who manage these facilities. • Hold training seminars on stormwater infrastructure management.	WCWIPSC; KREP; Illinois EPA	• Number of reported debris blocks decrease. • Number of reported culvert issues decrease. • Infrastructure problems are reported to the proper authorities.

Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Provide information to residents living within and along the 100-year floodplain on the benefits of a functional floodplain.	A & B	RR	• Develop and distribute an information booklet/pamphlet. • Provide contacts for flood assistance on the website. • Hold workshops for landowners on flood proofing and flood awareness.	FEMA; IEMA; WC; ROCK	• Number of flood prone properties owners reached increase. • Number of structures insured, flood proofed, or removed from the flood prone areas increase.
Educate landowners and municipal Public Works about the use of environmentally-friendly (phosphorus-free) fertilizer.	A	GP, WC, ROCK	• Develop and distribute an information booklet/pamphlet. • Use media (radio, newspapers, website, etc) to communicate the negative impacts of using a phosphorus-based fertilizer.	WCWIPSC; KREP	• Decrease in the number of Public Works and homeowners utilizing phosphorus-based fertilizers
Provide information to residents and business owners on the benefits of native landscaping.	A & C	RR, NR, HOA, BI, CC	• Offer free workshops that help individuals choose the appropriate native plants and trees for their yards, planting beds, etc. • Host native plant and seed sales and exchanges.	WCSWCD; WCWIPSC; KREP	• Stakeholders can identify native plants. • Number of native plantings in residential yards and near businesses increase. • Stakeholders recognize the benefits of native plants on water quality and habitat.

Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Educate riparian property owners on ways on streambank stabilization methods that promote water quality and stream habitat.	A, B & C	RR, HOA, BI, CC	• Conduct technical workshops for riparian property owners that recommend bioengineering options, funding sources, and certified contractors for stabilizing eroded streambanks. • Install streambank stabilization demonstration projects. • Provide stream stabilization and restoration stewardship volunteer opportunities. • Develop and distribute an information booklet/pamphlet • Provide a list of funding and technical assistance sources.	WCWIPSC; WCSWCD; IDNR; Illinois EPA	• Riparian landowners recognize the benefits of bioeneginnering techniques for streambank stabilization. • Bioengineering techniques are utilized to stabilize streambanks over hardscape armoring. • Participation in volunteer opportunities. • Requests for technical assistance with projects. • Number of stakeholders attending technical workshops. • Number of stream restoration and stabilization projects increase.
Educate riparian property owners on ways to improve riparian buffer conditions for water quality and habitat.	A, B & C	RR, HOA, BI, CC	• Hold riparian landowner training workshops on riparian zone management. • Publish articles in newsletters and newspapers. • Provide stream management volunteer opportunities.	WCWIPSC; WCSWCD; IDNR; Illinois EPA	• Participation in volunteer opportunities. • Number of stakeholders attending workshops. • Requests for assistance for riparian buffer restoration projects. • Riparian landowners plant native buffers. • Riparian landowners stop dumping yard waste and other trash in the stream.

Education Action	Primary Goal	Target Audience	Package (vehicle)	Lead and Supporting Organizations	Outcomes/Behavior Changes
Educate landowners on lot level BMPs aimed at improving water quality and reducing stormwater	A & B	RR, HOA, BI, CC	• Hold technical sessions on the use and construction of rain gardens, rain barrels, and other lot level BMPs. • Provide detailed instructions on the construction of rain gardens and the use of rain barrels on the website. • Distribute stormwater management how-to materials for rain gardens and rain barrels.	WCWIPSC; WCSWCD; IDNR; Illinois EPA	• Landowners voluntarily act to reduce the rate and volume of stormwater runoff from their lot. • Number of rain gardens constructed increases. • Number of rain barrels in the watershed increase.
Educate school children, adults, corporate and political entities on how to provide stewardship in the watershed.	F	All stakeholders	• Provide stewardship volunteer opportunities. • Host activities such as stream cleanups, storm drain painting, and natural area maintenance.	KREP; WCSWCD	• Number of people in the watershed aware of how their daily activities affect water quality and stream health increases. • Individuals make behavior changes to protect and improve water quality and stream health.



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Feet

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Legend

- Streams & Flowlines
- Buckbee Creek Mainstem
- Infiltration Basin BMP Locations, #25a & 25b
- Stormwater Management Plan BMP Location

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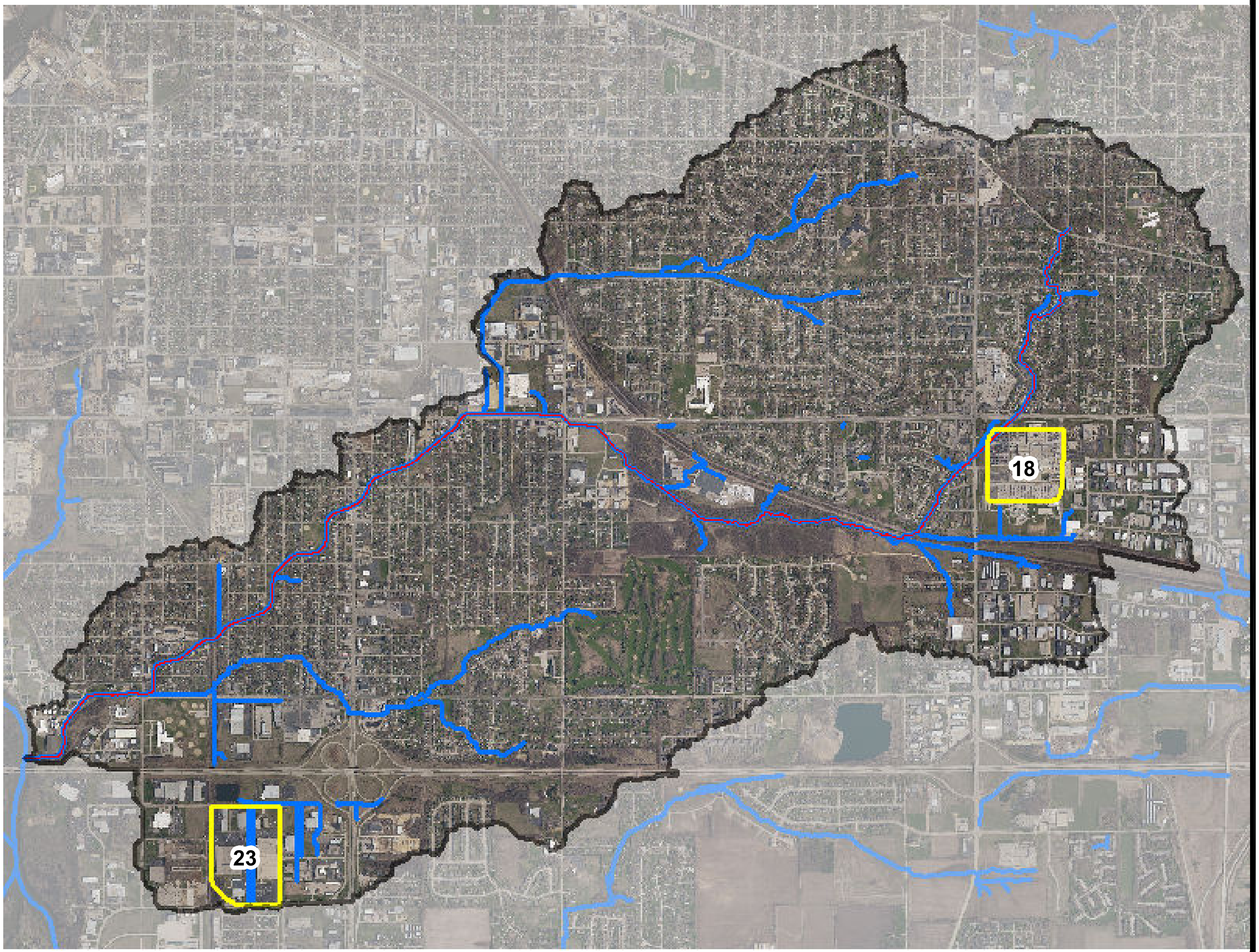
Winnebago County
Watershed Planning

Buckbee Creek - Infiltration Basin & Stormwater Management Plan BMP Locations

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	5-1
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

FINAL



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Legend

- Streams & Flowlines
- Buckbee Creek Mainstem
- BMP w/ Number

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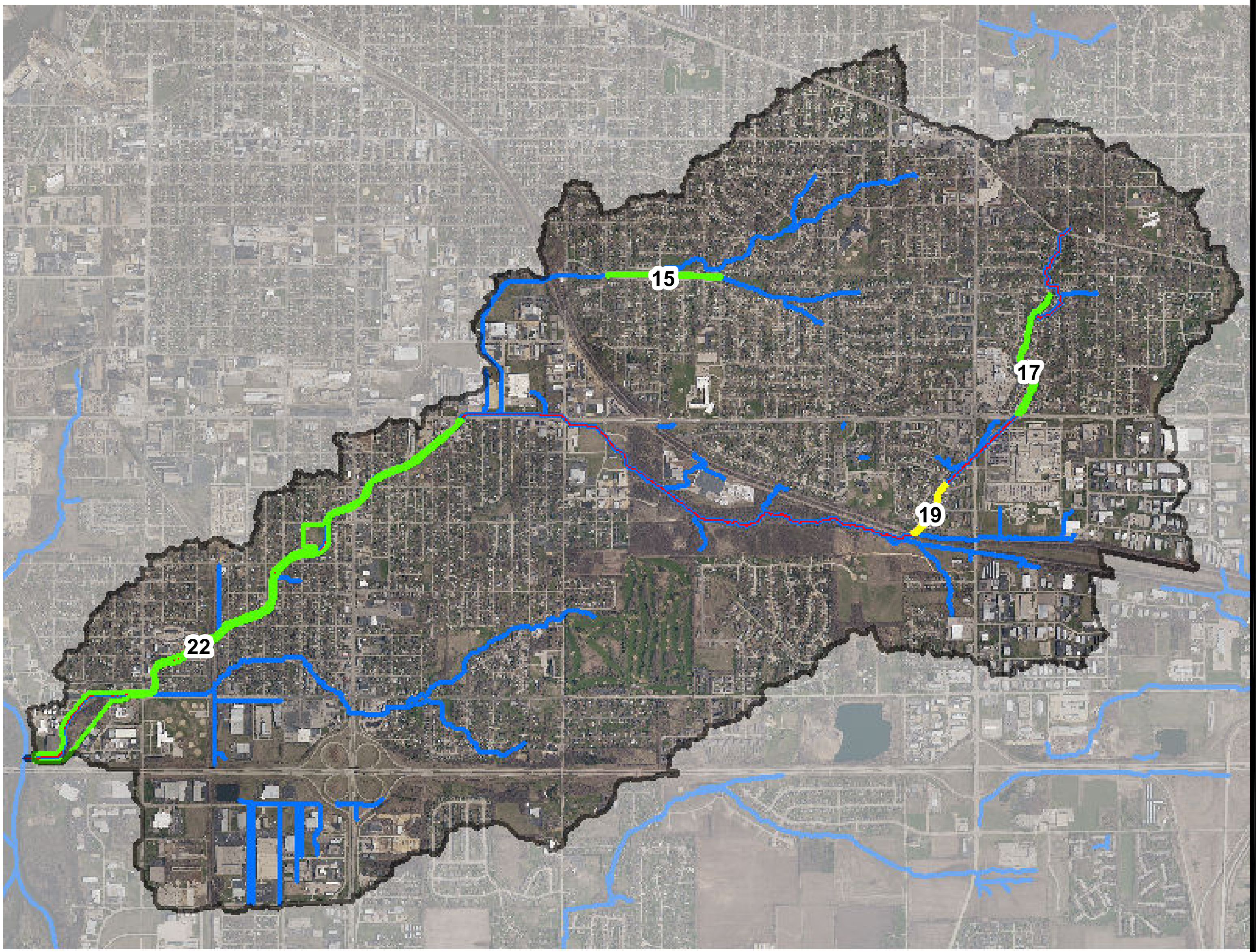
Winnebago County Watershed Planning

Buckbee Creek - Permeable Pavement BMP Locations

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	5-2
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

FINAL



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Feet

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W E
S

Legend

- Streams & Flowlines
- Buckbee Creek Mainstem
- Streambank Stabilization BMP Location
- Streambank Restoration BMP Locations

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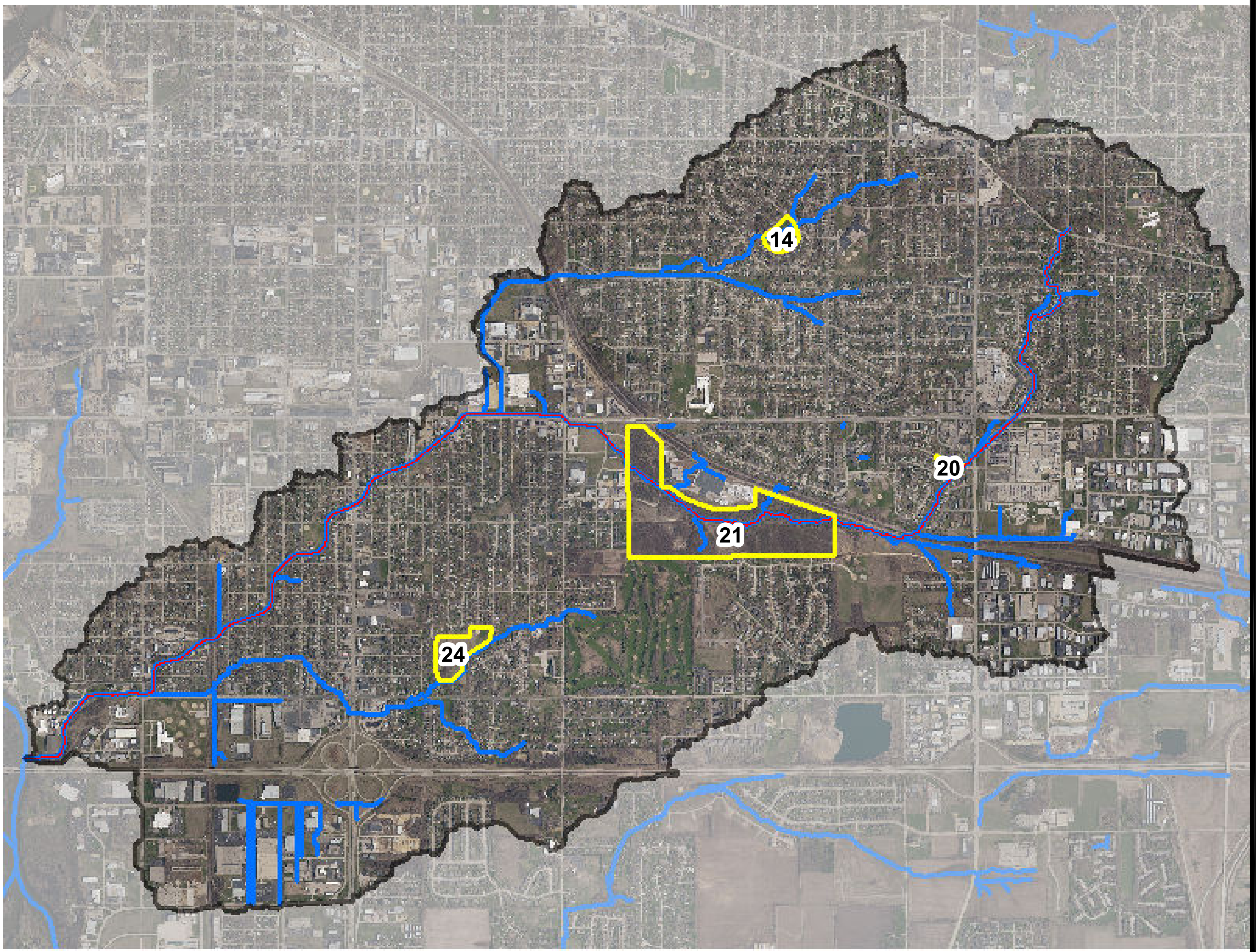
Winnebago County
Watershed Planning

Buckbee Creek - Streambank Stabilization & Restoration BMP Locations

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	5-3
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

