Lozier and Highland Park Drains Engineering Feasibility Study

Kosciusko County, Indiana

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LOZIER AND HIGHLAND PARK DRAINS ENGINEERING FEASIBILITY STUDY
CHAPMAN LAKES WATERSHED, KOSCIUSKO COUNTY, INDIANA

EXECUTIVE SUMMARY

The Chapman Lake Foundation (CLF) received an Indiana Department of Natural Resources (IDNR) Lake and River Enhancement (LARE) grant to complete an engineering feasibility study on lake improvement projects identified during the Chapman Lakes Diagnostic Study in 2001. The goal of the feasibility study was to analyze potential project sites where sources of pollution may exist, suggest projects that may address pollution, and examine the feasibility of project design and construction. To be deemed feasible, a project and project sites need to be acceptable to property owners, receive regulatory agency support, be physically constructible, and be environmentally and socially justifiable.

This study pursued the feasibility of four projects within the Lozier and Highland Park Drains subwatershed. These included bed and bank stabilization of Highland Park Drain, pond construction along Lozier (Bixler) Drain, erosion control structure replacement along Lozier (Bixler) Drain, and channel stabilization along Lozier (Gilliam) Drain. The order of the above projects is the order in which the projects will be pursued for design and construction funding in the future. The Highland Drain bed and bank stabilization project was estimated to cost $31,500 with design-build funding available from the IDNR LARE Program in 2006 and Chapman Lakes Foundation or Chapman Lakes Conservation Association (CLCA) as a 25% cost-share. The cost estimate for the Lozier (Bixler) Drain pond construction design was $28,000, while the structure replacement project was estimated to cost $20,000. The channel stabilization project along Lozier (Gilliam) Drain was estimated to cost $29,000.

It is recommended that the Chapman Lakes Conservation Association or Chapman Lakes Foundation pursue a LARE grant to complete work on Highland Park Drain in 2006/2007. The CLCA should also pursue a LARE grant for the design of the pond project along Lozier (Bixler) Drain in 2006 with the construction grant sought in 2007. Work along Lozier (Gilliam) Drain should also be pursued in 2007 through the LARE program. Finally, the CLCA and the CLF should continue to work with the Kosciusko County NRCS to determine what, if any, projects can be implemented through the Conservation Reserve Program and/or Wetland Reserve Program.

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LOZIER AND HIGHLAND PARK DRAINS ENGINEERING FEASIBILITY STUDY
CHAPMAN LAKES WATERSHED, KOSCIUSKO COUNTY, INDIANA

1.0 Introduction

1.1 Background

Over the past six years, Chapman Lake property owners and lake users have worked to improve water quality within the Chapman Lakes (Figures 1 and 2). Work began in 2000 with the Chapman Lakes Diagnostic Study (JFNew, 2001), which was funded by the Indiana Department of Natural Resources (IDNR) Lake and River Enhancement (LARE) Program. The study focused on documenting lake and watershed quality concerns, diagnosing potential pollutant sources to the lake, and identifying potential lake and watershed improvement projects to address these issues. Noted lake and watershed water quality concerns identified for the Chapman Lakes include: increasing quantities of aquatic plants, increasing sediment bar deposition at the mouths of tributaries and in bays, and poor water clarity. According to the study, water quality in Big Chapman Lake was better than most Indiana lakes, but concern for worsening conditions was warranted (JFNew, 2001). Conversely, Little Chapman Lake was eutrophic with rooted plant problem areas and poor transparency. Phosphorus modeling suggested than the majority of phosphorus loading to both lakes originated from external sources in the watershed. The study recommended addressing watershed-level issues before attempting in-lake treatment.

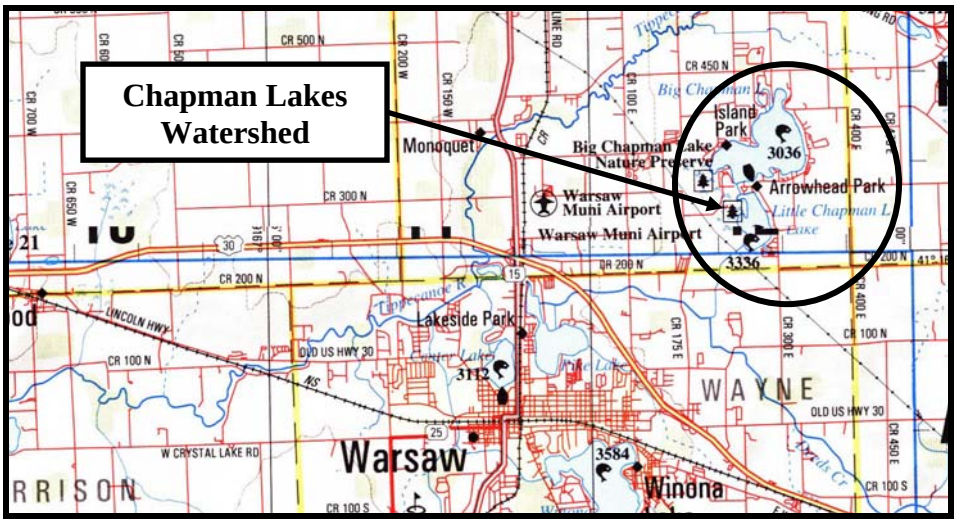

Figure 1. General location.

Chapman Lakes residents heeded this advice and began working in their watershed in 2001. Efforts since this time have focused on bank and channel erosion in the lower portion of Crooked Creek, bank and channel erosion along Arrowhead Drain, and an assessment of storm drains delivering stormwater runoff directly to the Chapman Lakes (JFNew, 2003a). This resulted in the completion of an engineering feasibility study for the two major drainages (Crooked Creek and Arrowhead Drain) to the Chapman Lakes. Resultant streambank stabilization along Crooked Creek was completed in the summer of 2003 (JFNew, 2003b), while JFNew completed channel restoration work along Arrowhead Drain in the fall of 2004 (JFNew, 2004). The Chapman Lakes Conservation Association (CLCA) and the Chapman Lakes Foundation (CLF) continue to work

on both in-lake and watershed water quality improvement projects. Current efforts focus on the development of an aquatic plant management plan (CLCA, 2004), creation of a lake and watershed strategic management plan, and completion of watershed-level water quality improvement projects. In 2004, the CLF received grant funding from the IDNR LARE program to complete a feasibility study for Lozier and Highland Park Drains, the two remaining inlet streams draining to Little Chapman Lake. Neither of these streams were previously assessed through the completion of an engineering feasibility study. The purpose of the current study is to determine design and construction feasibility for projects identified during and following the completion of the Chapman Lakes Diagnostic Study within the Lozier Drain and Highland Park Drain subwatersheds.

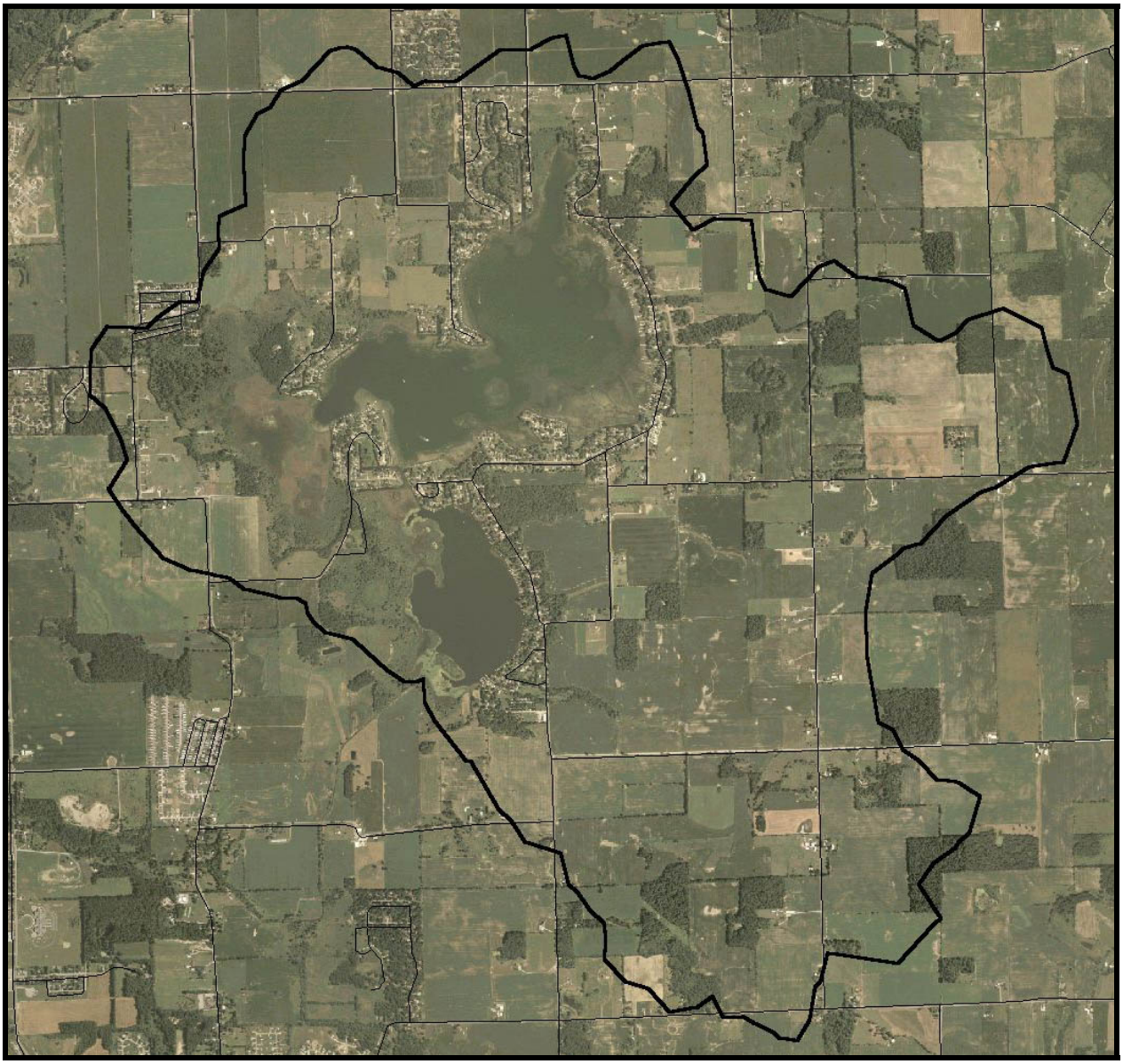

Figure 2. Chapman Lakes watershed.

1.2 Scope of Study

This feasibility study specifically targeted the Lozier Drain and Highland Park Drain subwatershed areas for project implementation (Figure 3). JFNew conducted field surveys in these subwatersheds in order to identify locations where meaningful projects could be implemented that would result in improvements to Little Chapman Lake and its surrounding watershed. Surveys included several lake/watershed driving tours; visual inspection and mapping of project sites; and several public and private meetings with landowners, the CLCA and CLF boards, and watershed stakeholders.

