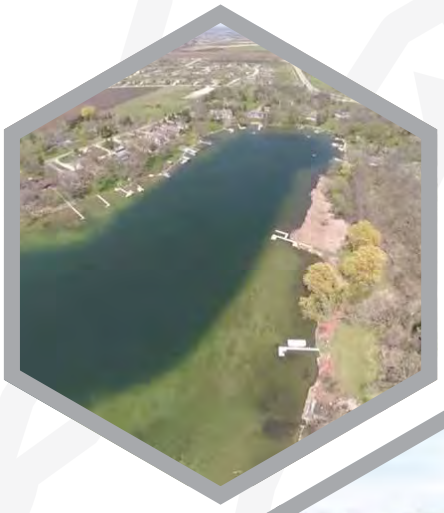
Town of Empire
Lake De Neveu Drainage Study & Action Plan
July, 2015



TOWN OF Empire

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ABSTRACT

TITLE:	Lake DeNeveu Drainage Study & Action Plan
CONTACT:	Jim Pierquet, Chair – Town of Empire
AUTHORS:	Eric W. Fowle, AICP – Executive Director Joe Huffman, Planner
SUBJECT:	Stormwater Management / Watershed Planning
DATE:	July, 2015
PLANNING AGENCY:	East Central Wisconsin Regional Planning Commission
SOURCE OF COPIES:	East Central Wisconsin Regional Planning Commission 400 Ahnaip Street, Suite 100 Menasha, WI 54952 (920) 751-4770 www.ecwrpc.org

TABLE OF CONTENTS

FIGURES

MAPS

TABLES

CHAPTER 1: INTRODUCTION

BACKGROUND

In late 2014, the Town of Empire requested the assistance of the Commission to help them better assess the causes and potential solutions for minor flooding and water quality issues along the northeastern shore of Lake DeNeveu (Figure 1). Through the Commission's Technical Assistance program the following items were felt to be best addressed through this report:

1. **Assess the current situation with drainage/flooding problems.** While separate issues associated with construction impacts on the Niagara Escarpment and oak trees, those items are not dealt with in this report.

2. **Develop and provide information which provides a broader context** in order to understand both the "systems" nature of the problem, as well as to facilitate appropriate conceptual solutions;

3. **Foster collaboration and cooperation amongst area stakeholders** which include: lake residents/association members; town officials; escarpment residents and landowners; agricultural landowners; various county departments; the Wisconsin Dept. of Transportation, and; the Wisconsin Department of Natural Resources;

Figure 1: View of Northern Lake DeNeveu

4. **Develop consensus on strategies to move forward**, which are contained within this Action Plan;

5. **Provide ongoing support and assistance to the Town where appropriate,** perhaps including such things as hiring a consultant; the development of grant applications; or additional outreach and education program development or activities;

This report was generated as a result and provides the Town Board, the Lake Association, and other stakeholders with information and direction on how to address the problem. This report is not meant to provide a final "engineered" solution, however; it does provide several things, including:

1. A compilation of information and data that will eventually be useful to engineers and consulting firms that will need to retro-actively design natural and man-made stormwater management infrastructure for the specific drainage areas (catchments) identified in the report;

2. Documentation of the systematic causes of the current problem. Which, in turn, will give both residents and town leaders a better understanding of - and deeper appreciation for - land use change and its impacts on the natural environment;

3. Documentation of the problem in a formal manner which may be useful for garnering more formalized feedback from stakeholders and / or in apply for grants or other technical assistance from state and federal agencies, and;

4. A consensus on the direction, and overall steps, that needs to be taken to ultimately address this concern and to protect the quality of the Lake DeNeveu (and Lake Winnebago) water resources.

The information in this report was acquired mainly through extensive meetings and interviews with area stakeholders – each of whom may be affected by the problem in different ways. To that end, the Commission would like to thank the following individuals for their time in sharing information, perspective, and expertise:

- Jim Pierquet, Town Chair – Town of Empire
- Jim Pflum, President – Lake DeNeveu Lake Association
- Phil Twohig, Treasurer – Lake DeNeveu Lake Association
- Fred Christ, Board Member - Lake DeNeveu Lake Association
- Mary Toriello, Board Member – Lake DeNeveu Lake Association
- Mary Jo Keating - Past President - Lake DeNeveu Lake Association
- Brian Learst, Project Manager – Wisconsin Department of Natural Resources
- Jay Schiefelbein, Env. Analysis and Review Specialist - Wisconsin Dept. of Natural Resources
- Allen Buechel, County Executive – Fond du Lac County
- Paul Tollard, Director – Fond du Lac County Land & Water Conservation Dept.
- Tom Janke, Highway Commissioner – Fond du Lac County

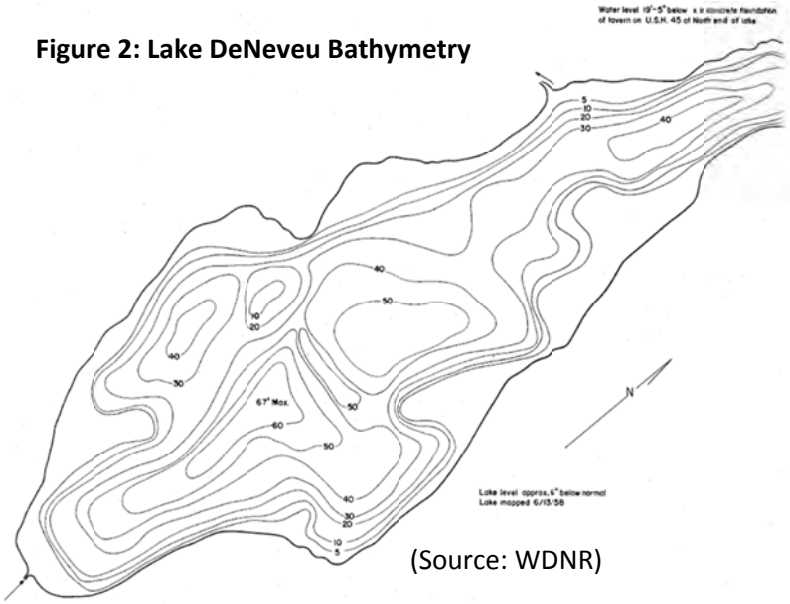
CHAPTER 2: EXISTING CONDITIONS

LANDSCAPE SETTING

Lake DeNeveu

As defined by the WDNR, Lake DeNeveu is an 80 acre 'seepage' lake located in Fond du Lac County (Fig. 2). A seepage lake is a lake formed by rain, runoff and groundwater and does not have an inlet or an outlet. These types of lakes have inconsistent water levels. This exact definition does not quite fit this lake however; as water does, in fact, regularly flow out of a single outlet draining to DeNeveu Creek located at the lake's northwestern end. The lake was likely created when the last glaciers pushed through, scouring out softer materials at the base of the Niagara Escarpment. It has a maximum depth of 67 feet and its bottom is 30% sand, 20% gravel, 0% rock, and 50% muck. Waters have historically been clean (until recent years) and fish species include panfish, largemouth bass, northern pike and walleye. Most of the lake's shoreline is developed with single-family homes and cottages, with the exception of the southern end which remains as wetlands and woods. There is no public access provided to this lake.

Figure 2: Lake DeNeveu Bathymetry



(Source: WDNR)

Recent flooding and water quality concerns have arisen on the northern end of Lake DeNeveu, particularly in spring, when heavy rains create excess overland water flow (stormwater runoff) over the edge of the Niagara Escarpment and down the northern and eastern ditches of CTH H and USH 45 (Map 1). This stormwater then enters the lake at two locations, most notably at two separate culverts which cross underneath USH 45, across several residential properties, and then into the lake (Fig. 3). Water flows can be enhanced by early snow melt-off as well.

Figure 3 – Flooding Downstream of USH 45 Culvert

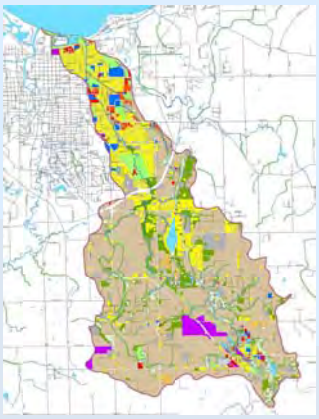
Source: www.lakedeneveu.com

Map 1 – Lake De Neveu Eastern Catchments

The stormwater runoff also contributes to water quality problems in the lake which did not exist previously. The additional runoff adds both sediment (from cropped agricultural lands, gully erosion, and construction activities) and phosphorus (food for algae) which is derived mainly from agricultural and residential lawn fertilizers. These water quality concerns have been monitored for the past 7 to 9 years by the Lake Association and by WDNR. Detailed information about both problems can be found on the Lake Association's website http://lakedeneveu.com/.

WE ALL LIVE ON THE WATER!