FINAL



0 1,500 3,000
Feet

N
E
S
W

Legend

- Streams & Flowlines
- Buckbee Creek Mainstem
- BMP w/ Number

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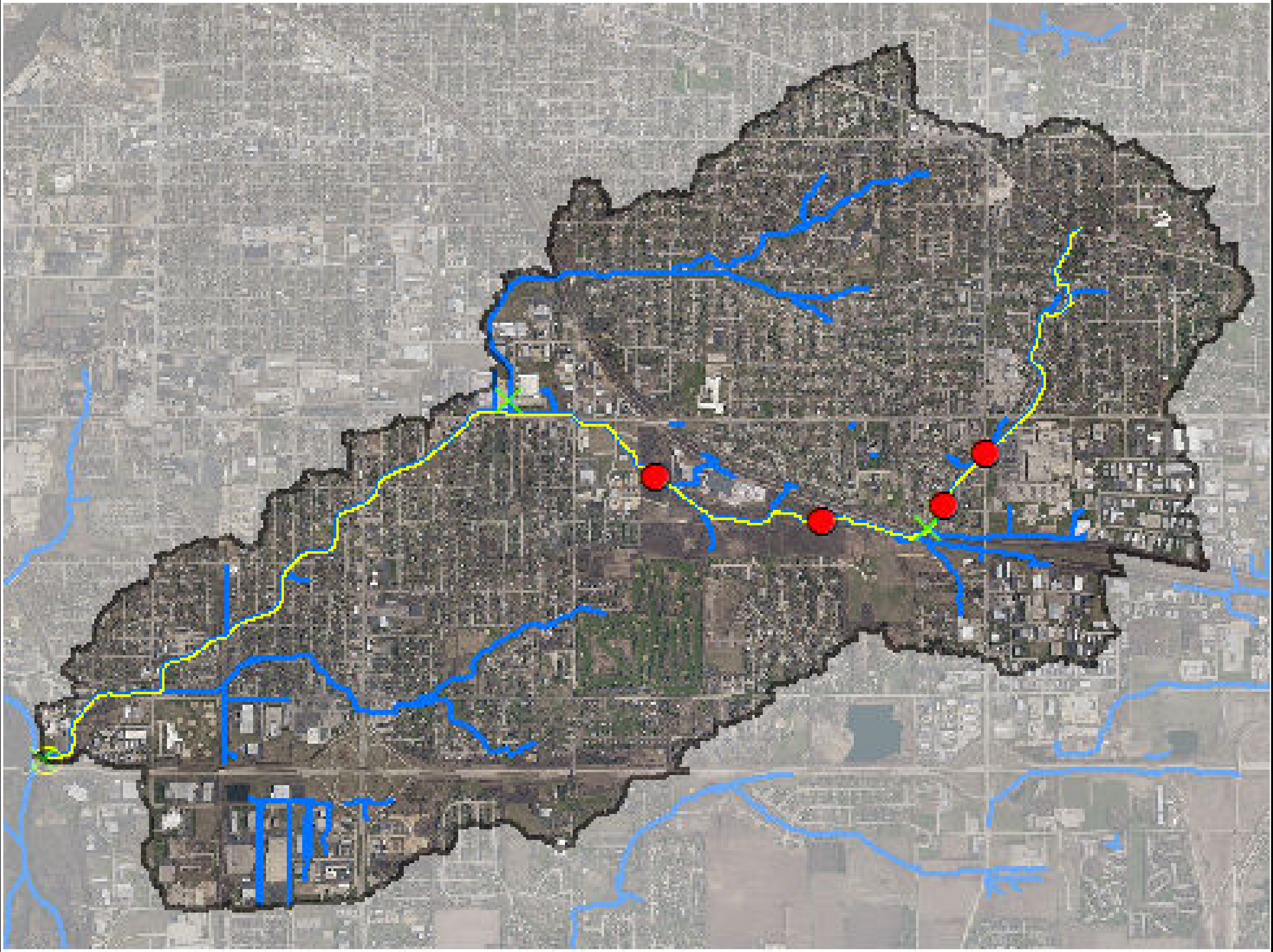
Winnebago County Watershed Planning

Buckbee Creek - Naturalized Detention BMP Locations

PROJECT NO: 11-0174		SHEET NO:
DESIGNED BY	BRO	5-4
DRAWN BY	BRO	
CHECKED BY	DAD	
APPROVED BY	JAW	
ISSUE DATE	06/30/2013	

FINAL



Legend

- Buckbee Creek Mainstem
- Streams & Flowlines
- Macroinvertebrate Sampling/Fish Sampling
- Streambank, Bed Erosion, and Deposition Measurements
- Baseline Sampling

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Winnebago County Watershed Planning

Buckbee Creek - Monitoring Plan

PROJECT NO: 11-0174		SHEET NO:
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Section 6.0 Plan Implementation and Evaluation

This chapter identifies a strategy for moving from planning to implementation of the action plan recommendations. How frequently this plan is used and implemented by watershed stakeholders is one indicator of its success. Improvement in water quality and watershed resources, the reduction of nonpoint source pollution, and the reduction of flooding is also important indicator. Successful plan implementation will require significant cooperation and coordination among watershed stakeholders to secure project funding and to efficiently and effectively move the action plan from paper to the watershed.

This chapter also relates some more technical details about the expected results of putting action recommendations in place. It also presents a plan for monitoring and evaluating plan implementation as a way to determine progress towards meeting the watershed goals and objectives.

6.1 Plan Implementation Roles Strategy

Successful plan implementation is dependent on watershed stakeholders forming partnerships as a means of maximizing efforts to complete watershed projects. Key stakeholders that have potential to form watershed partnerships for the implementation of the watershed plan are listed in Chapter 5 Section 2. These and other stakeholders are encouraged to:

- Acquire funding through grants and other means;
- Implement educational programs;
- Sponsor and participate in water quality sampling;
- Provide technical and regulatory guidance;
- Maintain and monitor water quality improvement projects; and
- Update and amend the watershed plan as changes occur.

Throughout the planning process the Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC) functioned as the stakeholder forum for the watershed. The implementation of the Buckbee Creek Watershed-Based Action Plan will ultimately depend on the WCWIPSC continuing to serve as the lead organization focused on the implementation of the plan.

6.2 Pollutant Load Reductions and Targets

In order to meet the requirements for a watershed-based plan, the plan must pay particular attention to water quality pollutants and impairments and measures for reducing the impairment. The high priority water quality pollutants for the Buckbee Creek Watershed include low dissolved oxygen, Total Suspended Solids/sedimentation, and nutrients (phosphorous). Additional impairments addressed by the plan include degraded watershed aquatic habitat, impacted or lack of stream buffers and riparian zones, and flood flows and damages. See Chapter 3 for additional details on the causes and sources of water quality impairments.

For each of these impairments, the intent of the action plan recommendations is to reduce the impairment to an acceptable level. The 'acceptable level' for some pollutants is set by the Illinois Pollution Control Board and Illinois Environmental Protection Agency. However, Illinois standards only exist for one of these impairments, dissolved oxygen, which is set at a concentration of 5.0

mg/L for most conditions. For other impairments, reduction targets are set according to best professional opinion.

Setting impairment reduction targets and estimating the improvement expected by implementing plan recommendations are important for assessing the effectiveness of watershed plan recommendations for determining whether watershed impairments are being addressed. Targets and reduction estimates also satisfy one of the nine required watershed-based plan elements established by the US Environmental Protection Agency.

Targets and reduction estimates can be based on water quality criteria, data analysis, reference conditions, literature values, and/or expert examination of water quality conditions that support "Designated Uses" and biological integrity. Progress towards meeting the targets and reduction estimates indicated whether implemented BMPs are effective at achieving the watershed plan's goals. If the implemented BMPs are determined to not be making progress towards obtaining the goals, the Action Plan should be altered. Table 6-1 includes specific target values and indicators for meeting the water quality objectives developed for this watershed-based plan. Section 6.5 contains Report Cards that can be used to evaluate the effectiveness of the implemented Action Plan projects.

Table 6-1 Targets and Indicators to meet water quality objectives

Water Quality Objective	Target Value and Indicator
1) Stream shall meet state water quality standards to fully support designated uses.	• *Dissolved Oxygen:* No less than 5 mg/L (Illinois EPA standard) • *Temperature:* Less than 90 degrees F (Illinois EPA standard) • *pH: Between 6.5 and 9 (*Illinois EPA Standard*)* • *Chemical water quality standards:* See Illinois EPA standards in Table 3-32 • *Macroinvertebrate Biotic Index (MBI):* Less than 5.7 • *Public Opinion:* 50% of surveyed citizens feel water quality is improving.
2) Reduce sediment and nutrient loading by restoring eroded streambanks using bioengineering techniques.	• *Linear feet of restored stream:* Implement stream channel restoration improvement projects: one project in years 1-5 and two projects in years 5-10 and 10+ • *Linear feet of stabilized streambanks:* Implement stream stabilization improvement projects: one project in years 1-5 and two projects in years 5-10 and 10+ • *Linear feet of restored buffer:* Riparian buffers restored on three parcels within each timeframe: 1-5 years, 5-10 years, and 10+ years. • *Macroinvertebrate Biotic Index (MBI):* Less than 5.7 • *Chemical water quality standards:* See Illinois EPA standards in Table 3-32

Water Quality Objective	Target Value and Indicator
3) Retrofit existing stormwater management facilities and install new facilities within developed areas to reduce nutrient and sediment loading.	• *Retrofits:* Implement detention basin retrofits: one project in years 1-5 and two projects in years 5-10 and 10+ • *New Facilities:* Construct new stormwater management facilities in developed areas: one project in years 1-5 and two projects in years 5-10 and 10+ • *Chemical water quality standards:* Discharges from stormwater management facilities meet Illinois EPA standards
4) Identify open space parcels for implementation of BMPs designed for water quality improvement	• *Acres of wetland/depressional area restoration/creation:* Implement at least one wetland/depressional area creation/restoration during years 5-10 and 10+ • *Linear feet of restored stream:* Implement stream channel restoration improvement projects: one project in years 1-5 and two projects in years 5-10 and 10+ • *Linear feet of restored buffer:* Riparian buffers restored on three parcels within each timeframe: 1-5 years, 5-10 years, and 10+ years • *Retrofits:* Implement detention basin retrofits: one project in years 1-5 and two projects in years 5-10 and 10+
5) Implement stormwater management practices to stabilize stream flows and reduce stormwater runoff entering streams.	• *Flood problem areas:* Implement at least two flood mitigation projects within each timeframe: 1-5 years, 5-10 years, and 10+ years • *Linear feet of restored stream:* Implement stream channel restoration improvement projects: one project in years 1-5 and two projects in years 5-10 and 10+ • *Linear feet of stabilized streambanks:* Implement stream stabilization improvement projects: one project in years 1-5 and two projects in years 5-10 and 10+ • *Acres of wetland/depressional area restoration/creation:* Implement at least one wetland/depressional area creation/restoration during years 5-10 and 10+ • *Retrofits:* Implement detention basin retrofits: one project in years 1-5 and two projects in years 5-10 and 10+ • *New Facilities:* Construct new stormwater management facilities in developed areas: one project in years 1-5 and two projects in years 5-10 and 10+
5) Educate the public about protecting and improving water quality	• *Public Opinion:* 50% of surveyed citizens feel water quality is improving.

6.2.1 Estimating Pollutant Load Reductions

PLOAD was used for estimating pollutant load reductions associated with action plan implementation at the subbasin level. PLOAD allows a planner to rapidly evaluate the pollutant loading reductions at a site for several BMP types. It should be noted that calculated load reductions by the model are estimates and not absolute values to be expected in the field.

PLOAD facilitates watershed BMP evaluation, but still requires the results to be reviewed for accuracy and feasibility. For example, the tributary area to each BMP must be calculated and inputted into the model so that the model properly estimates the load reductions that can be attributed to the BMP. Also, the modeler is responsible for choosing a BMP that will have a sufficient volume or area to properly treat the drainage area as PLOAD does not have this ability.

Reducing pollutant loading in the watershed can be accomplished by reducing the percent of impervious surfaces within the watershed, construction of new BMPs, improvements to existing pollutant control practices, and or a combination of the methods. Typically improvements to existing practices can be implemented more quickly and at a lesser cost the construction of new BMPs. However, retrofitting existing practices alone is not efficient to reduce pollutant loads to meet the goals of the watershed-based plan. As such, new BMPs and the reduction of impervious area need to be integrated in to plans to reduce pollutant water in the watershed.

PLOAD was used to calculate pollutant load reductions for four BMP types identified in the site specific action plan (Chapter 5 Section 5.4): permeable pavements, streambank stabilization, infiltration basins, and wetland/naturalized detention basins. Pollutant load reductions in the PLOAD model are based on predicted pollutant load removal efficiencies developed by the Indiana Department Environmental Management (IDEM), Michigan Department of Environmental Quality (MDEQ), Illinois State Water Survey (ISWS), and Illinois Environmental Protection Agency (Illinois EPA). Table 6-2 includes a list of BMPs and predicted removal efficiencies.

BMP Recommendations for Water Quality Improvement (Pollutant Load Reductions)

PLOAD was used to calculate pollutant load reductions for five BMP types: infiltration basins, permeable pavements, streambank stabilization, and wetland/naturalized detention basins on a watershed scale. While other BMP types such as flood mitigation projects and streambank restoration (removal of concrete channels) were identified in the Site Specific Action Plan (Section 5.4), PLOAD was only applicable to calculate loading reductions for the five above-listed BMPs.

Infiltration Basins

Typically, rain gardens are seen in parking lots and at the end of downspouts from roof-drains. The specific implementation being utilized in Buckbee Creek is for outfall separation. By giving stormwater runoff a chance to infiltrate before being directly discharged to the Creek, this helps in reducing runoff volume and the velocity of flow in the downstream channels. Installation of rain gardens at outfalls consists of removing a section of the outfall, grading and excavating the channel

Table 6-2 BMP percent pollutant removal efficiencies

BMP	TSS	TDS	BOD	COD	TN	TKN	DP	TP	Cadmium	Lead	Copper	Zinc
Vegetated Filter Strips	73%	*	50.5%	40%	40%	*	*	45%	*	45%	*	60%
Grass Swales	65%	*	30%	25%	10%	*	*	25%	50%	70%	50%	60%
Infiltration Devices	94%	*	83%	*	*	*	*	83%	*	*	*	*
Extended Wet Detention	86%	*	72%	*	55%	*	*	68.5%	*	40%	*	20%
Wetland Detention	77.5%	*	63%	50%	20%	*	*	44%	*	65%	*	35%
Dry Detention	57.5%	*	27%	20%	30%	*	*	26%	*	50%	*	20%
Settling Basin	81.5%	*	56%	*	*	*	*	51.5%	*	*	*	*
Sand Filters	82.5%	*	40%	*	*	*	*	37.5%	*	*	*	*
Water Quality Inlets	37%	*	13%	5%	20%	*	*	9%	*	15%	*	5%
Weekly Street Sweeping	16%	*	6%	*	*	*	*	6%	*	*	*	*
Infiltration Basin	75%	*	*	65%	60%	*	*	65%	*	65%	*	65%
Infiltration Trench	75%	*	*	65%	55%	*	*	60%	*	65%	*	65%
Porous Pavement	90%	*	*	80%	85%	*	*	65%	*	1%	*	1%
Concrete Grid Pavement	90%	*	*	90%	90%	*	*	90%	*	90%	*	90%
Sand Filter/Infiltration Basin	80%	*	*	55%	35%	*	*	50%	*	60%	*	65%
WQ Inlet with Sand Filter	80%	*	*	55%	35%	*	*	*	*	80%	*	65%
Oil/Grit Separator	15%	*	*	5%	5%	*	*	5%	*	15%	*	5%
Wet Pond	60%	*	*	40%	35%	*	*	45%	*	75%	*	60%
Agricultural Filter Strip	*	*	*	*	53%	*	*	61%	*	*	*	*
Streambank Stabilization	Streambank stabilization pollutant efficiencies vary depending on bank height and lateral recession rates. The USEPA only estimates the removal of sediment, phosphorus and nitrogen from streambank stabilization.											

slope, installing engineered soils for proper infiltration, and stabilizing the rain garden. Final stabilization consists of native vegetation, mulch, erosion control blanket, and turf reinforcement matting for the overflow into the channel. It is recommended that outfall separation only occur with pipes 12-inches or less in diameter as anything larger would result in too large of velocities being conveyed to the rain gardens. Any installation of a rain garden should come with a maintenance program so it remains effective for as long as possible. Pollutant load reduction impact areas for rain gardens are accounted for by calculating the amount of tributary area that each rain garden could infiltrate 0.5-inches of rain with approximately a one-foot of storage. In total, there are seventeen rain garden installation locations in the watershed.