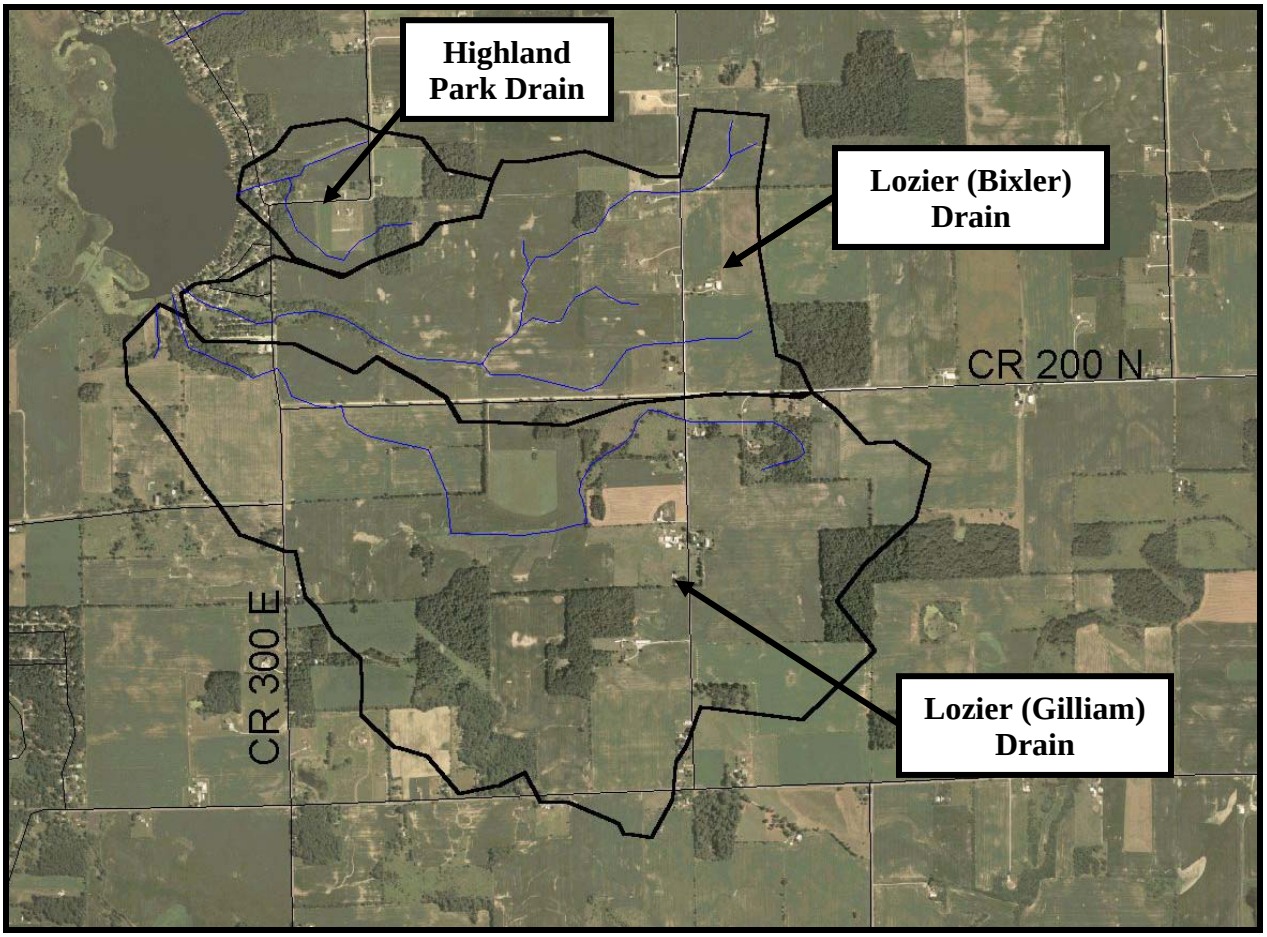

Figure 3. Lozier and Highland Park Drain subwatersheds.

The following projects (Figure 4) are included in this engineering feasibility study based on the surveys' findings:

1. Streambank and Bed Stabilization, Highland Park Drain, Slater Property
2. Check dam installation and/or pond construction, Lozier Drain, Reiff Property
3. Erosion control structure replacement, Lozier Drain, Deatsman Property
4. Channel stabilization, Lozier Drain, Gilliam Property

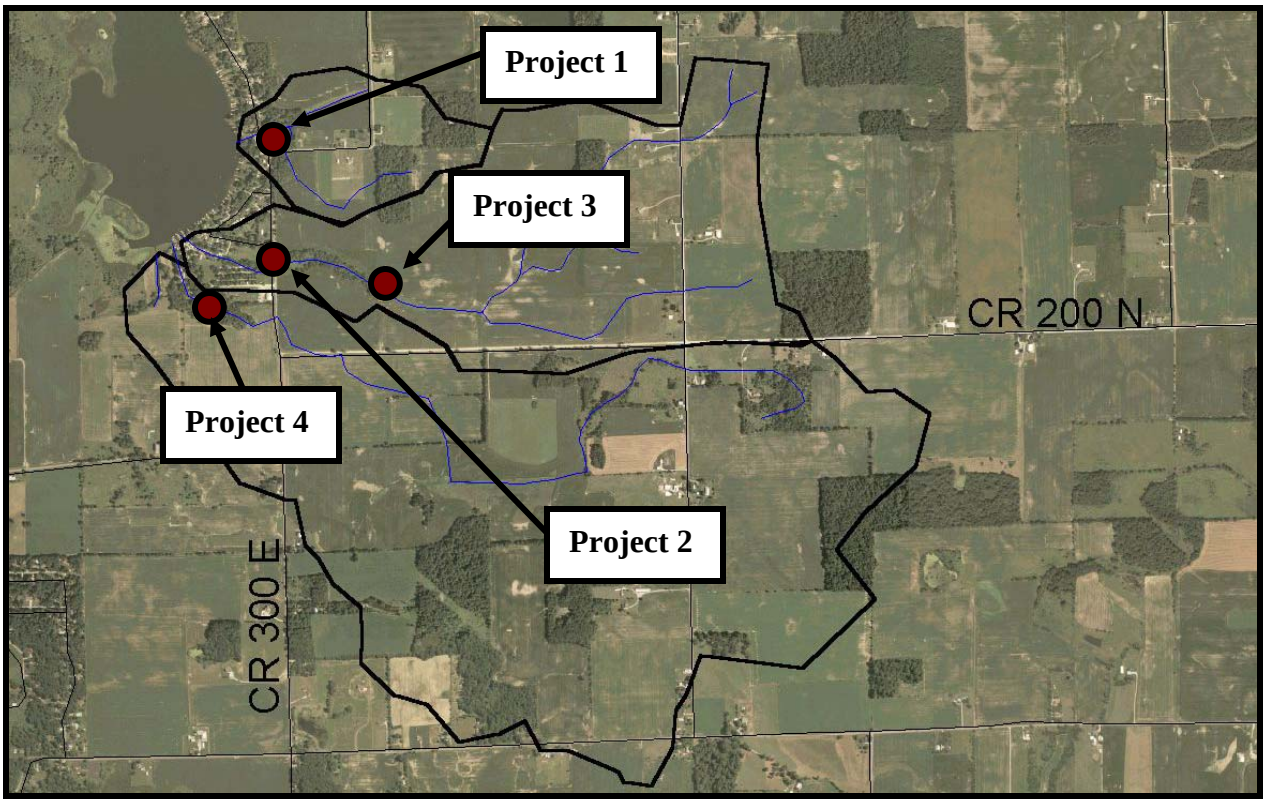

Figure 4. Projects pursued during the Lozier and Highland Park Drains Engineering Feasibility Study.

1.3 Goals and Objectives

The goal of this study was to identify feasible projects that could be designed and implemented within a reasonable time frame. A project was deemed feasible if it was physically capable of being constructed, was acceptable to effected landowners, was economically justifiable, and could receive regulatory approval. The feasibility study attempted to ensure project success by investigating all avenues that could potentially cause project failure.

2.0 <u>Description of the Study Area</u>

2.1 Location

The Chapman Lakes watershed encompasses 4,808 acres (1,945 ha) in central Kosciusko County, Indiana (Figure 1). The relatively small Chapman Lakes watershed is part of the Tippecanoe River Basin, which conducts water to the Wabash River, a tributary of the Ohio River. Four main drainages transport runoff water from the watershed to the Chapman Lakes (Figure 5). These drainages include: Crooked Creek, Arrowhead Drain, Highland Park Drain, and Lozier Drain. This project focuses specifically on the Highland Park Drain and Lozier Drain subwatersheds. Highland Park Drain carries runoff from approximately 96 acres (39 ha) to Little Chapman Lake. Lozier Drain possesses two main branches including Bixler Drain, which drains the northern portion of the subwatershed, and Gilliam Drain, which drains the southern portion of the subwatershed (Figure 2). In total, the Lozier Drain subwatershed drains approximately 1,282 acres (518.8 ha). The remaining 3,430 acres (1,388 ha) of land drains into Little Chapman Lake either directly, via Arrowhead Drain, or via drainage from Big Chapman Lake. Water

drains from Little Chapman Lake through Heeter Ditch on the lake's southeast shore and into Deeds Creek. Deeds Creek in turn flows into Pike Lake before entering the Tippecanoe River.

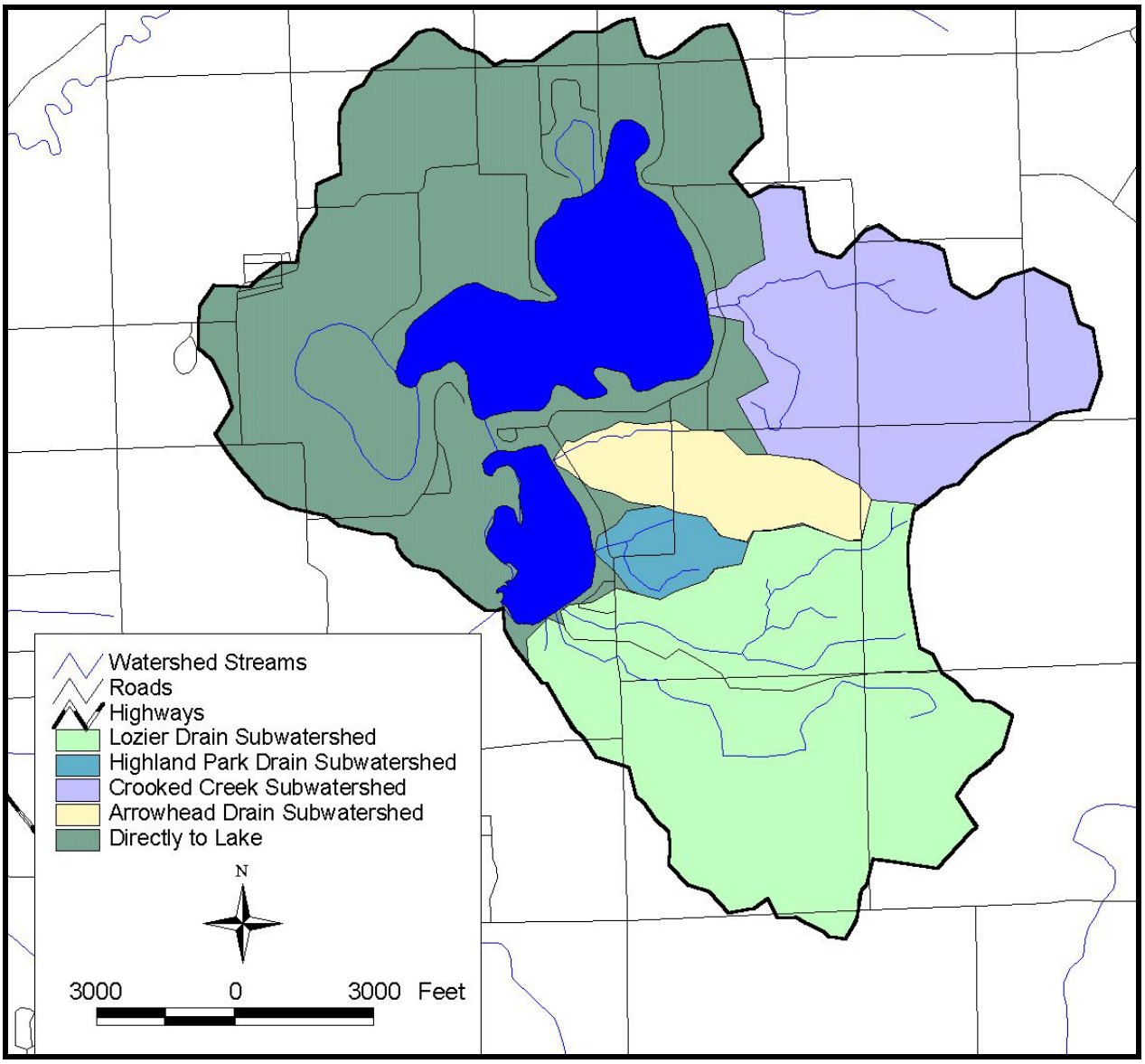

Figure 5. Chapman Lakes subwatersheds.