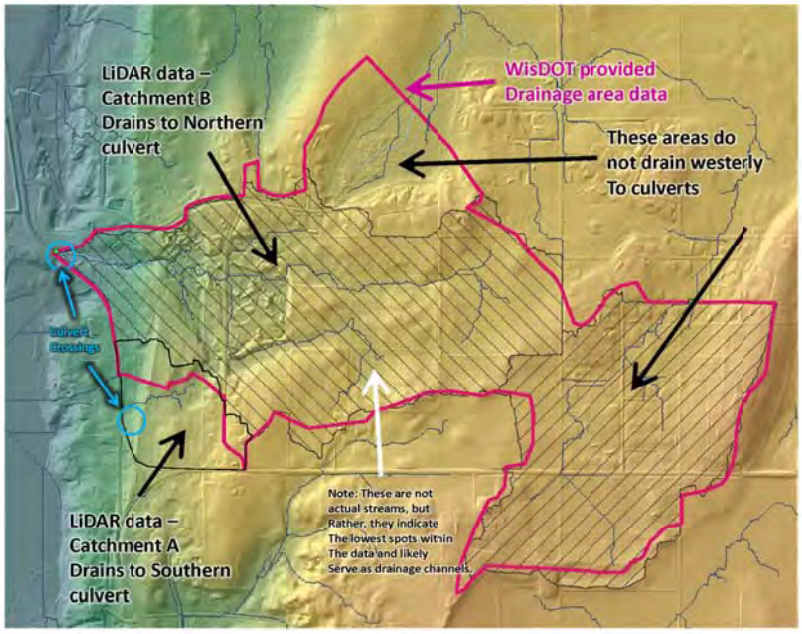
A watershed is an area of land that drains to a lake, river, wetland, or other waterway. When precipitation occurs, water travels over forest, agricultural, or urban/suburban land areas before entering a waterway. Water can also travel into underground aquifers on its way to larger bodies of water. Together, land and water make up a watershed system. DeNeveu Creek (below) is part of East Lake Winnebago Watershed, which is part of the Fox-Wolf Basin that drains into Lake Michigan.



Current Drainage System

Two primary drainage (catchment) areas (Map 1) feed the aforementioned two culverts and were mapped based on Fond du Lac County LiDAR data and digital elevation model processing. This area should be relatively accurate and is drastically different from the drainage area data provided to the Commission from the Wisconsin Department of Transportation (Fig. 4). These areas total approximately 269.2 acres and generally capture surface runoff from lands located on top of the Niagara Escarpment.

Figure 4: LiDAR Data Analysis of Catchment Areas



These drainage areas represent only a small fraction of the lands that drain into Lake DeNeveu. All waters from the Lake eventually make their way down DeNeveu Creek into Lake Winnebago and then the Great Lakes system (see sidebar). Due to water

quality concerns from within the broader watershed, DeNeveu Creek was recently designated as a 303d "Impaired Waterway by the WDNR and EPA. This designation may come into play as solutions to the localized flooding are evaluated.

Within the two escarpment catchment areas, only one defined, navigable stream exists (Map 2). Surface waters are generally channeled through the watershed through undefined low areas and roadside ditches until the reach a pond/stream corridor below Ledgetop Drive. Additionally, an existing spring-fed pond atop the escarpment (east of Ledgetop Drive) provides a small constant flow of water into this drainage-way. Within these catchment areas, no designated wetlands exist as currently mapped by the WDNR. Additionally, there are no 100-year floodplains or other identified flood storage areas.

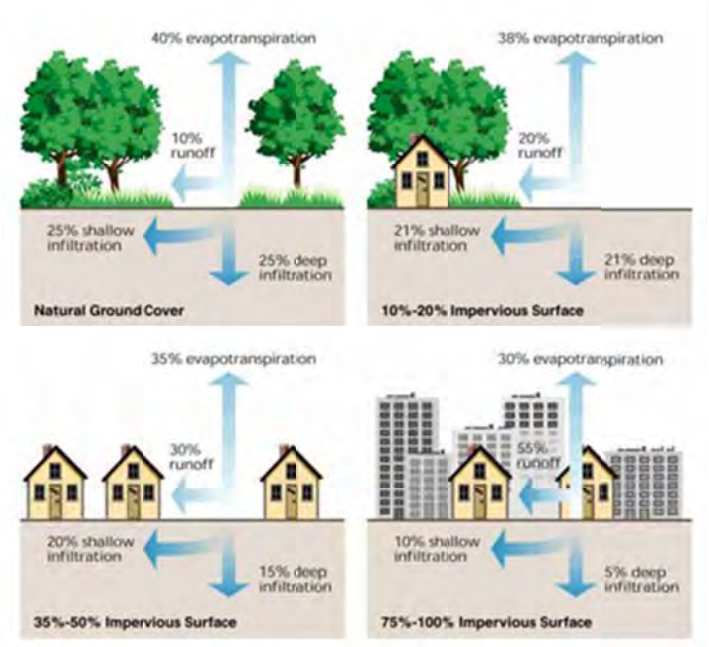
Groundwater resources and interactions with the surface water are definitely present with the catchment areas as well. According to soils data, several areas of high groundwater exist along/parallel to USH 45, as well as Ledgetop Drive, and a separate area in the easternmost portion of the catchment. Numerous springs and seeps emanate from the Niagara Escarpment and may, in some way, contribute to the problem at hand, however; no good documentation exists regarding the issues' relation to groundwater discharge.

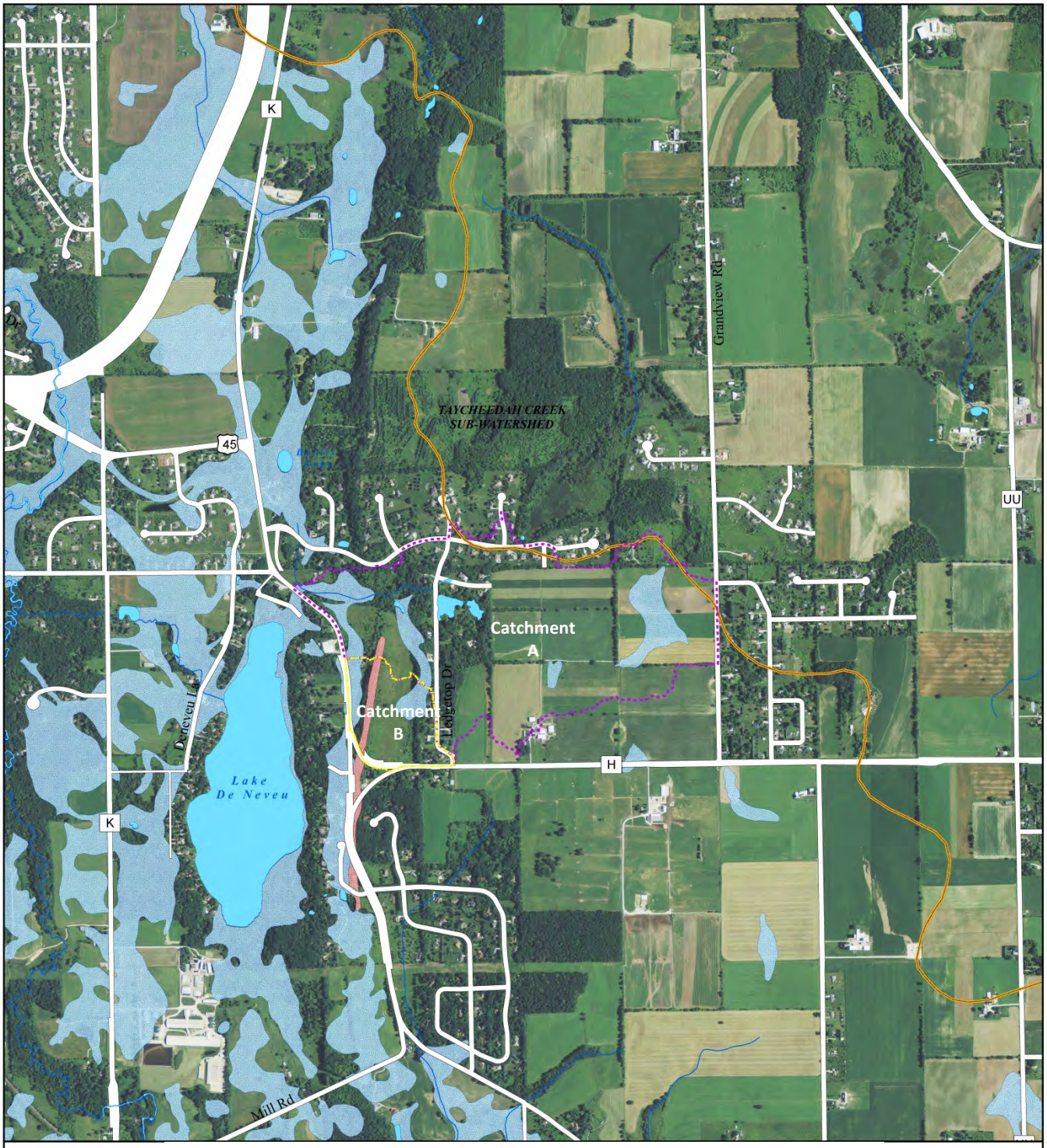
DEVELOPMENT IMPACTS OVER TIME

One of the root causes of water quantity/quality issues is incremental changes to a watershed over time. Numerous areas around the State have experienced declines in water quality, and increases in flooding events, simply due to the amount of development that has occurred within the watershed.

New development contains impervious surfaces (pavement, roofs, etc.) that shed water, versus letting it infiltrate into the ground. When heavy rains occur, soils become saturated and more water runs off/over the ground surface. The relationship been scientifically documented between these two items has been known for years. In most instances, it is felt that when a watershed reaches 10-20% of its area in impervious uses, it begins to negatively affect water quantity and water quality (Figure 5).

Figure 5: Development Impacts on a Watershed





Map 2 – Lake De Neveu Eastern Catchments & Limiting Conditions

An assessment of the historical development of these two catchments is critical to understanding the dynamics of the current flooding concerns.

Subdivision Plats

Over the past 50 years, the landscape of the Town of Empire has changed significantly. Mostly due to its proximity to the City of Fond du Lac urban area. As a regional center of employment, urban development pressures reached the Town of Empire quickly and, due to the attractive landscape, the area has appealed to many upscale subdivision developments within a short drive of the City.

Since 1965, thirteen (13) separate residential subdivision plats have been approved within this general area of the Town of Empire. As shown on Map 3, these subdivisions are scattered along the Niagara Escarpment, with several being constructed within Catchment Area A.