Permeable Pavements

Utilized as a detention method for stormwater runoff on impervious surfaces, permeable pavement/pavers provide a practical means toward reducing runoff while not having to use traditional detention storage methods. The aggregate beneath the pavers provides storage while also providing a pathway for water to infiltrate into an underdrain or the ground. Permeable pavement systems are utilized in many applications such as parking lots, alleys, and access roads. The main application in the Buckbee Creek watershed will be in commercial parking lots. Used in combination with traditional storm sewer systems, stormwater runoff can be reduced by allowing water to infiltrate into the porous pavement. Installation consists of pavement removal and excavation, followed by the placement of stone aggregate and pavers/pavement. Permeable pavement is a practical best management practice as it enables the full use of a facility for driving while at the same time providing a means to infiltrate stormwater runoff. Pollutant load reduction impact area for permeable pavement is calculated to be two-times the area of actual permeable pavement installation at each location. In total, there are two proposed installation locations for permeable pavement within the watershed.

Streambank Stabilization

The Buckbee Creek watershed has a large amount of impervious area, subsequently causing higher amounts of flow greater than pre-development rates. This in turn causes the erosion and degradation of channels throughout the watershed. Implementing measures to reduce these impacts can be done in several ways. Soft-stabilization measures such as grading to eliminate steep slopes and scour areas, with the subsequent planting of native vegetation, and bioengineering practices can be utilized to achieve a more aesthetically pleasing channel. The planting of native vegetation provides stabilization by embedded root growth that helps hold soil together. However, soft-stabilization measures should be used in channels with lower velocities. In channels with higher velocities and sheer stress, more hard-scape or armoring measures are used such as articulating concrete pads, gabions, and rip rap. These practices are more adept at handling larger amounts of water than just planting native vegetation. Ideally, a combination of soft-stabilization and hard-scape measures is used when stabilizing a streambank. This offers protection against high velocities of flow while also giving a water quality and fish habitat benefit. Riffles, cross-vanes, chevrons, stone toes, and bendway weirs are additional methods that can be used with both soft-stabilization and hard-scape methods to improve the dissolved oxygen content of water along with fish habitat. Pollutant load reduction impact areas are accounted from the channel itself to the top-of-bank/limits of construction work and the immediate vicinity of the channel. In total, there are approximately 1,150-feet (0.22-miles) of proposed streambank stabilization within the watershed.

Wetland/Naturalized Detention Basins

The implementation or retrofitting of wetland detention in a watershed can provide numerous benefits. By eliminating low-flow concrete channels in the bottom of a detention basin (as seen in many locations) and subsequently re-grading and planting native wetland vegetation, the residence time of stormwater runoff can be increased. With a low-flow concrete channel in place, stormwater runoff is not given the chance to attenuate, infiltrate, or evaporate in the basin. It is immediately conveyed to the outlet of the detention basin causing increased flow and velocities in the downstream channel. A water quality benefit also results by helping to reduce pollutant loads by filtering through wetland vegetation. Even in basins with no low-flow concrete channels, multiple locations exist in both watersheds that will be able to utilize the implementation and retrofitting of wetland detention basins from re-grading to increase residence time further and from the planting of native wetland vegetation. To ensure these basins are designed correctly, detailed hydrologic and hydraulic studies should be completed. Additional volume may need to be added to a basin because of increased development in its watershed from the time it was initially designed. This can be implemented when retrofitting the wetland detention basin with the appropriate measures. Wetland detention areas provide the most effective water quality benefits when they are at least 3-5 percent as large as the watershed they serve.. Within the watershed, there are eighteen wetland detention basin installations or retrofits.

Pollutant Load Reductions Following the Implementation of Recommended BMPs

If all of the modeled BMPs (bioswales, permeable pavements, streambank stabilization, and wetland/naturalized detention basins) are implemented, the estimated percentage of pollutant load reductions for each pollutant of concern (BOD, COD, and total phosphorus) for each subbasin is detailed in Table 6-3. Table 6-4 summarizes the overall watershed load reductions associated with the implementation of the four BMPs types modeled in PLOAD. Appendix C includes expanded load reductions results for each pollutant of concern.

Table 6-3 Pollutant Load Reductions for Pollutants of Concerns

Subbasin	Acres	Percent Reduction following BMP implementation		
		BOD	COD	Total Phosphorus
1	192.53	63%	50%	44%
2	98.86	63%	50%	44%
3	129.29	9%	7.4%	6.5%
4	136.25	0%	0%	0%
5	260.04	0%	0.5%	0.5%
6	121.20	0%	0%	0%
7	317.44	66.6%	55.1%	48.6%
8	125.70	0%	0%	0%
9	279.15	0%	0.8%	0.8%
10	299.19	0%	0.9%	0.9%
11	108.94	63%	50%	44%
12	64.55	63%	50%	44%
13	104.62	63%	50%	44%
14	93.19	63%	50%	44%
15	34.01	63%	51.5%	45.6%
16	177.09	63%	50.9%	44.7%
17	177.96	63%	50%	44%
18	95.53	0%	0 %	0%
19	140.25	0%	0 %	0%
20	275.27	47.2%	37.5%	33%

Subbasin	Acres	Percent Reduction following BMP implementation		
		BOD	COD	Total Phosphorus
21	154.88	0.00%	0.00%	0.00%
22	62.83	0.00%	0.00%	0.00%
23	93.93	0.00%	0.00%	0.00%
24	165.17	0.00%	0.00%	0.00%
25	484.98	0.00%	0.47%	0.38%
26	150.21	63.00%	50.00%	44.00%
27	98.66	63.00%	50.00%	44.00%

Ideally, the water quality goal of the watershed-based plan would be to decrease pollutant levels to meet water quality standards. With the exception of BOD and COD in Subbasin 13, implementing the four BMPs types modeled by PLOAD will not solely be able to bring the watershed in compliance with water quality standards. However, implementation of these four types of BMPs discussed in this analysis is a big step in meeting this goal. The PLOAD model will allow stakeholders to quickly estimate the reductions in pollutant loadings if BMPs are installed.

Simply constructing all of the BMPs modeled in PLOAD will not solve all of the problems in the Buckbee Creek watershed. Additional water quality BMPs should be installed in the watershed. These BMPs could include native vegetation, downspout disconnection on residential lots, and the construction of rain gardens on individual lots. Table 6-5 lists and compares additional BMPs that are designed to achieve water quality goals and standards. The table also includes a rating for each BMP that represents their effectiveness when applied to a particular land use. The ratings include High (H), Medium (M), and Low (L). Chapter 4 also includes additional information on BMPs that can be implemented in the watershed.

Table 6-4 Overall Watershed Load Reductions Modeled by PLOAD

BMP Type	Unit of Measurement	Cumulative Size	Cumulative Cost	Pollutant Load Reductions (lbs)								
				TSS	**BOD**	**COD**	**TN**	**TP**	**Cd**	**Pb**	**Cu**	**Zn**
All BMPs	-	-	$ 41,034,100.00	508785.9	58663.4	199794.8	2971.4	1314	0	0	508785.9	58663.4
Infiltration Basin	feet	17	$ 346,650.00	3310.5	-	1763.6	58.3	13.2	0	0	3310.5	-
Wetland/ Naturalized Detention**	acre	56.31	$ 39,731,950.00	499976.9	58663.4	195167.2	2798.5	1282.3	0	0	499976.9	58663.4
Permeable Pavement	acre	5.28	$ 860,550.00	5241.9	-	2864.1	109.0	17.4	0	0	5241.9	-
Streambank Stabilization*	feet	1,150	$ 94,950.00	256.6	-	-	5.6	1.2	-	-	256.6	-
Existing Load	-	**-**	**-**	3455129	241113	1010162	36197.7	7540.2	496.5	2016.6	3455129	241113.6

*Streambank Stabilization amount and cost does not include Restoration projects, as these were not included in PLOAD.

**Only the Harmon Park area is accounted for in the amount of Wetland Detention. The included cost is for the entire project ($7,500,000).

Table 6-5 List of urban/transitional BMPs for reducing pollutant loading

Land Use	Contaminant Reduction							Runoff Reduction	
	TSS	BOD	Oil/ Grease	Total N	Sediment	Total P	Metals	Rate	Volume
Developed Areas									
Native Landscaping	M	M	M	H	M	H	L		
Paved Area Sweeping	M	L	L	L	H	H	M		
Rain Gardens		L		L	L	L		M	M
Construction Sites									
Maintenance of Erosion Control	L				M		L		
Expedited Stabilization	L				H		L		
Use of Polymers	L				M	L	L		
Retrofits and New Development									
Sediment Basins	M	L	M	L	H	M	M	H	L
Swales	M	L	M	L	M	M	M	M	M
Wetland Treatment	M	M	H	H	H	M	M	H	M
Stormwater Treatment Train	H	H	H	H	H	H	H	H	M
Permeable Pavement	H	M	M	M	H	M	M	H	H
Infiltration Basins	H	H	H	H	H	H	H	H	H
Naturalized Detention	M	L	M	L	H	M	M	H	L

Two recommendations included in the Action Plan for the watershed that were not modeled by PLOAD should be discussed in more detail as they are priority recommendations: Stormwater Management Plan Feasibility Study and Streambank Restoration.

Stormwater Management Plan Feasibility Study

It is recommended that a stormwater management plan feasibility study for the Buckbee Creek watershed be completed to obtain a detailed understanding of stormwater runoff management issues in the watershed. It was identified early in this planning process that hydromodification was a significant cause of impairments in the watershed. A detailed stormwater management plan will identify and further quantify specific areas where stormwater management projects would be most beneficial. Also, the detailed hydrologic and hydraulic modeling prepared to support a stormwater management plan can also be used to identify flood risks. Throughout the planning process, watershed residents and stakeholders expressed concern about increased flooding and property damage. By quantifying flood risk problems, the value and benefits of stormwater management projects to reduce flood risk may be identified. As a result of recent flood events in Illinois, there have grant opportunities for flood risk reduction projects, but information on existing flood risk and project benefits is needed to build support or secure grant monies. If implemented, many flood risk reduction projects would also benefit the health of the watershed.

Streambank Restoration

In addition to streambank stabilization, multiple locations exist in which restoration activities can take place within the watershed. These mainly occur in existing areas of concrete channel. With already higher amounts of flow and greater velocities due to increased impervious area upstream, the concrete channel magnifies these factors even more causing impacts downstream. By removing the concrete and employing soft-stabilization or hard-scape methods like those previously mentioned in the Streambank Stabilization section, channel velocities can be reduced along with providing habitat for fish and native vegetation. In addition to improving the channel itself, it also provides an aesthetically pleasing area for nearby residents and recreational users to enjoy. Removal of concrete channel and restoration of a more naturalized streambank condition does not directly result in pollutant constituent reduction. However, it reduces the impacts of hydromodification by reducing channel velocity and improving in-stream habitat. Streambank restoration will provide significant habitat benefits and is necessary to achieve the watershed goals.

6.3 Plan Implementation Schedule

Watershed planning is an ongoing process that does not end with the completion of this plan. The implementation schedule acts as a guide for these future efforts by directing the priority given to the various Action Plan recommendations selected for the watershed. Higher priority or less expensive BMPs are often scheduled for implementation prior to very expensive or highly technical projects. The schedule also provides a framework for implementation by spreading out project implementation over time and allowing for reasonable timeframe for securing funding.

The Implementation Schedule for the Buckbee Creek Watershed-Based Plan is included in the Action Plan tables (Chapter 5). The Site Specific Action Plan tables include a column with a recommended implementation schedule based on short term (1-5 years), medium term (5-10 years) and long term (greater than 10 years) objectives. The tables also include a column denoting priority (low, medium, or high) of the implementation of the Action Item. In many cases implementation schedule and priority reflect higher priority items being implemented on a short term schedule and lower priority items being implemented on a long term scheduled. However, it should be noted that some high priority goals have been included as a long term goal due to the cost and technical resources required for the implementation of the project. Table 6-6 presents a summary of the plan implementation schedule. The number of short, medium, and long term actions is shown to give watershed plan implementers an idea of how many actions are recommended to be implemented in each of these time frames.

Table 6-6 Plan Implementation Summary Schedule

Implementation Term	Number of Action Items
Short (1-5 years)	21
Medium (5-10 years)	26
Long (greater than 10 years)	20

6.4 Funding Sources

Plan implementation is largely based on the availability of funding and technical assistance available in the watershed for the implementation of watershed wide and site specific action items. It is no secret that securing funding is one of the biggest challenges that watershed stakeholders will face during plan implementation.

A list of potential funding sources that may be used to move forward with plan implementation is included in Table 6-7.

6.5 Plan Monitoring and Evaluation

6.5.1 Monitoring Plan Implementation

Continued monitoring is essential for providing feedback on the progress of the implementation of this watershed-based plan. The implementation and effectiveness of the plan and its recommendations, and an assessment of whether the plan goals are being achieved its measured through this monitoring. Simply, monitoring is observing and tracking watershed conditions for both positive and negative changes that are a result of the implementation of the plan. These conditions can then be compared to water quality monitoring data to determine whether there is a correlation between them. If no correlation between water quality improvement and recommendation implementation can be determined and/or is progress is not being made towards reaching the goals of the plan, WCWIPSC, as the implementation team, should consider whether the recommended strategies are having the desired effect or if the plan should be updated and modified.

Recommendations that are physical or structural in nature such as streambank stabilization, the construction of infiltration BMPs, and restoring riparian buffers, can be assessed in terms of the reduction of pollutant loads discharged into the watershed, improved biological and habitat health, and the degree of change in stormwater runoff volume and flow. The effectiveness of non-structural recommendations such as the implementation of education/outreach programs, stream maintenance programs, and changes to policies and regulations are much more difficult to monitor. Changes in behavior following the implementation of non-structural recommendations, can be assessed by gathering feedback through meetings with watershed stakeholders and tools such as surveys and focus groups.

Evaluation is a critical part of watershed planning. It will tell you whether or not your efforts are successful and provide a feedback loop for improving project implementation. A well-planned milestone and evaluation process will provide a way to measure the effectiveness of the watershed-based plan. As projects are implementation and results are demonstrated, additional support from the community will be gained and the likelihood of project sustainability will be greatly increased.

The goal of the Buckbee Creek Watershed-Based Plan's evaluation process is to not turn evaluation and monitoring into an academic process. This monitoring strategy is intended to help track and measure the implementation of recommendations made in this plan using a variety of indicators that are monitored regularly, typically on an annual basis or every three years. Progress on overall plan implementation should be reviewed using the milestones and indicators every 5 years and the plan should be updated as needed. As a means of facilitating plan evaluation, "Report Cards" were developed for each watershed goals (Chapter 2). The report cards are intended to provide a brief description of current conditions, suggest performance indicators that should be evaluated and monitored, milestone to be met, and remedial actions if milestones are not being met.

As water quality is one of the primary goals of this plan, stream and lake water quality impairments should be monitored by regularly collecting and testing water samples, either manually or using constant monitoring equipment. A recommended sampling program for the watershed was included in Chapter 5, Section 5.5.

Watershed issues, opportunities, and conditions will change over time. This watershed-based plan should be evaluated and updated every five years to account for these changes. At each evaluation and update, completed projects can be removed from the plan and new projects should be added. In addition to this 5-year update, plan implementation should be monitored annually by the Winnebago County Watershed Improvement Plan Steering Committee (WCWIPSC). At the time of the annual evaluation, the committee should assess the list of priorities and identify the top priority actions for the following year.

As projects are implemented, they should be recorded using the Report Cards and the tables in Chapter 5 which track the implementation of actions against the watershed plan goals and objectives as a means of monitoring watershed plan implementation.