2.2 Geologic History and Topography

The Chapman Lakes and their watershed formed during the most recent glacial retreat of the Pleistocene era. The advance and retreat of the Saginaw Lobe of a late Wisconsin Age glacier as well as the deposits left by the lobe shaped much of the landscape found in northeastern Indiana (Homoya et al., 1985). The Saginaw Lobe retreat left a broad, flat to rolling glaciated plain, which has been classified as the Northern Indiana Till Plain Ecoregion (Omernik and Gallant, 1988). Glacial fill and outwash, sandy gravelly beach ridges, flat belts of morainal hills, and bog kettle depressions characterize this ecoregion (Simon, 1997). The topography of the Chapman Lakes watershed is typical of much of Kosciusko County and was determined to a large extent by glaciation. Land to the east of the Big and Little Chapman Lakes exhibits a gently rolling

topography. Relief ranges from approximately 940 feet above mean sea level at the highest point in the watershed to approximately 828 feet mean sea level at the lakes. Land to the west of the lakes is flatter than the land to the east of the lakes with large wetland expanses lying adjacent to the lakes. Erosion from the more strongly sloped lands to the east was identified as a concern during the 2001 diagnostic study.

2.3 Land Use

The Chapman Lakes watershed lies within the Northern Lake Natural Area (Homoya et al., 1985). Natural communities found in this region prior to European settlement included bogs, fens, marshes, prairies, sedge meadows, swamps, seep springs, lakes, and deciduous forests. Like much of the landscape in Kosciusko County, a large portion of the Chapman Lakes watershed was converted to agricultural land uses. Today, about 71% of the watershed is utilized for agricultural purposes including row crop and pasture (Table 1; Figure 6). Corn, soybeans, and tomatoes are the major crops grown on this land. An additional land use change has been residential development of much of the lakes' northern, eastern, and southern shorelines, which currently composes about 3% of the total watershed acreage. Wetlands, forests, and open water account for approximately 26% of the total watershed.

Table 1. Land use in the Chapman Lakes watershed.

Land Use	Acreage	Percentage of Watershed
Row Crops	2,830.8	58.9%
Open Water	603.8	12.6%
Pasture/Hay	566.5	11.8%
Deciduous Forest	262.9	5.5%
Woody Wetlands	215.3	4.5%
Emergent Herbaceous Wetlands	168.1	3.5%
Low Intensity Residential	116.6	2.4%
High Intensity Commercial	24.5	0.5%
Evergreen Forest	9.9	0.2%
High Intensity Residential	9.4	0.2%
Mixed Forest	0.4	0.0%
Total	**4,808.5**	**100%**

Land use within the Highland Park Drain and Lozier Drain subwatersheds mimics the pattern observed throughout the entire Chapman Lakes watershed. Agricultural row crops cover a large portion of the Highland Park Drain (75.7 acres or 78.7%) and Lozier Drain (1,099 acres or 85.7%) subwatersheds. Deciduous forest (11.9 acres or 12.4%) and land used for pasture or hay (5.6 acres or 5.9%) are also predominant within the Highland Park Drain subwatershed. Likewise, pasture/hay (73.4 acres or 5.7%), deciduous forest (55.8 acres or 4.4%), and woody wetlands (29.6 acres or 2.3%) cover the remainder of the Lozier Drain subwatershed.

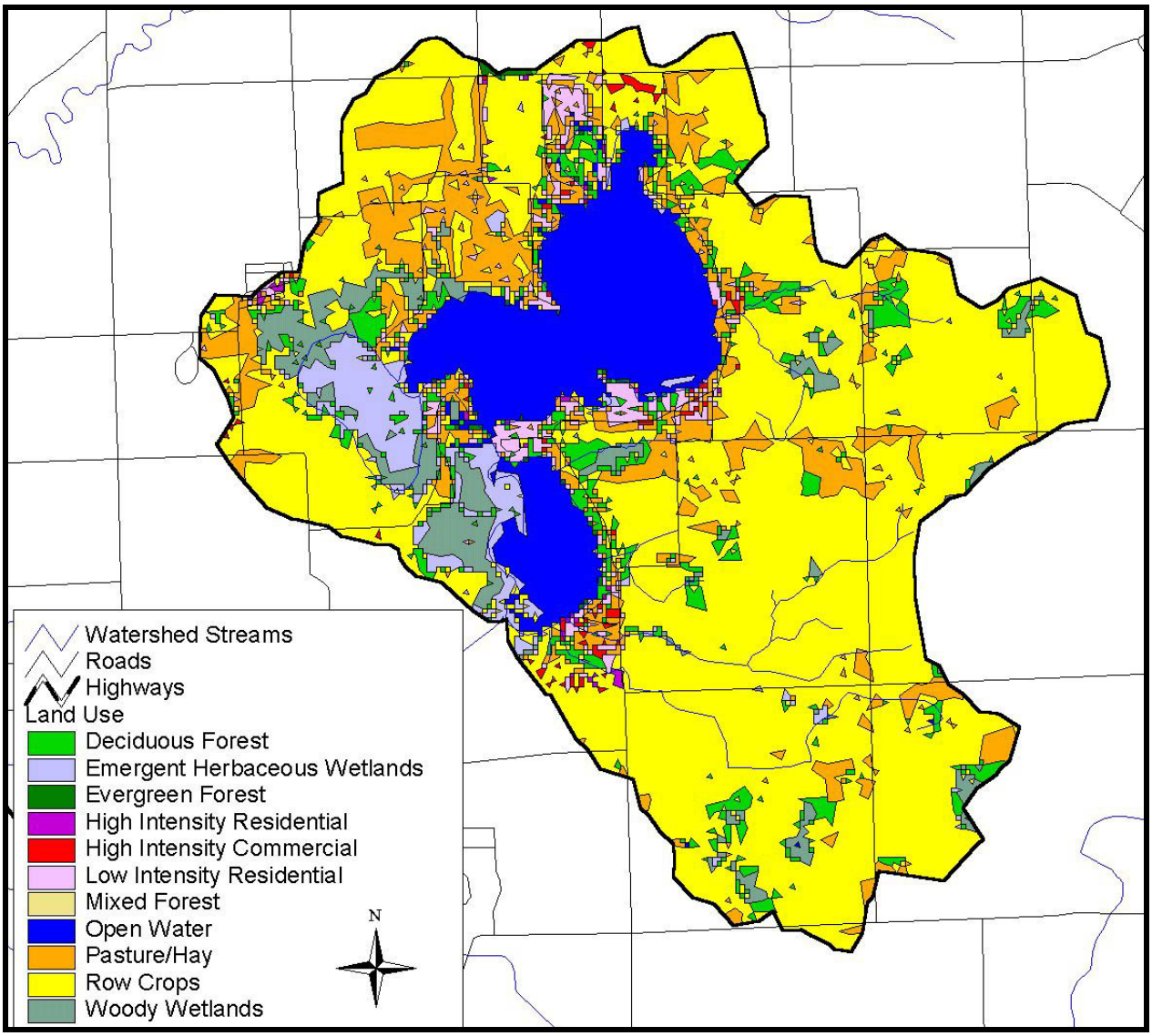

Figure 6. Watershed land use.

2.4 Soils

The soil types found in the Chapman Lakes watershed are a product of the original parent materials deposited by the glaciers that traversed the area 12,000 to 15,000 years ago. Soils that directly border the lakes are of the Houghton-Palms Association, which is primarily composed of mucky, poorly drained soils that formed in organic material. The Crosier-Barry Association covers most of the Highland Park Drain subwatershed and much of the northern portion (Bixler Drain) of the Lozier Drain subwatershed. The Riddles-Wawasee Association covers most of the southern portion (Gilliam Drain) of the Lozier Drain subwatershed. Soils of these two associations are loamy, well-drained soils formed in outwash deposits or glacial till (Staley, 1989).

The Chapman Lakes watershed contains a relatively small amount of highly erodible land (137 acres or about 3% of the watershed). However, the entirety of the watershed's highly erodible land is located within the southern portion of the Lozier Drain subwatershed which is drained by

Gilliam Drain. In total, highly erodible land accounts for approximately 16% of the land draining through Gilliam Drain. An additional 444.2 acres (179.7 ha) of Highland Park Drain and Lozier Drain subwatersheds are mapped as potentially highly erodible soil. By subwatershed, Lozier Drain contains the smallest percentage of land (46%) in potentially highly erodible soils units, while Highland Drain contains the greatest percentage of land (54%) mapped as potential highly erodible soils. Additionally, about 23% or 1,064 acres of the Chapman Lakes watershed is mapped as hydric soils (JFNew, 2001) a significant portion of which lie within the Highland Park Drain and Lozier Drain subwatersheds. Hydric soils developed under wet conditions and are indicative of the historical presence of wetlands.

2.5 Existing Watershed-wide Water Quality Improvement Projects

Several water quality improvement projects have been completed throughout the Chapman Lakes watershed; however, none of these projects lie within the Highland Park Drain or Lozier Drain subwatersheds. Existing best management practices within the Chapman Lakes watershed include a 73-acre parcel of land enrolled in the Conservation Reserve Program (CRP) just south of Crooked Creek. Another property owner established a grassed waterway at the headwaters of Arrowhead Drain. Several lakeshore property owners purchased 35 acres of agricultural land north of Crooked Creek with the intention of developing it as wildlife habitat. Conservation tillage practices are also evident on fields in the watershed. Additionally, two LARE-funded construction projects have been completed within the Chapman Lakes watershed. The first project consisted of streambank stabilization of approximately 1,370 lineal feet of streambank of Crooked Creek and its tributary using coir logs, cribwalls, soil-encapsulated lifts, wing deflectors, and check dams. The second project occurred along the mainstem of Arrowhead Drain and included streambank and bed stabilization through the use of erosion control blankets, soil-encapsulated lifts, and grade control structures. The current study represents the second Best Management Practice (BMP) implementation plan sponsored by the CLF.

2.6 Prior Studies

Table 2 documents prior studies conducted in the Chapman Lakes watershed. Most of the early studies conducted in the area focused on documenting existing water quality or fishery conditions within the lake. The 2001 diagnostic study was the first study to address watershed management of the areas draining into the Chapman Lakes. The goals of the 2001 Chapman Lakes Diagnostic Study were to: 1) identify the sources of pollution within the lakes and the watershed that contribute to eutrophication and sedimentation; 2) evaluate the opinions of lake residents with respect to watershed, shoreline, and lake management; 3) recommend actions that can be taken to protect and restore the ecological integrity and recreational value of the lakes.