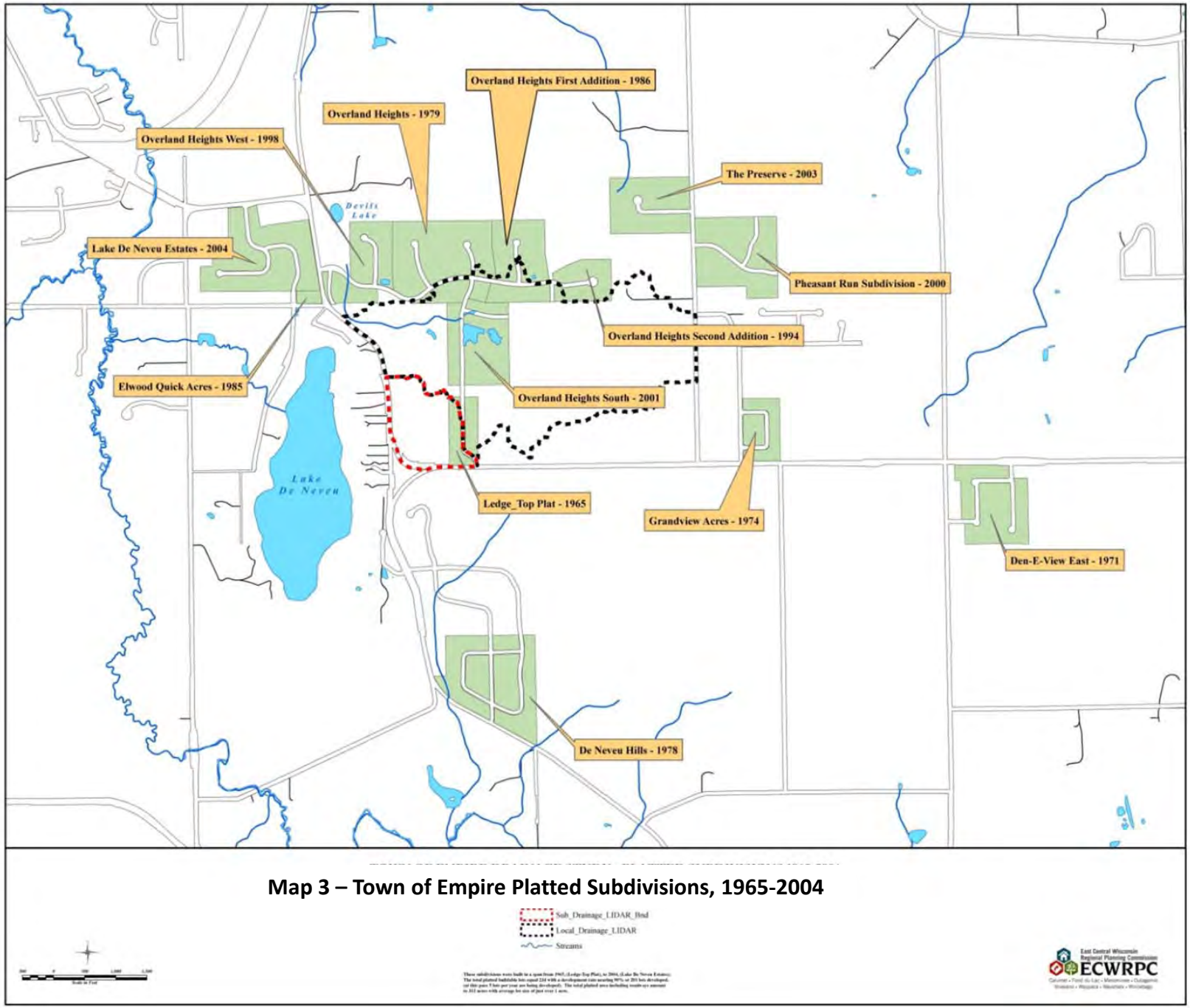
Land Use Change

Changes in land use are evident within the catchments that feed water to the two culverts and then the Lake. As shown on Maps 4 and 5, significant amounts of change have occurred between 1972 and 2013. As detailed further in Table 1, the amount of developed land rose from 6.6% of the total area to 23.4% between these years. Of this, new residential development increased the most, from 8.0 acres to 39.3 acres, an increase of over 490%! New roadways increased from 5.6 acres to 12.3 acres, or about 120%! While these figures do not represent the actual amounts of impervious surface, they do provide an indicator that the amounts of land use change has certainly affected the function of the catchments to accommodate stormwater within their boundaries.

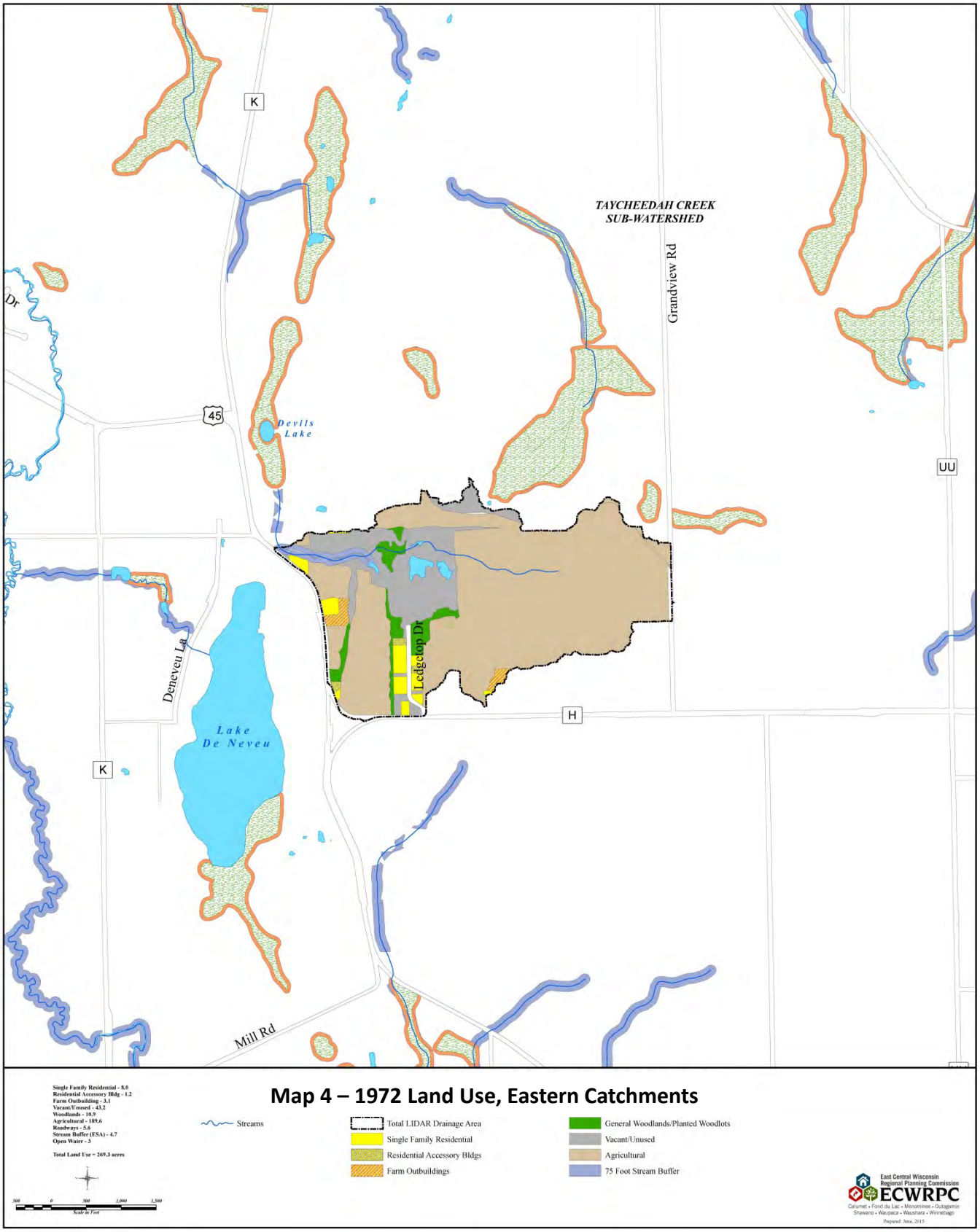
Table 1: Land Use Change in Catchments

	1972 Acres				2013 Acres					
Land Use Type	Catchment A	Catchment B	Total Acres	% of Total Acres	Catchment A	Catchment B	Total Acres	% of Total Acres	Change in Acres (1972-2013)	% Change (1972-2013)
Single Family Residential	4.5	3.5	8.0	3.0%	4.5	42.8	47.3	17.6%	39.3	491.3%
Residential Accessory	1	0.2	1.2	0.4%	1.0	0.7	1.7	0.6%	0.5	41.7%
Farm Outbuildings	0.6	2.5	3.1	1.2%	0.6	2.0	2.6	1.0%	(0.5)	-16.1%
Roadways	2.9	2.7	5.6	2.1%	2.9	9.4	12.3	4.6%	6.7	119.6%
Vacant/Undeveloped	20.5	27.4	47.9	17.8%	20.5	19.1	39.6	14.7%	(8.3)	-17.3%
Woodlands	5	5.9	10.9	4.0%	5.0	33.2	38.2	14.2%	27.3	250.5%
Agricultural	-	189.6	189.6	70.4%	-	124.6	124.6	46.3%	(65.0)	-34.3%
Open Water	-	2.9	2.9	1.1%	-	2.9	2.9	1.1%	-	0.0%
Total	**34.5**	**234.7**	**269.2**	**100.0%**	**34.5**	**234.7**	**269.2**	**100.0%**	-	**0.0%**
Total of Developed Land Uses (Catchments A& B)			**17.9**	**6.6%**			**54.9**	**23.4%**	**37.0**	**206.7%**
Total of Undeveloped Land Uses (Catchments A&B)			**251.3**	**93.4%**			**179.8**	**76.6%**	**(71.5)**	**-28.5%**