<table>
<tr><td colspan="2">Goal A: Protect and enhance overall surface and groundwater quality in the Buckbee Creek watershed</td></tr>
<tr><td colspan="2">Current Conditions and Problems:
• Water quality modeling indicates that predicted levels of phosphorus, COD, and BOD are above state standards. Low dissolved oxygen levels and high levels of total suspended solids/sedimentation and total dissolved solids/salinity may also be potential water quality impairments.
• Streambank erosion, hydromodification and channelization are prevalent throughout the watershed.
• Very limited water quality and habitat data is available for the watershed.</td></tr>
<tr><td colspan="2">Indicators to Meet Objectives:
• Chemical water quality parameters (nutrients, metals, etc) meet Illinois EPA standards for designate use of the waterbody.
• All physical water quality parameters (DO, pH, TSS, etc) meet Illinois EPA standards.
• Linear feet of streambank stabilization and restoration.
• Number of detention basin retrofits to improve water quality.
• Number of wetland/depressional area creation projects.
• Percentage of surveyed citizens who feel water quality is improving, are able to identify where water pollution originates, and are able to identify methods of protecting and restoring water quality.</td></tr>
<tr><td>Milestones:
1-5 Years:
1. Establish and fund a water quality monitoring program (Chapter 5, Section 5).
2. Develop stream restoration concept plans for at least two stream reaches.
3. Construct at least one detention basin retrofits.
4. Identify at least three locations for BMP implementation (rain gardens, bioinfiltration basins, etc).
5. Develop concept plans for two wetland/depressional area restoration projects.
6. Homeowners and business be required to use phosphorus-free fertilizers.
7. Promote alternatives to salt on roads and driveways to reduce salt usage.</td><td>Grade</td></tr>
<tr><td>5-10 Years
1. Implement the water quality monitoring program.
2. Implement at least two stream restoration projects in the watershed.
3. Construct at least two detention basin retrofits.
4. Construct at least one wetland/depressional area restoration project.
5. Install at least three BMPs designed for water quality improvement.
6. Develop stream restoration concept plans for at least two stream reaches.
7. Develop concept plans for two wetland/depressional area restoration projects.
8. Reduce salt concentrations used on roads to levels that are not harmful to aquatic species.</td><td></td></tr>
</table>

10+ Years 1. Implement at least two stream restoration projects in the watershed. 2. Construct at least two detention basin retrofits. 3. Construct at least one wetland/depressional area restoration project. 4. Install at least three BMPs designed for water quality improvement. 5. A survey posted to the WCWIPSC or KREP website indicated that at least 50% of the watershed stakeholders feel that water quality is improving and is able to identify sources of pollution and methods to protect water quality.	
Monitoring Needs/Efforts: • Regular monitoring of physical, chemical, and biological water quality parameters. See Chapter 5, Section 5 for more information. • Periodically visit stream restoration and stabilization project locations to access successes and failures. • Periodically visit all installed retrofits and BMPs to access successes and failures.	
Remedial Actions: • Assess the number of projects that have been implemented versus water quality changes to determine if projects are improving water and habitat quality. If not, conduct an assessment to find causes of pollution and address. • If stream restoration and stabilization projects do not improve instrem and streamside habitat, determine if hydraulic problems upstream or downstream are damaging the project and/or conduct remedial work such as re-seeding or habitat installation.	
Notes:	

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved
C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved
F = Milestone(s) not achieved

Goal B: Reduce existing flood damage in the watershed and prevent flooding from worsening

Current Conditions and Problems:

- Urbanization has drastically altered the historic hydrology in the watershed.
- The changes in hydrology have lead to changes in stream function and decreased in infiltration.
- Storm sewers collect a greater volume of runoff and transport it to streams more quickly. Additionally, runoff from many impervious surfaces is not detained.
- Current flooding in the watershed includes: overbank flooding, local drainage problems, sanitary sewer backups, and depressional flooding.

Indicators to Meet Objectives:

- Number of flood problem areas that are mitigated or reduced by BMP implementation.
- Number of stream restoration projects that reconnect the stream channel to the floodplain.
- Number of new and existing developments that implement flood reduction BMPs.
- Number of stream reaches with problematic debris jams or culverts that are repaired and/or removed.
- Number of detention basins that are retrofitted or repaired to increase flood storage capacity.

Milestones: Grade

1-5 Years

1. Secure funding for and complete a Stormwater Management Plan including a detailed H&H study of the watershed.
2. Identify and develop concept plans to mitigate for at least two flood problems areas by construction projects recommended in the Site Specific Action Plan.
3. Develop stream stabilization concept plans for at least two stream reaches.
4. Conduct a detention basin inventory
5. Construct at least one detention basin retrofits designed to reduce flooding.
6. All new or re-development incorporate infiltration BMPs.
7. Implement a watershed-wide stream maintenance program to clear streams channels of problematic debris jams.

5-10 Years

1. Mitigate for at least two flood problems areas constructing projects recommended in the Site Specific Action Plan.
2. Identify and protect at least two parcels located in the 100-year floodplain.
3. Implement at least two streambank stabilization projects.
4. Implement at least one streambank restoration project where the stream is reconnected to the floodplain.
5. Construct at least two detention basin retrofits designed to reduce flooding.
6. Retrofit at least two older developments with flood reduction BMPs.
7. Identify and develop concept plans to mitigate for at least two flood problems areas by construction projects recommended in the Site Specific Action Plan.

10+ Years 1. Mitigate for at least two flood problems areas constructing projects recommended in the Site Specific Action Plan. 2. Identify and protect at least two parcels located in the 100-year floodplain. 3. Implement at least one streambank stabilization projects. 4. Implement at least one streambank restoration project where the stream is reconnected to the floodplain. 5. Construct at least two detention basin retrofits designed to reduce flooding. 6. Retrofit at least two older developments with flood reduction BMPs.	
Monitoring Needs/Efforts: • Track the number of mitigated/reduced flood problem areas. • Track the linear feet of stream restoration projects that reconnect the stream channel to the floodplain. • Track the number of stream reaches where problematic debris jams or culverts are repaired. • Track the number of retrofitted or repaired detention basins. • Track the number of older developments that construct flood reduction BMPs.	
Remedial Actions: • Conduct follow-up visits to flood problem areas during flood events to determine if additional work is needed. • Conduct an inventory of detention basins to determine if retrofits are possible.	
Notes:	

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved
C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved
F = Milestone(s) not achieved

<table>
<tr><td colspan="2">Goal C: Improve aquatic and wildlife habitat in the Buckbee Creek watershed</td></tr>
<tr><td colspan="2">Current Conditions and Problems:
• Vegetation along the creek channels is not diverse and is dominated by turf grass.
• There are very few natural stream features (pools, riffles, etc) present in the watershed's creeks.
• Significant hydromodification including channelization and streambank erosion is present in the watershed.
• Portions of the creek channel have been placed in a concrete-lined channel and in storm sewer.</td></tr>
<tr><td colspan="2">Indicators to Meet Objectives:
• Linear feet of stream habitat restoration (including in-stream habitat and native buffers).
• Number of riparian buffers restored with native vegetation.
• Number of detention basins retrofitted with native vegetation.
• Number of stakeholder landscapes that incorporate native vegetation.
• Number of wetland and/or depressional area projects that incorporate native vegetation.</td></tr>
<tr><td>Milestones:
1-5 Years
1. Implement at least one stream projects restoration (concrete removal or projects that install instream habitat) in the watershed.
2. Develop concept plans for at least two additional stream restoration projects in the watershed.
3. Conduct at least one detention basin retrofits where turf grass basins are converted into native vegetation.
4. Develop concept plans for two wetland/depressional area restoration projects.
5. At least ten watershed stakeholders (private residents, business owners, etc) incorporate native vegetation into existing landscapes.
6. Riparian buffers restored on at least three parcels.</td><td>Grade</td></tr>
<tr><td>5-10 Years
1. Implement at least two stream restoration projects in the watershed.
2. Conduct at least two detention basin retrofits where turf grass basins are converted into native vegetation.
3. Construct at least one wetland/depressional area restoration project.
4. At least twenty watershed stakeholders (private residents, business owners, etc) incorporate native vegetation into existing landscapes.
5. Riparian buffers restored on at least three parcels.</td><td></td></tr>
<tr><td>10+ Years
1. Implement at least two stream restoration projects in the watershed.
2. Conduct at least two detention basin retrofits where turf grass basins are converted into native vegetation.
3. Construct at least one wetland/depressional area restoration project.
4. At least 25% of watershed stakeholders (private residents, business owners, etc) incorporate native vegetation into existing landscapes.
5. Riparian buffers restored on at least three parcels.</td><td></td></tr>
</table>

Monitoring Needs/Efforts:	
• Periodically visit stream and wetland restoration projects to assess function and success. • Track the number (linear feet) of stream restoration projects in the watershed. • Track the number of detention basin retrofits. • Track the number of parcels where riparian buffers are established. • Track the number of stakeholders that incorporate native plants into landscapes each year.	
Remedial Actions:	
• If stream and wetland restoration projects are failing, conduct remedial work such as re-seeding and habitat installation. • If the buffer and native grass installation milestones cannot be met, reduce the number to more feasible goals.	
Notes:	

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved
C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved
F = Milestone(s) not achieved

Goal D: Develop open space in the Buckbee Creek watershed and provide recreational opportunities	
Current Conditions and Problems: • The pre-settlement landscape consisting mostly of savanna, marsh, and prairie communities has been significantly altered by urbanization. • Very few parcels of open space are preserved in the watershed.	
Indicators to Meet Objectives: • Number of riparian buffers restored with native vegetation. • Number of new development that is designed to include and protect open space. • Number of linear feet of new trail constructed in the watershed as part of the Boone and Winnebago County Greenway Plan.	
Milestones: 1-5 Years 1. Riparian buffers restored on at least three parcels. 2. Conduct at least one seminar for developments on methods to integrate open space into residential and commercial development. 3. All municipalities incorporate the recommendations of the Boone and Winnebago County Greenway Plan into their comprehensive plans. 4. Construction of at least one segment of trail included on the Boone and Winnebago County Greenway Plan.	Grade
5-10 Years 1. Riparian buffers restored on at least three parcels. 2. Conduct at least one seminar for developments on methods to integrate open space into residential and commercial development. 3. Construction of at least one segment of trail included on the Boone and Winnebago County Greenway Plan.	
10+ Years 1. Riparian buffers restored on at least three parcels. 2. At least one new development constructed designed to include and protect open space. 3. Complete a Natural Areas Management Plan for all park and open space in the watershed. 5. Completion of the trails included on the Boone and Winnebago County Greenway Plan.	
Monitoring Needs/Efforts: • Track the linear feet of new trails constructed. • Track the number of parcels where riparian buffers are established. • Track the number of developments that are designed to include and protect open space.	
Remedial Actions: • Reassess municipal budgets for open space protection efforts. • Apply for grant monies for the acquisition of additional open space. • Apply for grant monies for the preparation of a Natural Areas Management Plan.	

Notes:	

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved
C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved
F = Milestone(s) not achieved

Goal E: Increase coordination between decision makers and other stakeholders in the watershed.

Current Conditions and Problems:

- A limited number of stakeholders are currently working together to pursue grant funds to implement watershed improvement projects.
- Municipal decisions-makers need to work together to develop beneficial multi-jurisdictional partnerships related to funding, technical assistance, grant proposals, and open space/greenway protection.

Indicators to Meet Objectives:

- Number of municipalities in the watershed that adopt the watershed-based plan.
- Number of municipalities and stakeholders that participate in WCWIPSC activities.
- Number of municipalities that implement Action Items.
- Number of municipalities that adopt comprehensive plan, codes, and ordinances that support the recommendations of the watershed-based plan.

Milestones:	Grade
1-5 Years 1. WCWIPSC to hold a minimum of two meetings per year to discuss plan recommendations and track plan implementation. 2. All municipalities adopt the watershed-based plan and implement changes to plans, codes, and ordinances that support plan recommendations. 3. Representatives from all municipalities and other stakeholders attend the WCWIPSC meetings. 4. At least two multi-jurisdictional and/or public-private stream channel maintenance projects (streambank stabilization, streambank restoration, culvert maintenance, etc) are implemented.	
5-10 Years 1. WCWIPSC to hold a minimum of two meetings per year to discuss plan recommendations and track plan implementation. 2. Representatives from all municipalities and other stakeholders attend the WCWIPSC meetings. 3. At least two multi-jurisdictional and/or public-private stream channel maintenance projects (streambank stabilization, streambank restoration, culvert maintenance, etc) are implemented.	
10+ Years 1. WCWIPSC to hold a minimum of two meetings per year to discuss plan recommendations and track plan implementation. 2. Representatives from all municipalities and other stakeholders attend the WCWIPSC meetings. 3. At least two multi-jurisdictional and/or public-private stream channel maintenance projects (streambank stabilization, streambank restoration, culvert maintenance, etc) be implemented	

Monitoring Needs/Efforts: • Track number of WCWIPSC meetings and what was discussed. • Track the number of municipalities in the watershed that adopt the watershed-based plan. • Track the number of Action Items implemented by municipalities.
Remedial Actions: • WCWIPSC encourage government officials to adopt the watershed-based plan if not adopted in years 1-5. • WCWIPSC to meet with government officials to discuss Action Items that have not been implemented.

Notes:	

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved
C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved
F = Milestone(s) not achieved

	Grade
Goal F: Raise stakeholder awareness (residents, public officials, etc) about the importance of best management practices of watershed stewardship	
Current Conditions and Problems: • KREP has done a wonderful job of leading the education process through plan development, however, education is an ongoing process. • Education on stream maintenance and water quality and habitat improvements is needed for residents living in the watershed.	
Indicators to Meet Objectives: • Number of members of KREP. • Number of seminars or workshops related to educating the public on the benefits of native plants and natural area restoration. • Number of seminars or workshops related to general water quality. • Attendance at seminars and workshops. • Number of publicized watershed improvement projects in the new media, newsletters, websites, etc. • Number of homeowners associations (HOA) programs related to water quality and stream maintenance.	
Milestones: 1-5 Years 1. Maintain watershed website. 2. Conduct at least 2 seminars related to benefits of native plants and natural area restoration and track attendance. 3. Conduct at least 2 seminars related to water quality and stream habitat improvement and track attendance. 4. Publicize all watershed improvement projects in the news media, newsletters, websites, etc. 5. Identify at least 1 HOA interesting in hosting an educational program.	Grade
5-10 Years 1. Maintain watershed website. 2. Conduct at least 2 seminars related to benefits of native plants and natural area restoration and track attendance. 3. Conduct at least 2 seminars related to water quality and stream habitat improvement and track attendance. 4. Publicize all watershed improvement projects in the news media, newsletters, websites, etc. 5. Conduct at least 1 HOA interesting in hosting an educational program.	
10+ Years 1. Maintain watershed website. 2. Conduct at least 2 seminars related to benefits of native plants and natural area restoration and track attendance. Hold at least 1 of these workshops in a park or open space. 3. Conduct at least 2 seminars related to water quality and stream habitat improvement and track attendance. 4. Publicize all watershed improvement projects in the news media, newsletters, websites, etc. 5. Conduct at least 1 HOA interesting in hosting an educational program.	

Monitoring Needs/Efforts:

- Track all watershed projects being implemented each year.
- Track number and topic of workshops each year.
- Track changes in attendance at workshops and seminars.
- Track number of workshops hosted by HOAs.

Remedial Actions:

- Ask local, state, and federal agencies to host workshops.
- If attendance at workshops is low, experiment with different types of events to see which draw larger participation.
- Identify a volunteer or hire staff to lead the educational efforts.

Notes:

Grade Evaluation: A = Met or exceeded milestone(s) B = Milestone(s) 75% achieved C = Milestone(s) 50% achieved D = Milestone(s) 25% achieved F = Milestone(s) not achieved

Appendix A

Winnebago County Watershed Improvement Plan Steering Committee Meeting Minutes

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Thursday, June 03, 2010
4:30 p.m.
424 N. Springfield Avenue

1. Welcome – Mr. Vanderwerff introduced himself as the County Engineer for Winnebago County

2. Roll Call – Dennis Anthony, Judy Barnard, Joe Cavney, Jim Claeyssen, Steve Ernst, Carol Dmmondt, Don Krizan, Marcy Leach, Pat Michelsen, Wendy Owano, Jerry Paulson, Kelly Spera, Jessica Vanderbaum, Joe Vanderwerff, Wayne Vlk, Stuart R. Wahlin.

3. Temporary Chairperson / Committee Organization – Mr. Krizan asked the steering committee if there would be any committee member willing to come forward and become a temporary chairperson. Motion made to nominate Ms. Owano. Seconded by other members. Ms. Owano declined position. Motion made to nominate Mr. Krizan. Seconded by all members. Motion carried.

   Mr. Krizan made a motion to the Steering Committee that as far as the steering committee we invited many agencies and other groups. What the Highway Department is suggesting for some initial guidelines is that we need representatives from each group and agency. In addition, how the committee wanted to organize themselves. Seconded by all members. Motion carried.

