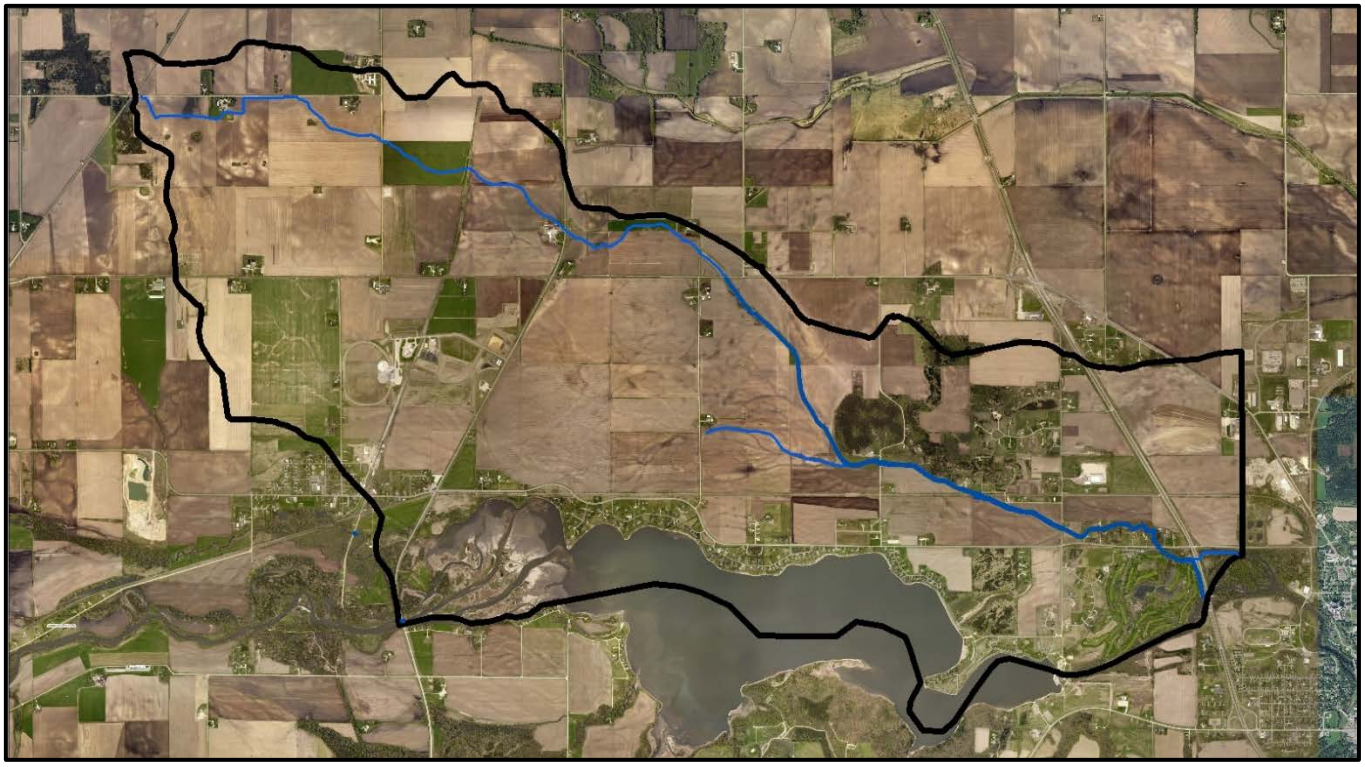
SUBWATERSHED ANALYSIS

FOR

NORTH LAKE BYLLESBY

DAKOTA COUNTY, MN

December 2019



Prepared by:

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

CLEAN WATER LAND & LEGACY AMENDMENT

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This report details a rural sub-watershed analysis (SWA) that was completed to generate recommended locations for implementing conservation practices. The SWA prioritizes and targets future efforts of the Dakota County Soil and Water Conservation District (SWCD) and its various partners at a subwatershed scale. This document should be considered one part of an overall watershed restoration plan. Additional watershed restoration efforts include educational outreach, stream restoration, riparian zone management, upstream discharge reductions, upland native plant community restoration, pollutant source control and other rural best management practices.

Results of this analysis are based on the development of conceptual project-specific best management practices that provide water quality treatment and water volume reductions on the landscape. Relative comparisons are then made between projects to determine where a stronger focus should occur to further design and initiate implementation efforts. Final, site-specific designs will need to be developed to obtain more refined estimates of the reported pollution removal amounts reported herein. This typically occurs after the procurement of committed partnerships and funds relative to the specific target project.

The pollutant removal estimates may be used to prioritize practices within the North Lake Byllesby Subwatershed and for grant applications but in no case should this data be used to represent actual pollutant removal until after installation is complete and site-specific modeling and/or monitoring data is available.

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Executive Summary

The North Lake Byllesby subwatershed encompasses 7,705 acres within the Cannon River watershed. Surface runoff from this subwatershed flows through an unnamed stream (locally known as Dorden Glen Creek), which flows eastward and connects to the Cannon River downstream of Lake Byllesby. Land use within the subwatershed is predominantly agricultural with some rural residential areas, a portion of the small town of Randolph, and a golf course. Topography, in general, is relatively flat with some hills in portions of the subwatershed. Water monitoring data is not available within this subwatershed but is available for the Cannon River.

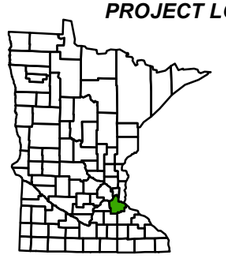
This report details an analysis focused on identifying and assessing potential sediment reduction Best Management Practices (BMPs) in the North Lake Byllesby subwatershed. Residue Management and cover crops are BMPs that were identified as needed throughout the North Lake Byllesby subwatershed during the field reconnaissance stage of this analysis. These BMPs were not modeled for this report due to the large number of conventionally tilled acres, variation in implementation on a year-to-year basis, and lack of an accurate treatment analysis model for pollutant reduction. It has been and will continue to be, however, an ongoing goal of the Dakota County SWCD to promote these BMPs throughout the North Lake Byllesby subwatershed, especially in areas dominated by erosive soils and high potential for pollutant delivery.

Potential structural BMPs were identified through a series of steps that included desktop analysis, field reconnaissance, and identifying site-specific constraints and characteristics. After feasible projects were identified, potential sediment reductions were calculated and preliminary cost estimates were compiled. The projects were then ranked based on the cost per ton of sediment removal per year over a 10-year life cycle. The top 41 practices are identified and prioritized by cost effectiveness.

This report includes maps of the proposed location and aerial extent of recommended BMP projects within the North Lake Byllesby subwatershed to provide a general understanding and approach to reducing sediment loss and improving water quality. If a specific project outlined in this report is selected for installation, site specific designs, landowner agreements, and funding sources must be secured to implement the BMP. The collection of projects listed in this report should be updated on a regular basis as new projects or new technologies are identified.

Source: (Aerial) Dakota County 2017

PROJECT LOCATION



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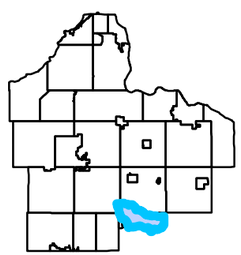
State of Minnesota



North Lake Byllesby Subwatershed

North Lake Byllesby Subwatershed

Potential Practices

- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Pine Creek Watershed

0 0.5 1 2 Miles

N

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Summary of Potential BMPs

Rank	Feasibility Code	Feature ID (Township-section-1/4-#)	BMP Type	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
1	III	RAN-04-03-01	Critical Area Planting	1.22	acres	18.6	$2,530	$14
2	II	RAN-06-01-01	Critical Area Planting	1.28	acres	16.7	$2,560	$15
3	II	RAN-01-04-01	Critical Area Planting	10.7	acres	45.0	$7,270	$16
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5	II	RAN-03-04-01	Grassed Waterway	250	Lin. Feet	37.2	$7,115	$19
6	II	HAM-33-04-01	Grassed Waterway	1575	Lin. Feet	58.6	$13,340	$23
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15	II	HAM-32-02-01	Grassed Waterway	2700	Lin. Feet	35.9	$13,540	$38
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33	II	RAN-06-01-04	Grassed Waterway	650	Lin. Feet	1.2	$7,390	$611
34	II	RAN-06-01-05	Grassed Waterway	600	Lin. Feet	1.1	$8,340	$751
35	II	RAN-01-03-01	Grassed Waterway	600	Lin. Feet	1.0	$8,340	$810
36	II	HAM-31-02-03	Grassed Waterway	400	Lin. Feet	0.6	$6,640	$1,186
37	II	HAM-30-03-01	Grassed Waterway	825	Lin. Feet	0.6	$7,915	$1,365
38	II	HAM-31-02-04	Grassed Waterway	500	Lin. Feet	0.3	$6,940	$2,103
39	II	HAM-30-04-01	Water and Sediment Control Basin	1	Each	0.6	$14,640	$2,440
40	II	HAM-30-04-02	Water and Sediment Control Basin	1	Each	0.6	$14,640	$2,481
41	II	HAM-31-03-01	Water and Sediment Control Basin	1	Each	0.5	$14,640	$3,115

Document Overview

The North Lake Byllesby Subwatershed Analysis (SWA) is a watershed management tool developed to proactively identify and prioritize potential BMP projects based on performance and cost effectiveness. This process is intended, ultimately, to assist local water management organizations and partner agencies in maximizing the value of each dollar spent.

The methods and analysis behind this document provide the ability to quickly assess subwatersheds for optimal locations for BMPs that are most appropriate and feasible based on actual site conditions. While this analysis is accurate and sufficient for that purpose, estimated final construction costs and pollutant removals will need to be refined once projects are selected for construction. Construction projects should be considered as only one part of an overall watershed restoration plan that includes, but is not limited to, educational outreach, upstream discharge reductions, and pollutant source control.

This document is organized into three sections including Methods, Cost/Benefit Analysis Ranking, and Project Profiles for the proposed BMPs. References used in the assessment protocol and appendices provide additional information relevant to the assessment. Each section is briefly described below:

Methods

The Methods section outlines the general procedures used when assessing the subwatershed. It details the processes of *Project Scoping, Desktop Analysis, Field Reconnaissance, and Cost/Treatment Analysis*. This protocol attempts to provide a sufficient level of detail to rapidly assess watersheds and catchments of variable scales and land uses. It provides defined project goals that aid the assessor in quickly narrowing down multiple potential sites to a point where the assessor can look critically at site-specific driven design options that affect BMP selection.

Cost/Benefit Analysis Ranking

Projects that are 1) most able to address the project goals, 2) are compatible with current land use and 3) appear to have reasonable design, installation and maintenance costs were chosen for a cost/benefit analysis and ranked (see Table 3). The list is sorted by cost per ton of sediment treated by the BMP over a duration (i.e. life-cycle) of 10 years, the typical minimum maintenance period for publicly-funded projects on private land. The final cost per ton of treatment value includes design and installation costs. While sediment is used as the primary ranking tool, project priority would be very similar when projects are ranked for phosphorus reduction.

Project Profiles

Each BMP that was identified through the analysis was given its own unique identification code to coincide with the project location, type, and number. This identification code is used to reference each individual project. Within the *Project Profiles* section, BMPs are grouped by section, township, and range to most easily identify the physical location of each project.

A rendered aerial photo highlights the specific locations identified for each grouping. Additional field inspections will be required to verify project feasibility, but the most ideal locations for BMP project installations based on available data are identified here. Paired with each aerial photograph is a description of the typical land use, soil types, topography, and other relevant information for each section.

The Land Management Recommendation section describes cultural practices that are encouraged as part of ongoing land management. A BMP Cost Benefit Analysis table provides for the direct comparison of the expected amount of treatment within a section per invested dollar estimated. In most cases, several BMPs were reviewed with the most feasible ones recommended based on how it fits with current use of the land, efficiency of pollutant reduction and estimated cost.

Methods

Step #1: Project Scoping

Determining the resource of concern and the subsequent drainage area to analyze is the first step in the assessment process. Water quality monitoring data, inclusion on Minnesota's impaired waters list, availability of accurate GIS data, and availability of other plans or assessments are a few of the considerations in determining which waterbodies are a priority.

The North Lake Byllesby subwatershed is located within the Cannon River Watershed and the authority of the North Cannon River Watershed Management Organization (NCRWMO). Dakota County SWCD Staff coordinated with the NCRWMO Board in selection of the North Lake Byllesby subwatershed for analysis. The North Lake Byllesby subwatershed was targeted to reduce pollutant loading to the Cannon River.

The North Lake Byllesby subwatershed consists of 7,705 acres in Southern Dakota County. An unnamed creek, locally called Dorden Glen Creek, flows from west to east and carries most of the runoff from the subwatershed. Flow from Dorden Glen Creek joins the Cannon River downstream of Lake Byllesby at Highway 52. At this time, there is no known data regarding the water quality or quantity of this stream. Within the subwatershed, specifically from some residential areas adjacent to Lake Byllesby, surface water runoff flows directly to Lake Byllesby rather than flowing to Dorden Glen Creek.

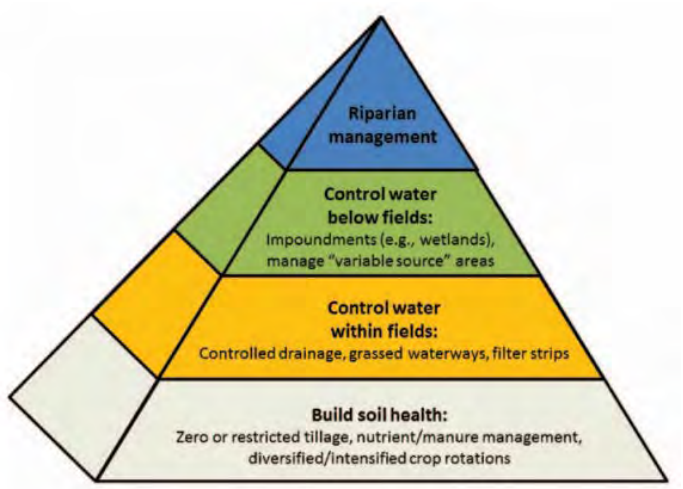
Land use within the subwatershed is primarily agricultural but also includes a portion of the city of Randolph, rural residential areas, a golf course, and Lake Byllesby Regional Park. 57% of the subwatershed is row-crop agriculture. Topography within the subwatershed is relatively flat, but some steep slopes are present on hills. Most of the steep slopes are in perennial vegetation.