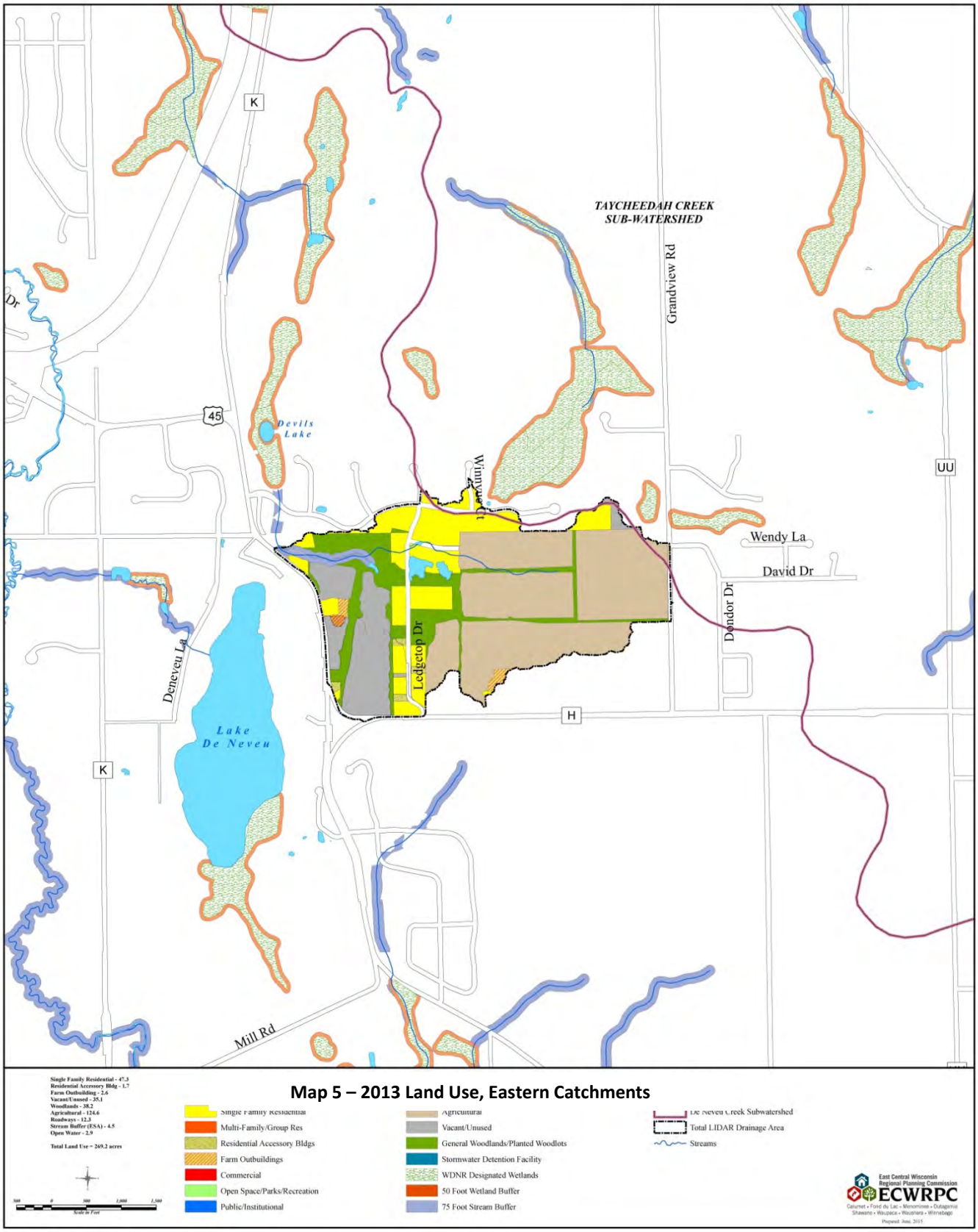
Source: East Central Wisconsin Regional Planning Commission, July 2015.



Map 3 – Town of Empire Platted Subdivisions, 1965-2004



Map 4 – 1972 Land Use, Eastern Catchments



Map 5 – 2013 Land Use, Eastern Catchments

Land Use Impacts

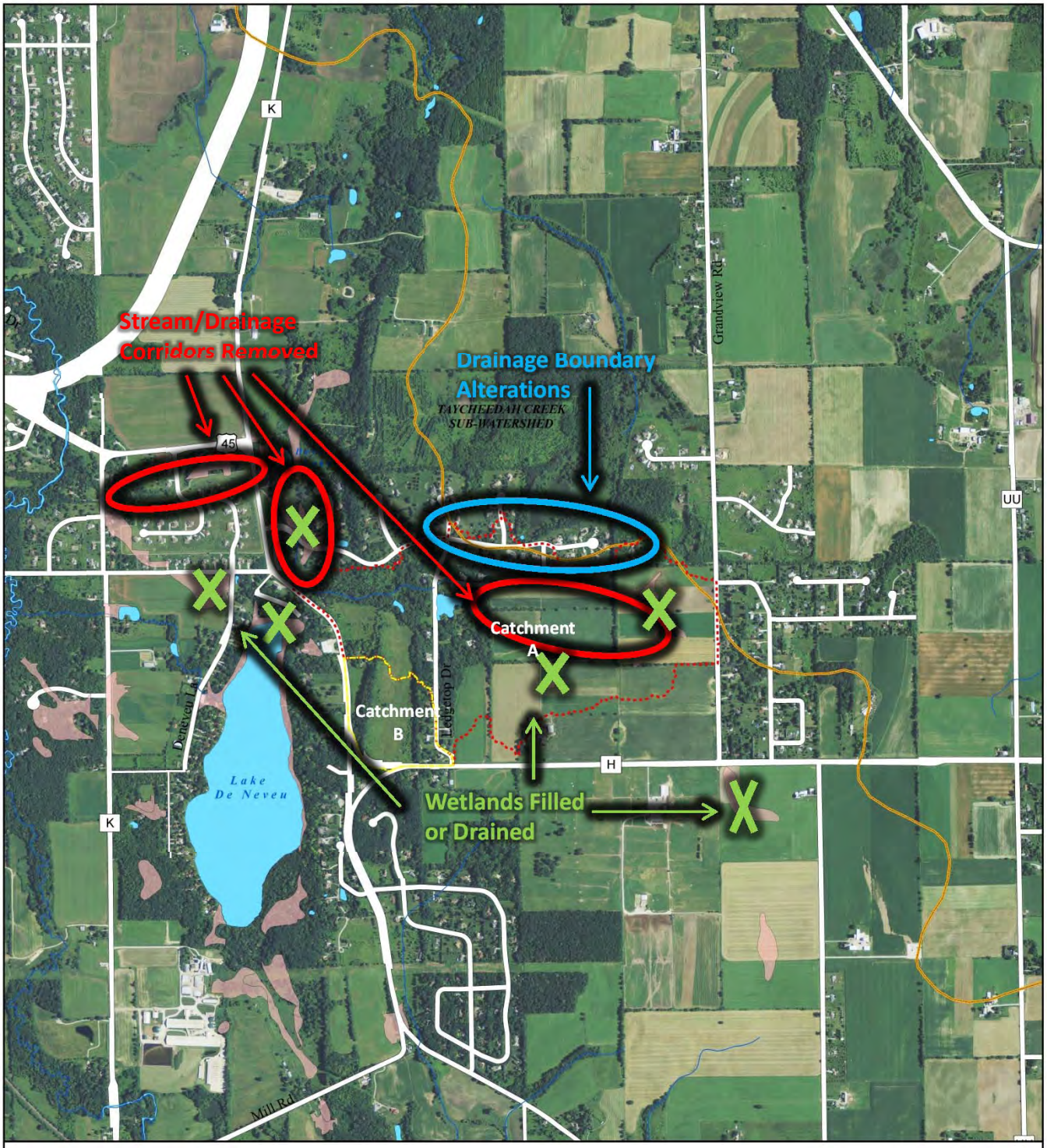
Overall, the areal change in land use has undoubtedly had a major role in the increased amount of stormwater runoff generated from these two catchments. Even more concerning is the fact as this development occurred, other natural features – many of which functioned in some manner to naturally accommodate stormwater – have been either modified or obliterated from the landscape, further decreasing the ability of the catchments to absorb and control stormwater (Map 6).

Historically, the drainage in this area was much different. Based on historic mapping and anecdotal evidence, as well as deductive reasoning, the original drainage patterns of this system can be established. First off, it is unlikely that significant amounts of concentrated water flow existed at all in the original, pre-development landscape – most was likely to be 'sheet' flow if anything. Furthermore, knowing that most of it was likely forested, rainwater was absorbed to a greater degree. Soils were not as compacted, allowing for better infiltration into the shallow bedrock below. Low areas and drainage corridors may have existed, but did not carry an amount of water as compared to now.

Certainly, features like CTH H and USH 45 roadways did not exist, and therefore stormwater was not channelized and re-directed to the degree it is now. In fact, it was likely that the main east-west drainage-way did not even flow directly into Lake DeNeveu, but rather, turned northward along the east side of what is now USH 45 and flowed through low areas (now turned into backyards), and connected with Devil's Pond. Devil's Pond, in turn, would drain to the west, across USH 45, through the historic John B. Macy House property, the Lake DeNeveu Estates Subdivision, and eventually to DeNeveu Creek. This portion of the drainage system is nearly non-existent now due to development and other alterations of the landscape.

A longer, more defined stream corridor once existed east of Ledgetop Drive, along Lac Vue Court, and draining agricultural lands in the easternmost part of the watershed. Based on mapping and development patterns, it's even likely the actual boundaries of Catchment B have been altered due to agricultural and residential land uses, and the like.

Other features such as ephemeral springs and ponds are gone (or nearly gone), or at a minimum, more 'flashy' in nature at best. Important wetlands have also been filled or drained as illustrated on Map 6 using recently made available data from the WDNR showing potentially restorable wetland areas. Each of these areas played an important role in the management of stormwater. While these areas have historically been treated as 'low value', from an economic perspective, their true worth, in terms of 'natural services', are just now being realized.