Since 2001, multiple studies focused on the feasibility and implementation of water quality improvement projects have been completed in the Chapman Lakes watershed. The 2002 Chapman Lakes Engineering Feasibility Study explored the feasibility of implementing three of the primary recommendations made in the 2001 Chapman Lakes Diagnostic Study: *implement bank and channel erosion control techniques along the lower portions of Crooked Creek*; *implement bank and channel erosion control techniques along Arrowhead Drain*; *and fit storm water drain pipes with catch basins and filtration technology*. The Crooked Creek and Arrowhead Drain projects were implemented in 2003 and 2004, respectively. The 2004 Aquatic Plant Management Plan completed by the Chapman Lakes Conservation Association addresses

an additional recommendation from the diagnostic study, which was to *develop an aquatic plant management plan*. The current study explores the feasibility of implementing two of the diagnostic study's other recommendations, including: *work with local agencies and landowners to install BMPs and restore wetlands in the Lozier Creek Subwatershed* and *implement streambank stabilization techniques along Highland Park Drain*. Concurrent with this project, the CLF is developing a strategic lake management plan, which will assess the watershed for additional projects, document landowner concerns and provide mechanisms for addressing in-lake and watershed issues, and address the remaining recommendations from the diagnostic study (JFNew, 2001).

Table 2. Prior studies conducted in the Chapman Lakes watershed.

Year	Entity	Topic	Study
1964	IDNR, DFW	Fisheries	Lake Survey Report, Big Chapman Lake
1969	IDNR, DFW	Fisheries	Lake Survey Report, Little Chapman Lake
1986	IDEM	Water Quality	IN Lake Classification System and Management Plan
1976	IDNR, DFW	Fisheries	Big Chapman Lake Fisheries Management Report
1976	IDNR, DFW	Fisheries	Little Chapman Lake Fisheries Management Report
1980	IDNR, DFW	Fisheries	Preliminary Investigations of the Chapman Lake Walleye Population
1981	IDNR, DFW	Fisheries	Fishing Pressure and Harvest at Big Chapman Lake
1989	IDNR, DFW	Fisheries	Largemouth Bass Population Size and Exploitation Rate
1989	IDEM, CLP	Water Quality	Indiana Clean Lakes Assessment
1991	IDNR, DFW	Fisheries	Big Chapman Lake Fish Population Survey
1994	IDEM, CLP	Water Quality	Indiana Clean Lakes Assessment
1998	IDEM, CLP	Water Quality	Indiana Clean Lakes Assessment
1999	IDNR, DFW	Fisheries	Big Chapman Lake Fish Management Report
1999	IDNR, DFW	Fisheries	Little Chapman Lake Fish Management Report
1999	IDNR, DFW	Mussels	Natural Lakes Mussel Survey
2000	IDEM, CLP	Water Quality	Indiana Clean Lakes Assessment
2001	IDNR, DSC/ JFNew/CLF	Watershed Management	Chapman Lake Diagnostic Study
2001	IDNR, DFW	Fisheries	Northern Pike Spawning Habitat Investigations at Two Natural Lakes
2002	IDNR, DSC/ JFNew/CLF	Watershed Management	Chapman Lakes Engineering Feasibility Study
2003	IDNR, DSC/ JFNew/CLF	Water Quality Improvement	Crooked Creek Design-Build Project
2004	IDNR, DSC/ JFNew/CLF	Water Quality Improvement	Arrowhead Drain Design-Build Project
2004	IDNR, DSC/ JFNew/CLF	In-Lake Management	Aquatic Plant Management Plan for the Chapman Lakes
2004	IDEM, CLP	Water Quality	Indiana Clean Lakes Assessment
2005	IDNR, DFW/ JFNew/CLF	Watershed Management	Chapman Lakes Strategic Management Plan
2005	IDNR, DFW, JFNew/CLF	Watershed Management	Lozier and Highland Park Drains Engineering Feasibility Study

CLF=Chapman Lakes Foundation
CLP=Clean Lakes Program
DFW=Division of Fish and Wildlife
DSC=Division of Soil Conservation
IDEM=Indiana Department of Environmental Management
IDNR=Indiana Department of Natural Resources
JFNew=J.F. New & Associates, Inc.

3.0 Potential Water Quality Improvement Projects

Targeting areas of concern and selecting sites for future management are the goals of a visual watershed inspection. A walking tour of the Lozier Drain and Highland Park Drain subwatersheds was conducted in November and December 2004. A total of twelve potential water quality improvement project sites were identified during the tours. Specifics regarding each of the projects are listed in Table 3. The identified projects are mapped in Figure 7. Additionally, site photographs for representative projects are included in Appendix A.

Table 3. Potential water quality improvement projects.

Site	Drain	Issue/Source of Impairment	Potential Project(s)
A	Highland Park	Stream flows through old pond structure; Severe erosion occurs along length of streambed and banks	Stream Restoration
B	Highland Park	Rill and gully erosion are forming throughout row crop agricultural field; Water flow unchecked across property and would benefit from on-site retention	1. CRP Enrollment (bare ground) and Wetland Restoration (woodlot);
			2. Grassed Waterway and WASCOB* Installation;
			3. Sediment Basin Installation
C	Highland Park	Grassed waterway is overgrown with woody material; Waterway needs to be mowed and properly maintained to provide optimal function	Grassed Waterway Maintenance
D	Lozier (Bixler)	Stream is eroding streambank and is disconnected from its floodplain; Best benefit achieved by improving on-site retention; Secondary benefit from restoring streambank	Stream Restoration (Check Dams)/Wetland Enhancement/Pond Installation
E	Lozier (Bixler)	Field drainage flows around existing concrete structure previously installed by the NRCS; Structure needs to be replaced or repaired to correct erosion issues	Structure Replacement/Repair
F	Lozier (Bixler)	Minor rill and gully erosion are occurring within the field; Improve on-site retention or reduce sediment loading	CRP Enrollment
G	Lozier (Bixler)	Minor rill and gully erosion are occurring within the field; Improve on-site retention or reduce sediment loading	Grassed Waterway Installation
H	Lozier (Gilliam)	Erosion is occurring within field at tile outlet and at outlet of pipe under road; Correct erosion issues and improve on-site retention	Structure Replacement/Repair; WASCOB and Tile Installation; Rock Outfall at Road
I	Lozier (Gilliam)	Minor rill and gully erosion are occurring within the field; Improve on-site retention or reduce sediment loading	Grassed Waterway Installation
J	Lozier (Gilliam)	Drain flows along gravel road; Little or no filtration of roadside or open field sediment loading	Roadside Drain or Infiltration Trench Installation
K	Lozier (Gilliam)	Degraded, partially farmed wetland; Increase on-site retention and water filtration	Wetland Restoration
L	Lozier (Gilliam)	Degraded, partially farmed wetland; Increase on-site retention and water filtration	Wetland Enhancement

*WASCOB=Water and sediment control basin.

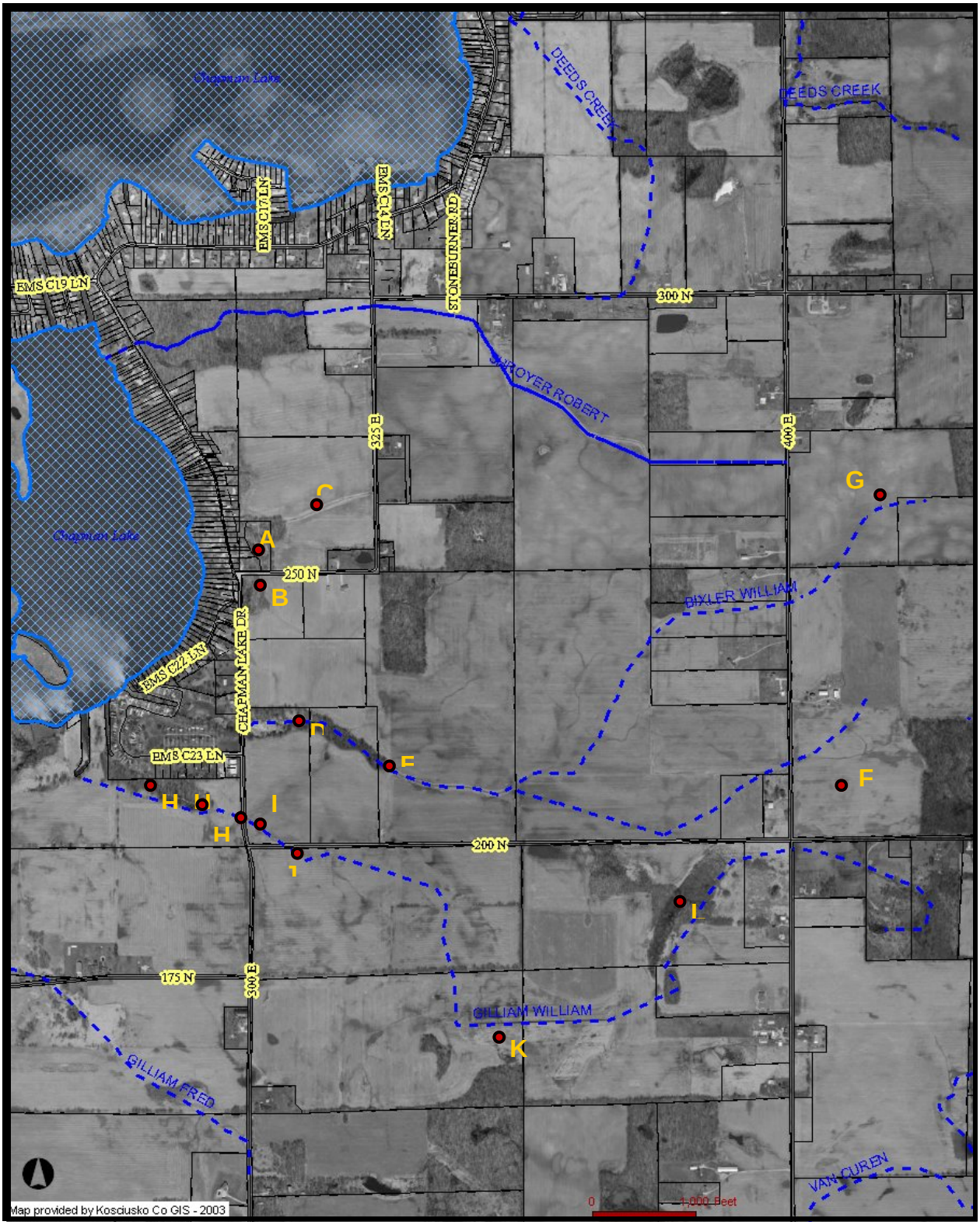

Figure 7. Potential water quality improvement projects identified in the Lozier Drain and Highland Park Drain subwatersheds.

All of the potential projects were discussed during a strategy meeting including the Chapman Lakes Conservation Association, Chapman Lakes Foundation, JFNew, and Kosciusko County Natural Resources Conservation Service (NRCS) personnel. During this meeting, it was determined that the NRCS would pursue any projects that could be funded through the Conservation Reserve Program (CRP) or the Wetland Reserve Program (WRP). This included projects B, F, G, I, K, and L as identified in Figure 7. Specifically, these projects target Conservation Reserve Program enrollment (B and F), grassed waterway installation (G and I), and wetland enhancement or restoration (K and L). The NRCS agreed to discuss grassed waterway maintenance issues with the landowner and farmer at project B. The Chapman Lakes Conservation Association indicated that they would talk with the landowners of these properties to facilitate the implementation of water quality improvement projects on these properties. Additionally, they agreed to discuss drainage ditch maintenance options for project J with the Kosciusko County Surveyor's office. The four remaining projects (A, D, E, and H) were identified as those to be pursued through the LARE-funded engineering feasibility study. As described above, these projects include: streambank and bed stabilization at project site A, pond construction at project site D, erosion control structure replacement at project site E, and channel stabilization at project site H (Figure 3).