Lake Byllesby, a reservoir on the Cannon River, was formed when the Byllesby hydroelectric dam was constructed on the Cannon River near Cannon Falls in 1910. The majority of the Cannon River watershed (including the Straight River) lies upstream of Lake Byllesby, resulting in a high degree of sedimentation within the reservoir on the upstream side of the dam. Because of this, tributaries on the downstream side of the dam, including Dorden Glen Creek, serve as immediate and significant sources of sediment and other pollutants to the lower reach of the Cannon River

Dorden Glen Creek flowing through the North Lake Byllesby subwatershed

For this report, the Dakota County SWCD, in coordination with the NCRWMO, determined that the primary pollutant of focus within the subwatershed is sediment. Due to the close association between sediment and phosphorus, many of the identified BMPs would rank similarly when ranked by their cost-benefit ratio with regards to phosphorus reduction.

It is important to note that this subwatershed analysis does not explicitly identify and rank practices that may be adopted within fields in order to build soil health, maintain residue cover, improve nutrient use efficiency, reduce runoff, and reduce nutrient leaching. These practices, including cover crops, no-till, proper nutrient management, and alternative crop systems, are recommended on virtually any field and all landowners are encouraged to implement them. These land management practices are recommended as a high priority and may have greater water quality benefit than most structural BMPs. Because the practices are applicable on most landscapes throughout the North Lake Byllesby subwatershed, they are not specifically identified in the cost-benefit rankings but are nonetheless recommended as a high priority.



Land management practices provide foundation to agricultural watershed management (Agricultural Conservation Planning Framework)

This analysis is not intended to address flooding or surface water quantity issues on a large scale. Projects such as wetland restorations or water and sediment control basins identified within this analysis are for the primary purpose of erosion and sediment reduction. A separate effort is currently underway by Dakota County to study the watershed on a larger scale, analyze rural flow patterns, identify flood prone areas, and identify wetland and water retention projects on a larger scale.

Step #2: Desktop Analysis

The purpose of the desktop analysis was to narrow the amount of field reconnaissance and other time-consuming tasks needed to complete the SWA by identifying and prioritizing potential projects within the watershed which would likely yield the greatest pollutant (sediment) reductions. Desktop analysis primarily compiled existing data to highlight the locations where BMPs would be most beneficial.

The desktop analysis involved computer-based scanning of the subwatershed for potential retrofit projects. Accurate GIS data was extremely valuable in conducting the desktop review. Some of the most important GIS layers included: 1-foot topography, soils, watershed and subcatchment boundaries, parcel boundaries, land cover, stream and ditch networks, wetland inventory, culverts, database of existing conservation practices, and high-resolution aerial photography (all years that were available).

Topographic data was used to identify steep slopes, areas of concentrated flow, and depressional areas that may be suitable for treatment of runoff and storage within the watershed. Aerial photography was used to identify locations that had indicators of surface erosion from concentrated

flow. Photography from multiple years and varied seasons was used to identify issues such as gully erosion that may not have been evident in a single aerial photo due to recent tillage activity, cropping rotations, or variations in weather. Soils information was used to identify highly erodible soils and hydric soils and determine the appropriate BMP.

As a tool for the field reconnaissance, maps were created for each 1-mile by 1-mile section showing the desktop identified BMPs with relevant information including 2017 aerial photos, parcel boundaries, landowner information, existing and previously installed BMPs, wetlands, and contour lines. Staff from the Dakota County SWCD office used the maps to verify the feasibility and effectiveness of each BMP.

Step #3: Field Reconnaissance

Using the created maps for each section as a guide, field investigations were conducted to evaluate as many sites as possible to test assumptions and identify site-limiting factors for BMP design. Site constraints were assessed to determine the most feasible BMP options as well as eliminate sites from consideration. The field investigation also revealed BMP opportunities that could have gone unnoticed using only a desktop analysis. During the investigation, the drainage area and other mapped data was verified. Public right-of-way and public land within priority catchments was used as a starting point for visual assessment. Potential BMP locations that were identified during the Desktop Analysis step but could not be seen from public areas were visited by contacting individual landowners and scheduling formal site visits when possible.

Field reconnaissance was done in the spring when soil surfaces were visible and not obstructed by crops. BMPs that were deemed feasible were recorded and appropriate information was gathered to calculate the size, pollutant removal potential, and cost of the BMP. Linear BMPs such as grass waterways that spanned across more than one parcel were split on parcel boundaries and identified as two separate practices. This was done to appropriately estimate installation costs as they would likely need coordination with multiple landowners with separate agreements and design documents. It is important to note that BMPs spanning multiple parcels are likely to be contingent upon up gradient or downgradient practices being installed on adjacent properties for each of the BMPs to be effective.

Example of a location identified for a grassed waterway

BMPs were selected from the Natural Resources Conservation Service (NRCS) practice standards. Sites identified during the field reconnaissance were determined to be the best locations for BMP installations for pollutant treatment based on professional knowledge and experience. Following field reconnaissance, field maps and recorded notes were digitized in preparation for the cost-benefit ranking. Staff identified 41 potential locations that would benefit from BMP installations. Table 1 illustrates pollution reduction practices that were considered for each site.

Table 1. Pollution Reduction Practices	
Practice & NRCS Code	**Description**
340 - Cover Crop	**Grasses, legumes, and forbs planted for seasonal vegetative cover.**
342 - Critical Area Planting (Native plants)	**Planting of permanent native grasses, usually on a field with steep slopes over 6%.**
393 - Filter Strip	**Strip of perennial grasses and legumes planted along a stream, ditch, or wetland to capture sediment before it runs into the waterbody.**
410 - Grade Stabilization Structure	**A structure used to control the grade in natural or constructed channels to slow the flow of water, stabilize the channel, and reduce erosion.**
412 - Grassed Waterway	**A perennially vegetated conveyance in a crop field that is planted to reduce erosion where there is concentrated flow of water.**
580 - Stream and Shoreline Protection	**Treatments to stabilize and protect the banks of streams to prevent the loss of soil and reduce the offsite or downstream effects of sediment resulting from bank erosion.**
582 - Open Channel	**A natural or artificial channel in which water flows with a free surface.**
638 - Water & Sediment Control Basin	**An earthen embankment which traps water and sediment running off cropland upslope, thereby slowing the flow of runoff and allowing sediment to drop out of suspension.**
658 - Wetland Creation	**Construction of a new wetland by establishing hydrology, holding time and capacity, water levels, and plant species of a wetland. Constructed wetlands typically treat stormwater or agricultural runoff.**

Step #4: Cost/Treatment Analysis

After feasible BMP projects were identified, potential sediment reductions were calculated and preliminary cost estimates compiled. The projects were then ranked based on the cost per ton of sediment removal per year, over a 10-year life-cycle. The final value for the cost per pound of treatment includes design and installation. The top ranking projects have the lowest cost per ton of sediment removal.

Treatment Analysis

Modeling of the sediment loading for each selected BMP, before and after project installation, was completed with the Board of Water and Soil Resources (BWSR) Pollution Reduction Estimator using inputs from RUSLE2. Distance to surface water was calculated based on distances between the project and identified watercourses from the Dakota County SWCD's surface water inventory. The sediment reduction estimates associated with the installation of each project should be considered as pollutant reduction to watercourses within the North Byllesby subwatershed, but not necessarily pollutant load reductions to the Cannon River. It is important to note that reported treatment levels

are dependent upon optimal site selection and sizing. Not all locations and sizes will yield the same results. The pollutant removal estimates may be used to prioritize practices within the Trout Brook watershed and for grant applications but in no case should this data be used to represent actual pollutant removal until after installation is complete and site-specific modeling and/or monitoring data is available.

Cost estimates

Each project was assigned estimated costs for design and installation based on a recent analysis of costs for similar projects installed in Dakota County from 2013 to 2018. The averaged costs used in the calculations can be found in the Appendix. An annual cost per ton of sediment removal was then calculated for the 10-year life-cycle. In the final evaluation and ranking, the estimated project costs for each BMP are listed.

Cost/Benefit and Project Ranking Table

More detail regarding each specific project can be found in the Project Profiles pages of this report. In addition to ranking, a "Feasibility Code" was assigned to each project as shown in Table 2. The purpose of this code is to provide a basic indication of the feasibility or "reasonable likelihood" the listed project would be applied and installed by the landowner on a voluntary basis. The selected code is based on relative success SWCD staff has had in promoting the selected BMP project type through promotional and landowner engagement initiatives conducted in recent history.

The following criteria apply to each of the three codes used:

Table 2. Project Feasibility Codes

Code	Considerations
I	**High likelihood: practice is not dependent on installation of other practices or coordination with other landowners, the landowner has a history of cooperation with SWCD/NRCS, practice does not hinder farmability and/or installation cost is not prohibitive**
II	**Medium likelihood: practice may be dependent on installation of one or two other conservation practices and coordination with additional landowners, landowner is willing to work with SWCD/NRCS, practice does not severely hinder farmability and/or cost is not prohibitive**
III	**Low likelihood: project requires installation of other practices in order to be effective and coordination with multiple landowners, landowner has not previously worked with SWCD/NRCS, practice disrupts ability to farm the field and/or installation cost is prohibitive**

Table 3 summarizes the identified potential projects within the study area. Potential projects are listed from most cost effective to least cost effective, based on cost per ton of sediment removed over the life-cycle timeframe.

Cost estimates represent design and construction costs for each project installed on that particular site. Depending on complexity, additional project costs ranging from 25% to 50% of the construction cost should be added to account for project outreach and promotion. The reported treatment levels are dependent upon optimal siting and sizing which would be completed during the actual design phase of the proposed project, as well as obtaining landowner cooperation. Due to changing land use over time, these project profiles should be re-assessed periodically to update BMP suitability and priority ranking.

Table 3. Summary of Potential BMPs

Rank	Feasibility Code	Feature ID (Township-section-1/4-#)	BMP Type	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
1	III	RAN-04-03-01	Critical Area Planting	1.22	acres	18.6	$2,530	$14
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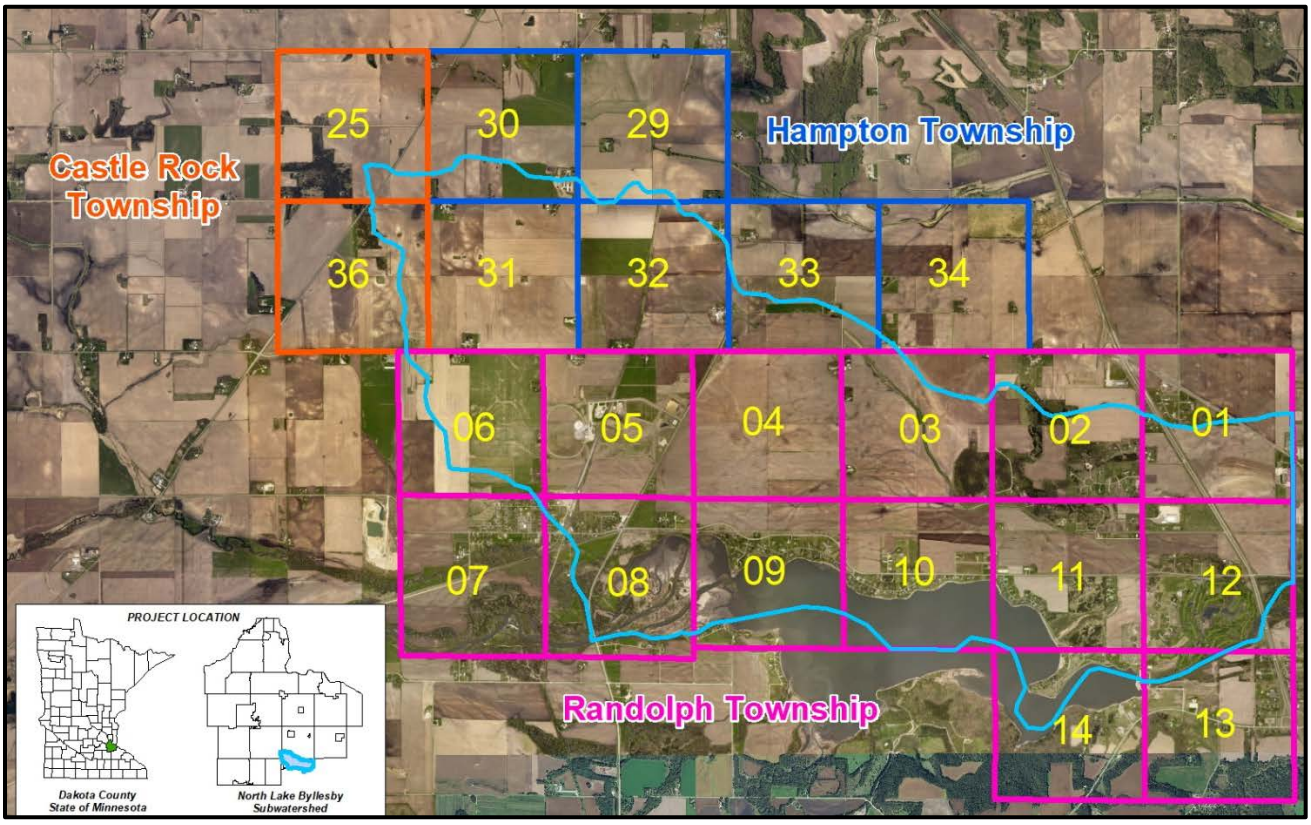
34	II	RAN-06-01-05	Grassed Waterway	600	Lin. Feet	1.1	$8,340	$751
35	II	RAN-01-03-01	Grassed Waterway	600	Lin. Feet	1.0	$8,340	$810
36	II	HAM-31-02-03	Grassed Waterway	400	Lin. Feet	0.6	$6,640	$1,186
37	II	HAM-30-03-01	Grassed Waterway	825	Lin. Feet	0.6	$7,915	$1,365
38	II	HAM-31-02-04	Grassed Waterway	500	Lin. Feet	0.3	$6,940	$2,103
39	II	HAM-30-04-01	Water and Sediment Control Basin	1	Each	0.6	$14,640	$2,440
40	II	HAM-30-04-02	Water and Sediment Control Basin	1	Each	0.6	$14,640	$2,481
41	II	HAM-31-03-01	Water and Sediment Control Basin	1	Each	0.5	$14,640	$3,115

Project Profiles

The following pages provide definition and detailed assessments for each of the projects identified through the field reconnaissance and subsequent evaluation of each BMP. For organizational purposes the selected projects are grouped by section, as shown below. The one-mile by one-mail sections are identified by the township name and section number within the township. Projects are displayed with 2017 aerial imagery and Dakota County parcel boundaries. Individual projects are identified by a unique number and project specific information is included in the BMP Cost Benefit Analysis table.