Map 6 – Development Impacts on Natural Landscape

Northern Drainage Boundary
Sub Drainage Boundary
De Neveu Creek Subwatershed
Restorable Wetlands Potential
Streams

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Prepared: June, 2015

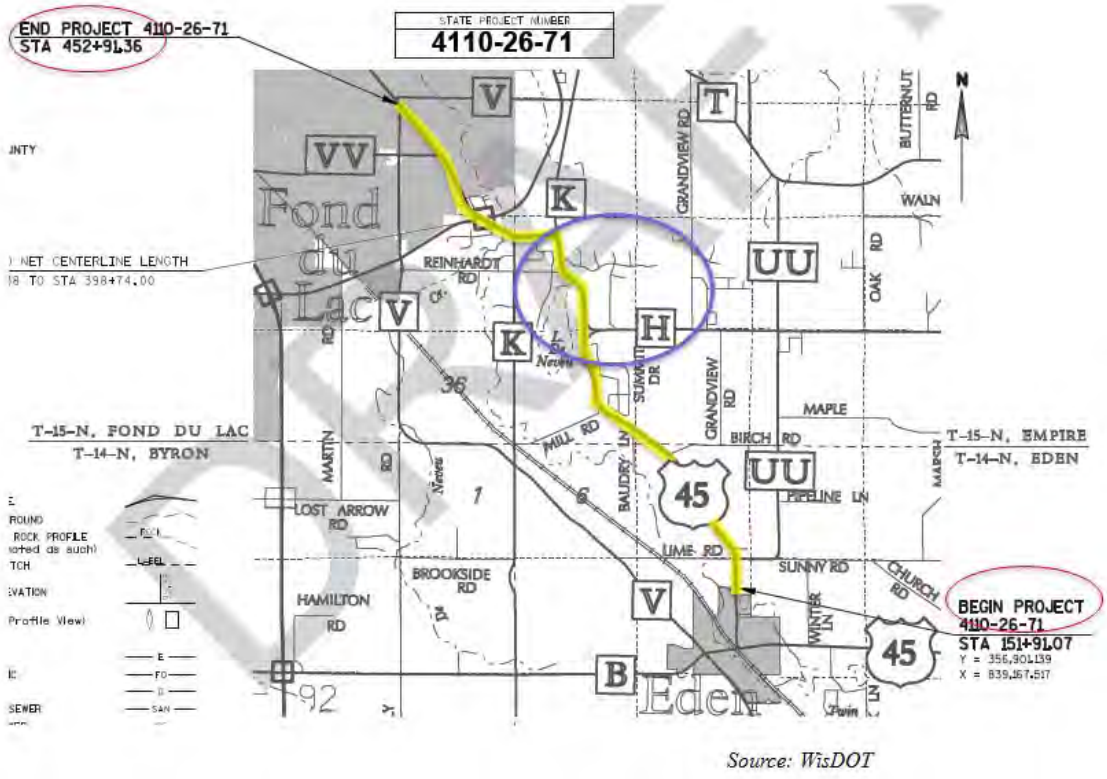
Future Changes

Two major items must be considered when looking at additional land use change within the watershed. The first being an impending highway improvement project being planned by the State, as well as the locally developed *Town of Empire Comprehensive Plan* which guides future land use decisions:

USH 45 Re-Surfacing Project

The Wisconsin Department of Transportation has been actively planning for a pavement re-surfacing project along an approximate 6 mile stretch of USH 45 between the City of Fond du Lac and the Village of Eden (Figure 6). This project is expected to be initiated in the spring of 2018, with final design and engineering is being completed in 2015.

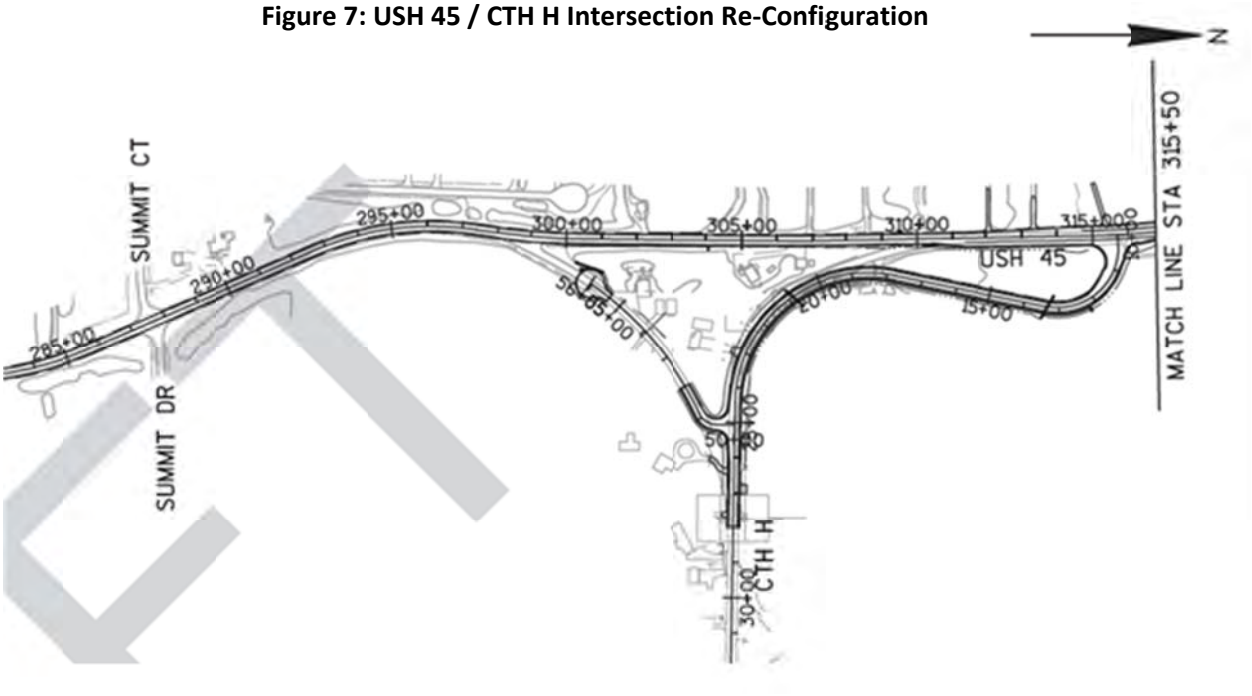
Figure 6: USH 45 Re-Surfacing Project



Source: WisDOT

The proposed project within the Town of Empire will not alter the current USH 45 alignment or its pavement width as it passes through/adjacent to the drainage areas being studied. However, USH 45's intersection with CTH H (Figure 7) has been re-designed to improve its functionality and safety.

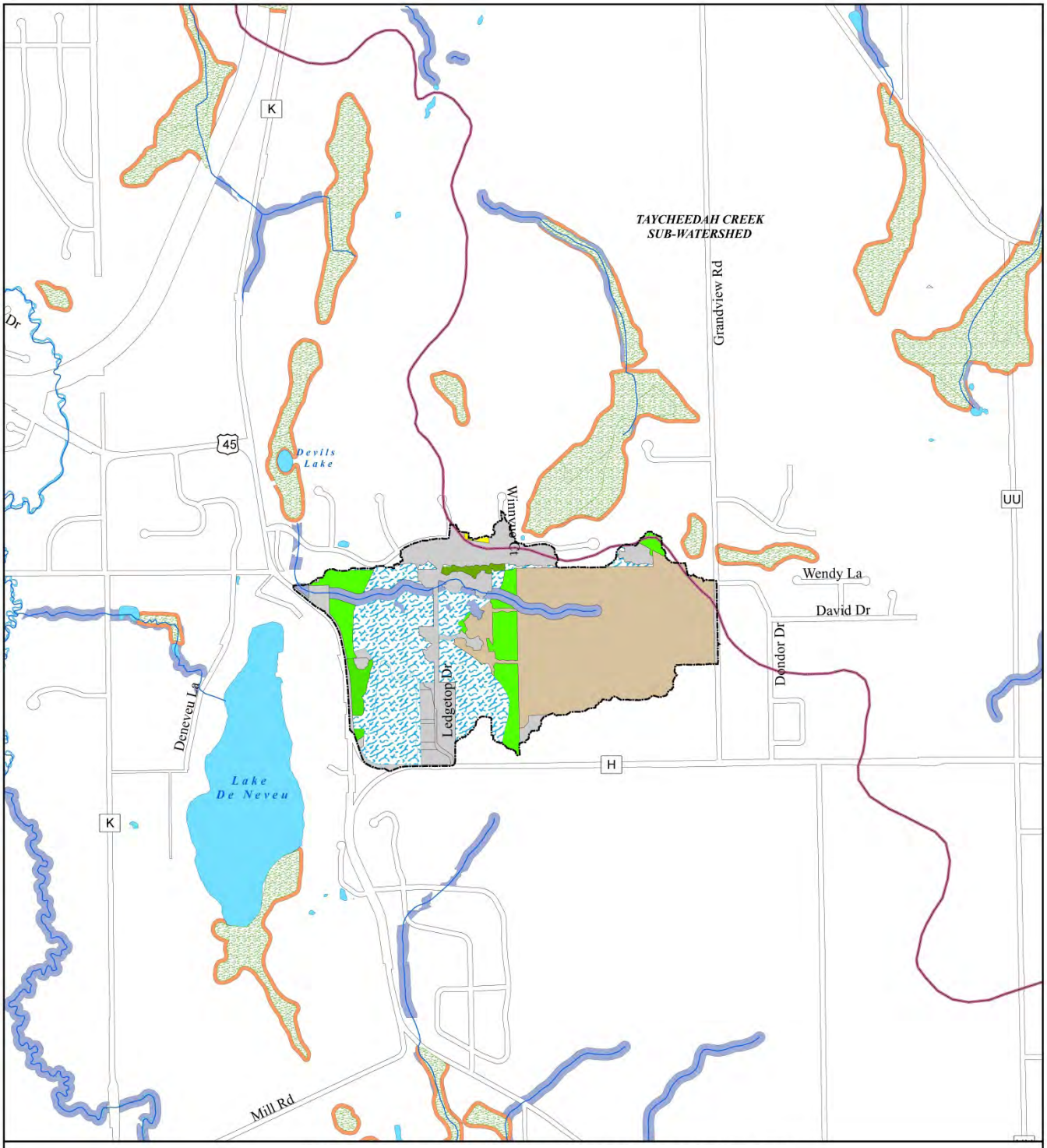
Figure 7: USH 45 / CTH H Intersection Re-Configuration



These alterations will not likely have significant impacts on the current flooding problem as the ditching and drainage are not proposed to be altered as part of the project. Furthermore, no significant increase in stormwater runoff is expected as only a slight increase in impervious surface will result due to the intersection re-design. Additional studies or work regarding drainage outside of the rights-of-way are not expected to be needed for this project.