4.0 Project Review

4.1 Streambank and Bed Stabilization, Highland Park Drain, Slater Property

4.1.1 Site Description and Alternatives

The Highland Park Drain project site is located along the eastern side of Little Chapman Lake northeast of the intersection of County Road 250 North and Chapman Lake Drive (Figure 3). The Highland Park Drain subwatershed drains approximately 96 acres (39 ha) from its headwaters to its mouth. The drain originates as two branches including a grassed waterway to the north and an open drain through an agricultural field to the east. Both branches converge on the Slater property. The drain is not a legal drain, which means that the Kosciusko County Surveyor's office does not collect ditch assessment fees or maintain the ditch itself in any fashion.

The reach assessed during the current feasibility study includes approximately 1,000 lineal feet of intermittent stream channels. The stream is generally dry; however, during periods of high flow, water moves through the meandering channels at a rapid pace thereby creating a flashy system. Flashy streams, such as Highland Park Drain, are often subjected to greater peak flows as a result of the volume and velocity of surface runoff (Fergus and Deak, 1994). Rapidly fluctuating water levels and high flow volumes increase the erosive force of the water resulting in streambank and bed erosion and channel head-cutting. As water erodes material at the toe of the slope, the streambanks become unstable. This results in the sloughing of bank material. The material is then carried downstream and deposited in areas of lower velocity, like Little Chapman Lake.

One main channel from the south and a tributary channel from the east carry storm water through the property (Figure 8). The main channel flows roughly north then west towards Little Chapman

Lake. A small impoundment historically existed on the main stream just downstream of the tributary's confluence. This impoundment was created by a small earthen dam which had been constructed across the stream channel. At some point, the earthen dam was breached near its center creating another source of sediment to be carried away by the erosive force of the water. The dam is no longer functional. An intermittent tributary stream enters the main channel immediately upstream of the former earthen dam. The stream receives water from two smaller channels which combine approximately 200 feet to the east of the small stream's confluence with the main channel. The larger of the original two channels receives water from a 6-inch drainage tile that exits the grassed waterway in the agricultural field to the east, while the smaller of the two channels captures flow from an 8-inch tile draining the agricultural field to the east. Ultimately all of the channels combine to flow into a culvert which carries water beneath Chapman Lake Drive and into Little Chapman Lake. Due to the meandering nature of the stream, the channels exhibit varying degrees of head-cutting and streambank erosion along their length. (See Appendix A for photographs of the site.)

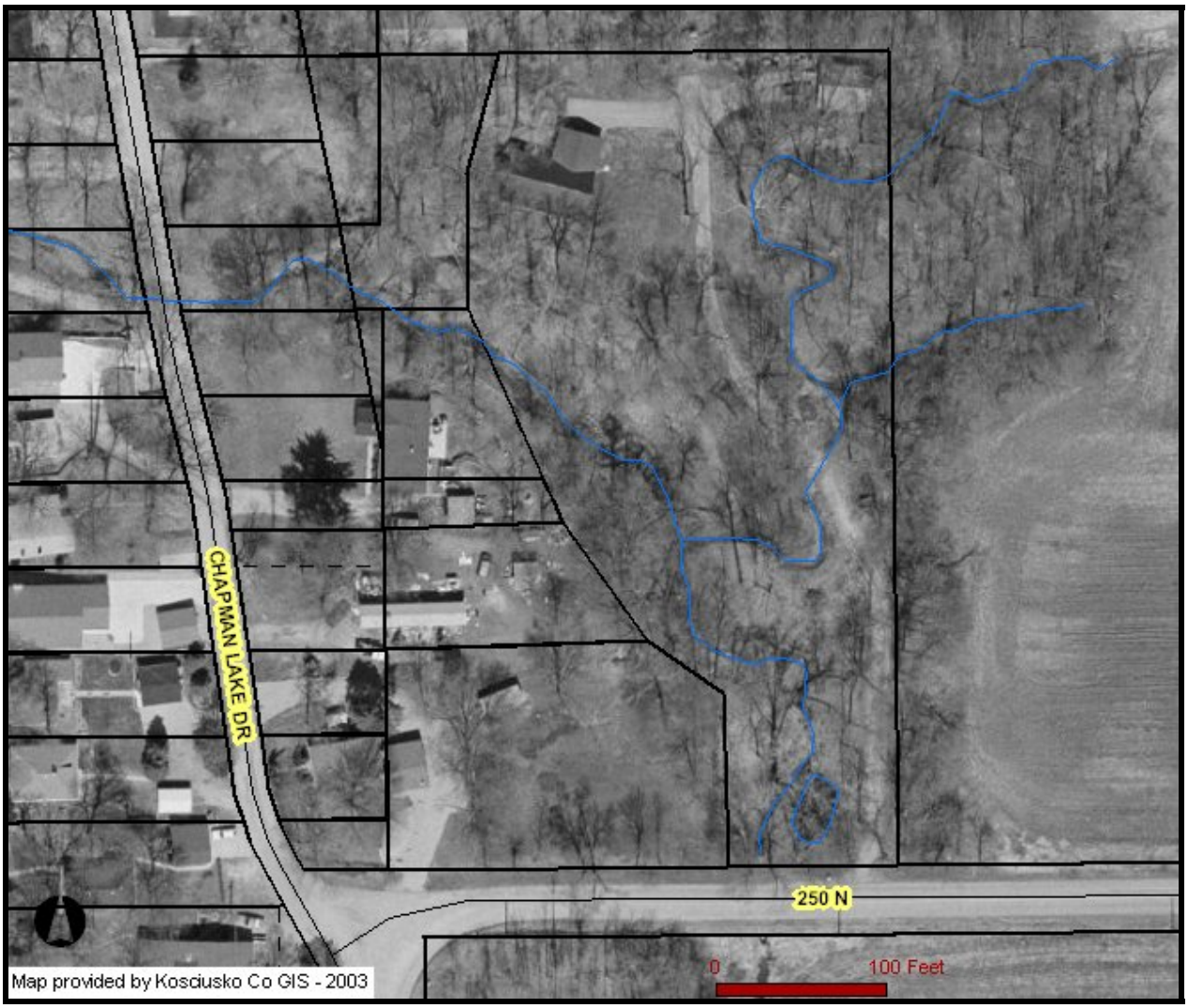

Figure 8. Aerial photograph of the streambank and bed stabilization project site, Highland Park Drain.

Stabilization of the eroded stream banks and the installation of check dams to slow the flow of water through the braided stream system are recommended to reduce sediment and sediment-attached nutrient delivery to Little Chapman Lake. Alternatives include: restoration of the earthen dam to form a basin or pond to store water and hold back sediment; installation of rock check dams; reformation of the streambanks using erosion control blankets; or leaving the system in its current state.

4.1.2 Easement and Land Availability Determination

The Highland Park Drain project site is located entirely on the Slater property. Mr. Slater has agreed to the conceptual plan of installing a series of check dams to control the erosion occurring within the intermittent streams located on his property and subsequent seeding and erosion control blanket installation along Highland Park Drain's streambanks. A copy of this agreement is included in Appendix B.

4.1.3 Preliminary Design and Conceptual Drawings

Channel stabilization of Highland Park Drain will consist of the installation of a series of six rock check dams. (Figure 9 depicts a typical cross section view of a check dam.) Check dams are designed to effectively raise the bed elevation of the stream channel to a level where the two-year flow fills the channel banks. Flows greater than a two-year event would overtop the streambanks and spill over into the floodplain. This would expend the water's energy in the floodplain rather than in the stream itself, thereby reducing the water's erosive action within the channel. Fine sediment and sediment-attached nutrients are deposited within the floodplain as well. Furthermore, over a period of time, sediment that is suspended in the water column during channel inundation would be deposited in the slack water areas between check dams. The sediment deposition will over time raise the stream bed elevation.

Concurrent with the installation of the rock check dams, the streambanks will be resloped, seeded, and covered with erosion control blankets. The new slopes will redirect water to limit rill and gully erosion along the length of the streambanks. Additionally, seeding and blanketing the slopes will provide a long-term cover for the streambanks which are currently bare soil in most locations.

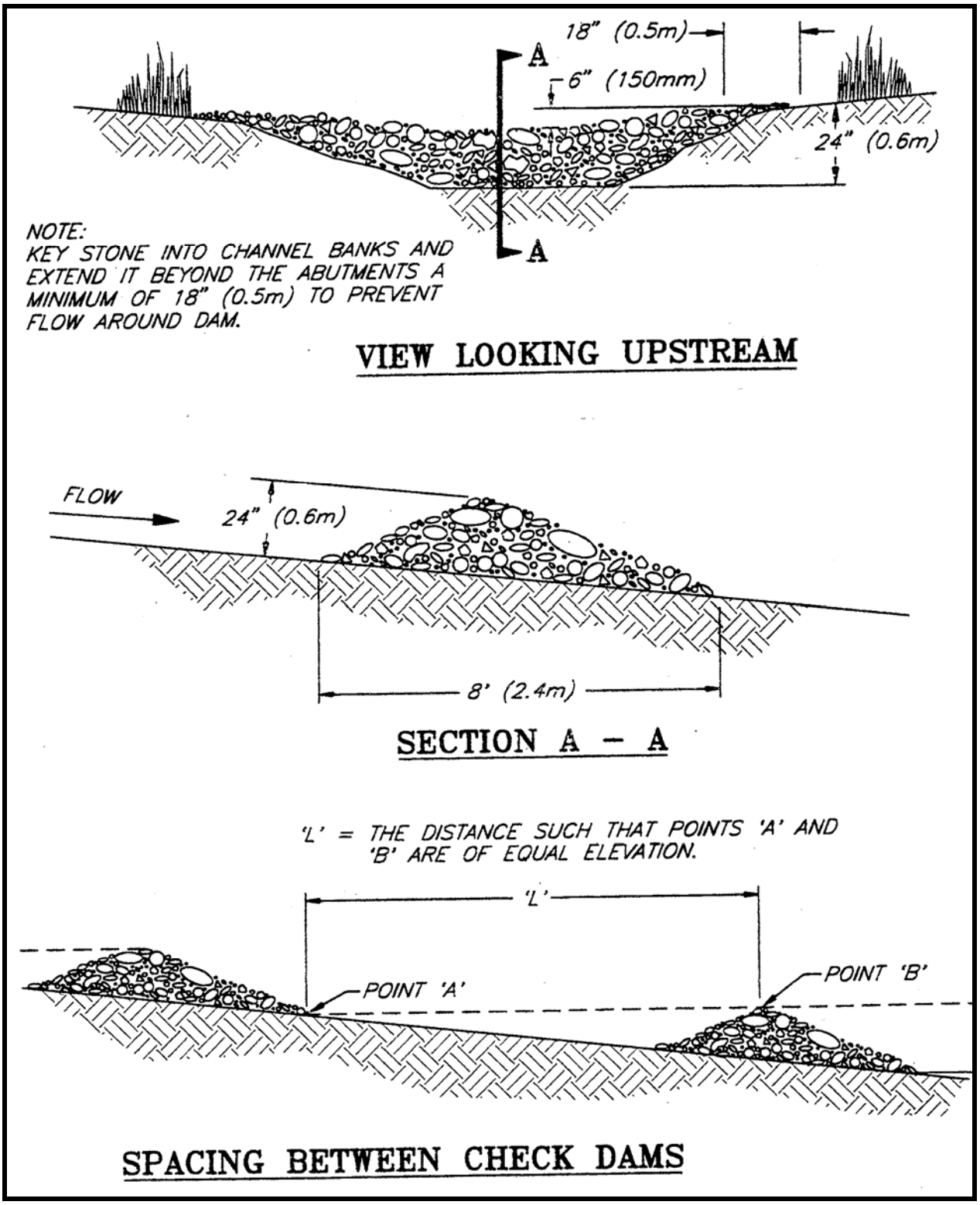

Figure 9. Typical cross section of a rock check dam.