The Project Profiles are part of the subwatershed analysis and should be retained with the document to provide context for identified BMPs. The drawings are neither legally recorded maps nor surveys and are not intended to be used as such. The drawings are a compilation of records, information, and data located in various City, County, and State Offices and other sources, affecting the areas shown, and are to be used for reference purposes only. Dakota County SWCD is not responsible for any inaccuracies herein contained. If discrepancies are found, please contact the Dakota County Soil and Water Conservation District at 651-480-7777.

Proiect Profile Reference Sections



Castle Rock Township, Section 25

Description:

The area of the North Lake Byllesby subwatershed that lies within Section 25 of Castle Rock Township is approximately 51 acres. It consists of agricultural cropland and is bisected by Highway 47. Conventional tillage practices are utilized on most of the cropland. Ostrander loam with slopes of 1% - 6% is the predominant soil.

Land Management Recommendations:

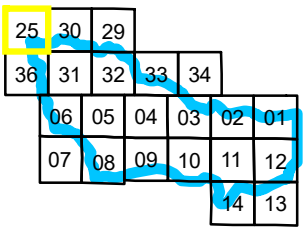
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.

Source: (Aerial) Dakota County 2017

Township: Castle Rock
Section: 25



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Castle Rock Township, Section 36

Description:

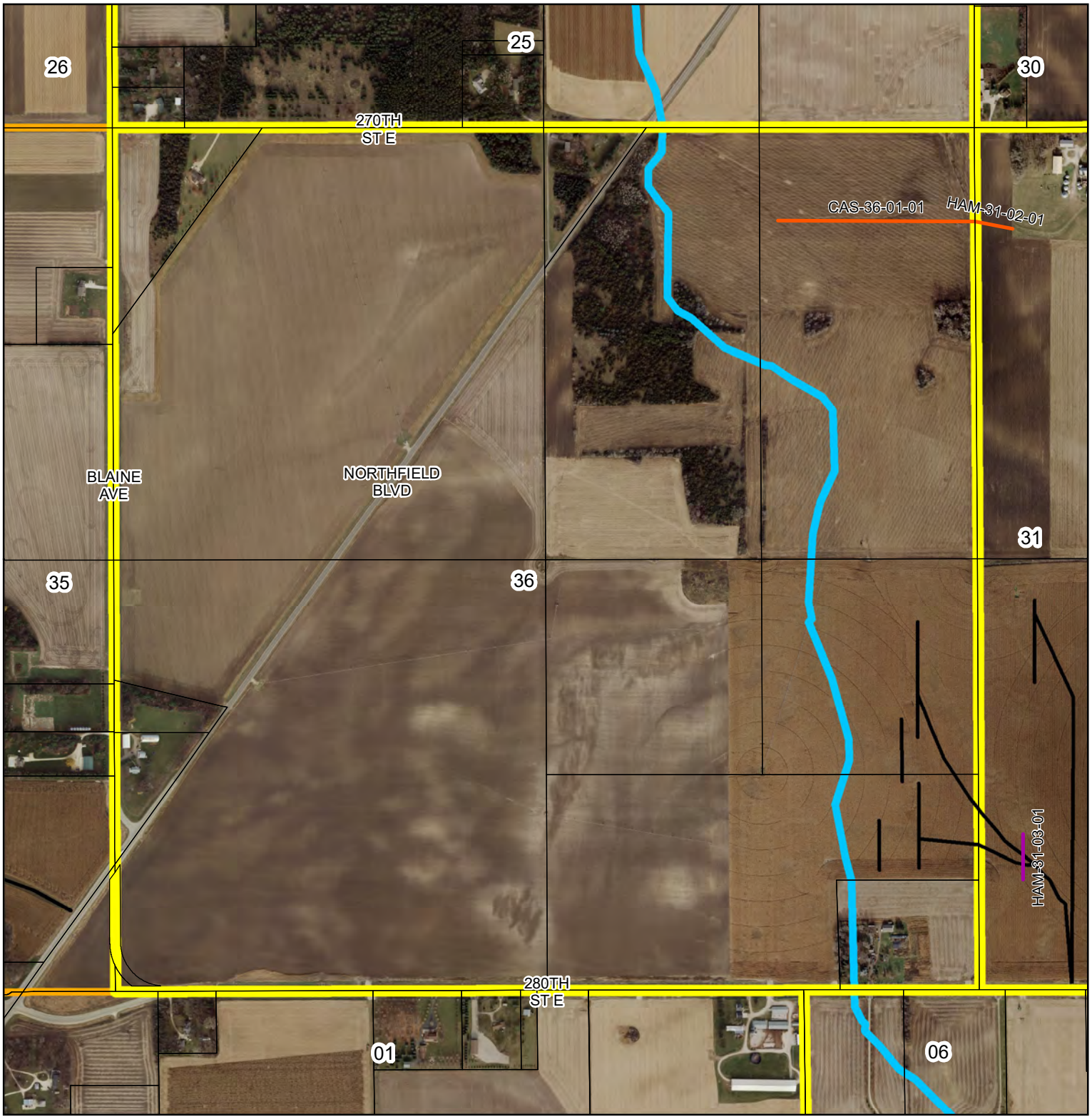
The area of the North Lake Byllesby subwatershed that lies within Section 36 of Castle Rock Township is approximately 139 acres. It consists primarily of agricultural cropland. Conventional tillage practices are utilized on most of the cropland. Some of the cropland is irrigated and several structural best management practices have been installed to reduce sediment transport from the field. Osrtander loam with slopes of 1% - 6% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

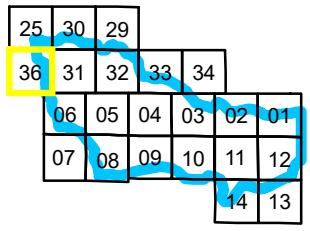
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
CAS-36-01-01	412 - Grassed Waterway - complex 20' design	1200	Lin. Feet	41.3	$10,440	$25



Source: (Aerial) Dakota County 2017

Township: Castle Rock
Section: 36



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

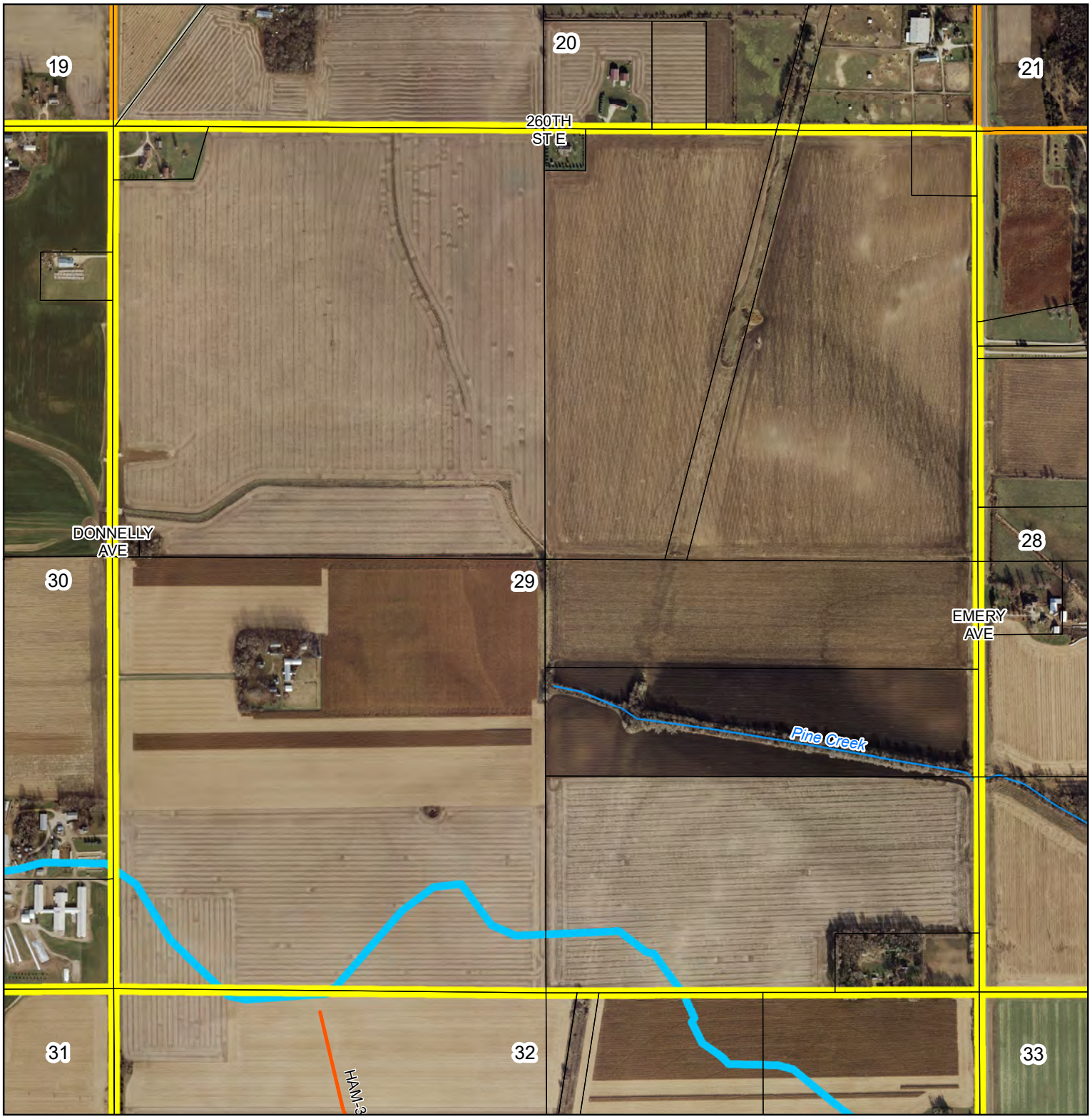
N

Hampton Township, Section 29

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 29 of Hampton Township is approximately 24 acres. It consists primarily of agricultural cropland. Conventional tillage practices are utilized on the cropland. Ostrander loam with slopes of 1% - 6% is the predominant soil.

Land Management Recommendations:
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

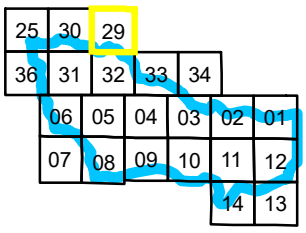
BMP Cost Benefit Analysis:
There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Source: (Aerial) Dakota County 2017

Township: Hampton

Section: 29



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Hampton Township, Section 30

Description:

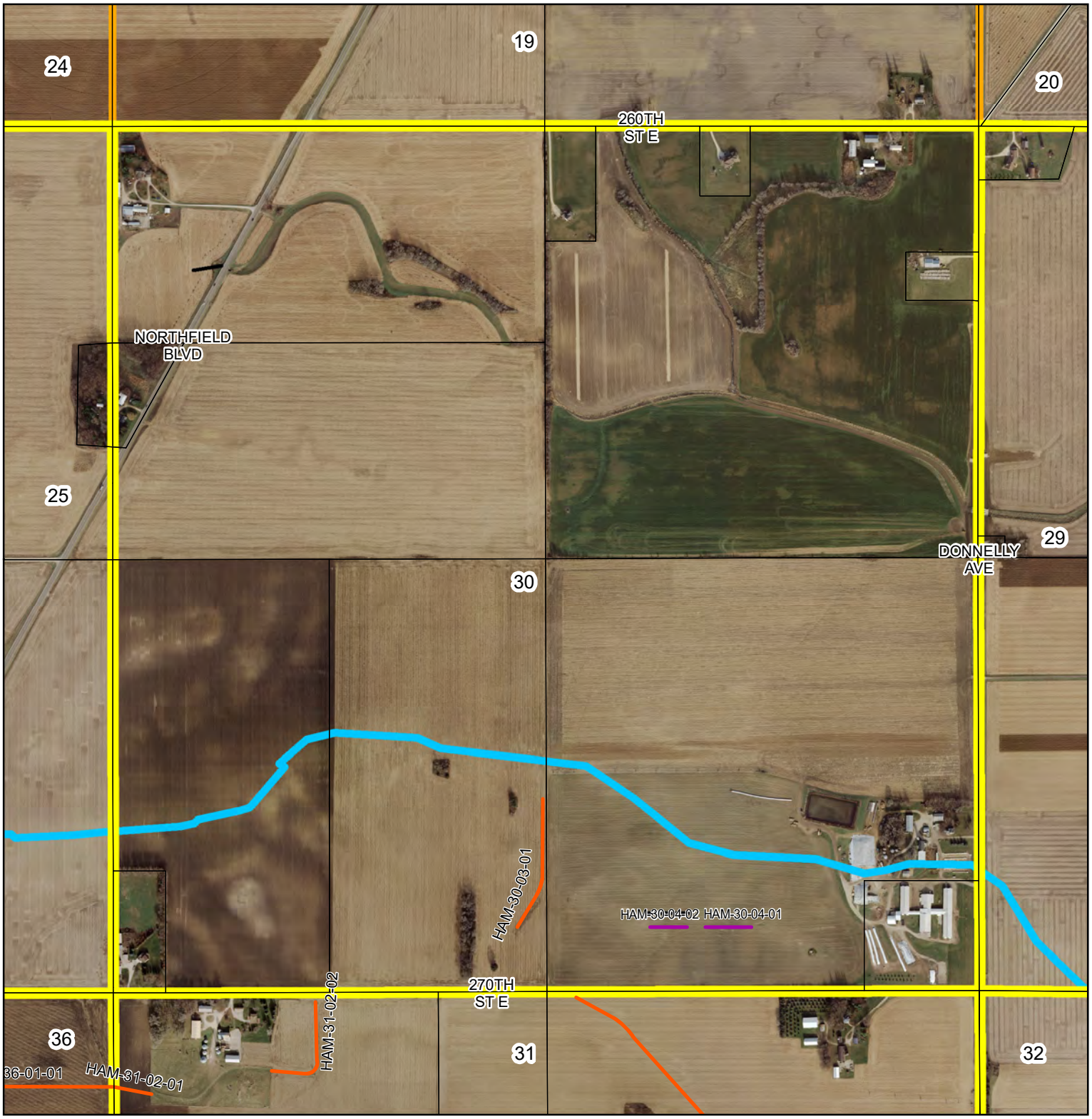
The area of the North Lake Byllesby subwatershed that lies within Section 30 of Hampton Township is approximately 137 acres. The area consists primarily of agricultural cropland with a feedlot in the southeast corner of the section. Conventional tillage practices are utilized on most of the cropland and some of the cropland is irrigated. Etter fine sandy soil with slopes of 2% - 6% and Ostrander loam with slopes of 1% - 6% are the predominant soils.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