Town of Empire Comprehensive Plan

The *Town of Empire Comprehensive Plan* was adopted in 2007 to serve as a guide for land use change over a 20 year period. According to the plan (Map 7), a majority of the lands within these two catchments are to remain unchanged from their current use. Many of the areas are shown to remain as agriculture or conservancy, thereby reducing any concern about future major developments within the catchments that might further increase stormwater flows.



Map 7 – Future Land Use Map, T. Empire Comprehensive Plan

CHAPTER 3: A STRATEGY AND ACTION PLAN

STRATEGIES & APPROACHES

Based on the information collected and examined, a proper path needs to be identified for moving forward with. It is fair to say that the complexity of the solution (or solutions) is likely to be as complex as the landscape, or the combination of historical factors that brought it about.

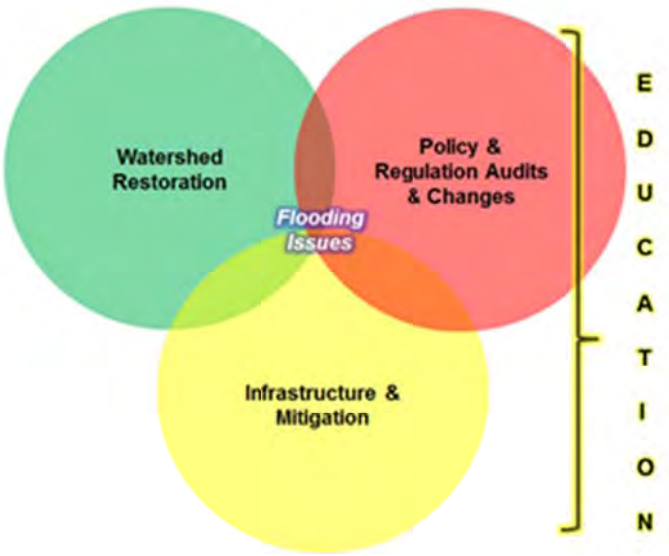
Figure 8: Spectrum of Management Options

Overall, the Town would be remiss if it did not take a watershed approach to the entire issue. Dealing with the entire landscape that drains to the 'pressure points' is the only way to deal with the issue. As the Town embarks on this process, it should also recognize that many of the watershed management options will fall within a range, or spectrum (Figure 8) that is comprised of both simple, low-cost, voluntary actions by its individual citizens, to high cost, high tech solutions.

The Town will also need to institute an intensive, collaborative and educational approach – working with many stakeholders – to address solutions which can most easily be described as being part of three integrated areas:

- Mitigation & Infrastructure;
- Watershed Restoration, and;
- Policy, Planning & Best Practices

Figure 9: Integrated Approach to Address Flooding



The discussion of each arena (Figure 9) is provided and forms the basis for many of the detailed recommendations contained within the 'action plan' section of this document. Ultimately, the Town will need to spend additional time, and may need to enlist additional volunteers or professional help, to address this and other stormwater management issues which may creep up occasionally. If the Town wishes to see safe and quality conditions for its current residents, or if it desires to see new development in the community, it will need to put forth this effort.

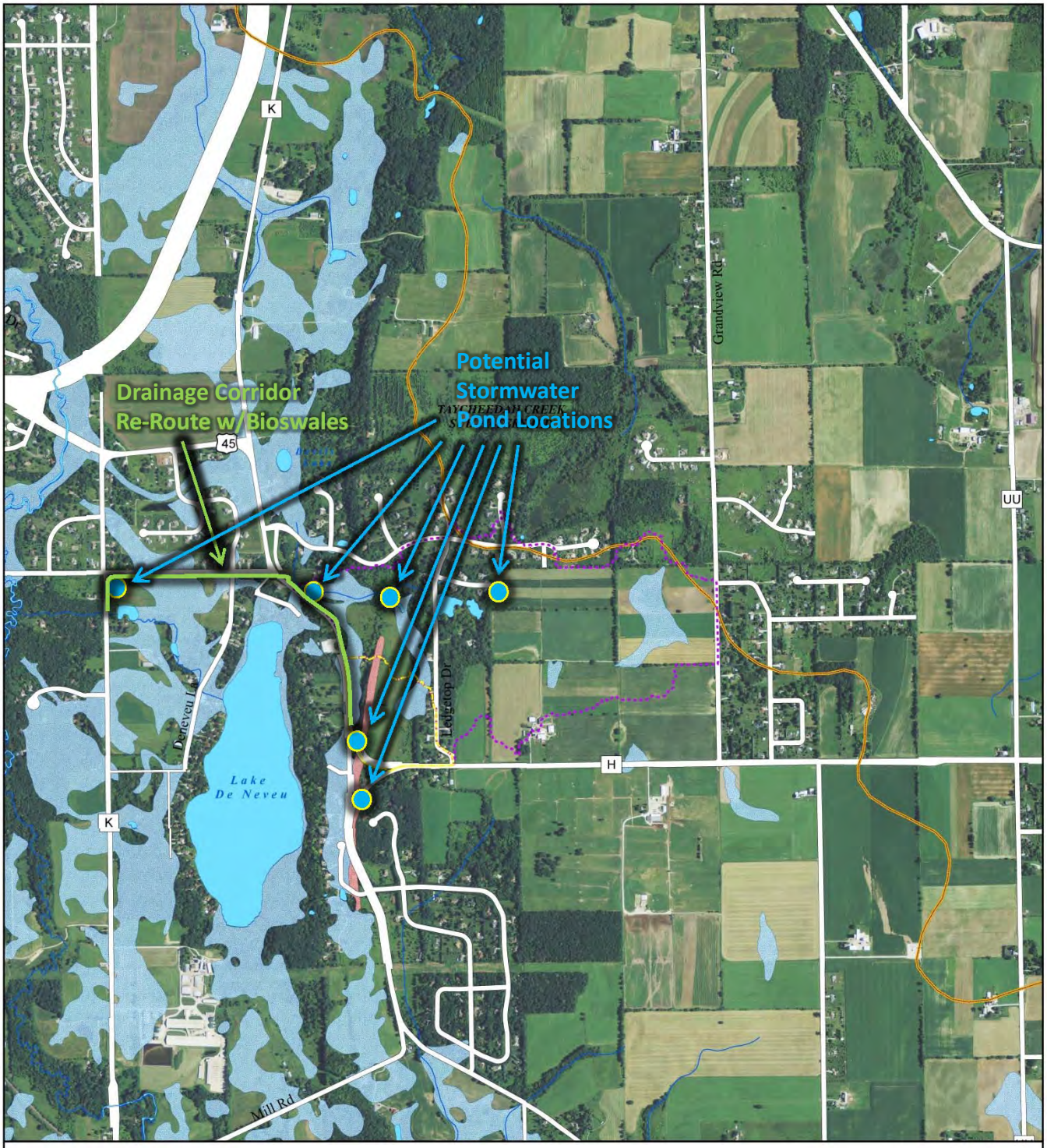
STRATEGY #1: INFRASTRUCTURE & MITIGATION

Typically, retro-fitting existing stormwater problem areas requires the design of, and investment in, traditional infrastructure such as detention and retention ponds to hold excess stormwater back for a period of time in order to let suspended solids settle, and/or to control peak volumes of stormwater which is then released slowly. Such facilities can be expensive to build and maintain, as well as challenge to locate within areas that have existing development. Ideally, these types of facilities would have been planned for and accommodated during the platting of lands. The ideas shown and discussed below are the culmination of possible solutions and represent conceptual ideas on how stormwater might be addressed. A thorough review of these concepts and ideas by a qualified stormwater/civil engineer should occur early in implementation of the final action plan recommendations.

Assuming that some type of retention/detention pond(s) may be needed to control volumes, it may be a challenge siting such facilities given the topography of the area and the potential for areas of high or exposed bedrock due to the existence of the Niagara Escarpment. Based on the existing drainage of the catchments, the location of existing culverts, and existing development patterns, it makes sense to try and locate such facilities near points that collect a majority of the water. Lands within or adjacent to the USH 45 rights-of-way hold the most potential for such uses as illustrated in Map 8. While it may be possible to locate other ponds within the central part of the drainage corridor or further east to capture agricultural runoff, access to, and the effectiveness of facilities in these areas makes them lower in priority.

As shown in Figures 10 and 11, it may be possible to design/fit small pond facilities within the right-of-way of the reconfigured CTH H/USH 45 intersection. This concept also includes the evaluation of diverting some of the water in the northerly ditch of CTH H to the south side of the new drainage system.