4.1.4 Permit Requirements

No permits will be required from the Indiana Department of Natural Resources for this project. Since the project site has a drainage area of less than one square mile at its downstream end and no excavation will occur below the legal lake level of Little Chapman Lake, the DNR does not have jurisdiction. Permits or, at a minimum, notifications will be required from the U.S. Army Corps of Engineers (Corps) and Indiana Department of Environmental Management (IDEM) since fill will be placed into a "waters of the United States". The determination on whether permit applications or notifications need to be filed with each of these regulatory agencies is largely dependent upon the amount of fill that will be required during the construction of the check dams. If less than 1/10-acre of "waters of the United States" is filled and less than 1 cubic yard of fill per lineal foot is placed, then only notifications will be required. Furthermore, a permit will not be required from the Kosciusko County Drainage Board since Highland Park Drain is not a regulated drain.

4.1.5 Wetland Functional Assessment

No wetlands are located within the vicinity of the project site.

4.1.6 Biological and Habitat Integrity Survey

On August 1, 2005, JFNew attempted to survey the macroinvertebrate community of Highland Park Drain. However, since the stream was dry at the time of the assessment, an assessment of the macroinvertebrate community was not completed. Based on the stream's intermittent nature, the likelihood of this site supporting a high quality macroinvertebrate community is remote. It is far more likely that the macroinvertebrates present in Highland Park Drain are adapted to the periods of dryness and therefore, would not adequately represent water quality within the stream.

Habitat was evaluated on August 1, 2005 using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin, 1989 and 1995). While the Ohio EPA originally developed the QHEI to evaluate fish habitat in streams, IDEM and other agencies routinely utilize the QHEI as a measure of general "habitat" health. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrate; amount and quality of in-stream cover; channel morphology; extent and quality of riparian vegetation; pool, riffle, and run development and quality; and gradient are the metrics used to determined the QHEI score. Each metric is scored individually then summed to provide the total QHEI score. QHEI scores typically range from 20 to 100.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio indicate that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 typify conditions that have the ability to support exceptional warmwater faunas (Ohio EPA, 1999). IDEM indicates that QHEI scores above 64 suggest that the habitat is capable of supporting a balanced warmwater community; scores between 51 and 64 are considered only partially

supportive of the stream's aquatic life use designation, while scores less than 51 are considered non-supporting for the stream's aquatic life use designation (IDEM, 2000).

The Highland Park Drain sampling reach received a QHEI score of 24 indicating that IDEM would likely consider the stream habitat to be non-supporting of its aquatic life use designation. (QHEI metric scores are listed in Table 4 with datasheets in Appendix C.) The overall QHEI score indicates that the habitat within this portion of Highland Park Drain is relatively poor. Scores for substrate quality (1 of 20) pool development (0 of 12), riffle development (0 of 8), channel morphology (6 of 20), and instream cover (8 of 20) were below those observed in streams with quality habitat.

Table 4. QHEI Scores for the Highland Park Drain assessment reach as sampled August 1, 2005.

Site	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Score	Total Score
Maximum Possible Score	20	20	20	10	12	8	10	100
Highland Park Drain	1	8	6	5	0	0	4	24

4.1.7 Environmental Impact Assessment

Minimal environmental impacts are associated with this project. No wetlands were found on the project site by JFNew. Also, the likelihood of the intermittent streams supporting viable, sustainable macroinvertebrate or fish populations is highly remote. Although no endangered species survey was conducted on site, review of the DNR Division of Nature Preserves Natural Heritage database indicates that no endangered, threatened, or rare flora or fauna have been documented in the Highland Drain subwatershed.

4.1.8 Unusual Physical and Social Costs

Unusual physical and social costs are limited to construction access along the project site.

4.1.9 Opinions of Probable Cost and Proposed Time Line

The opinion of probable cost for this project is approximately $31,500. Table 5 contains a break down of project costs for engineering, permitting, construction, and project supervision.

Table 5. Opinion of probable cost for check dam construction on the Slater property.

Item	Total Cost
Engineering	$2,750
Permitting	$2,300
Mobilization/Demobilization	$600
Rock for check dams	$4,200
Construction Activities	
Installation of check dams	$6,000
Seeding and blanketing	$7,500
Contract Administration/Construction Supervision	$3,000
Contingency (20%)	$5,750
Total	**$31,500**

The project timeline is dependent on LARE grant funding cycles. The Chapman Lake Conservation Association applied for LARE funding for the design and construction of this project in early 2006. Therefore, if funding is awarded, the CLCA should contract out the design and construction of the project in late 2006 and construction could be completed by late 2006 or early 2007.

4.2 Pond Construction, Lozier Drain, Reiff Property

4.2.1 Site Description and Alternatives

In total, the Lozier Drain subwatershed drains approximately 1,282 acres (518.8 ha) from its headwaters to its mouth. The Bixler Drain portion of the Lozier Drain subwatershed drains 409 acres (165.5 ha). The drain originates as two branches which begin as small drainage channels east of County Road 400 East. The northern branch flows south and west while the southern branch flows almost directly west to converge into one channel east of the Reiff property. Lozier (Bixler) Drain is a legal drain from its headwaters to its intersection with County Road 300 East. This means that the Kosciusko County Surveyor's office can collect ditch assessment fees along this portion of the drain in order to maintain proper drainage. Additionally, any work completed on this portion of the drain must be completed under the jurisdiction of the Kosciusko County Surveyor. The Lozier Drain pond construction project site is located along the southeastern side of Little Chapman Lake northeast of the intersection of County Road 350 North and County Road 300 East (Figure 3). Specifically, this project site is located immediately upstream of Lozier (Bixler) Drain's (northern branch of Lozier Drain) intersection with County Road 300 East (Figure 3).

The reach assessed during the current feasibility study includes approximately 650 lineal feet of Lozier (Bixler) Drain (Figure 10). The downstream portion of the project site consists of perennial stream channel while the upper portion of the project site is drained by an intermittent channel. Soils nearest the creek are loams and sandy loams. At the project site, Lozier (Bixler) Drain is disconnected from its floodplain. Minor areas of erosion are present along the length of the assessed reach. (Appendix A contains representative photos of the project site.) The streambanks are uniformly low measuring 1 to 2 feet in height throughout the project reach. This portion of the stream does not appear to have been dredged or straightened in the past. Herbaceous and shrubby material border the stream channel as it meanders through the property. Specifically, reed canary grass, fescue, asters, multiflora rose, poison ivy, grapevine, honey suckle, and elderberry border the stream channel and cover the floodplain adjacent to the stream.

Figure 10. Aerial photograph of the pond construction project site, Lozier (Bixler) Drain.

Of greatest concern in the Lozier (Bixler) Drain subwatershed is the volume and velocity of water and the resultant sediment and sediment-attached nutrients that are carried through the steam channel to Little Chapman Lake. The riparian area is very narrow along much of the length of Lozier (Bixler) Drain upstream of the project site. This is primarily due to adjacent land use and narrow stream bank vegetation. Agricultural fields are cultivated near to the stream's edge along the length of the drain. Fescue and reed canary grass are the predominant vegetation along a majority of this portion of the drain. The conversion of natural landscapes to agricultural land uses typically results in the removal of vegetative cover (Basnyat et al., 2000). The lack of vegetation to intercept precipitation and runoff results in a decline in the volume of water infiltrating the soil (Corbett et al., 1997). The lack of infiltration causes stormwater, which normally would move through the soil as groundwater or subsurface flow, to move as overland or surface flow. Eventually, overland flow enters the stream channel. Ultimately, the lack of emergent vegetation and absence of stormwater infiltration results in more surface water reaching the stream at a faster rate, thereby creating a flashy stream system characterized by greater variability in water level fluctuations (Tourbier, 1994).

Creation of mechanism for storm water to leave the stream channel, dissipate its energy, and drop some of its sediment load is necessary to improve the quality of water entering Little Chapman Lake from Lozier (Bixler) Drain. The primary recommendation to accomplish this was the installation of check dams along the length of the stream channel within this property. As previously described, check dams raise the bed of the channel allowing water to exit the stream during high flow events and dissipate energy into the adjacent floodplain. However, this option

was not in favor with the landowner; therefore, the project was redirected to the design and construction of a pond. A pond structure will slow the flow of water and hold it for a period of time before allowing its release to Little Chapman Lake. Alternatives to slow the volume and velocity of water flowing through Lozier (Bixler) Drain to Little Chapman Lake include: installation of an earthen dam to form a basin or pond to store water and reduce sediment loading; installation of rock check dams to allow water to exit the channel and dissipate energy and sediment into the floodplain; or leaving the system in its current state.

4.2.2 Easement and Land Availability Determination

The Lozier (Bixler) Drain project site is located entirely on the Reiff property. Mr. Reiff was originally approached to garner permission to install check dams within the stream. However, Mr. Reiff insisted that the only project that he would allow to be constructed on his property at this time was a pond. Therefore, the feasibility of a pond was proposed. Mr. Reiff has agreed to the conceptual plan of a water control structure and subsequent pond creation on his property. A copy of this agreement is included in Appendix B.

4.2.3 Preliminary Design and Conceptual Drawings

The preliminary design includes the placement of water control structure upstream of the wetlands located within the floodplain. This structure will create a pond housed entirely within the Reiff property (Figure 11). Final design of the project will determine the exact necessity for structure sizing and the resultant pond size.