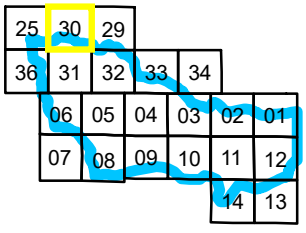
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
HAM-30-03-01	412 - Grassed Waterway - simple design	825	Lin. Feet	0.6	$7,915	$1,365
HAM-30-04-01	638 - Water & Sediment Control Basin(wide)	1	Each	0.6	$14,640	$2,440
HAM-30-04-02	638 - Water & Sediment Control Basin(wide)	1	Each	0.6	$14,640	$2,481



Source: (Aerial) Dakota County 2017

Township: Hampton
Section: 30



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Hampton Township, Section 31

Description:

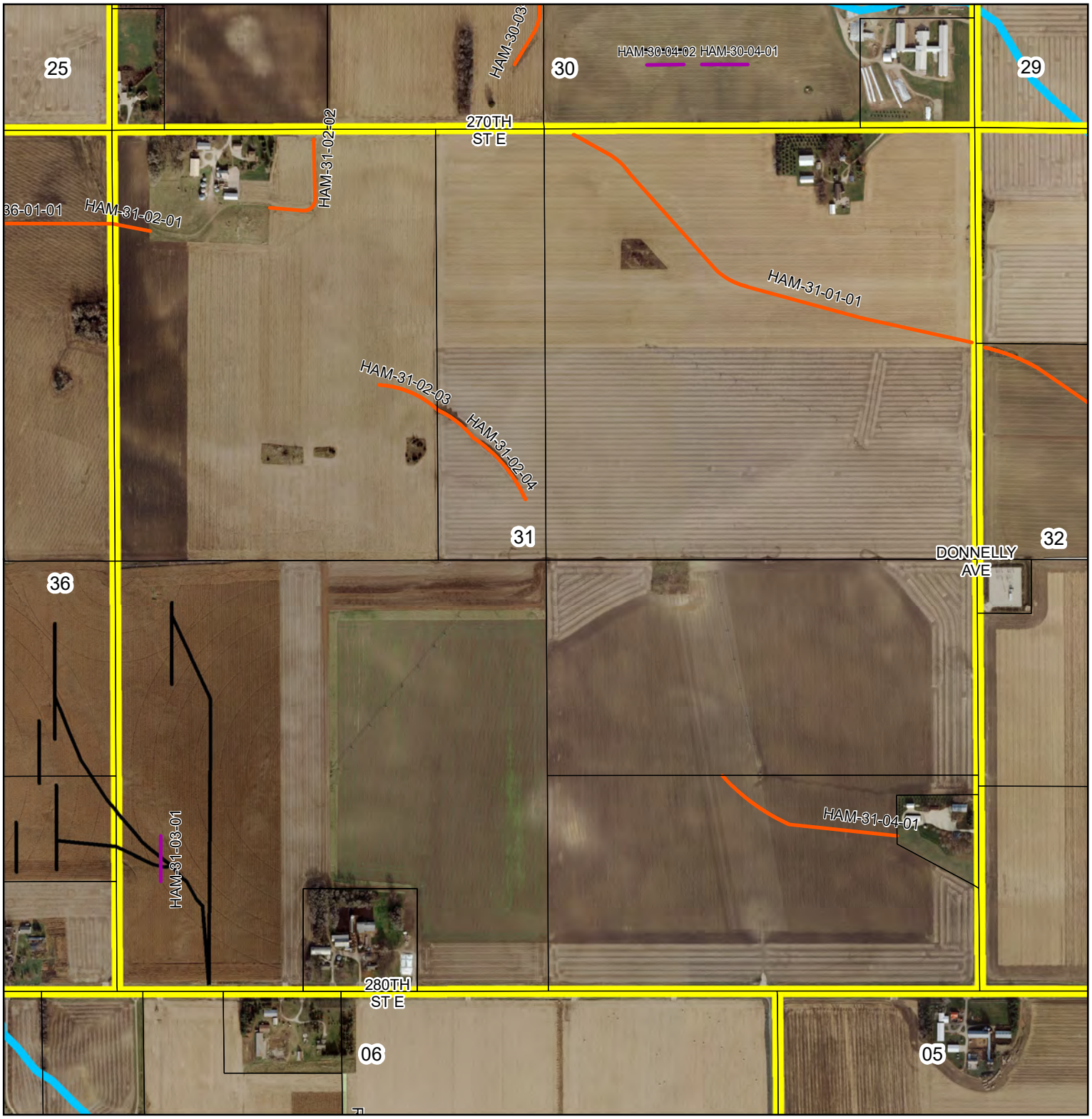
All 640 acres of Hampton Township Section 31 lie within the North Lake Byllesby subwatershed. The area consists primarily of agricultural cropland with several farm sites. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Waukegan silt loam, bedrock substratum, with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

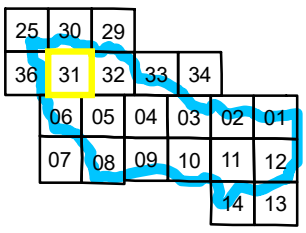
Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
HAM-31-01-01	412 - Grassed Waterway - complex 20' design	2850	Lin. Feet	53.0	$16,215	$31
HAM-31-02-02	412 - Grassed Waterway - complex 20' design	690	Lin. Feet	24.7	$8,655	$35
HAM-31-02-01	412 - Grassed Waterway - complex 20' design	230	Lin. Feet	15.8	$7,045	$45
HAM-31-04-01	412 - Grassed Waterway- complex 30' design	1175	Lin. Feet	5.8	$11,740	$202
HAM-31-02-03	412 - Grassed Waterway - simple design	400	Lin. Feet	0.6	$6,640	$1,186
HAM-31-02-04	412 - Grassed Waterway - simple design	500	Lin. Feet	0.3	$6,940	$2,103
HAM-31-03-01	638 - Water & Sediment Control Basin(wide)	1	Each	0.5	$14,640	$3,115



Source: (Aerial) Dakota County 2017

Township: Hampton

Section: 31



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Hampton Township, Section 32

Description:

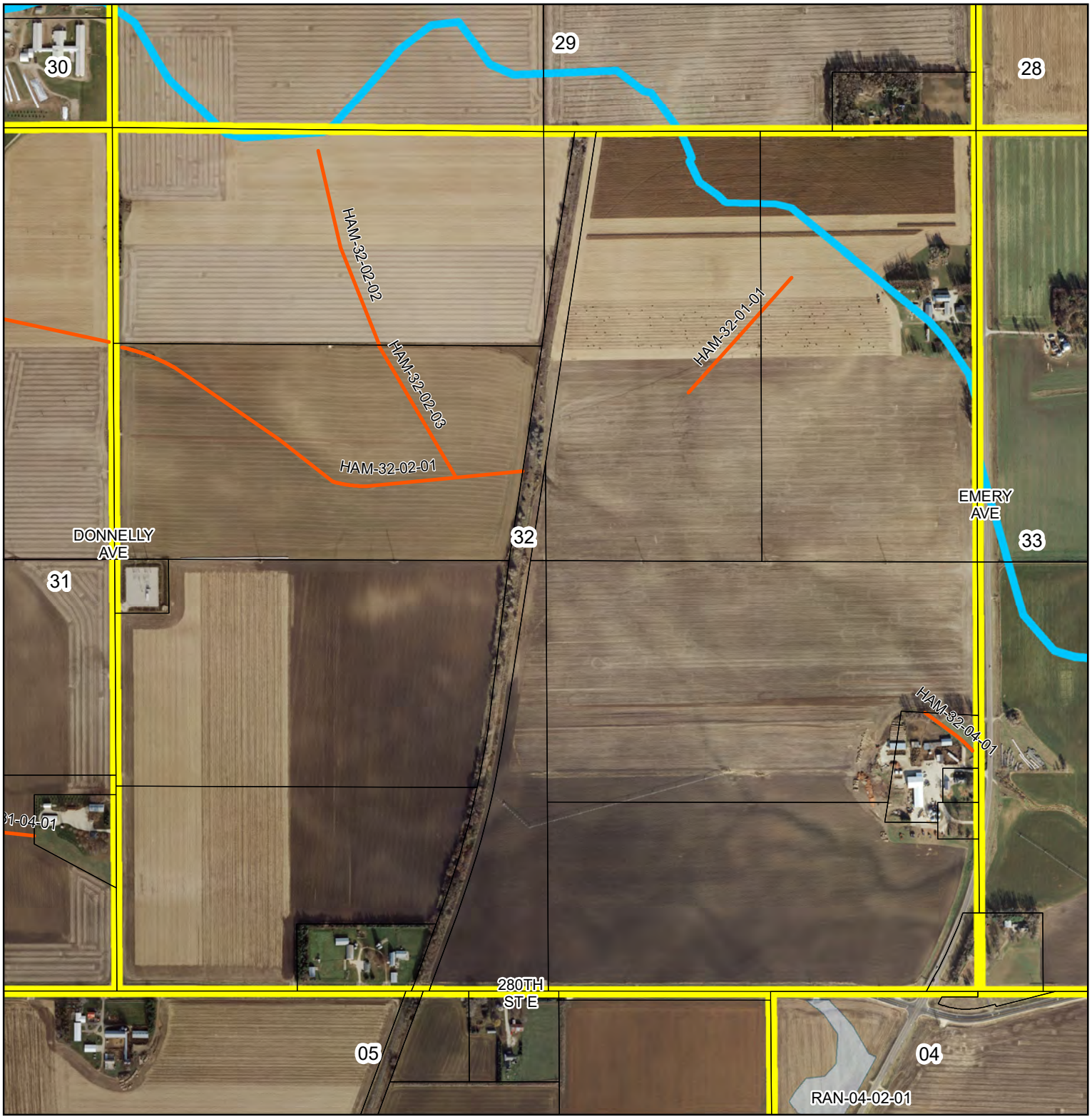
The area of the North Lake Byllesby subwatershed that lies within Section 32 of Hampton Township is approximately 607 acres. It consists primarily of agricultural cropland with some farmsites. Conventional tillage practices are utilized on most of the cropland and about half of the cropland is irrigated. Ostrander loam with slopes of 1% - 6% and Waukegan silt loam, bedrock substratum, with slopes of 0% - 2% are the predominant soils.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

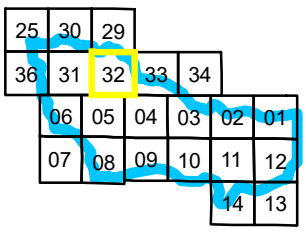
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
HAM-32-02-01	412 - Grassed Waterway - simple design	2700	Lin. Feet	35.9	$13,540	$38
HAM-32-02-03	412 - Grassed Waterway - complex 20' design	940	Lin. Feet	13.0	$9,530	$73
HAM-32-04-01	582 - Open Channel	300	Lin. Feet	12.4	$9,840	$79
HAM-32-01-01	412 - Grassed Waterway - simple design	950	Lin. Feet	2.1	$8,290	$387
HAM-32-02-02	412 - Grassed Waterway - simple design	1250	Lin. Feet	2.3	$9,190	$400



Source: (Aerial) Dakota County 2017

Township: Hampton
Section: 32



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

Hampton Township, Section 33

Description:

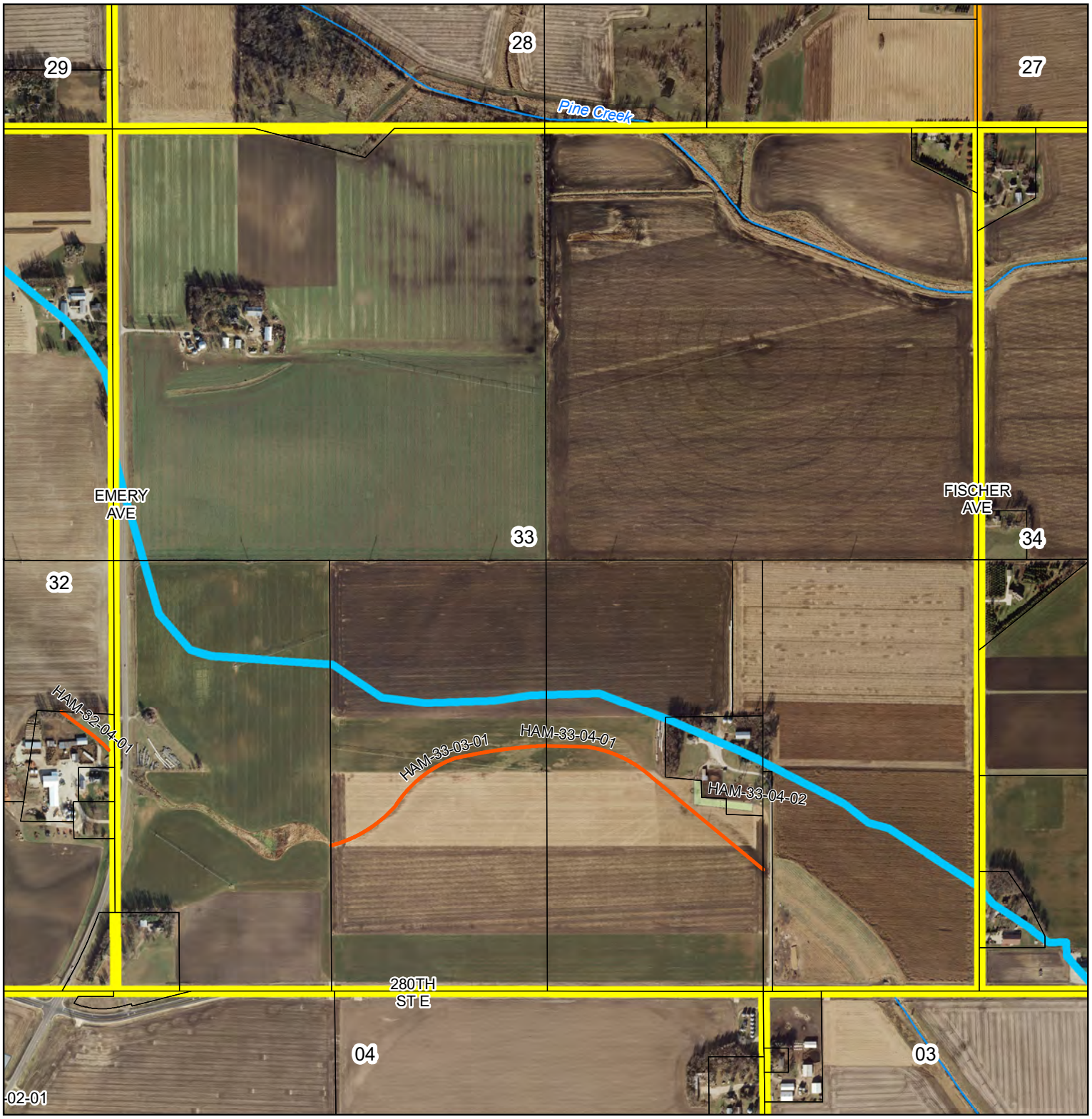
The area of the North Lake Byllesby subwatershed that lies within Section 33 of Hampton Township is approximately 203 acres. This area lies in the southern portion of the section and consists primarily of agricultural cropland. Conventional tillage practices are utilized on most of the cropland. Most of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

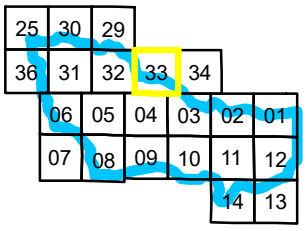
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
HAM-33-04-01	412 - Grassed Waterway- complex 30' design	1575	Lin. Feet	58.6	$13,340	$23
HAM-33-03-01	412 - Grassed Waterway- complex 30' design	1500	Lin. Feet	27.9	$13,040	$47
HAM-33-04-02	342 - Critical Area Planting (Native)	0.5	acres	1.1	$2,170	$203



Source: (Aerial) Dakota County 2017

Township: Hampton
Section: 33



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

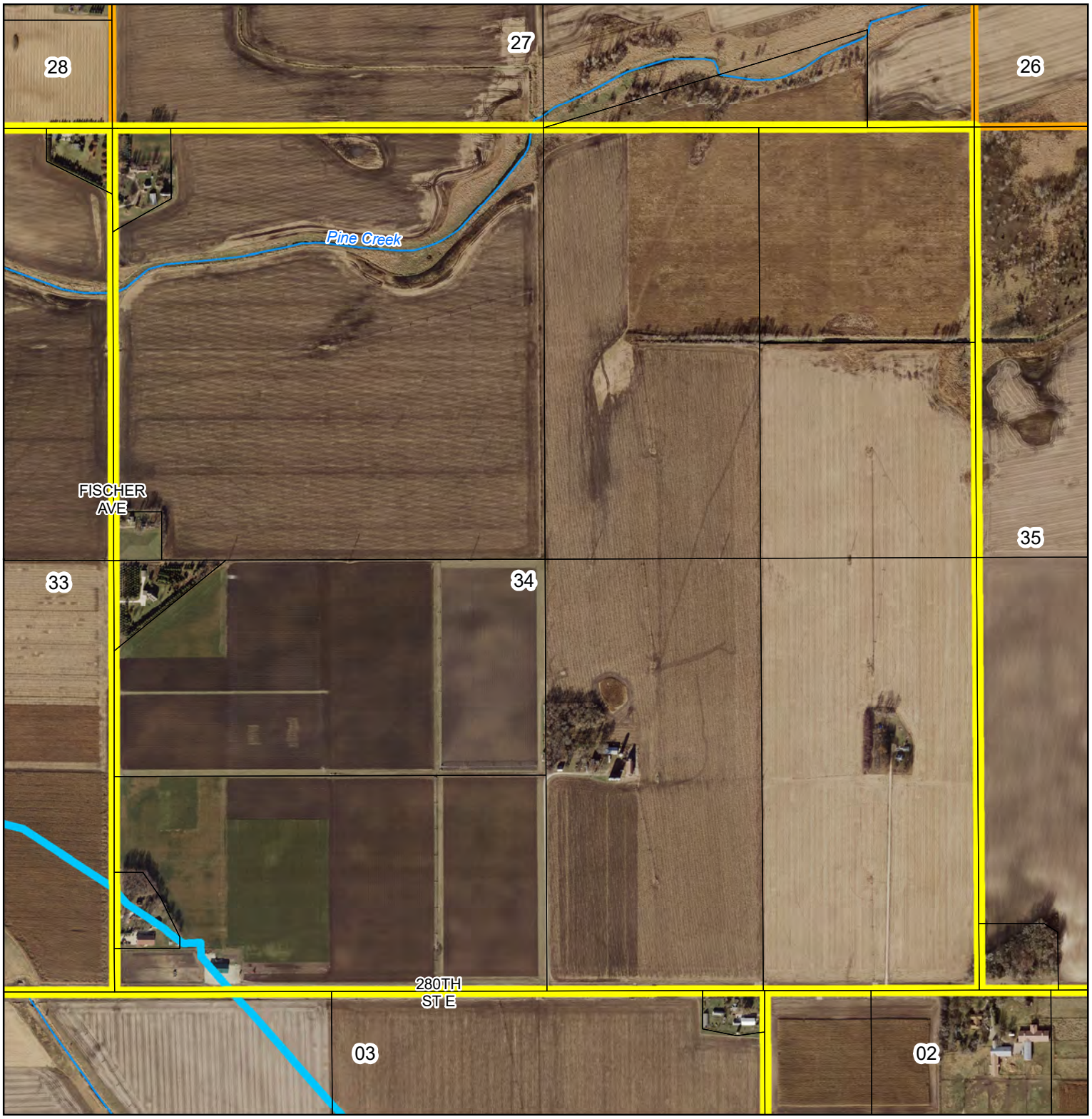
0 400 800 1,600 Feet

Hampton Township, Section 34

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 34 of Hampton Township is approximately 5.5 acres. This area lies in the southwest portion of the section and consists primarily of rural residential and cropland used for seed production. Conventional tillage practices are utilized on most of the cropland. Waukegan silt loam with slopes of 0% - 1% is the predominant soil.

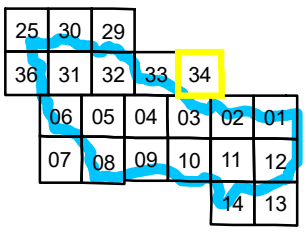
Land Management Recommendations:
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:
There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Source: (Aerial) Dakota County 2017

Township: Hampton
Section: 34



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 1

Description:

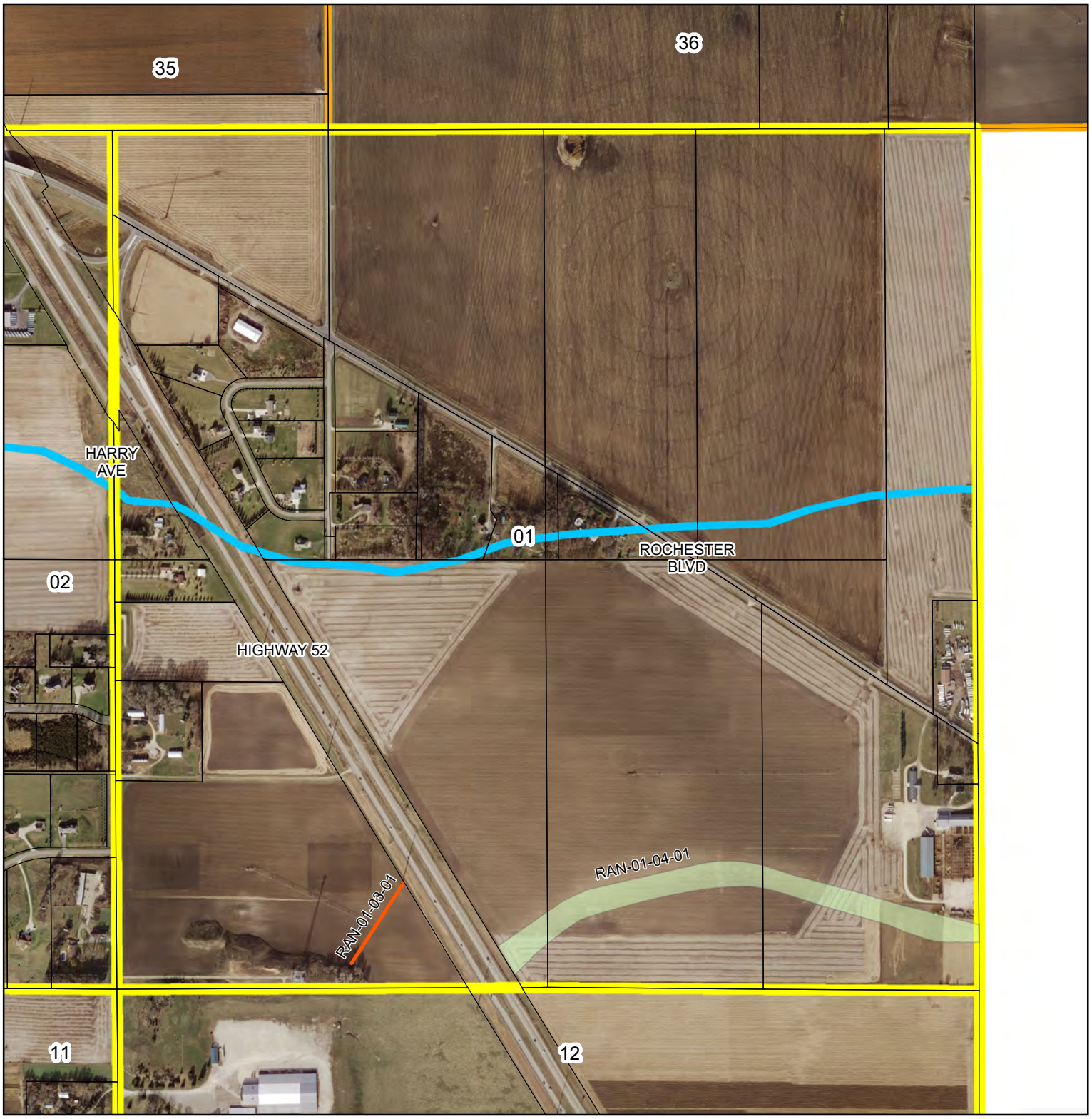
The area of the North Lake Byllesby subwatershed that lies within Section 1 of Randolph Township is approximately 340 acres. This area lies in the southern portion of the section and consists primarily of agricultural cropland, road and right-of-way associated with Highway 52, rural residential, and a meat processing facility. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Waukegan silt loam with slopes of 0% - 1% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

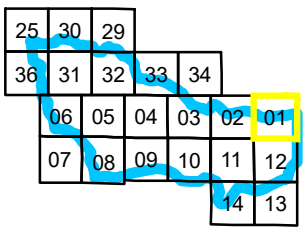
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-01-04-01	342 - Critical Area Planting (Native)	10.7	acres	45.0	$7,270	$16
RAN-01-03-01	412 - Grassed Waterway - complex 20' design	600	Lin. Feet	1.0	$8,340	$810