4. Grant Application Schedule –

   a. June 3 - WCHD Distributes List of Applicants – Mr. Krizan informed the Committee of the 21 consultants to whom we sent the qualifications. Only six responded with the qualifications, so we will have that group of six to whittle down. Further discussion by the Steering Committee.

   b. June 4-11 - Committee Members Review Qualifications / Rate Consultants – Mr. Krizan informed the Committee that we would like the members to come to the Highway Department to review and rate the 6 qualified consultants during the week of June 4-11. Mr. Krizan further discussed how the rating sheets were set up and how Committee Members were to use them. Please have your ratings back to our office by June 11. Further discussion by the Steering Committee.

5. June 14-15 - Rating Sheets Evaluated / Consultant Selected – Mr. Krizan made a motion that the Highway Department totals the votes and selects the consultants. Further Discussion by the Steering Committee. Seconded by all Committee Members. Motion carried.

   a. June 15 - Committee Members Notified

   b. June 16 - Selected Consultant Notified

   c. June 16-21 - Meeting Scheduled with Consultant to Review Application Process

   d. June 16-July 23 - Application Data Provided as Needed

   e. July 26-28 - Meeting Scheduled with Consultant to Review Grant Applications

   f. July 30 - Grant Applications Submitted to Illinois EPA

6. Questions / Comments - The statement was made that we need a lot of backyard space. Mr. Vanderwerff informed the Steering Committee that we need a wide girth for the watershed, and that is why we need the residents to be involved in this watershed improvement plan.
   The comment was also noted that the EPA is trying to impose further restrictions on quality of storm water discharge. The question was whether or not we are opening ourselves up by applying for these grants? Mr. Vanderwerff informed the Steering Committee that this project will unfold as we go forward, and we will have to make decisions as we move forward. Right now, it is only one group for both watersheds. We will determine the best way to handle the funding of both watersheds as a group. Further discussion by the Steering Committee.

7. Next Meeting - Tentative meeting on Monday June 14, at 12:00 p.m., possibly to interview some candidates.

8. Adjourn / Recess - Mr. Krizan made a motion to adjourn the meeting. Unanimous by all present. Motion Carried.

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Wednesday, April 20, 2011
10:00 a.m.
Winnebago County Highway Department
424 N. Springfield Avenue
Rockford, IL

I. Welcome by Don Krizan (WCHD), Temporary Chairman.

II. Presentation by Deanna Doohaluk, Hey and Associates, Inc. (see Slide 1 on the attached Kickoff Presentation).

A. Overview of Watershed Planning (Slides 2-12)

1. The Section 319 standard of performance for watershed planning consists of the Nine Minimum Criteria for Watershed-Based Plans (Slide 2).

2. A general approach to comprehensive watershed planning has been developed and is presented in IEPA's "Guidance for Developing Watershed Action Plans in Illinois" as the seven Illinois Model Watershed Planning Stages (Slide 3).

B. Planning Schedule (Slide 13)

1. Deanna believes that the critical project dates can be met without difficulty.

2. The final watershed plans are due to IEPA by **March 1, 2013**.

C. WCWIPSC Roles and Committees (Slides 14-15)

1. The WCWIPSC was created by a group of stakeholders (Slide 14) that includes citizens and several governmental and independent agencies. Deanna asked if there are other entities that might have a stake in this planning process. Committee members suggested the following:

a. CherryVale Mall, Menards, Lowes, Walmart (Madigan)
b. CBro Development (Madigan)
c. United Technologies/Hamilton Sundstrand (Welworth/Wentworth)
d. UPRR (both); CNRR (Welworth/Wentworth)
e. RRWRD (both)
f. Rolling Green HOA (Welworth/Wentworth)
g. Kishwaukee Corridor Improvement Committee (Madigan)
h. J.L. Clark (?? May be north of Welworth/Wentworth.)
i. Winnebago County Health Department (both)
j. Farmers (both)

2. The structure of the WCWIPSC (Slides 14-15) needs to be further developed to handle comprehensive watershed planning. Deanna suggested an organizational leadership chart which Committee members discussed and endorsed (see the attached Organization Chart).

D. The Watershed Concerns / Preliminary Goals (Slides 16-17)

1. Deanna asked for, and received from Committee members, the following list of the problems associated with the two watersheds from which planning goals and objectives can be developed:

   a. Hydromodification (erosion/sedimentation) – (both)
   b. Need for stream restoration (Madigan)
   c. Flooding (both)
   d. Nonpoint source pollution (both)
   e. Need for greenway/open space development (both)
   f. Degraded groundwater quality (both)
   g. Quarry impacts (Madigan)
   h. Habitat degradation (both)
   i. Illicit dumping / landowner “bad-housekeeping” (both)
   j. Impacts from Superfund / CERCLA sites (Welworth/Wentworth)
   k. Lack of collaboration between government / business / private interests (Welworth/Wentworth)

2. Deanna asked for, and received from Committee members, the following list of the desired outcomes for the two watersheds from which planning goals and objectives can be developed:

   a. Restore hydrology / perennial flow (Madigan)
   b. Increase open space / public access (both)
   c. Mitigate flooding (both)
   d. Increase green infrastructure BMPs (both)
   e. Restore habitat (both)
   f. Increase educational outreach (both)
   g. Improve water quality (both)
   h. Restore infiltration / groundwater (both)
   i. Revise / amend local ordinances to address watershed improvements (Madigan)
   j. Address Superfund / CERCLA impacts (Welworth/Wentworth)

E. Watershed Resource and Condition Inventory (Slides 18-21)

1. Deanna described the various data requirements for performing the watershed inventories (Slide 19). Committee members cited existing data sources including WinGIS – perhaps 80% to 85% of required data are currently available.

2. Deanna recommended that stream walks (Slide 21) be undertaken within the period from late June (after June 15) to early July. The new Committee leadership group will work with her to schedule one-day, weekday stream walks for each watershed.

F. Public Workshops (Slides 22-23)

1. Deanna suggested a seven-module format for public workshops (three per watershed) that will be held to obtain input for each watershed (Slide 22). Modules 1-3 consist of presentations by Committee members – modules 4-6 consist of work by breakout groups.

2. Deanna recommended scheduling the first workshops on weeknights in July after the stream walks. The new Committee leadership group will work with her to schedule the first workshop for each watershed.

III. Committee Appointments (confirmed by voice votes of the Committee members):

A. Chairperson – Michael Maddox (RMAP)
B. Co-Vice Chairpersons – Jerry Paulson (KREP), Dennis Anthony (URREP)
C. Secretary – Don Krizan (WCHD)
D. Madigan Co-Captains – Bonnie Whitmer (citizen), Pat Michelsen (citizen)
E. Welworth/Wentworth Co-Captains – Carol Ommodt (citizen), John Ekberg (County Board Member)

IV. Next meeting – July 13, 2011. The time and location are to be announced. **This will be the first Quarterly Meeting.**

V. Closing Comments / Adjournment

Respectfully submitted,

Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN EXECUTIVE COMMITTEE

Thursday, May 12, 2011
9:00 a.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

1. Attendance

   Present: Chairperson Michael Maddox
   Co-Vice Chairpersons Dennis Anthony and Jerry Paulson
   Secretary Don Krizan

2. Stakeholder contacts

   Committee members will contact and/or compile more information regarding the following potential stakeholders:

   CherryVale Mall; vacant land owners – by Maddox

   Rock River Water Reclamation District (RRWRD); Jonah Katz (planner/developer); IEPA regional office (Chuck Corley, Nancy Sisson); Home Builders Association of the Greater Rockford Area (HBAGRA); Rockford Home Builders Association (RHBA); farmers – by Anthony

   Larry Swacina (Director, Winnebago County Health Department); CBro (developer); Rubloff (developer) – by Paulson

   Railroads – by Krizan

   Contact information will be forwarded to Krizan who will send letters inviting participation in the Steering Committee's watershed planning activities.

3. Stream Walks, Quarterly Meeting, and Workshops scheduling

   Committee members discussed the following tentative general schedules:

   Stream Walks – two 1-day walks during the period June 20 to June 30
   Quarterly Meeting – July 13 (set by Steering Committee at April 20 meeting)
   Workshops – after Quarterly Meeting, later July

   Krizan will contact Deanna Doohaluk to discuss her preferences for meeting dates and inform Committee members by Friday, May 13.

4. Respectfully submitted,
   Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Friday, July 13, 2011
9:00 a.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

I. Welcome by Michael Maddox (RMAP), Chairman

II. Deanna Doohaluk, Hey and Associates, Inc., provided comments and led discussions on several topics:

A. Review of stream walks & data collection, in general

1. Charles Street portion of the Madigan basin walk will be completed today

2. Hey needs any available information regarding the following:

a. WinGIS (raw ArcView) including land use & cover

b. Gap data (2007)

c. 2-foot topo

d. Soils

e. Census data

f. Wetlands / floodplains

g. Storm sewers

h. Roads / streets

i. Greenways, parks, trails, green infrastructure, including anecdotal information regarding rain gardens, rain barrels, etc.

j. Point source discharges (e.g., quarries)

k. Agricultural drainage tiles

l. Weather data / storm events (rainfall amounts, high water marks, flood damage reports)

m. Detention ponds

n. Water supply, ground water, well & septic data

o. Fish & benthic surveys

3. All available information will be considered for its usefulness in the process of model selection

B. Workshop planning

1. Madigan

a. July 27th at the Rock Church

b. 500 fliers have been mailed notifying the public

c. Organizers are obtaining addresses & providing notices via reverse 911 calls

d. Other invitees include stakeholders, board members & other political representatives, media

e. Deanna reminded all that the agenda at the meetings must be water-quality driven

f. Presenters will include Mike M., Jerry P., Nathan H., Deanna D.

g. Breakout groups will be asked to consider: What are the problems?; Who is responsible?; What projects/activities are you aware of that help/harm conditions?

h. Preparations underway for handouts, display boards, maps

2. Welworth/Wentworth

a. Mid to late August

b. Possibly at the Heartland Church in Colonial Village

C. Other items:

1. Deanna will provide information for soliciting technical assistance

2. Hey will provide a draft of the watershed inventory

3. Discussed having a future meeting of the Technical (Executive) Committee

4. Discussed scheduling for the **next Quarterly Meeting**

    a. Tentatively, October 12^{th} at RMAP

    b. Decision will have to be made regarding the modeling approach based on recommendations of Hey and the Technical Committee

III. Closing Comments / Adjournment

Respectfully submitted,

Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Wednesday, November 2, 2011
2:00 p.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

I. Welcome by Michael Maddox, Chairman

II. The Quarterly Meeting Minutes from July 13, 2011, were reviewed and approved.

III. Deanna Doohaluk, Hey and Associates, Inc., reviewed procedures for completion and submittal of the Inkind Match Logs (timesheets).

IV. Deanna provided a Watershed Resource Inventory update and reviewed the list of required data and the sources of the data (i.e., agencies that are compiling and submitting data to her).

V. The Committee reviewed the Public Meeting #1 Minutes for each watershed and discussed the conduct and accomplishments of the meetings.

VI. The Committee reviewed watershed problems and concerns that were raised at the public meetings and discussed goals and objectives to be achieved by the study of each watershed (see Attachment 1).

VII. To put into perspective the approximate quantity of effective detention that would have to be provided by environmentally-sound and sustainable watershed management practices in order to improve conditions that negatively affect water quality, Deanna provided information regarding theoretical detention volumes provided by traditional means that would be required for each watershed (see Attachment 2).

VIII. The next steps to be taken by the Committee include continuation of data input to Deanna and organization of a Technical Committee.

IX. The next Quarterly Meeting of the Steering Committee will be held late winter-early spring.

X. Closing comments / adjournment.

Respectfully submitted,

Don Krizan, Secretary

Watershed Problems and Goals/Objectives
Madigan and Welworth/Wentworth Watersheds
November 2, 2011

Watershed Problems

a. Hydromodification (erosion/sedimentation) – (both)
b. Need for stream restoration (Madigan)
c. Flooding (both)
d. Nonpoint source pollution (both)
e. Need for greenway/open space development (both)
f. Degraded groundwater quality (both)
g. Quarry impacts (Madigan)
h. Habitat degradation (both)
i. Illicit dumping / landowner "bad-housekeeping" (both)
j. impacts from Superfund / CERCLA sites (Welworth/Wentworth)
k. Lack of collaboration between government / business / private interests (Welworth/Wentworth)
l. Storm sewers back up (Welworth/Wentworth)

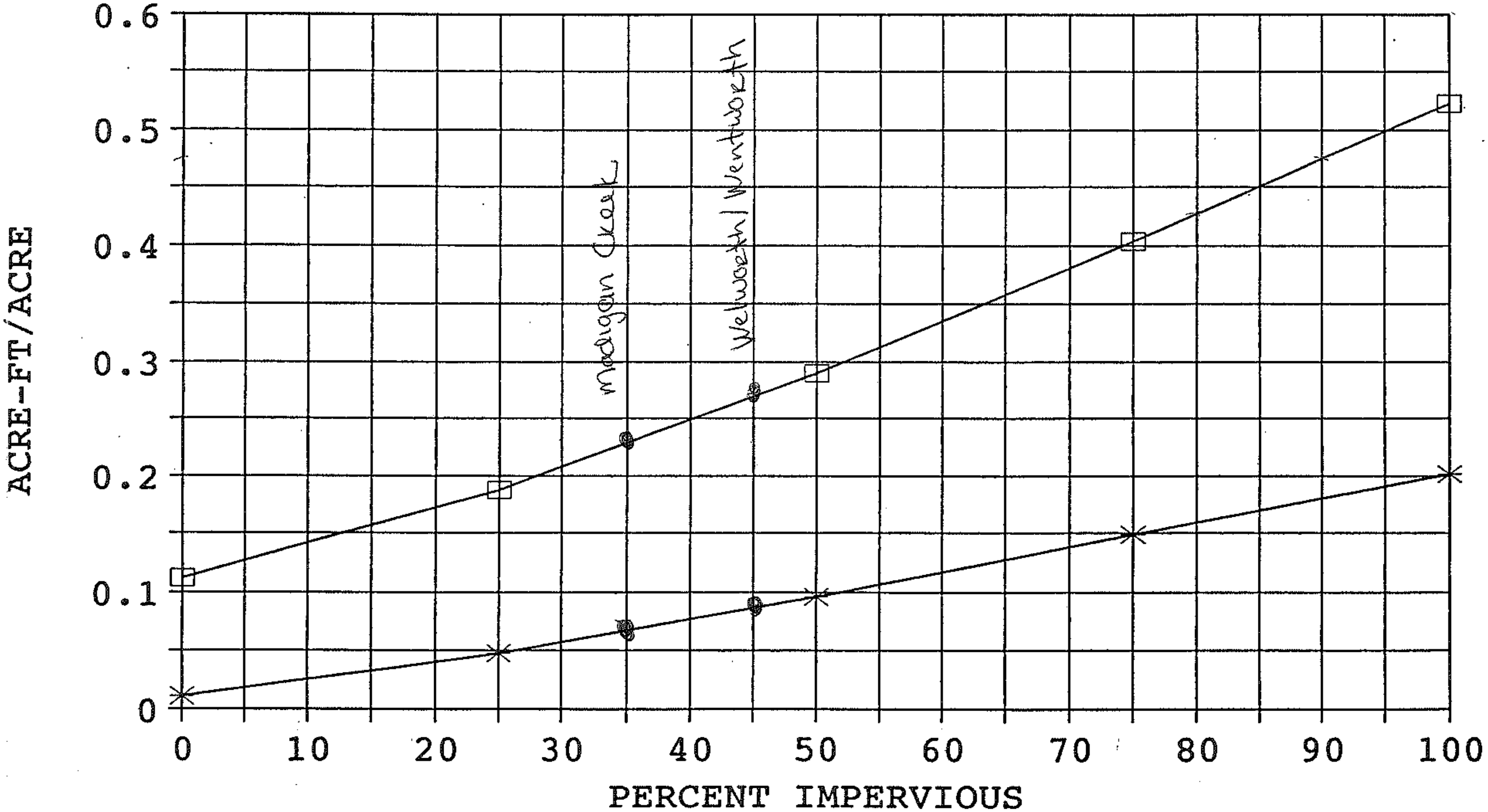
Watershed Goals

a. Restore hydrology / perennial flow (Madigan)
b. Increase open space / public access (both)
c. Mitigate flooding (both)
d. Increase green infrastructure BMPs (both)
e. Restore habitat (both)
f. Increase educational outreach (both)
g. Improve water quality (both)
h. Restore infiltration / groundwater (both)
i. Revise / amend local ordinances to address watershed improvements (Madigan)
j. Address Superfund / CERCLA impacts (Welworth/Wentworth)
k. Monitoring results (both)
l. Sustainable funding (both)