Additionally, as illustrated in Map 8, the potential exists for re-grading ditches and culverts along USH 45 and Reinhardt Road to better accommodate flow direction around the lake (vs. through it), flow volumes, and filtering using the properties of bioswales. A conceptual illustration of a series of such controls is contained in Figure 12.



Map 8– Potential Infrastructure Solutions

Northern Drainage Boundary
Sub Drainage Boundary
De Neveu Creek Subwatershed
Bedrock Within 5 Feet of Surface
Groundwater Within 2 Feet of Surface
Streams

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Figure 10: Potential Stormwater Facility, CTH H & USH 45

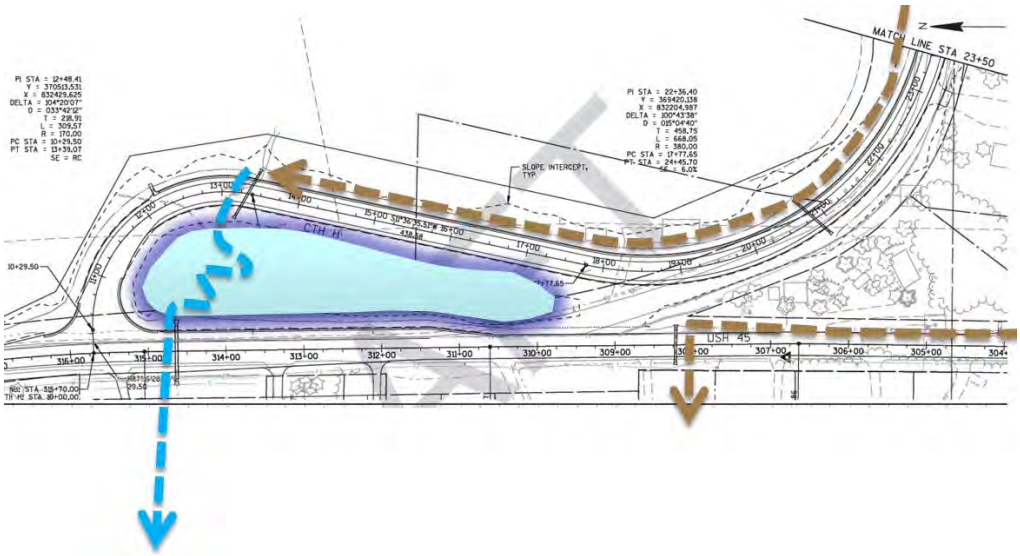


Figure 11: Potential Stormwater Facility, USH 45/Old CTH H

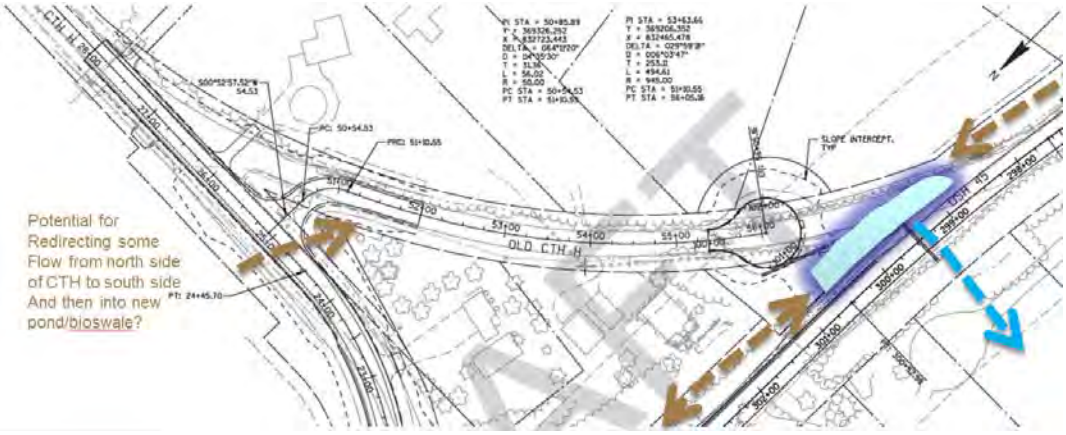
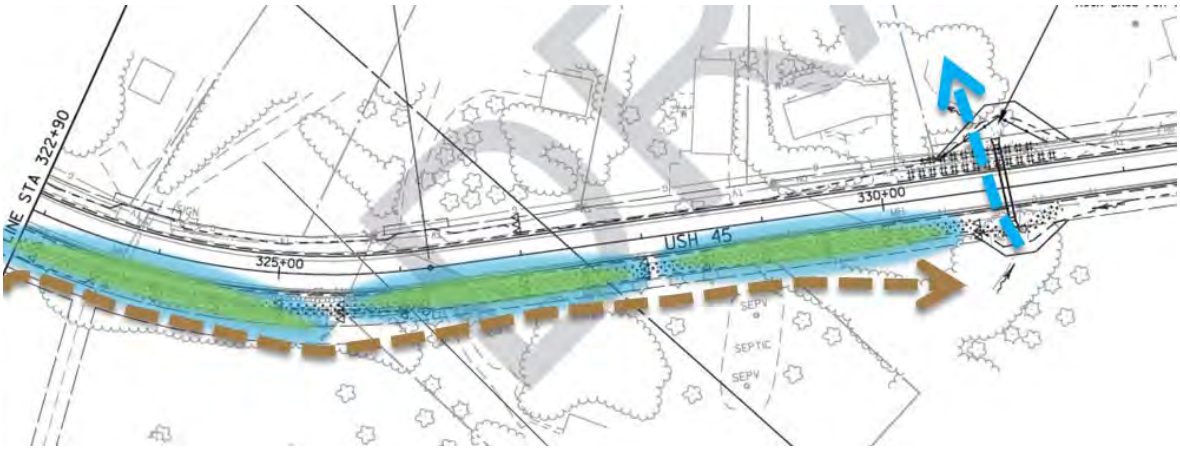


Figure 12: Potential Stormwater (Bioswale) Facility, USH 45



STRATEGY #2 - WATERSHED RESTORATION

As noted previously, many of the historic drainage patterns within this portion of the Town have been altered by the placement of new development and roads. A second viable strategy may be to restore, or re-construct, some or all of the elements that natural guided or accommodated surface water runoff within these and nearby catchments.

As illustrated on Map 9, three key areas could be further examined and considered within the Lake DeNeveu environs that may assist with addressing the current and future water quality and flooding issues.

Stream Corridor Re-Construction

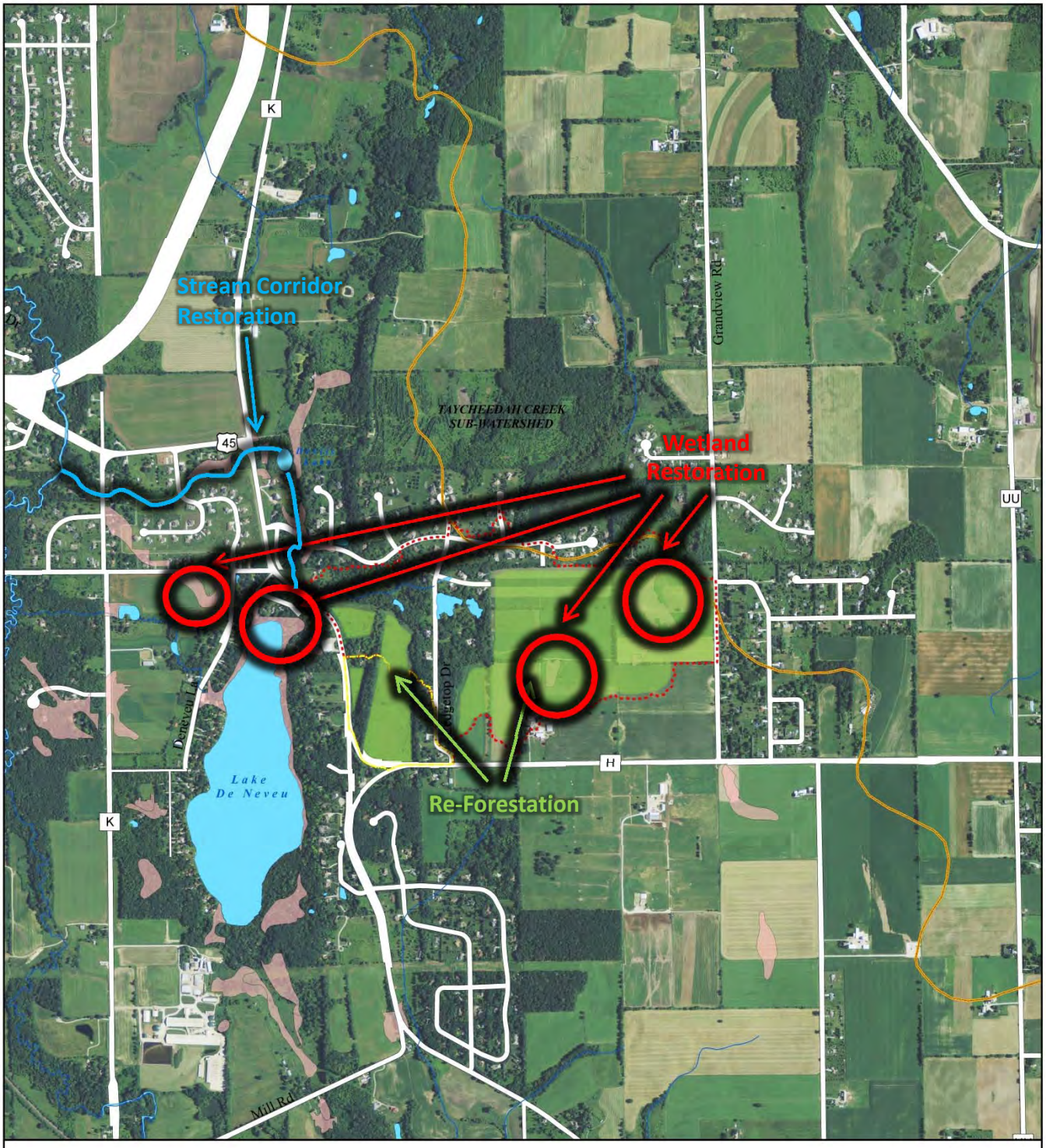
The restoration of historical flow patterns may provide some relief in the sense that they bypass the Lake, as they likely did prior to development. The re-establishment of a drainage/stream corridor that re-connects northward to Devil's Pond, and then west along the original path to DeNeveu Creek could be considered as part of a long-term solution. Such an effort may be difficult due to the residential uses that exist along the original corridor, plus culvert replacements and integration/use of the existing stormwater detention system located in the Lake DeNeveu Estates subdivision. Additionally, limitations may need to be addressed with respect to the 303d Impaired Water status of DeNeveu Creek.