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 01



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

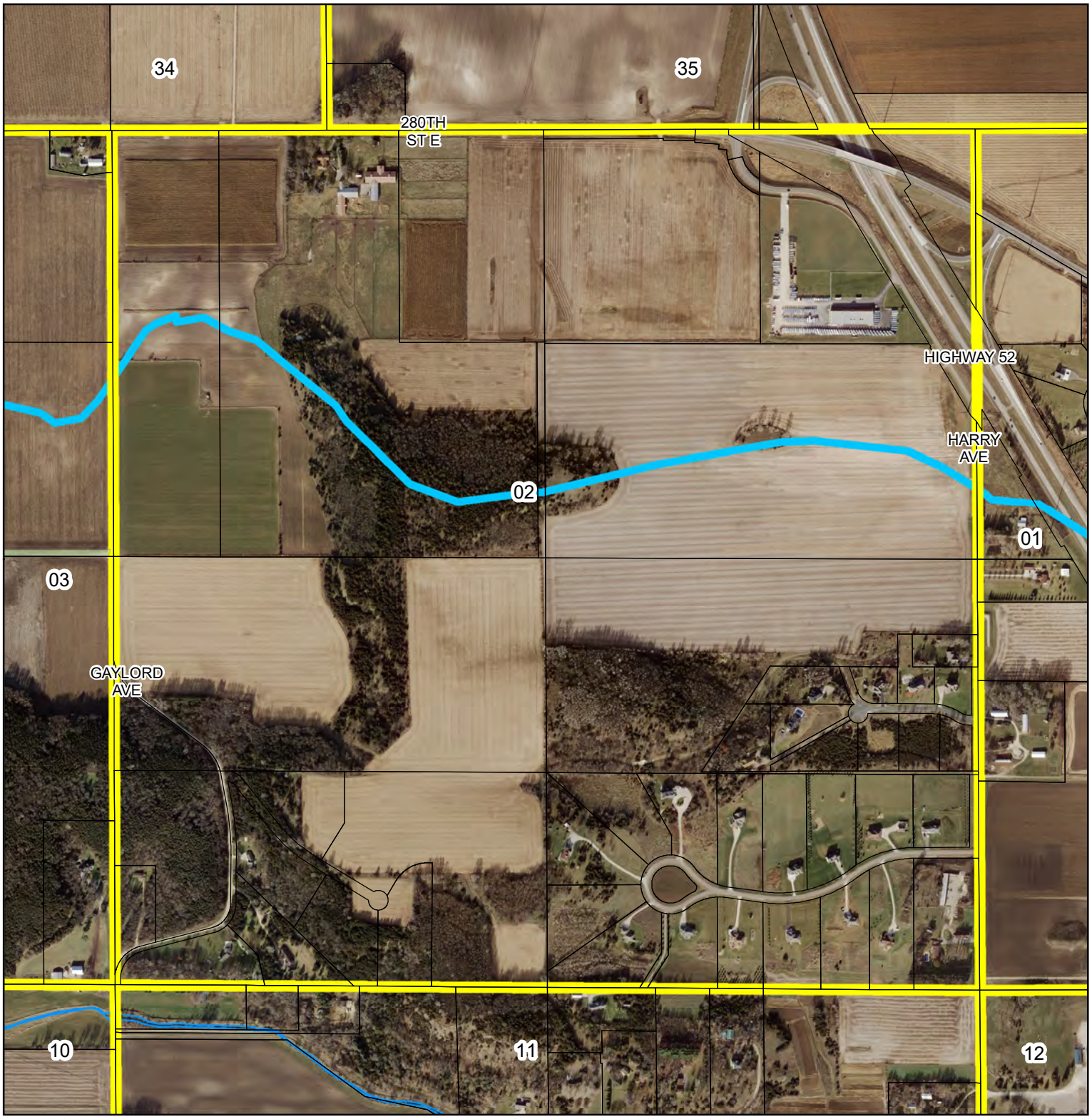
N

Randolph Township, Section 2

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 2 of Randolph Township is approximately 408 acres. This area comprises the southern portion of the section and consists primarily of agricultural cropland, rural residential, and shrubland/woodland. There are some steep slopes, most of which are in perennial vegetation that is transitioning from shrubland to woodland. Conventional tillage practices are utilized on most of the cropland. Wadena loam with slopes of 2% - 6% and Etter-Brodale complex with slopes of 25% - 60% are the predominant soils.

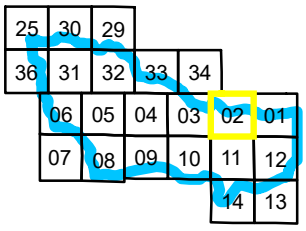
Land Management Recommendations:
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:
There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 02



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 3

Description:

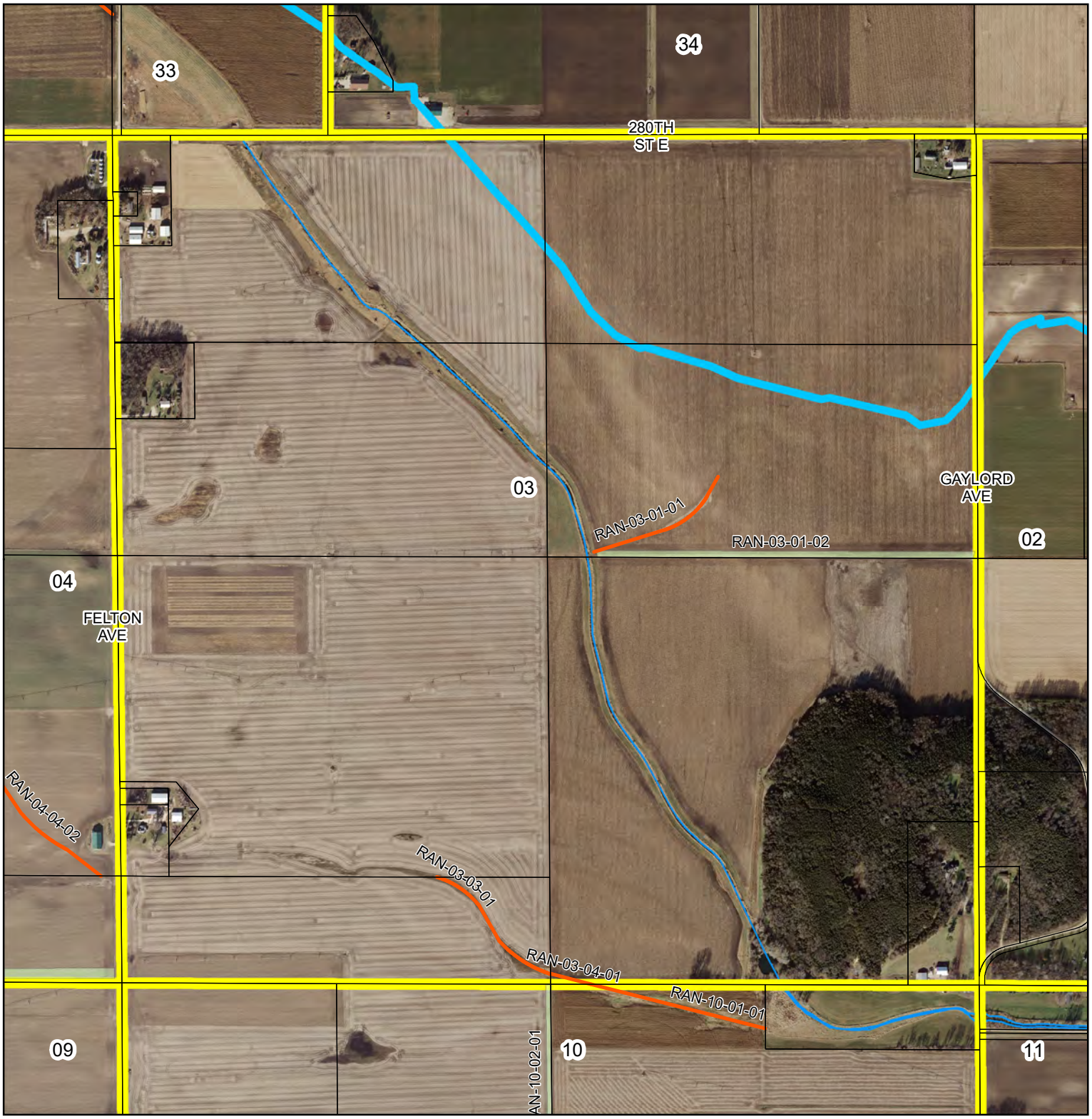
The area of the North Lake Byllesby subwatershed that lies within Section 3 of Randolph Township is approximately 536 acres. This area includes most of the section except the northeast corner and consists mostly of agricultural cropland with some farm sites and a recently-installed solar field in the northwest corner of the section (not visible in 2017 aerial photos). Conventional tillage practices are utilized on most of the cropland. Most of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

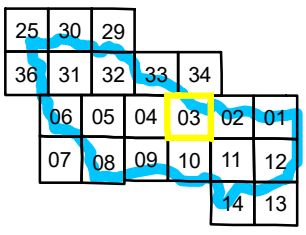
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-03-01-02	342 - Critical Area Planting (Native)	2.15	acres	16.0	$2,995	$19
RAN-03-04-01	412 - Grassed Waterway - complex 20' design	250	Lin. Feet	37.2	$7,115	$19
RAN-03-03-01	412 - Grassed Waterway - complex 20' design	950	Lin. Feet	35.3	$9,565	$27
RAN-03-01-01	412 - Grassed Waterway - complex 20' design	925	Lin. Feet	11.6	$9,478	$82



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 03



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

Randolph Township, Section 4

Description:

All of Randolph Township Section 4 is within the North Lake Byllesby subwatershed. This section consists almost entirely of agricultural cropland. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

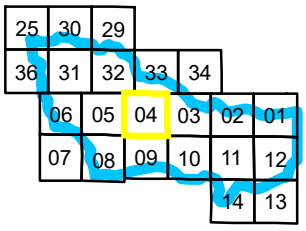
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-04-03-01	342 - Critical Area Planting (Native)	1.22	acres	18.6	$2,530	$14
RAN-04-04-02	412 - Grassed Waterway - complex 20' design	1400	Lin. Feet	47.2	$11,140	$24
RAN-04-04-01	342 - Critical Area Planting (Native)	1.89	acres	8.2	$2,865	$35
RAN-04-02-01	658 - Wetland Creation	4.6	Acres	8.5	$44,000	$518

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 04



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 5

Description:

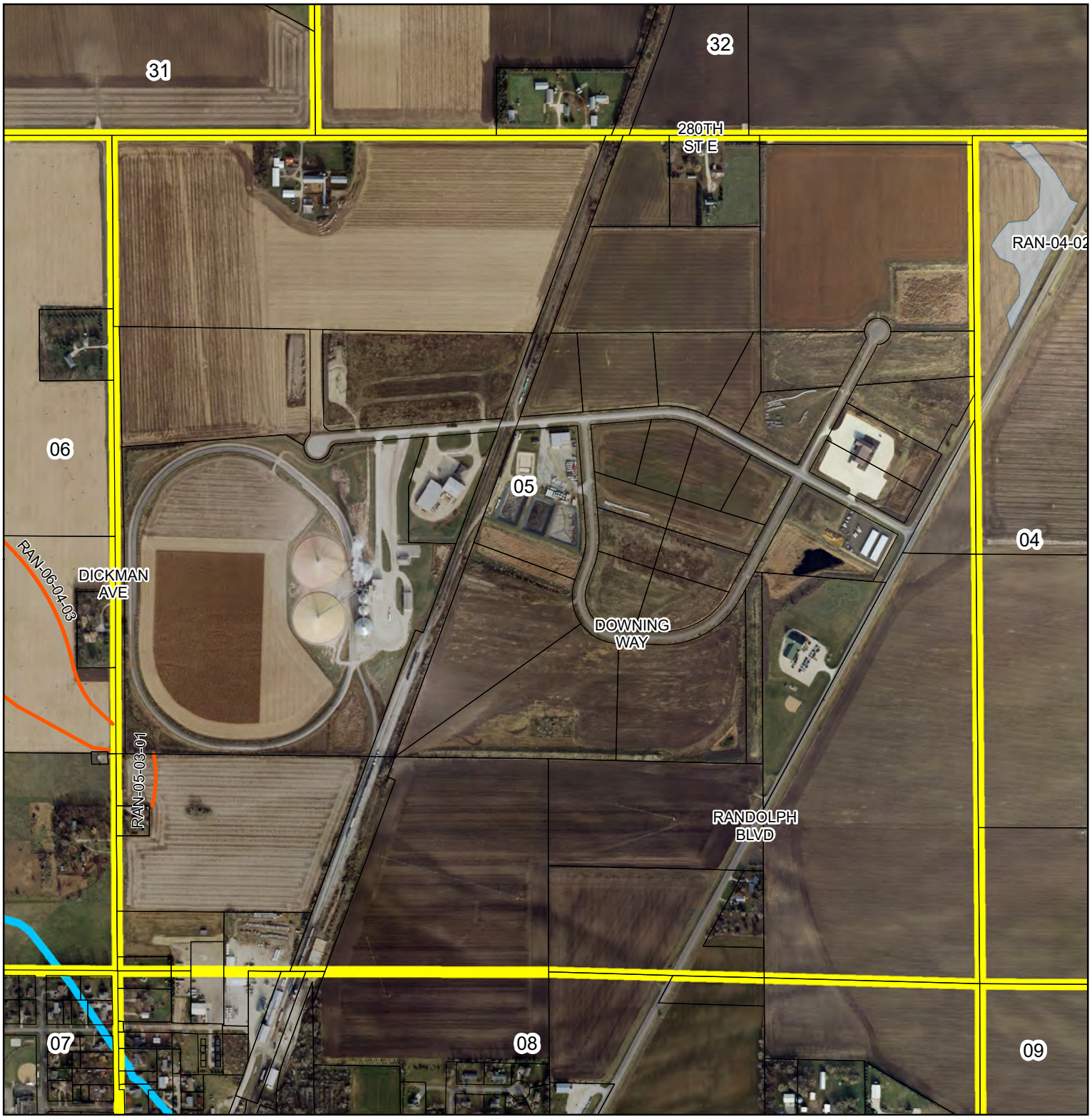
All of Section 5 of Randolph Township is within the North Lake Byllesby subwatershed. This section consists primarily of an industrial park and agricultural cropland. The industrial park has developed gradually over a number of years and several of the undeveloped lots are currently being farmed. Conventional tillage practices are utilized on most of the cropland and some of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% and Waukegan silt loam with slopes of 0% - 1% are the predominant soils.