FIGUI 3-10

DETENTION VOLUME VS PERCENT IMPERVIOUS

2-YEAR AND 100-YEAR UNIT AREA DETENTION



2-year release = 0.04 cfs/acre, 100-year release = 0.15 cfs/acre

2-YEAR 100-YEAR

Reference: Northeastern Illinois Planning Commission, Investigation of Hydrologic Methods for Urban Development in Northeastern Illinois

Attachment 2

Watershed Problems and Goals/Objectives
Madigan and Welworth/Wentworth Watersheds
November 2, 2011

Watershed Problems

a. Hydromodification (erosion/sedimentation) – (both)
b. Need for stream restoration (Madigan)
c. Flooding (both)
d. Nonpoint source pollution (both)
e. Need for greenway/open space development (both)
f. Degraded groundwater quality (both)
g. Quarry impacts (Madigan)
h. Habitat degradation (both)
i. Illicit dumping / landowner "bad-housekeeping" (both)
j. impacts from Superfund / CERCLA sites (Welworth/Wentworth)
k. Lack of collaboration between government / business / private interests (Welworth/Wentworth)
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Watershed Goals

a. Restore hydrology / perennial flow (Madigan)
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k. Monitoring results (both)
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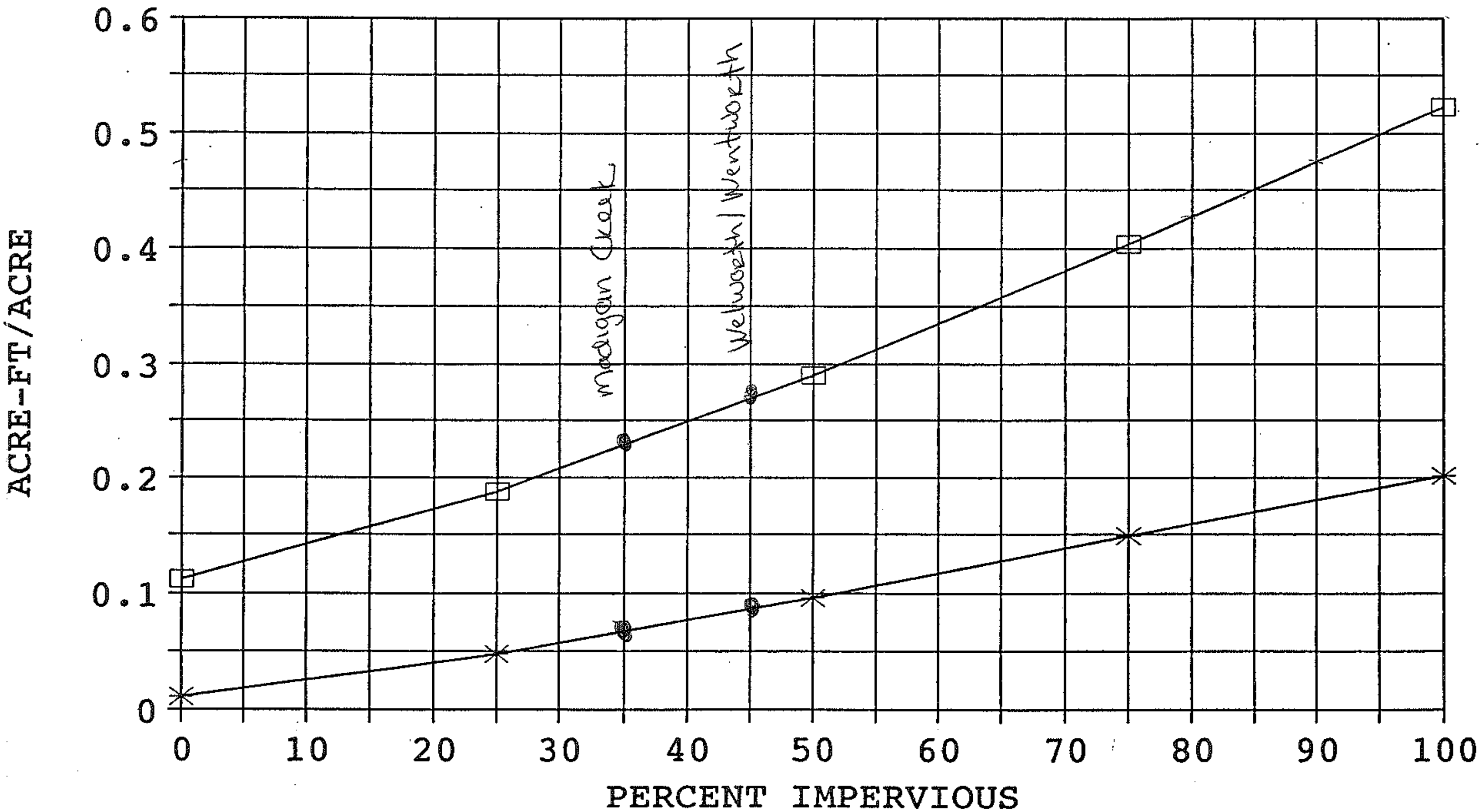
FIGUI 3-10

DETENTION VOLUME VS PERCENT IMPERVIOUS

2-YEAR AND 100-YEAR UNIT AREA DETENTION



2-year release = 0.04 cfs/acre, 100-year release = 0.15 cfs/acre

—✳— 2-YEAR —□— 100-YEAR

Reference: Northeastern Illinois Planning Commission, Investigation of Hydrologic Methods for Urban Development in Northeastern Illinois

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN EXECUTIVE COMMITTEE

Monday, January 23, 2012
10:00 a.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

1. Attendance

Present: Co-Vice Chairpersons Dennis Anthony and Jerry Paulson
Secretary Don Krizan
Consultant Deanna Doohaluk
Madigan Co-Captain Bonnie Whitmer
RMAP Representative Gary McIntyre

2. Chairperson Election

Members discussed the resignation of Chairperson Mike Maddox from his position with RMAP effective January 6th, and his subsequent move to a new job in North Dakota. By a unanimous vote of the Committee and gracious acceptance by Mr. McIntyre, Gary was selected as the new Chairperson.

3. Re-naming the Welworth/Wentworth Basin

Based on community and Committee member suggestions, the Committee agreed to re-designate the Welworth/Wentworth waterway and basin as Buckbee Creek and Buckbee basin, in commemoration of Congressman John T. Buckbee, founder of the Buckbee Seed Company and person after whom a new public school was named in 1928. Built at the intersection of Alpine Road and Harrison Avenue (at the center of the upper reach of the future Buckbee basin), the new school replaced the original local school which was built in 1866.

4. General Discussion Regarding Past, Current and Future Issues / Event and Task Scheduling

a. Data providers (e.g., City of Rockford, Village of Cherry Valley, Winnebago County) will be reminded that input regarding watershed features should be provided to Deanna **a.s.a.p.**
b. Organization of the Technical Committee will proceed with invitations to other agencies and consultants, possibly by the **first week in February**.
c. The next quarterly meeting of the Steering Committee will be planned for **Mid-March, possibly March 14th**. Topics will include a review of data gathered to date, a discussion of the water resources inventory, and a discussion of the up-coming meeting of the Technical Committee.
d. The first meeting of the Technical Committee will be held **mid-to-late March**.
e. Public workshops will be planned for the **April-May** time period covering topics such as good housekeeping (e.g., use of rain barrels, use and disposal of pesticides/herbicides, and yard waste disposal) and understanding drainage easements.
f. The next round of public meetings will be planned for the **July-August** time period during which the preliminary Water Resource Inventory will be presented and discussed and opinions will be solicited regarding potential solutions to water quality/quantity problems.

g. The Water Resource Inventory will be submitted to IEPA in **November**.
h. The first invoice and quarterly report were discussed.
i. The Illinois State Water Survey (ISWS)/FEMA floodplain study of the Rock River watershed in Winnebago County was discussed.
j. Creation of a website for the Buckbee basin was discussed.
k. The need for the documentation of follow-ups with citizens who registered complaints at public meetings regarding drainage issues was discussed. The listing of complaints and resolutions on the Madigan and Buckbee websites was suggested.

5. Respectfully submitted,
   Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN EXECUTIVE COMMITTEE

Friday, March 16, 2012
9:00 a.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

1. Attendance

Present: Chairperson, Gary McIntyre
Co-Vice Chairperson, Dennis Anthony (by telephone)
Co-Vice Chairperson, Jerry Paulson
Secretary, Don Krizan
Consultant, Deanna Doohaluk (by telephone)
IEPA Grant Manager, Scott Tomkins (by telephone)

2. General Discussion of Topics Regarding Project Goals, Objectives, and Progress

   a. MBE/WBE utilization (DOC Standard Form 334)
   b. Quarterly progress reports, Nos. 1 & 2
   c. Format for future quarterly reports (**New!**)
   d. Submittal of project progress schedule (**New!**)
   e. Documentation summary sheet (**New!**)
   f. Watershed resource inventories / base plans
   g. Success of initial public meetings
   h. Possible informal public workshops
   i. Submittal of invoices / receipt of reimbursements

Respectfully submitted,
Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Wednesday, July 25, 2012
10:00 a.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

I. Welcome by Gary McIntyre, Chairman, & introductions by participants.

II. Jerry Paulson reported that Pat Michelsen will be moving from the area and will no longer be able to serve as Co-Captain for the Madigan Watershed. Recommendations for a replacement will be welcomed.

III. Deanna Doohaluk, Hey and Associates, Inc. (Hey), reminded the Steering Committee of the need to establish a Technical Advisory Committee (TAC) to review and provide comments regarding the model selection for the watersheds. Members of the Executive Committee will contact people who have been recommended for participation on the TAC.

IV. After the review and comments by the TAC, Hey will complete preliminary work on the watershed modeling including defining basins, creating map layers, and preparing exhibits.

V. Future Steering Committee activities will include a review of the Watershed Resource Inventory, a review and endorsement of the model selection, a review of flood inventory data from questionnaires submitted by citizens, and planning of public workshops.

VI. The flood inventory questionnaires will serve to identify candidate areas for specific watershed improvements and to provide data for inclusion in the spatial database. City of Rockford and Madigan Watershed representatives on the Steering Committee will work together to create a questionnaire.

VII. Suggested topics for public workshops include watershed good housekeeping and Best Management Practices (BMPs), and a presentation and discussion regarding Illinois drainage law and ownership issues.

VIII. After the Watershed Improvement Plan (WIP) is completed, final public workshops for each of the two watersheds will be held to present the final plan. The presentation will include educational topics to encourage the participation of citizens in making improvements on an individual basis.

IX. The tentative date of the next Quarterly Meeting of the Steering Committee is October 10, 2012.

X. Closing comments / adjournment.

Respectfully submitted,

Don Krizan, Secretary

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN EXECUTIVE COMMITTEE

Tuesday, October 30, 2012
1:00 p.m.
Rockford Metropolitan Agency for Planning
313 N. Main Street
Rockford, IL

1. Attendance

   Present: Chairperson, Gary McIntyre
   Co-Vice Chairperson (Buckbee), Dennis Anthony
   Co-Vice Chairperson (Madigan), Jerry Paulson
   Co-Captain (Madigan), Bonnie Whitmer
   RMAP Representatives, Colin Belle & Colleen Hoesly
   Secretary, Don Krizan

2. Madigan Co-Captain Replacement

   Bonnie is still seeking a replacement for Pat Michelsen.

3. General discussion regarding a homeowners workshop dealing with legal aspects of the ownership of property located within drainageway easements

   a. Tentative date/time: Tuesday, November 13th, 6:00-8:00 p.m.
   b. Tentative location: Shepherd of the Valley Lutheran Church
      2715 S. Mulford Road, Rockford
      (southwest corner at Mulford & Harrison)
   c. Principal presenter/topics: Brent O. Denzin, Attorney at Law
      - Stormwater law
      - Local ordinances
      - Easements/setbacks
   d. Other presenters/topics: Brad Holcomb - Best Management Practices for homeowners
      Deanna Doohaluk - Improvement Plan impacts
      Gary McIntyre & Don Krizan - Improvement Plan Update
   e. Planning/arrangements: Continuing under the capable guidance of Jerry Paulson

4. Meeting follow-up

   Gary and Don called Deanna – she supports this event and will plan to attend. She confirmed that Scott Tomkins, the IEPA Grant Manager for our study, has concurred with extending the deadline for submittal of the draft watershed plans and executive summary beyond the original date, November 1, 2012. All remaining activities (including two more watershed planning workshops, the final watershed plans, and the final executive summary) will be completed by the final deadline, March 1, 2013.

Respectfully submitted,
Don Krizan, Secretary

Attachment: IEPA Agreement / Scope of Work and Project Schedule

MEETING OF THE WINNEBAGO COUNTY WATERSHED IMPROVEMENT PLAN STEERING COMMITTEE

Wednesday, March 6, 2013
2:30 p.m.
Cherry Valley Village Hall
806 E. State Street
Cherry Valley, IL

I. Welcome by Deanna Doohaluk, Hey and Associates, Inc., & introductions by participants.

II. In-kind Match Logs (time logs) should be updated and sent to Deanna before April 1st.

III. An amendment to our grant agreement is being routed through IEPA channels for final approval. The amendment will extend the end date of the agreement period to July 31, 2013.

IV. The Watershed Resource Inventory for each watershed was discussed. Final review comments should be submitted to Deanna prior to April 1st.

V. Deanna presented preliminary modeling results for each watershed. While the percentage of impervious areas was high for each basin (46.5% for Buckbee and 40.5% for Madigan), the preliminary analyses raised no significant "red flags" regarding either stream quality or quantity measures. Discussion followed.

VI. Deanna asked that Committee members help to identify watershed-wide and site-specific action items (projects) that can be included in the improvement plan recommendations. Discussion followed.

VII. Deanna reminded the local agencies that an EPA Water Quality Scorecard she had earlier distributed is to be prepared for each jurisdiction. After a discussion, a conference call was tentatively arranged for 10:30 a.m., Monday, March 18th, to discuss results and reach a consensus on scoring for each watershed.

VIII. A date/time for the next Steering Committee meeting was discussed – the next meeting will be held at 9:30 a.m. on Wednesday, March 20th, at the Cherry Valley Village Hall.

IX. The next round of public meetings for each watershed to discuss BMP identification and prioritization was discussed – meetings will be scheduled in April.