Wetland Creation/Restoration

The creation of new (constructed) wetland areas, particularly along the above noted stream corridor may increase the overall flood storage for these catchments. Additionally, as show in Map 9, previously established, restorable wetlands exist throughout the area based on WDNR data. These wetlands could be restored as part of an overall green infrastructure plan and could reduce overall runoff amounts into the Lake.

Re-Forestation

Lands located both below and above the Niagara Escarpment offer opportunities to restore the native vegetation of the landscape. By re-foresting vacant, undeveloped and agricultural lands, not only will the amount of habitat be increased, but the trees will take up additional rainfall that otherwise might runoff the land. While this might not provide immediate relief to flooding, it certainly could have some long-term beneficial impacts. Various programs may be available to assist willing landowners with some of the costs. Tree planting also makes for a great volunteer activity.



Map 9 – Potential Watershed Restoration Solutions

STRATEGY #3: POLICY, PLANNING, & BEST PRACTICES

This strategy encompasses a wide variety of process based (planning and development approval) and infrastructure based solutions. Each of these will likely play some role in figuring out the ultimate solution to the Lake DeNeveu stormwater and flooding issue.

EPA/WDNR Phase II Stormwater Regulations

Dealing with stormwater runoff is nothing new for the Town of Empire as some regulations have been put in place locally to better accommodate detention and retention within subdivision developments. However, in late 2014, the Town was formally notified that portions of it are now included in the defined MS4 Urbanized Area (Figure 13), thereby invoking federal water quality standards which are administered by the Wisconsin Department of Natural Resources. The Town will need to begin the process for applying for coverage under a Municipal Separate Storm Sewer System Permit and will need to comply with its requirements. The Town will likely need to hire a consultant to assist in this process, including the development of financing methods (such as a stormwater utility) for any new infrastructure that may be required. These more comprehensive efforts will likely have some relation to the specific issue, and selected strategies for dealing with it.

Figure 13: MS4 Urbanized Area Boundary

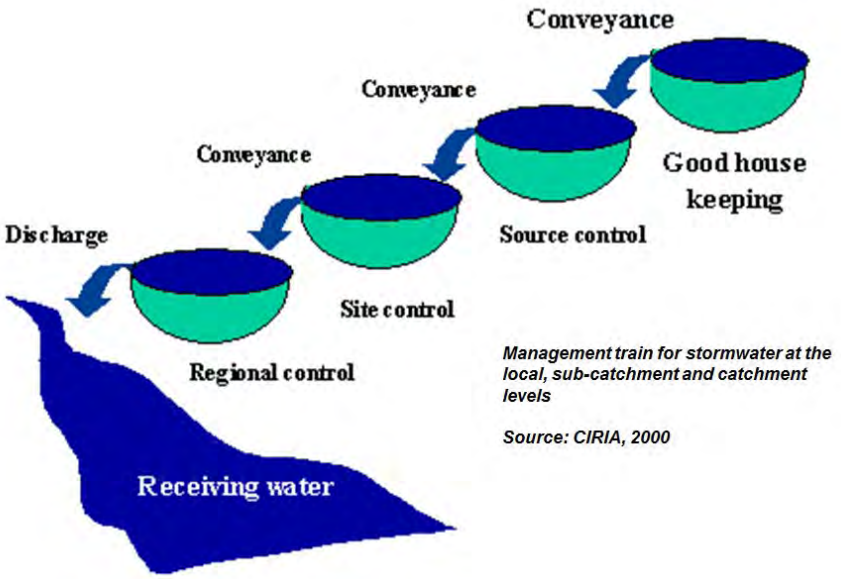
Green Infrastructure

As defined by EPA, "Green infrastructure" is a planning concept (Figure 14) which uses vegetation, soils, and natural processes to manage water and create healthier urban (or rural) environments. At the scale of a community or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water.

Figure 14: Green Infrastructure Concept

The proactive practice of identifying and protecting critical natural areas that provide functions related to natural stormwater management needs to be better employed by the Town. Using inventories, mapping, site visits, sketch plans, and development policies and regulations, the Town could better prevent some of the drainage systems and features which are critical to moving water in a natural way.

Figure 15: Stormwater Treatment Train



The Town should take more time during any upcoming planning processes to better evaluate and assess the integration of green infrastructure concepts and practices. This should include an assessment of specific implementation techniques ranging from voluntary land trusts, purchase of development rights programs, or even regulatory exaction tools. As shown in Figure 15, the management of stormwater as a 'treatment system', or 'treatment train' that needs to be addressed at many scales. This concept has been proven as effective by many communities.

Low Impact Development Techniques

Low Impact Development (LID) is a comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds. Techniques that limit the amount of impervious surfaces from roadways, parking areas and rooftops are some of the main goals of planning at this level. Low impact development can be best achieved by improving regulations so that road widths are reduced, or perhaps requirements that increase infiltration through wise use of the land's current assets. How land is developed adjacent to those 'green infrastructure' areas that were protected is critical to preserving their function.

Landowner Best Practices

A variety of proactive, relatively low-cost stormwater practices can be incorporated onto individual private lots at either part of a neighborhood retro-fit, or as a requirement of new development (Figure 16) These types of facilities help to store water on-site and release it/re-use it slowly and mainly assist with reducing the volume of water associated with the 'first flush' of stormwater.

Figure 16: Voluntary, Site-level Stormwater Management Techniques (rain barrel, cistern, rain garden, porous concrete, green roof, shoreland vegetative buffer)

AN ACTION PLAN

The following major recommendations are made to the Town Board based on the information contained within this report. These recommendations are listed in priority order and, in some cases; several of them may need to be addressed concurrently:

1. Share this report with WisDOT and WDNR project staff in order to garner a formal response as to the feasibility of implementing items contained in Strategies #1 and #2;

2. The Town should keep an open line of communication with WisDOT, WDNR, the Lake Association and Fond du Lac County with respect to meetings or other information which is generated as this issue is addressed;

3. The Town should seek/allocate funding for the hiring of an environmental engineering firm to further evaluate the recommendations contained within this report and to design an appropriate stormwater system which contains elements of one or more of the strategies listed previously;

4. The Town should work with the DeNeveu Lake Association and other partners to apply for a WDNR Small Lake Planning Grant to assist with costs of determining final needs within the two catchment areas. This grant application is due on December 10, 2015 so work on it should begin as soon as possible;

5. The Town should begin the planning and application process for coverage under the MS4 Permit;

6. Develop/create a watershed based joint task force to continue to develop and implement short and long-term strategies for improvement of the DeNeveu Creek/Lake DeNeveu watershed's resources. Consider using this task force to assist in writing grants, developing and implementing planning, conservation and restoration projects; providing review functions for land use changes within the watershed, and; provide community-based education for residents;

7. As discussed in Strategy #3, the Town should make a concerted effort to proactively review, audit and update plans and codes to better to better address current stormwater issues and meet future MS4 Permit requirements. This review should Incorporate the following:

    - Traditional Infrastructure (needs to meet MS4 requirements, evaluation of stormwater utility as financial mechanism);
    - Green Infrastructure (review of Comprehensive Plan, Zoning Ordinance, Subdivision Ordinance);
    - Low-Impact Development (LID) Techniques (review of Comprehensive Plan, Zoning Ordinance, and Subdivision Ordinance);
    - Landowner/Homeowner Best-Practices (development of voluntary cost-share programs/education programs);

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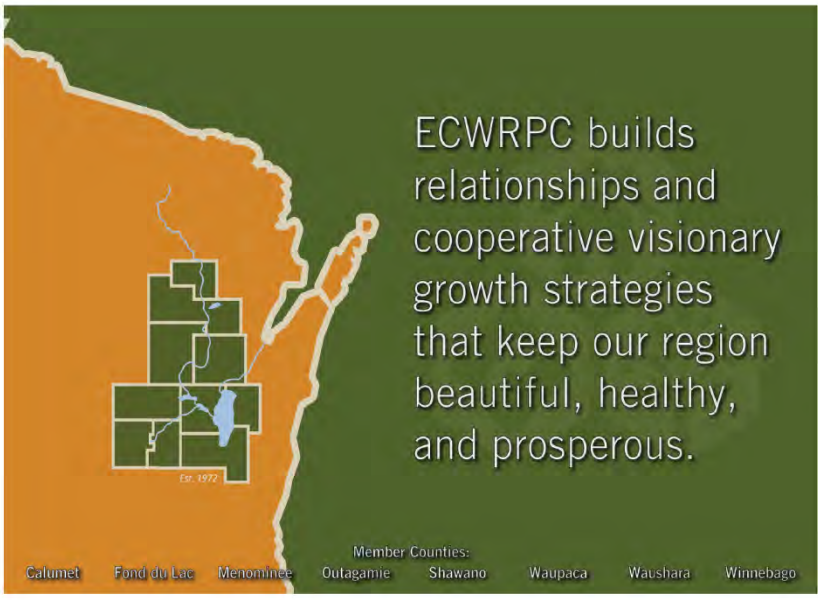

**To be determined*