Land Management Recommendations:

Land use within this section is a combination of agricultural and industrial. Land management practices recommended for the agricultural portion of the section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For the industrial portion of the section, recommendations include proper stormwater management, good housekeeping practices including a frequent outdoor sweeping schedule, following a Illicit Discharge Detection and Elimination program, non-structural practices including grassed or vegetated areas to catch sediment particles flowing in stormwater, and properly maintaining structural stormwater management BMPs. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

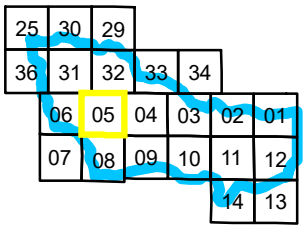
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-05-03-01	412 - Grassed Waterway - simple design	300	Lin. Feet	1.3	$6,340	$480



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 05



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

Randolph Township, Section 6

Description:

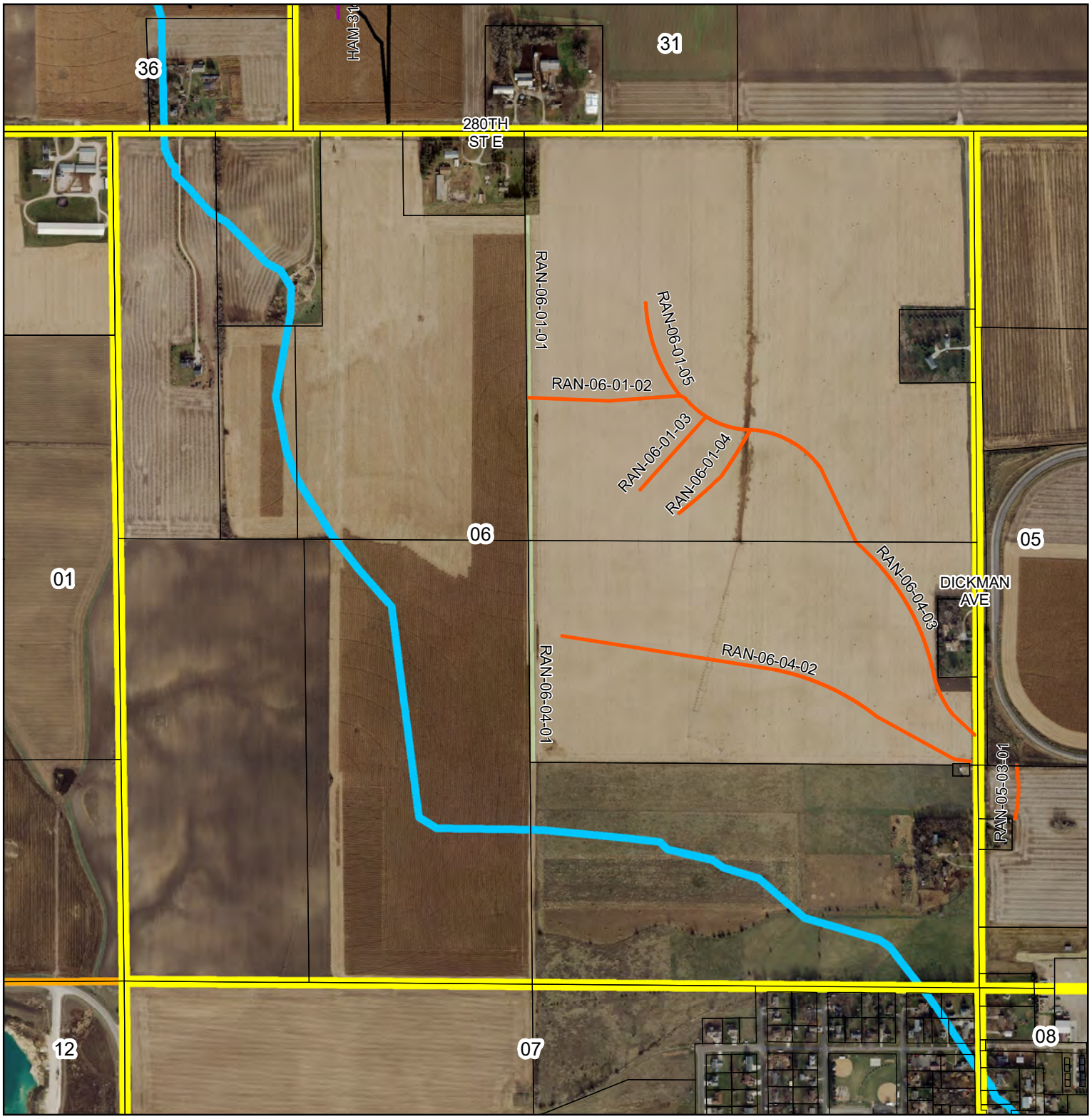
The area of the North Lake Byllesby subwatershed that lies within Section 6 of Randolph Township is approximately 395 acres. It consists primarily of agricultural cropland, pasture/hayed areas, and several residential sites. Both conventional tillage practices and conservation tillage practices are utilized on the cropland with cover crops planted on some of the cropland. Most of the cropland is irrigated. Waukegan silt loam with slopes of 0% - 1% and Ostrander loam with slopes of 1% - 6% are the predominant soils.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

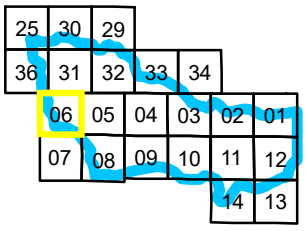
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-06-01-01	342 - Critical Area Planting (Native)	1.28	acres	16.7	$2,560	$15
RAN-06-04-01	342 - Critical Area Planting (Native)	0.88	acres	7.8	$2,360	$30
RAN-06-01-02	412 - Grassed Waterway- complex 30' design	2350	Lin. Feet	24.2	$16,440	$68
RAN-06-04-03	412 - Grassed Waterway - complex 20' design	1375	Lin. Feet	12.6	$11,053	$88
RAN-06-04-02	412 - Grassed Waterway - complex 20' design	2550	Lin. Feet	15.8	$15,165	$96
RAN-06-01-03	412 - Grassed Waterway - simple design	600	Lin. Feet	2.2	$7,240	$325
RAN-06-01-04	412 - Grassed Waterway - simple design	650	Lin. Feet	1.2	$7,390	$611
RAN-06-01-05	412 - Grassed Waterway - complex 20' design	600	Lin. Feet	1.1	$8,340	$751



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 06



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 7

Description:

The area of the North Lake Byllesby subwatershed that lies within Section 7 of Randolph Township is approximately 2.0 acres. This area is in the northeast corner of the section and is residential land use in the city of Randolph. With the exception of the impervious areas, all other land is in perennial vegetation. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

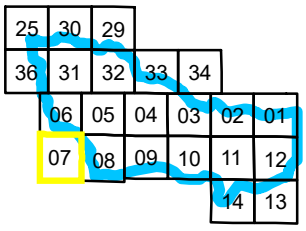
Sediment export from this portion of the subwatershed is assumed to be minimal. Land management recommendations include maintaining vegetative cover and limiting soil compaction.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 07



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

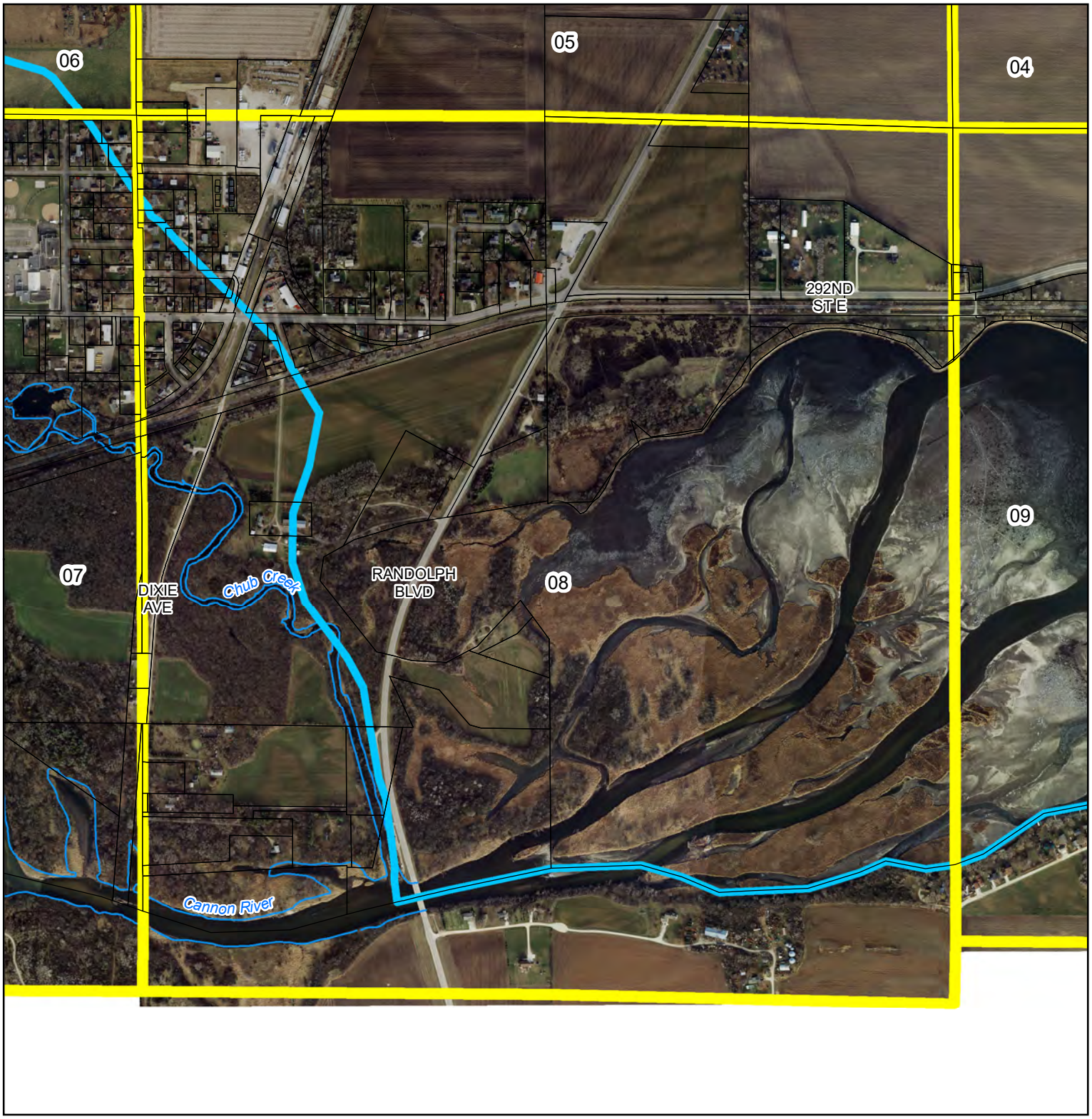
Randolph Township, Section 8

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 8 of Randolph Township is approximately 478 acres. The area consists of a portion of the city of Randolph, some agricultural land, some natural areas that are in perennial grassland or woodland, and a portion of Lake Byllesby that has substantial sediment deposits from the Cannon River. Conventional tillage practices are utilized on most of the cropland and some of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:
Land use within this section is a combination of agricultural, residential, and undeveloped natural areas. Land management practices recommended for agricultural portions of this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Much of the natural areas and parkland are in perennial woodland or grassland cover and land management practices in this portion include the management of invasive species and promotion of robust native vegetation. Within the residential areas, recommended land management practices include proper stormwater management, good housekeeping practices including a frequent street sweeping schedule, non-structural practices including grassed or vegetated areas to catch sediment particles flowing in stormwater, and properly maintaining structural stormwater management BMPs.

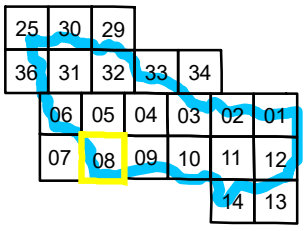
Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:
There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 08



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 9

Description:

The area of the North Lake Byllesby subwatershed that lies within Section 9 of Randolph Township is approximately 250 acres. The area consists primarily of agricultural cropland on the north side of County Road 88 and residential land on the south side of County Road 88. In general, runoff from the north side of County Road 88 flows east toward Dorden Glen Creek and runoff from the south side flows to Lake Byllesby. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Many of the residential shorelines adjacent to Lake Byllesby have substantial erosion due to the steep banks, varying water levels in Lake Byllesby, and non-cohesive soils. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

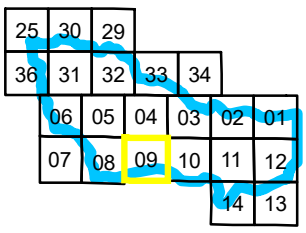
The primary land uses within this section are agricultural and residential. Land management practices recommended throughout the agricultural portion include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For residential areas, maintaining robust perennial vegetation and minimizing the erosion along the shoreline of Lake Byllesby are recommended. Due to the complexity of the shoreline, high costs for shoreline stabilization projects on Lake Byllesby, and limited stabilization success due to the varying lake water levels, individual locations of shoreline stabilization along Lake Byllesby were not identified. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-09-02-01	342 - Critical Area Planting (Native)	0.75	acres	4.0	$2,295	$58

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 09



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 10

Description:

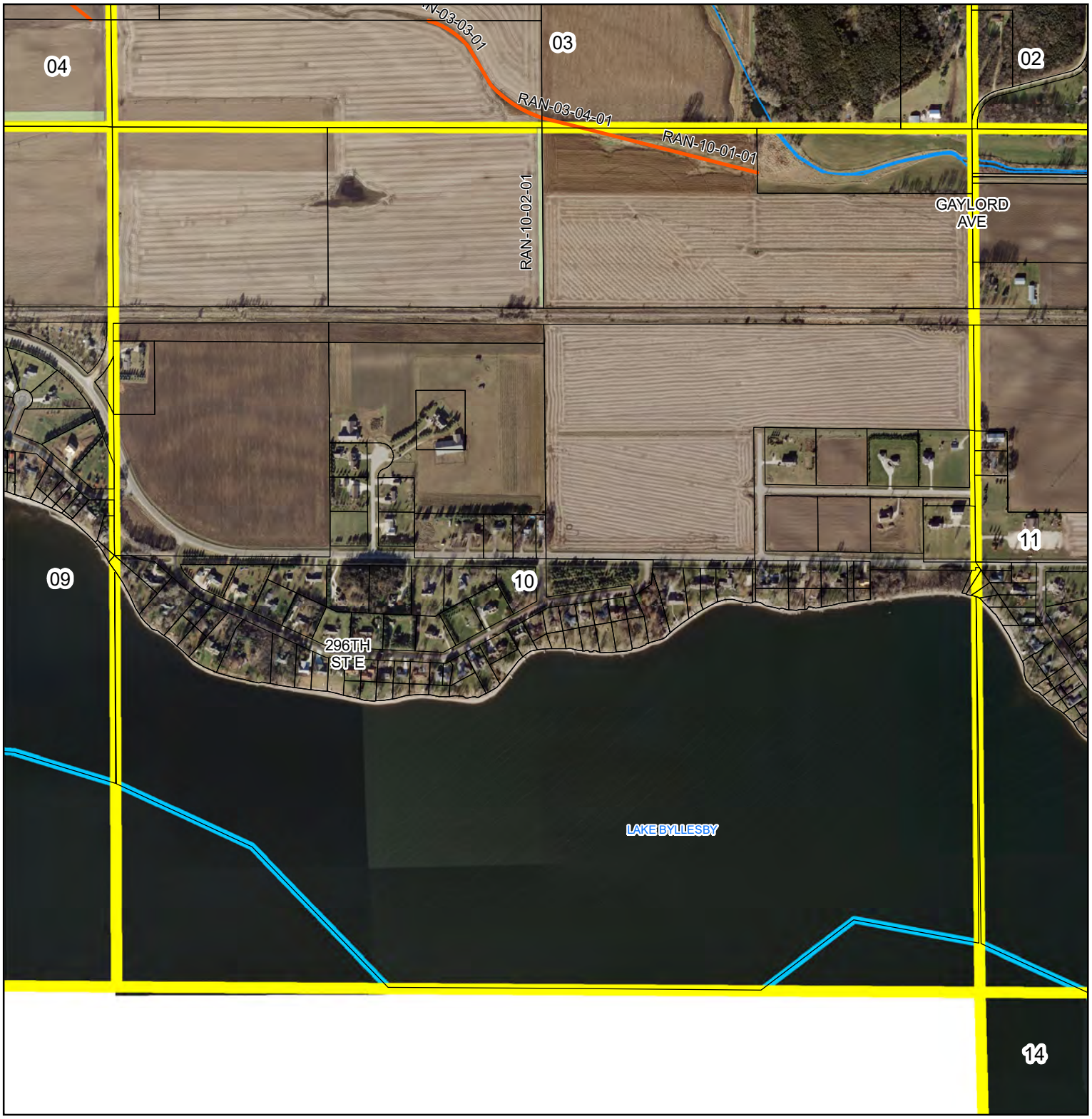
The area of the North Lake Byllesby subwatershed that lies within Section 10 of Randolph Township is approximately 385 acres. The area consists primarily of agricultural cropland with some residential land on the north side of County Road 88 and residential land on the south side of County Road 88. In general, runoff from the north side of County Road 88 flows east toward Dorden Glen Creek and runoff from the south side flows to Lake Byllesby. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Many of the residential shorelines adjacent to Lake Byllesby have substantial erosion due to the steep banks, varying water levels in Lake Byllesby, and non-cohesive soils. Estherville silty loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

The primary land uses within this section are agricultural and residential. Land management practices recommended throughout the agricultural portions of the section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For residential areas, maintaining robust perennial vegetation and minimizing the erosion along the shoreline of Lake Byllesby are recommended. Due to the complexity of the shoreline, high costs for shoreline stabilization projects on Lake Byllesby, and limited stabilization success due to the varying lake water levels, individual locations of shoreline stabilization along Lake Byllesby were not identified. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

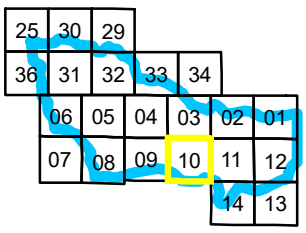
BMP Cost Benefit Analysis:

Feature ID (Township-section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr.)	Estimated Project Cost	Cost/Ton/yr. of Sediment Reduction
RAN-10-01-01	412 - Grassed Waterway - complex 20' design	1100	Lin. Feet	38.1	$10,090	$26
RAN-10-02-01	342 - Critical Area Planting (Native)	0.81	acres	3.4	$2,325	$68



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 10



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

Randolph Township, Section 11

Description:

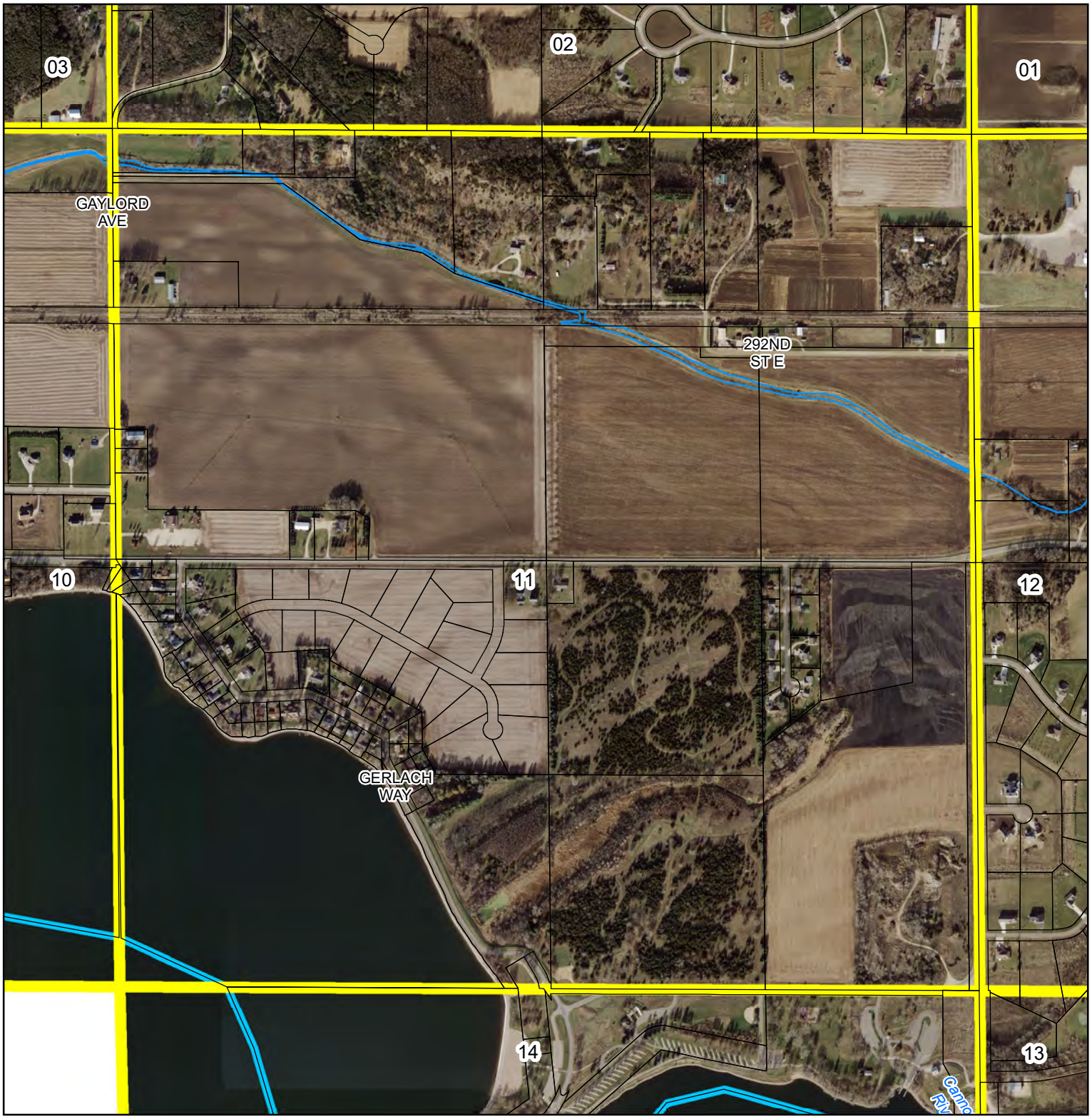
The area of the North Lake Byllesby subwatershed that lies within Section 11 of Randolph Township is approximately 565 acres. The area consists of a combination of agricultural cropland, residential land, and portions of Lake Byllesby Regional Park. Conventional tillage practices are utilized on most of the cropland and most of the cropland is irrigated. Many of the residential shorelines adjacent to Lake Byllesby have substantial erosion due to the steep banks, varying water levels in Lake Byllesby, and non-cohesive soils. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

The primary land use within this section is a combination of agriculture, parkland, and residential. Land management practices recommended for agricultural portions of this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Much of the natural areas and parkland are in perennial shrubland or grassland cover and land management practices in this portion include the management of invasive species and promotion of robust native vegetation. For residential areas, maintaining robust perennial vegetation and minimizing the erosion along the shoreline of Lake Byllesby are recommended. Due to the complexity of the shoreline, high costs for shoreline stabilization projects on Lake Byllesby, and limited stabilization success due to the varying lake water levels, individual locations of shoreline stabilization along Lake Byllesby were not identified. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

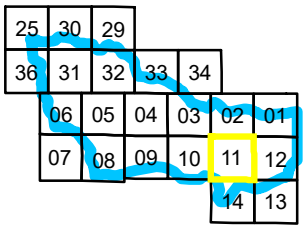
BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 11



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

Randolph Township, Section 12

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 12 of Randolph Township is approximately 581 acres. The area consists primarily of a golf course, rural residential, agricultural land, and pasture. Conventional tillage practices are utilized on the majority of the cropland and most of the cropland is irrigated. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

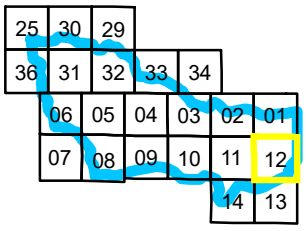
Land Management Recommendations:
The primary land use within this section is a combination of agriculture, golf course, and residential. Land management practices recommended for agricultural portions of this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Land management practices within the golf course include fertilizer management, the control of invasive species, and promotion of robust native vegetation. For residential areas, maintaining robust perennial vegetation and minimizing the erosion is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 12



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 13

Description:
The area of the North Lake Byllesby subwatershed that lies within Section 13 of Randolph Township is approximately 45 acres. The Lake Byllesby Dam is immediately west of this section. The area consists primarily of golf course, some restored prairie, and some natural areas that are a combination of shrubland and grassland. There are some unique wetlands on the upper streambanks of the Cannon River, just east of the Lake Byllesby Dam. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

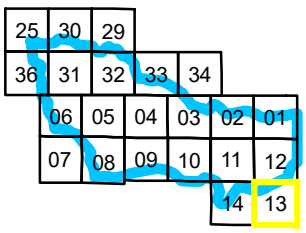
The primary land use within this section is a combination of golf course and parkland. Much of the parkland is perennial shrubland or grassland cover and land management practices in this portion include the control of invasive species and promotion of robust native vegetation. Land management practices within the golf course include fertilizer management, irrigation management, control of invasive species, and promotion of robust native vegetation. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 13



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

0 400 800 1,600 Feet

N

Randolph Township, Section 14

Description:

The area of the North Lake Byllesby subwatershed that lies within Section 14 of Randolph Township is approximately 65 acres. This area lies in the northeastern portion of the section and consists primarily of the Lake Byllesby regional Park campground, some residential lots on Echo Point (the peninsula that extends into Lake Byllesby), and an electric substation. Renovations to the campground, including grading and earthwork, was started in 2019. Estherville sandy loam with slopes of 0% - 2% is the predominant soil.

Land Management Recommendations:

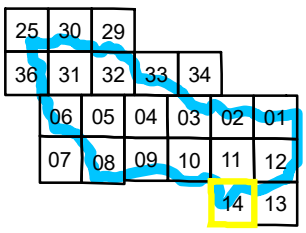
The primary land use within this section is residential and parkland. Land management practices recommended throughout this section include maintaining robust perennial vegetation and minimizing the erosion. At the time of writing this report, much of the campground was undergoing renovations and site grading. Management recommendations include maintaining erosion and sediment control during construction and establishing perennial vegetation on any disturbed areas. There is substantial erosion along the shoreline of Echo Point that has resulted from wave erosion and ice heaving. Due to the complexity of the shoreline, high costs for shoreline stabilization projects on Lake Byllesby, and limited success due to the varying lake water levels, individual locations of shoreline stabilization along Lake Byllesby were not identified for this report. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.

Source: (Aerial) Dakota County 2017

Township: Randolph
Section: 14



Potential Practices

- Stream Stabilization
- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Filter Strip / Critical Area Planting
- Wetland Restoration
- Existing SWCD Practices
- Existing SWCD Filter Strips
- North Lake Byllesby Subwatershed

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

0 400 800 1,600 Feet

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Appendix

Cost estimates were developed based upon the type of BMP and the historical cost of installation and management in Dakota County between 2013 and 2018. The following table provides a breakdown of the estimates used for each BMP:

BMP	Size of BMP (user entered)	Units	Construction Cost per Unit	Design and Project Management	Total BMP Cost (example based on user entered value)
340- Cover Crop	100	Acres	$50	$1,920	**$6,920**
342 - Critical Area Planting (Native Grasses)	10	Acres	$500	$1,920	**$6,920**
342 - Critical Area Planting with grading	1	Acres	$4,000	$5,680	**$9,680**
393- Filter Strip	10	Acres	$500	$1,920	**$6,920**
410- Grade Stabilization Structure 0-10ac	1	Each	$8,500	$5,440	**$13,940**
410- Grade Stabilization Structure 10-100ac	1	Each	$20,000	$6,640	**$26,640**
410- Grade Stabilization Structure100-250ac	1	Each	$30,000	$7,840	**$37,840**
410- Grade Stabilization Structure250+ ac	1	Each	$100,000	$12,640	**$112,640**
412- Grassed Waterway - simple design	500	Lin. Ft.	$3.00	$5,440	**$6,940**
412- Grassed Waterway - complex 20' design	500	Lin. Ft.	$3.50	$6,240	**$7,990**
412- Grassed Waterway- complex 30' design	500	Lin. Ft.	$4.00	$7,040	**$9,040**
580- Streambank and Shoreline Protection	500	Sq. Ft.	$20	$7,280	**$17,280**
582 - Open Channel	500	Lin. Ft.	$8	$7,440	**$11,440**
638-Water & Sediment Control Basin(narrow)	1	Each	$2,500	$5,440	**$7,940**
638-Water & Sediment Control Basin(wide)	1	Each	$8,000	$6,640	**$14,640**
657- Wetland Restoration	10	Acres	$5,000	$7,200	**$57,200**
658- Wetland Creation	10	Acres	$8,000	$7,200	**$87,200**