X. Closing comments / adjournment.

Respectfully submitted,

Don Krizan, Secretary

Appendix B

Rapid Bioassement Protocol (RPB) for Stream and Rivers
Field Data Sheets

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION Florence & Lamar
STATION # 1 RIVERMILE______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20 TIME 9:28 AM PM / REASON FOR SURVEY planning

WEATHER CONDITIONS	**Now** / **Past 24 hours** ❑ / ❑ storm (heavy rain) ❑ / ❑ rain (steady rain) ❑ / ☒ showers (intermittent) 100 % ☒ / ❑ ___% %cloud cover ❑ / ❑ clear/sunny **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No **Air Temperature**_____ °C **Other**______
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** Roadside ditch on S side of Road 1.5 inch silt/sand in culvert
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☒ Intermittent ❑ Tidal **Stream Type** ❑ Coldwater ☒ Warmwater **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other SW **Catchment Area**_______ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Field/Pasture ❑ Agricultural ☒ Residential ❑ Commercial ❑ Industrial ❑ Other ______ **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ☒ Obvious sources **Local Watershed Erosion** ☒ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ☒ Grasses ❑ Herbaceous **dominant species present** turf
INSTREAM FEATURES	**Estimated Reach Length** 100 m **Estimated Stream Width** no channel m **Sampling Reach Area** ______ m^2 **Area in km^2 (m^2x1000)** ______ km^2 **Estimated Stream Depth** ______ m **Surface Velocity (at thalweg)** ______ m/sec **Canopy Cover** ☒ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ____% ❑ Run ____% ❑ Pool ____% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ☒ No culverts
LARGE WOODY DEBRIS	**LWD** ______ m^2 **Density of LWD** ______ m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION No	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other ______ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other ______ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other ______ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ☒ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No No stones

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	—
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	/
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	/
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)	100			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION Florence & Lamar
STATION # 1 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dad, NR, SN	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 9:28 (AM) PM — REASON FOR SURVEY watershed planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 ~~(1)~~ (0) dad 6/20/11

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 2 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS daa, RM, SN	
FORM COMPLETED BY dad	DATE 6/20 TIME 9:45 AM PM — REASON FOR SURVEY planning

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☒
100% ☒	%cloud cover	☐ ___%
☐	clear/sunny	☐

Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature ____ °C

Other ____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

double culvert → on East view just Sq 24" on W side dolmano (N42°14.724, W089° 01.157)

3 culverts discharge into 2-24"

STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☒ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other ____

Catchment Area ____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other ______ ☒ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ☒ Obvious sources **Local Watershed Erosion** ☒ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ☒ Grasses ☒ Herbaceous **dominant species present** ______
INSTREAM FEATURES	**Estimated Reach Length** ______m **Estimated Stream Width** ______m 2-24" culvert **Sampling Reach Area** ______m^2 **Area in km^2 (m^2x1000)** ______km^2 **Estimated Stream Depth** ______m **Surface Velocity (at thalweg)** ______m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded **High Water Mark** ______m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle______% ❑ Run______% ❑ Pool______% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** ______m^2 **Density of LWD** ______m^2/km^2 (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature**______ °C **Specific Conductance**______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other______ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other______ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other______ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		
Boulder	> 256 mm (10")	culverts
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Characteristic**	**% Composition in Sampling Area**
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION Fast view (S) @ Delmar
STATION # 2 RIVERMILE ______	STREAM CLASS
LAT 42°14.723 LONG W089°01.158	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dad, NQ	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 9:45 (AM) PM — REASON FOR SURVEY planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 3 RIVERMILE ____	STREAM CLASS
LAT 42° 14.671 LONG 89° 01.435	RIVER BASIN
STOREt #	AGENCY
INVESTIGATORS NK, DAD	
FORM COMPLETED BY dad	DATE 6/20/11 dad TIME 10:12 (AM) PM
	REASON FOR SURVEY ~~pha~~ planning

WEATHER CONDITIONS	**Now**		**Past 24 hours**
	❑	storm (heavy rain)	❑
	❑	rain (steady rain)	❑
	❑	showers (intermittent)	☑
	100 % ☑	%cloud cover	❑ ___ %
	❑	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ☑ Yes ❑ No

Air Temperature _____ °C

Other ______________________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

2-48" from N + 1-60" from E into concrete channel

STREAM CHARACTERIZATION

Stream Subsystem
❑ Perennial ☑ Intermittent ❑ Tidal

Stream Type
☑ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
☑ Other ________

Catchment Area ________ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ☑ Agricultural ❑ Other ______ ☑ Residential **Local Watershed NPS Pollution** ☑ No evidence ❑ Some potential sources ☑ Obvious sources **Local Watershed Erosion** ☑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ☑ Grasses ❑ Herbaceous **dominant species present** Culvert
INSTREAM FEATURES	**Estimated Reach Length** ______m **Estimated Stream Width** ______m **Sampling Reach Area** ______m^2 **Area in km^2 (m^2x1000)** ______km^2 **Estimated Stream Depth** ______m **Surface Velocity (at thalweg)** ______m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☑ Shaded **High Water Mark** ______m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle______% ❑ Run______% ❑ Pool______% **Channelized** ☑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** ______m^2 **Density of LWD** ______m^2/km^2 (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other______ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ☑ None ❑ Other______ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other______
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other______ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 3 RIVERMILE	STREAM CLASS
LAT ' LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NR, dad, SN	
FORM COMPLETED BY dad	DATE 6/28/11 TIME 10:12 (AM) PM — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME W/W	LOCATION
STATION # 4 RIVERMILE	STREAM CLASS
LAT 42 14.492 LONG 89.°01.543	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dad, NK, SK	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 10.24 (AM) PM — REASON FOR SURVEY plannin

WEATHER CONDITIONS	Now / Past 24 hours: ❑ storm (heavy rain) ❑; ❑ rain (steady rain) ❑; ❑ showers (intermittent) ☒ (past 24 hours); 100 ☒ %cloud cover ❑ ___%; ❑ clear/sunny ❑. Has there been a heavy rain in the last 7 days? ☒ Yes ❑ No. Air Temperature _____ °C. Other ______
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) upland W. Winnetka 6' - botton. 26' top — N @ road L - bank 11.5' R - bank. culverts under road. (2) ~~Arch~~ elliptical 5.5' wide 3.5' tall - Residential lots back into channel - no baseflow
STREAM CHARACTERIZATION	Stream Subsystem: ❑ Perennial ☒ Intermittent ❑ Tidal Stream Type: ☒ Coldwater ❑ Warmwater Stream Origin: ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other ______ Catchment Area ______ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

Section	Fields
WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other ______ ☑ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☑ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous **dominant species present** ______
INSTREAM FEATURES	**Estimated Reach Length** ______m **Estimated Stream Width** ______m **Sampling Reach Area** ______m^2 **Area in km² (m^2x1000)** ______km^2 **Estimated Stream Depth** ______m **Surface Velocity (at thalweg)** ______m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☐ Shaded **High Water Mark** ______m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ______% ☐ Run ______% ☐ Pool ______% **Channelized** ☐ Yes ☐ No **Dam Present** ☐ Yes ☐ No
LARGE WOODY DEBRIS	**LWD** ______m^2 **Density of LWD** ______m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** weeds in joints of concrete **Portion of the reach with aquatic vegetation** ______%
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☐ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		concrete
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Characteristic**	**% Composition in Sampling Area**
Detritus	sticks, wood, coarse plant materials (CPOM)	—
Muck-Mud	black, very fine organic (FPOM)	—
Marl	grey, shell fragments	—

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION Upland just W of Winnetka
STATION # 4 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NR, dad, SN	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 10:25 (AM) PM — REASON FOR SURVEY planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION Holmes & Harrison
STATION # 5 RIVERMILE____	STREAM CLASS
LAT 42° 14.312 LONG 89° 01.857	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dac NO, SN	
FORM COMPLETED BY dac	DATE 6/20/11 TIME 10:47 AM PM — REASON FOR SURVEY planning

WEATHER CONDITIONS	**Now** / **Past 24 hours**: ❑ storm (heavy rain) ❑; ❑ rain (steady rain) ☑; ❑ showers (intermittent) ☑; 100 ☑ %cloud cover ❑___%; ❑ clear/sunny ❑. **Has there been a heavy rain in the last 7 days?** ☑ Yes ❑ No. **Air Temperature**____ °C. **Other**____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** concrete channel. Holmes - N of Harrison -outfalls into channel visible upstream bottom - 10' total - 34' -room on W side for BMPs discharge under Harrison in 7' x 5' (tall) (width)
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☑ Intermittent ❑ Tidal — **Stream Type** ☑ Coldwater ❑ Warmwater — **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☑ Other____ — **Catchment Area**____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☑ Industrial (s side) ☐ Agricultural ☐ Other ______ ☑ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☑ Obvious sources **Local Watershed Erosion** ☑ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous **dominant species present** ______
INSTREAM FEATURES	**Estimated Reach Length** ______m **Estimated Stream Width** ______m **Sampling Reach Area** ______m^2 **Area in km^2 (m^2x1000)** ______km^2 **Estimated Stream Depth** ______m **Surface Velocity (at thalweg)** ______m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☐ Shaded **High Water Mark** ______m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle______% ☐ Run______% ☐ Pool______% **Channelized** ☐ Yes ☐ No **Dam Present** ☐ Yes ☐ No
LARGE WOODY DEBRIS	**LWD** ______m^2 **Density of LWD** ______m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** _____%
WATER QUALITY	**Temperature**______ °C **Specific Conductance**______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other______ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other______
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other______ **Oils** ☐ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	concrete			
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 5 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dad, NO, SN	
FORM COMPLETED BY dad	DATE 6/20/11 TIME ______ AM PM / REASON FOR SURVEY planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 6 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NK, dad	
FORM COMPLETED BY dad	DATE 6/20 TIME 10:54 AM PM — REASON FOR SURVEY planning

WEATHER CONDITIONS	Now / Past 24 hours: ☐ ☐ storm (heavy rain); ☐ ☐ rain (steady rain); ☐ ☑ showers (intermittent); 100% ☑ ☐ ___% %cloud cover; ☐ ☐ clear/sunny. Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No. Air Temperature ____ °C. Other ____
SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph) by light of creek after Sunstrand -Not 100 ~~ft~~ m long - 150 ft -box culvert larger 7ft (High)
STREAM CHARACTERIZATION	**Stream Subsystem** ☐ Perennial ☑ Intermittent ☐ Tidal **Stream Type** ☑ Coldwater ☐ Warmwater **Stream Origin** ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☐ Mixture of origins ☑ Other ____ **Catchment Area** ____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☑ Other road
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☑ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous

dominant species present ____________

INSTREAM FEATURES

24ft at top of Bank

Estimated Reach Length 30 m

Estimated Stream Width 10 ft

Sampling Reach Area _______ m²

Area in km² (m²x1000) _______ km²

Estimated Stream Depth 1/2 ~~m~~ in

Surface Velocity (at thalweg) _______ m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _______ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _______% ☐ Run _______%
☐ Pool _______%

Channelized ☐ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD _______ m²

Density of LWD _______ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present ____________

Portion of the reach with aquatic vegetation _____%

WATER QUALITY

Temperature _______ °C

Specific Conductance _______

Dissolved Oxygen _______

pH _______

Turbidity _______

WQ Instrument Used _______

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _______

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _______

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _______

Oils
☐ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _______

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	50
Gravel	2-64 mm (0.1"-2.5")	50
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Characteristic**	**% Composition in Sampling Area**
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

mostly side material from bank stability projects

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # ________ RIVERMILE ________	STREAM CLASS
LAT ________ LONG ________	RIVER BASIN
STORET # 6	AGENCY
INVESTIGATORS	
FORM COMPLETED BY dad	DATE 6/26/11 TIME 10:52 AM PM — REASON FOR SURVEY

42° 14' 09.29" N
89° 01' 45.62" W

	Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
	nd		30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE		15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
			...xture of soft sand, mud, ...ay; mud may be ...inant; some root mats ...ubmerged vegetation ...t.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	...16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
	...ability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
Parameters	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 7 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS SN, dad NO	
FORM COMPLETED BY dad	DATE 6/20 TIME 11:20 AM PM — REASON FOR SURVEY planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 7 RIVERMILE	STREAM CLASS
LAT 42 14.149 LONG 89° 01.793	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NQ SN, dad	
FORM COMPLETED BY dad	DATE 6/20 TIME 11:20 AM PM / REASON FOR SURVEY planning

WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☑ ☐ showers (intermittent) ☑ 100 % ☐ %cloud cover ☐ ___ % ☐ clear/sunny ☐ **Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature**_____ ° C **Other**_______________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** Rockford is considering a project on this reach.
STREAM CHARACTERIZATION	**Stream Subsystem** ☐ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☐ Warmwater **Stream Origin** ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☐ Mixture of origins ☐ Swamp and bog ☐ Other__________ **Catchment Area**_________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ☑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ☑ Other Vacant ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ☑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ☑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Maple
INSTREAM FEATURES	**Estimated Reach Length** ____ m **Estimated Stream Width** 12 ~~m~~ ft **Sampling Reach Area** ____ m² **Area in km² (m²x1000)** ____ km² **Estimated Stream Depth** .3 ~~m~~ ft **Surface Velocity (at thalweg)** ~~m/sec~~ 0.06 ft/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** ____ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ____% ❑ Run ____% ❑ Pool ____% **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** ____ m² **Density of LWD** ____ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae none **dominant species present** ____ **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature** 20.4 °C **Specific Conductance** 2.42 **Dissolved Oxygen** 3.11 **pH** 7.65 **Turbidity** ____ **WQ Instrument Used** ____ **Water Odors** ☑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other ____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ☑ None ❑ Other ____ **Turbidity (if not measured)** ☑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other ____
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other ____ **Oils** ❑ Absent ☑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		~~20~~	Detritus	sticks, wood, coarse plant materials (CPOM)	30-40
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	~~30~~ 50	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	50			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

Calibrated meters 6/20 11:14

pH 7.37 = 7.00
9.79 = 10.01

cond. 1119 = 14.1
dead 6/21/11
00-alt-~~834~~, 800

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW 8	LOCATION
STATION # 8 RIVERMILE ________	STREAM CLASS
LAT ____________ LONG ____________	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS ddd, NO, SN	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 11:45 AM PM — REASON FOR SURVEY planning

WEATHER CONDITIONS	**Now** / **Past 24 hours**: ❑ / ❑ storm (heavy rain); ❑ / ❑ rain (steady rain); ☒ / ☒ showers (intermittent); 100 % ☒ / ❑ ___ % %cloud cover; ❑ / ❑ clear/sunny. **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No. **Air Temperature** _____ °C. **Other** ____________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** abuts #7 ~~body~~ separated by road bridge -lots of rock (man-added) ? -No flow. stagnant pool.
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☒ Intermittent ❑ Tidal **Stream Type** ☒ Coldwater ❑ Warmwater **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other ________ **Catchment Area** ________ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other ______ ☒ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☒ Obvious sources **Local Watershed Erosion** ☐ None ☒ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Oaks
INSTREAM FEATURES	**Estimated Reach Length** 100 m **Estimated Stream Width** 1.5 m **Sampling Reach Area** ______ m² **Area in km² (m²x1000)** ______ km² **Estimated Stream Depth** ______ m **Surface Velocity (at thalweg)** ______ m/sec **Canopy Cover** ☐ Partly open ☒ Partly shaded ☐ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ______% ☐ Run ______% ☐ Pool ______% **Channelized** ☐ Yes ☐ No **Dam Present** ☐ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** Ø m² **Density of LWD** ______ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** NONE **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	—
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	—
Gravel	2-64 mm (0.1"-2.5")	50			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	—
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 8 RIVERMILE ______	STREAM CLASS
LAT 42 14.095 LONG 89 01.857	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NO, SN, DAO	
FORM COMPLETED BY Dad	DATE 6/20/11 TIME 11:45 (AM) PM — REASON FOR SURVEY planner

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 9 RIVERMILE ____	STREAM CLASS
LAT 42 14.037 LONG 89 01.890	RIVER BASIN
STOREt #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20 TIME 13:00 AM PM (PM circled) — REASON FOR SURVEY: planning

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	☒
100% ☑	%cloud cover	❑ ___%
❑	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ☒ Yes ❑ No

Air Temperature_____ ° C

Other________________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

channel was relocated to current location

- bank erosion →
- gabions on S side + attempted rip rap on both sides ↳ put in by City - 4 years ago - already failing
- homeowner talked about how flashy the stream is
- stormsewer outfall on S bank. sanitary line on N bank

STREAM CHARACTERIZATION

Stream Subsystem ❑ Perennial ☑ Intermittent ❑ Tidal

Stream Type ☑ Coldwater ❑ Warmwater

Stream Origin ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other__________

Catchment Area_________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other ______ ☒ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ☒ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ☒ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ☒ Grasses ❑ Herbaceous **dominant species present** turf
INSTREAM FEATURES 3.2' ft @ TOB	**Estimated Reach Length** 100 m **Estimated Stream Width** 9.5 ft **Sampling Reach Area** ______ m² **Area in km² (m²x1000)** ______ km² **Estimated Stream Depth** ______ m **Surface Velocity (at thalweg)** ______ m/sec **Canopy Cover** ☒ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ___% ❑ Run ___% ❑ Pool ___% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** ______ m² **Density of LWD** ______ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** ___%
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other ______ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other ______ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other ______ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	\
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	\
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	\
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 9 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 10/2011 TIME 12:00 AM (PM) — REASON FOR SURVEY planning