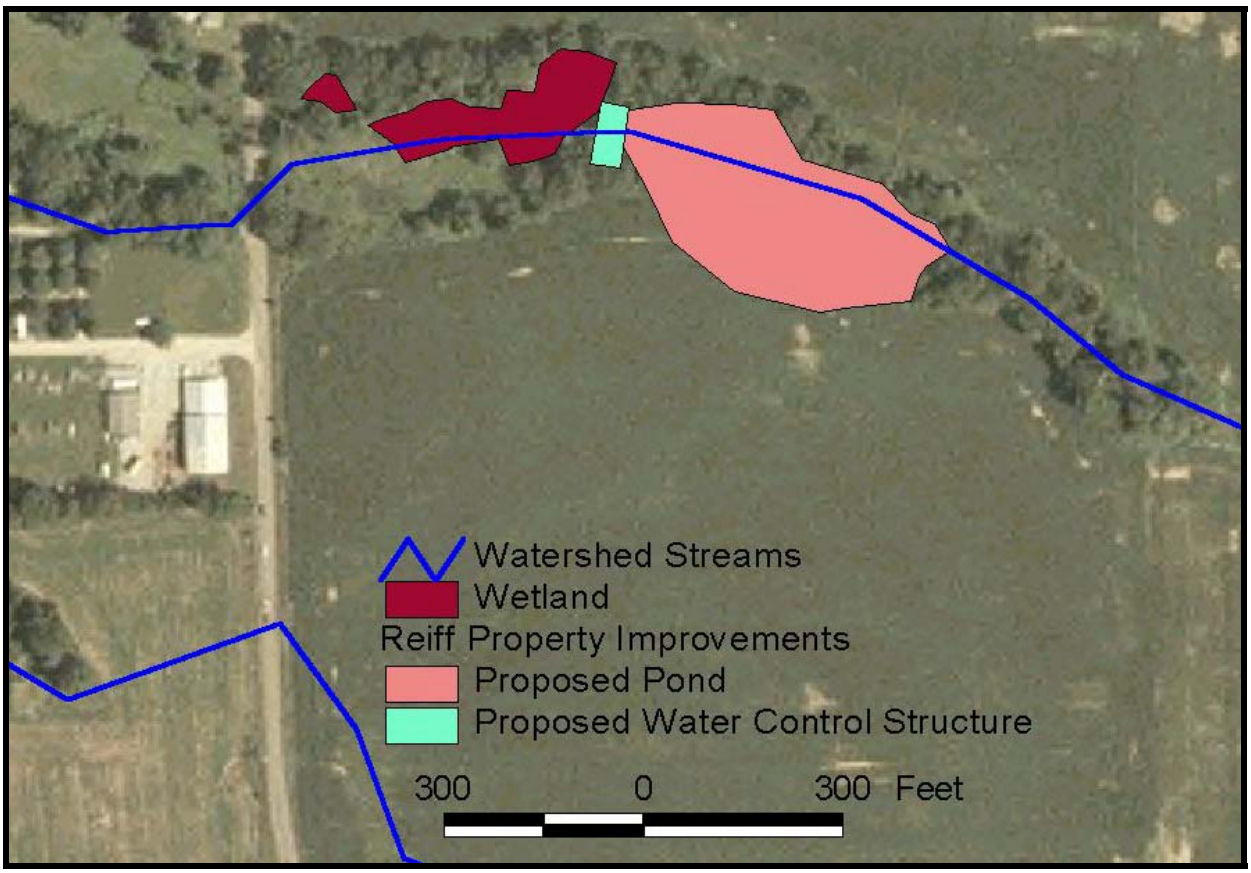

Figure 11. Conceptual design for pond construction, Lozier (Bixler) Drain.

4.2.4 Permit Requirements

Projects associated with Lozier (Bixler) Drain will require a permit from the Kosciusko Country Drainage Board since the stream is a legal drain. An IDNR construction in a floodway permit is not necessary for this project since the drainage area upstream of the project site is less than one square mile. A Section 401 Water Quality Certification from the IDEM and a Section 404 Permit from the Corps are required because Lozier (Bixler) Drain is a "waters of the United States." Preliminary comments were solicited from the Kosciusko County Surveyor's Office, the IDNR, the IDEM, and the Corps with this draft. Permit applications have not been submitted nor have permits been obtained for this project.

4.2.5 Wetland Functional Assessment

The general locations and extents of two wetlands were mapped during a field survey conducted on September 2, 2005. Figure 11 shows the approximate locations of these wetland areas. Appendix D contains wetland datasheets detailing the vegetation, soils, and hydrology of the wetlands and adjacent upland areas. Wetland A is located immediately east of County Road 300 East adjacent to the northern bank of Lozier (Bixler) Drain. Wetland B is located east of Wetland A along the channel of Lozier (Bixler) Drain. Wetland B covers a portion of the floodplain south of Lozier (Bixler) Drain and extends north of the drain through the northern floodplain as well. Reed canary grass (*Phalaris arundinacea*) and touch-me-not (*Impatiens capensis*) dominated Wetland A. Reed canary grass, aster (*Aster novae-angliae*), touch-me-not, and silky dogwood (*Cornus amomum*) vegetated Wetland B. Both wetlands are located downstream of the project site and will remain unimpacted by work completed upstream. Additionally, access roads to each of the project area will be located away from the two wetlands. The wetlands currently serve as good wildlife habitat, provide floodwater storage, and supply groundwater recharge.

4.2.6 Biological and Habitat Integrity Survey

On August 1, 2005, JFNew surveyed the macroinvertebrate community of Lozier (Bixler) Drain using the multihabitat approach detailed in the U.S. Environmental Protection Agency Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd edition (Barbour et al., 1999). This method was supplemented by qualitative picks from substrate and by surface netting. Using data collected during this survey, JFNew calculated IDEM's macroinvertebrate Index of Biotic Integrity (mIBI) (IDEM, unpublished). IDEM's mIBI is a multi-metric index designed to provide a complete assessment of a stream's biological integrity. Karr and Dudley (1981) define biological integrity as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region."

The mIBI is designed to assess biotic integrity directly through ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff's Family Biotic Index), number of taxa, number of individuals, percent dominant taxa, EPT index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. (EPT stands for the *Ephemeropteran*, *Plecopteran*, and *Trichopteran* orders.) After data from sampling sites have been collected, values for the ten metrics are compared with corresponding ranges and a rating of 0, 2, 4, 6, or 8 is assigned to each metric. The average of these ratings gives a total mIBI score, the best possible of which is

8.0. Macroinvertebrate communities in streams scoring less than 2 are considered severely impaired; these streams are rated by IDEM as non-supporting for their aquatic life use designation. Macroinvertebrate communities in streams scoring from 2 to 4 are considered moderately impaired and the associated streams are rated by IDEM as partially supporting their aquatic life use designation. Macroinvertebrate communities scoring from 4 to 6 and from 6 to 8 are rated as slightly impaired and non-impaired, respectively. These streams are designated as fully supporting of their aquatic life use designation as determined by IDEM.

Table 6 contains data from the biotic assessment of Lozier (Bixler) Drain conducted on August 1, 2005; data sheets are included in Appendix C. The mIBI score calculated for Lozier (Bixler) Drain (0.8) indicates that the macroinvertebrate community was severely impaired. Furthermore, the score suggests that IDEM would consider the stream to be non-supporting for its aquatic life use designation at the time of sampling. The most abundant macroinvertebrates at this site were members of the moderately pollution tolerant *Dipteran* family *Chironomidae*. A high (high=poor) HBI score; low density (number of individuals) and diversity (number of taxa); lack of high quality taxa from the mayfly, stonefly, and caddisfly families; and a dominance (61.5%) of the *Dipteran* family *Chironomidae* characterize the macroinvertebrate community along this reach of Lozier (Bixler) Drain.

Table 6. mIBI Scores for the Lozier (Bixler) Drain assessment reach as sampled August 1, 2005.

Metric	Value	Metric Score
HBI	5.4	2
Number of Taxa	4.0	0
Number of Individuals	39.0	0
Percent Dominant Taxa	0.6	2
EPT Index	1.0	0
EPT Count	1.0	0
EPT Count/Total Count	0.0	0
EPT Abundance/Chironomid Abundance	0.0	0
Total Number of Individuals per Square Sorted	0.5	0
Chironomid Count	24.0	4
mIBI Score		**0.8**
Integrity Class		**Severely Impaired**

Habitat was also evaluated on August 1, 2005 using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin, 1989 and 1995). While the Ohio EPA originally developed the QHEI to evaluate fish habitat in streams, IDEM and other agencies routinely utilize the QHEI as a measure of general “habitat” health. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrate; amount and quality of in-stream cover; channel morphology; extent and quality of riparian vegetation; pool, riffle, and run development and quality; and gradient are the metrics used to determined the

QHEI score. Each metric is scored individually then summed to provide the total QHEI score. QHEI scores typically range from 20 to 100.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio indicate that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 typify conditions that have the ability to support exceptional warmwater faunas (Ohio EPA, 1999). IDEM indicates that QHEI scores above 64 suggest that the habitat is capable of supporting a balanced warmwater community; scores between 51 and 64 are only partially supportive of a stream's aquatic life use designation, while scores less than 51 are considered non-supporting for the stream's aquatic life use designation (IDEM, 2000).

QHEI metric scores are listed in Table 7 with datasheets in Appendix C. The Lozier (Bixler) Drain sampling reach received a QHEI score of 45 indicating that the stream habitat is non-supporting of its aquatic life use designation. The overall QHEI score indicates that habitat may be one factor impairing aquatic life in the creek. The lack of pool and riffle development, poor instream cover, and a narrow riparian zone characterize the habitat at this reach. Scores for pool development (0 of 12), riffle development (0 of 8), channel morphology (13 of 20), instream cover (13 of 20), and substrate quality (7 of 20) were below those observed in streams with exceptional habitat. This lack of habitat likely contributes to depressed mIBI scores within Lozier (Bixler) Drain.

Table 7. QHEI Scores for the Lozier (Bixler) Drain assessment reach as sampled August 1, 2005.

Site	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Score	Total Score
Maximum Possible Score	20	20	20	10	12	8	10	**100**
Lozier (Bixler) Drain	7	13	13	8	0	0	4	**45**

4.2.7 Environmental Impact Assessment

As already discussed, pond construction work has been proposed along the mainstem of Lozier (Bixler) Drain. Environmental considerations relevant to the proposed project include: wetlands; endangered, threatened, and rare (ETR) species; water quality; flooding; stream habitat; and stream biota. Pond construction along Lozier (Bixler) Drain can proceed with minimal impact to environmental factors. Although an endangered species survey was not conducted, the plant species documented in the Lozier (Bixler) Drain project area did not include any state-listed species. Additionally, the IDNR Division of Nature Preserves (DNP) Natural Heritage Database does not contain documentation of any ETR plant species in the Lozier (Bixler) Drain subwatershed. Additionally, no ETR animal species were documented during the biotic survey and no listed ETR fauna are included in the IDNR DNP Heritage Database. Since the proposed project will not impact the wetlands near the drain, it is assumed that these areas will continue to function as they have historically. Pond construction should lead to improved water quality in the stream and in Little Chapman Lake as bank erosion is slowed. Sediment and sediment-attached

pollutant loading rates will also be slowed. During construction, excavation and localized disturbance of the riparian zone has the potential to impair both water quality and habitat temporarily. However, these negative impacts will be short lived.

4.2.8 Unusual Physical and Social Costs

Unusual physical costs associated with design and construction of the project include: avoiding wetland areas and constructing a water control structure that minimized risk. Access areas will be located in areas away from wetlands and in areas that minimize disturbance to the riparian corridor. The risk association with the water control structure will be handled during the final design of the project.

4.2.9 Opinions of Probable Cost and Proposed Time Line

The opinion of probable cost for the design of the pond project is $28,000 (Table 8).

Table 8. Opinion of probable cost for pond design at the Lozier (Bixler) Drain project site.

Item	Total Cost
Administrative services/Project management	$4,080
Survey	$4,200
Soil borings	$2,400
Draft and final design and design plans	$9,120
Permitting	$5,400
Subtotal	**$25,200**
Contingency	$2,800
Total	**$28,000**

The Chapman Lakes Conservation Association applied for design funding through the LARE program in early 2006. If the grant is awarded, services should be contracted for the design project in late 2006. Design of the project should be completed in the winter of 2006-2007 with project construction funding applications sought early in 2007. The project should be completed by early 2008.