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19 18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3 2) 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 10 RIVERMILE ______	STREAM CLASS
LAT 42. 13915 LONG W089 0204	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NO, dad, SW	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 1:36 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ❑ / ❑ storm (heavy rain) ❑ / ☒ rain (steady rain) ❑ / ☒ showers (intermittent) High ___% ☒ / ❑ ___% %cloud cover ☒ / ❑ clear/sunny **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No **Air Temperature** _____ °C **Other** ______________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** Just upstream - 2 tribs meet channel
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☒ Intermittent ❑ Tidal **Stream Type** ☒ Coldwater ❑ Warmwater **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ☒ Mixture of origins ☒ Other ________ **Catchment Area** _________ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ☒ Agricultural ☒ Other rail ❑ Residential ↳ former	**Local Watershed NPS Pollution** ❑ No evidence ☒ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ☒ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☒ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Cottonwood	
INSTREAM FEATURES	**Estimated Reach Length** 100 m dad **Estimated Stream Width** ~~0.2~~ 0.7ft **Sampling Reach Area** _______m² **Area in km² (m²x1000)** _______km² **Estimated Stream Depth** _______m **Surface Velocity (at thalweg)** _______ ~~m/sec~~ 0.6 ft/sec	**Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded **High Water Mark** _______m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle_______% ❑ Run_______% ❑ Pool_______% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** 20'0 m² **Density of LWD** _______m²/km² (LWD/ reach area)	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ☒ Attached Algae **dominant species present** None dad dept 0.2ft **Portion of the reach with aquatic vegetation** _____%	
WATER QUALITY	**Temperature** 23.2 °C **Specific Conductance** 1272 **Dissolved Oxygen** 11.59 / 21.4°C **pH** 7.97 **Turbidity** ________ **WQ Instrument Used** ________	**Water Odors** ☒ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other________ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ☒ None ❑ Other________ **Turbidity (if not measured)** ☒ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other________
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other________ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse	**Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other________ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	\
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	\
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	\
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 10 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 1:30 AM (PM) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition 1" sand"	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 11 RIVERMILE ____	STREAM CLASS
LAT 42 13951 LONG 89 0230	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 2:13 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
___%❑	%cloud cover	❑ ___%
☒	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ❑ Yes ❑ No

Air Temperature ____ °C

Other ________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

High flow - mainly cobble bypass channel N of main channel. 1/2 width of main channel → no flow

STREAM CHARACTERIZATION

Stream Subsystem
❑ Perennial ❑ Intermittent ❑ Tidal

Stream Type
❑ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other________

Catchment Area ________ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☒ Agricultural farm ☒ Other Rail ☐ Residential	**Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☒ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous dominant species present ______	
INSTREAM FEATURES depth 1ft 0.2	Estimated Reach Length ____ m Estimated Stream Width 6 ft Sampling Reach Area ____ m² Area in km² (m²x1000) ____ km² Estimated Stream Depth ____ m Surface Velocity (at thalweg) 0.08 ft/sec	**Canopy Cover** ☐ Partly open ☐ Partly shaded ☒ Shaded High Water Mark ____ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ____% ☐ Run ____% ☐ Pool ____% Channelized ☒ Yes ☐ No Dam Present ☐ Yes ☒ No
LARGE WOODY DEBRIS	LWD ____ m² Density of LWD ____ m²/km² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae dominant species present ______ Portion of the reach with aquatic vegetation ____%	
WATER QUALITY	Temperature 20.6 °C Specific Conductance 1177 Dissolved Oxygen 6.24 / 19.7°C pH 7.82 Turbidity ______ WQ Instrument Used ______	**Water Odors** ☒ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☒ None ☐ Other ______ **Turbidity (if not measured)** ☒ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	80
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Characteristic**	**% Composition in Sampling Area**
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

from R	1ft	2ft	3ft	4ft
Velocit	.08	.01	.06	0.01
depth	0.2	0.35	.45	.3

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 11 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 2:13 AM PM (circled) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
4. Sediment Deposition silt/sand	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 12 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STOREET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 2:48 AM PM — REASON FOR SURVEY

WEATHER CONDITIONS	**Now**		**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ☒ Yes ☐ No
	☐	storm (heavy rain)	☐	**Air Temperature** ____ °C
	☐	rain (steady rain)	☐	
	☐	showers (intermittent)	☒	**Other** ________
	___% ☐	%cloud cover	☐ ___%	
	☒	clear/sunny	☐	

SITE LOCATION/MAP — **Draw a map of the site and indicate the areas sampled (or attach a photograph)**

42° 13' 57.74" N

89° 02' 25.58" W

STREAM CHARAC

Stream Type
☒ Coldwater ☐ Warmwater

Catchment Area ________ km²

Glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other ________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
- [ ] Forest
- [ ] Field/Pasture
- [ ] Agricultural
- [x] Residential
- [ ] Commercial
- [ ] Industrial
- [ ] Other ____________

Local Watershed NPS Pollution
- [ ] No evidence
- [ ] Some potential sources
- [x] Obvious sources

Local Watershed Erosion
- [ ] None
- [ ] Moderate
- [ ] Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
- [x] Trees
- [x] Shrubs
- [ ] Grasses
- [ ] Herbaceous

dominant species present ____________

INSTREAM FEATURES

Estimated Reach Length 100 ft m

Estimated Stream Width 9 ft m

Sampling Reach Area ______ m^2

Area in km² (m^2x1000) ______ km^2

Estimated Stream Depth 0.1 ft

Surface Velocity (at thalweg) 0.2 m/sec

Canopy Cover
- [ ] Partly open
- [x] Partly shaded
- [ ] Shaded

High Water Mark ______ m

Proportion of Reach Represented by Stream Morphology Types
- [ ] Riffle ____%
- [ ] Run ____%
- [ ] Pool ____%

Channelized [ ] Yes [x] No

Dam Present [ ] Yes [x] No

LARGE WOODY DEBRIS

LWD ______ m^2

Density of LWD ______ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- [ ] Rooted emergent
- [ ] Rooted submergent
- [ ] Rooted floating
- [ ] Free floating
- [ ] Floating Algae
- [ ] Attached Algae

dominant species present NONE

Portion of the reach with aquatic vegetation ____%

WATER QUALITY

Temperature 216 °C

Specific Conductance 059

Dissolved Oxygen 6.22/20.8

pH 7.88

Turbidity ______

WQ Instrument Used ______

Water Odors
- [x] Normal/None
- [ ] Sewage
- [ ] Petroleum
- [ ] Chemical
- [ ] Fishy
- [ ] Other ______

Water Surface Oils
- [ ] Slick
- [ ] Sheen
- [ ] Globs
- [ ] Flecks
- [x] None
- [ ] Other ______

Turbidity (if not measured)
- [x] Clear
- [ ] Slightly turbid
- [ ] Turbid
- [ ] Opaque
- [ ] Stained
- [ ] Other ______

SEDIMENT/ SUBSTRATE

Odors
- [x] Normal
- [ ] Sewage
- [ ] Petroleum
- [ ] Chemical
- [ ] Anaerobic
- [ ] None
- [ ] Other ______

Oils
- [x] Absent
- [ ] Slight
- [ ] Moderate
- [ ] Profuse

Deposits
- [ ] Sludge
- [ ] Sawdust
- [ ] Paper fiber
- [ ] Sand
- [ ] Relict shells
- [ ] Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
[ ] Yes [x] No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	15
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	85
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Characteristic**	**% Composition in Sampling Area**
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 12 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 2:45 AM (PM) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability clay	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) (1) 0

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HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 13 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NO, SN, DD	
FORM COMPLETED BY DD	DATE 6/28/11 TIME 3:20 AM (PM) — REASON FOR SURVEY

42° 13' 58.08" N

89° 02' 50.91" W

Habitat Parameter		Condition Category			
		Optimal	Suboptimal	Marginal	Poor
		r … and … s, … cut … ge … n … s … l	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
		… 6	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
		… l	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
			15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
Parameters to …	…ity	shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other ______ ☒ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☒ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** ______
INSTREAM FEATURES	**Estimated Reach Length** ______ m **Estimated Stream Width** 8 ft/18 ft **Sampling Reach Area** ______ m^2 **Area in km^2 (m^2x1000)** ______ km^2 **Estimated Stream Depth** 0.1 ft **Surface Velocity (at thalweg)** ______ m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ____% ❑ Run ____% ❑ Pool ____% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** ______ m^2 **Density of LWD** ______ m^2/km^2 (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature** 23.[illegible] °C **Specific Conductance** 1088 **Dissolved Oxygen** 7.48/220 **pH** 8.58 **Turbidity** ______ **WQ Instrument Used** ______ **Water Odors** ☒ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other ______ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ☒ None ❑ Other ______ **Turbidity (if not measured)** ☒ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other ______ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	70			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 13 RIVERMILE ______	STREAM CLASS
LAT ________ LONG ________	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME 8:20 AM PM — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours**: ❑ ❑ storm (heavy rain); ❑ ❑ rain (steady rain); ❑ ☒ showers (intermittent); ___%❑ ❑___% %cloud cover; ☒ ❑ clear/sunny. **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No. **Air Temperature**_____ ⁰C. **Other**________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** 2 channels present in Reach H2O/ flow only S channel
STREAM CHARACTERIZATION	**Stream Subsystem**: ❑ Perennial ☒ Intermittent ❑ Tidal. **Stream Type**: ☒ Coldwater ❑ Warmwater. **Stream Origin**: ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ☒ Mixture of origins ❑ Other______. **Catchment Area**______km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 14 RIVERMILE ____	STREAM CLASS
LAT 42 14.059 LONG 89 03.041	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NQ, DAD, SN	
FORM COMPLETED BY dad	DATE 6/20/11 dad TIME 3:55 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ❑ / ❑ storm (heavy rain) ❑ / ❑ rain (steady rain) ❑ / ☒ showers (intermittent) ___% ❑ / ❑ ___% %cloud cover ☒ / ❑ clear/sunny **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No **Air Temperature** ____ °C **Other** ____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** Bridge at Corning upstream is similar to #13 downstream has 200 ft of concrete rubble then similar to 13 -Rep from Corning say H2O overtops bridge → bridge was washed out several yrs ago - No flow
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☒ Intermittent ❑ Tidal **Stream Type** ☒ Coldwater ❑ Warmwater **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other ____ **Catchment Area** ____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☑ Industrial ☐ Agricultural ☐ Other ______ ☐ Residential	**Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☑ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** ______	
INSTREAM FEATURES	**Estimated Reach Length** ______ m **Estimated Stream Width** NA m **Sampling Reach Area** ______ m^2 **Area in km^2 (m^2x1000)** ______ km^2 **Estimated Stream Depth** ______ m **Surface Velocity (at thalweg)** ______ m/sec	**Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ____% ☐ Run ____% ☐ Pool ____% **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
LARGE WOODY DEBRIS	**LWD** ______ m^2 **Density of LWD** ______ m^2/km^2 **(LWD/ reach area)**	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** NONE **Portion of the reach with aquatic vegetation** ____%	
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______	**Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	70			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 14 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NR, DAD, SN	
FORM COMPLETED BY dad	DATE 6/20/11 TIME 8:55 AM (PM) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW4	LOCATION
STATION # 15 RIVERMILE____	STREAM CLASS
LAT 42 14.220 LONG 89 03.271	RIVER BASIN
STOREТ #	AGENCY
INVESTIGATORS NO, DAD, SN	
FORM COMPLETED BY Dad	DATE 6/20 TIME 4:17 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours**: ❑ storm (heavy rain) ❑; ❑ rain (steady rain) ❑; ❑ showers (intermittent) ☒; 100% ☒ %cloud cover ❑ ___%; ☒ clear/sunny ❑ **Has there been a heavy rain in the last 7 days?** ☒ Yes ❑ No **Air Temperature**_____ °C **Other**__________
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** - limestone covered in algae w/sand - no flow - almost no H_2O - 100 m upstream of concrete channel - bedrock weathered
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ☒ Intermittent ❑ Tidal **Stream Type** ☒ Coldwater ❑ Warmwater **Stream Origin** ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ☒ Mixture of origins ☒ Other_____ **Catchment Area**_______km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☒ Commercial ☐ Field/Pasture ☒ Industrial ☐ Agricultural ☐ Other ______ ☐ Residential	**Local Watershed NPS Pollution** ☐ No evidence ☒ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☒ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** ______	
INSTREAM FEATURES	**Estimated Reach Length** 100 m **Estimated Stream Width** ______ m **Sampling Reach Area** ______ m² **Area in km² (m²x1000)** ______ km² **Estimated Stream Depth** — m **Surface Velocity (at thalweg)** — m/sec	**Canopy Cover** ☐ Partly open ☒ Partly shaded ☐ Shaded **High Water Mark** ______ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ______% ☐ Run ______% ☐ Pool ______% **Channelized** ☒ Yes ☐ No **Dam Present** ☐ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** ______ m² **Density of LWD** ______ m²/km² (LWD/ reach area)	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☒ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** ______%	
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______	**Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		100	Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

limestone | sand

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 15 RIVERMILE______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 6/20/11 TIME [illegible] AM PM (circled) / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (circled) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0 (circled)
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0 (circled)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (circled) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0 (circled)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION
STATION # 16 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE ______ TIME ______ AM PM / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 16 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NO, DAD, SN	
FORM COMPLETED BY dad	DATE 6/26/11 TIME 4:47 AM PM (circled) — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours**: ☐ storm (heavy rain) ☐; ☐ rain (steady rain) ☐; ☐ showers (intermittent) ☒; 100% ☒ %cloud cover ☐ ___%; ☒ clear/sunny ☐. **Has there been a heavy rain in the last 7 days?** ☐ Yes ☐ No. **Air Temperature**_____ °C. **Other**______
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** -concrete channel - no flow - 2 - 15x6 culverts channel - 30.5' wide 2:1 slope (12 ft wide) 6ft deep - just W of road. flow attenuator vertical drop 45" -same channel dimensions/geometry
STREAM CHARACTERIZATION	**Stream Subsystem** ☐ Perennial ☒ Intermittent ☐ Tidal. **Stream Type** ☒ Coldwater ☐ Warmwater. **Stream Origin** ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☐ Mixture of origins ☒ Other______. **Catchment Area**_______ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other ____________ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** ____________
INSTREAM FEATURES	**Estimated Reach Length** _______m **Estimated Stream Width** _______m **Sampling Reach Area** _______m² **Area in km² (m²x1000)** _______km² **Estimated Stream Depth** _______m **Surface Velocity (at thalweg)** _______m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** _______m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle_______% ❑ Run_______% ❑ Pool_______% **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _______m² **Density of LWD** _______m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** ____________ **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY	**Temperature**_______ °C **Specific Conductance**_______ **Dissolved Oxygen** _______ **pH**_______ **Turbidity** _______ **WQ Instrument Used** ____________ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other____________ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other____________ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other_______
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other____________ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other____________ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME WW	LOCATION 16th Waukee & Sandy Hallow
STATION # 17 RIVERMILE	STREAM CLASS
LAT 42 13.415 LONG 89.05.224	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS NO, SN, DK	
FORM COMPLETED BY Jack	DATE 6/26/11 TIME AM PM — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **(2)** 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 **(1)** 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 **(6)**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 **(7)** 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 **(7)** 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score __________

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME WW	LOCATION
STATION # 17 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS dad, WD, JSN	
FORM COMPLETED BY KW	DATE 6/20/11 TIME ____ AM PM / REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ / ☐ storm (heavy rain) ☐ / ☑ rain (steady rain) ☑ / ☒ showers (intermittent) ___% ☒ / ☐ ___% %cloud cover ☐ / ☐ clear/sunny **Has there been a heavy rain in the last 7 days?** ☒ Yes ☐ No **Air Temperature** ____ °C **Other** ____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** upstream of bridge → concrete channel downstream. SD property - "notmalized channel" -standing H2O - no flow -entrenched
STREAM CHARACTERIZATION	**Stream Subsystem** ☐ Perennial ☒ Intermittent ☐ Tidal **Stream Type** ☒ Coldwater ☐ Warmwater **Stream Origin** ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☐ Mixture of origins ☒ Other ____ **Catchment Area** ____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Field/Pasture ❑ Agricultural ❑ Residential ❑ Commercial ☒ Industrial ❑ Other ______ **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ☒ Grasses ❑ Herbaceous **dominant species present** turf
INSTREAM FEATURES	**Estimated Reach Length** ____m **Estimated Stream Width** ____m **Sampling Reach Area** ____m² **Area in km² (m²x1000)** ____km² **Estimated Stream Depth** ____m **Surface Velocity (at thalweg)** ____m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** ____m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ____% ❑ Run ____% ❑ Pool ____% **Channelized** ☒ Yes ❑ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** ____m² **Density of LWD** ____m²/km² (LWD/ reach area) None
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae None **dominant species present** ______ **Portion of the reach with aquatic vegetation** ____%
WATER QUALITY No access	**Temperature** ____ °C **Specific Conductance** ____ **Dissolved Oxygen** ____ **pH** ____ **Turbidity** ____ **WQ Instrument Used** ____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other ____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other ____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other ____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other ____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				