4.3 Erosion Control Structure Replacement, Lozier Drain, Deatsman Property

4.3.1 Site Description and Alternatives

The erosion control structure replacement project site is located along the southeastern side of Little Chapman Lake northeast of the intersection of County Road 200 North and County Road 300 East (Figure 3). Specifically, this project site is located immediately upstream of Reiff's property along Bixler Drain (northern branch of Lozier Drain; Figure 12). As described above, the Bixler Drain portion of the Lozier Drain subwatershed drains 409 acres (165.5 ha). Lozier (Bixler) Drain is a legal drain from its headwaters to its intersection with County Road 300 East. This means that the Kosciusko County Surveyor's office can collect ditch assessment fees along this portion of the drain in order to maintain proper drainage. Additionally, any work completed on this portion of the drain must be completed under the jurisdiction of the Kosciusko County Surveyor.

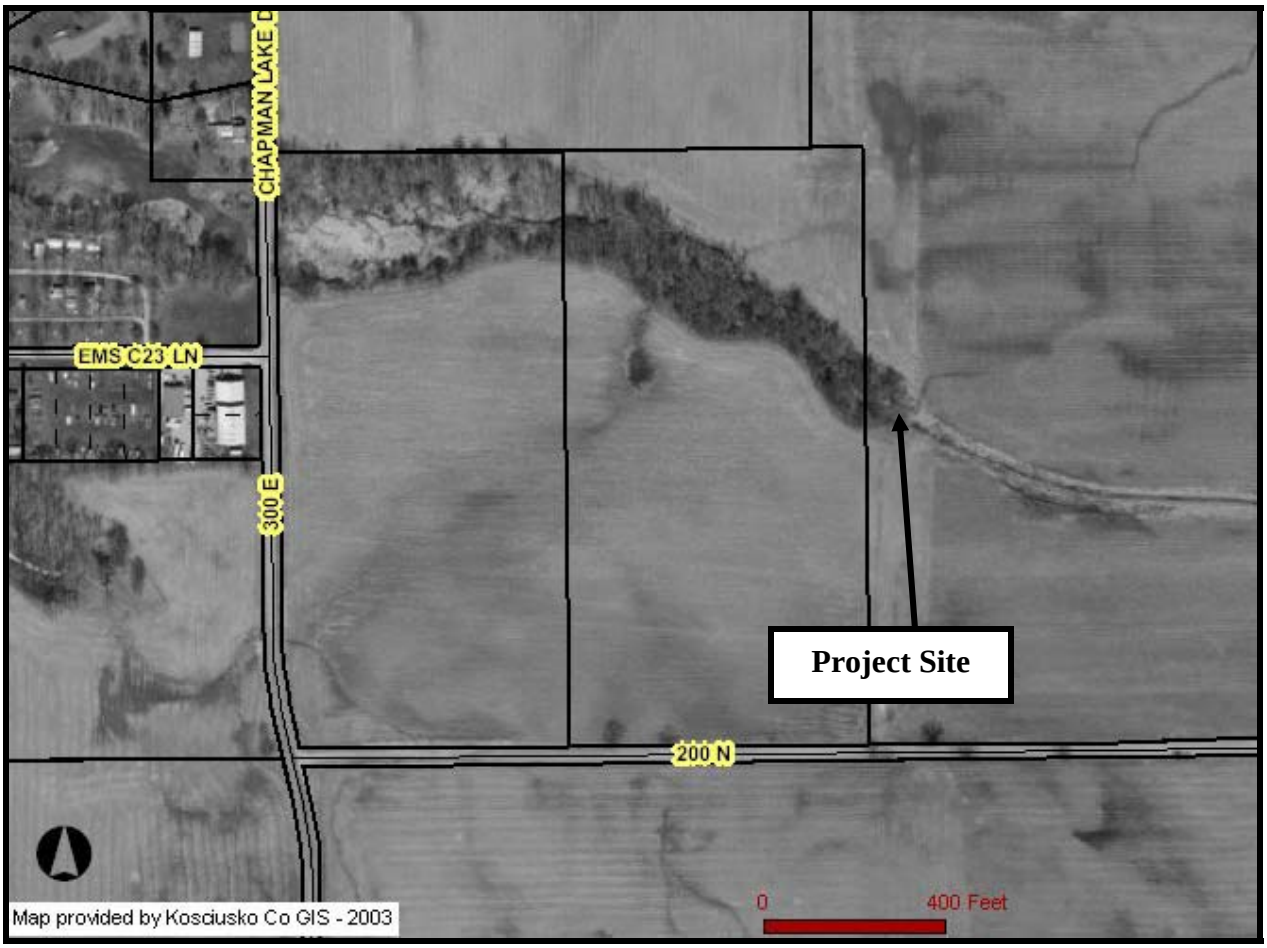

Figure 12. Aerial photograph of the erosion control structure replacement site, Lozier (Bixler) Drain.

The area assessed during the current feasibility study includes the western edge of the Deatsman property (Figure 12). A concrete toe drop spillway structure was installed at this location in 1990 (NRCS file records). This structure was designed to reduce the stream's gradient thereby slowing the velocity of water moving through Lozier (Bixler) Drain and reducing the potential for movement of sediment and attached nutrients to Little Chapman Lake. Over the past 15 years, the structure has become unstable due to runoff eroding around the structure and undercutting the left (downstream) headwall. (Appendix A contains representative photographs of the project site.) The south end of this headwall (left downstream) has dropped over 1.2 feet compared to the elevation of the right (downstream) headwall. In total, the structure's weir dropped in elevation more than 0.5 feet. When the structure shifted and dropped in elevation, cracks developed at some of the joints. The steel reinforcement pieces (rebar) are still holding the structure together; however, the stress from the shifting concrete is likely depleting the rebar's ability to maintain the structure's form. Based on the erosion, shifting, and cracking, the drop wall structure is no longer functioning as planned and designed. Furthermore, a large gully has formed around the left (downstream) headwall and is starting to work its way up into the adjacent waterway. If this structure is not repaired or replaced, then the erosion of the waterway and around the existing structure will continue and sediment and sediment-attached nutrients will continue loading to Little Chapman Lake.

Replacement of the structure is the ultimate recommendation for this project site. However, repair of the structure was completed during the summer of 2005. This repair included the installation of rock around the existing concrete structure in hopes of extending the lifetime of the remaining concrete. Areas of erosion adjacent to the structure were resloped, seeded, and blanketed. (Photographs of the temporary repair are included in Appendix A.) This repair is considered temporary; however, the rock may provide enough stability to reduce erosion from this project site. The site should continue to be monitored for erosion and structure instability. If the repaired structure becomes unstable, the structure should be replaced.

4.3.2 Easement and Land Availability Determination

The Lozier (Bixler) Drain structure replacement project site is located entirely on the Deatsman property. Mr. Deatsman has agreed to the conceptual plan of restoring the concrete structure on his property. A copy of this agreement is included in Appendix B. Mr. Deatsman further agreed to the temporary repair of the structure. The CLCA should continue to work with Mr. Deatsman to monitor structural stability and erosion from this area. If the structure becomes unstable, it should be replaced.

4.3.3 Preliminary Design and Conceptual Drawings

The preliminary design includes the replacement of the structure upstream. The new structure will mimic the design of the original structure constructed in 1990 (Figure 13). This structure was originally designed to carry the 10-year 24-hour storm event which is 4 inches of rain. The adjacent emergency spillway was designed to carry the additional water from the 25-year 24-hour storm event. In total, the new structure will possess a 4 foot over-fall, 8 foot by 8 foot box with concrete apron, and 14 foot headwalls extending approximately 2.5 feet above the weir.

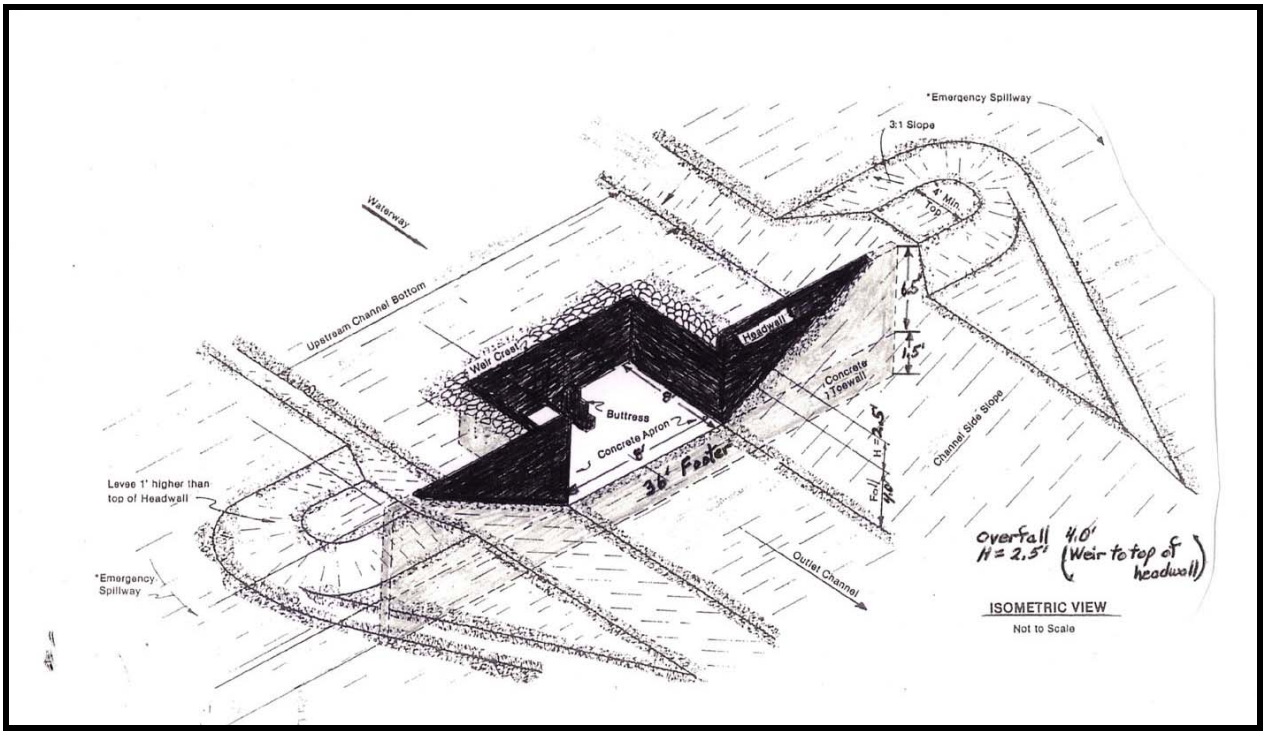

Figure 13. Conceptual design for the replacement of the concrete structure on the Deatsman property.

4.3.4 Permit Requirements
Projects associated with Lozier (Bixler) Drain will require a permit from the Kosciusko Country Drainage Board since the stream is a legal drain. No other permits are required for this project.

4.3.5 Wetland Functional Assessment
No wetlands are located at or adjacent to the project site.

4.3.6 Biological and Habitat Integrity Survey
A separate biological and habitat survey was not completed for the Deatsman project. Refer to the findings detailed in Section 4.2.6 for information on the Lozier (Bixler) Drain.

4.3.7 Environmental Impact Assessment
As already discussed, replacement of the concrete structure has been proposed along the mainstem of Lozier (Bixler) Drain. Environmental considerations relevant to the proposed project include: wetlands; endangered, threatened, and rare (ETR) species; water quality; flooding; stream habitat; and stream biota. Structure replacement along Lozier (Bixler) Drain can proceed with minimal impact to environmental factors. Although an endangered species survey was not conducted, the plant species documented in the Lozier (Bixler) Drain project area did not include any state-listed species. Additionally, the IDNR Division of Nature Preserves (DNP) Natural Heritage Database does not contain documentation of any ETR plant species in the Lozier (Bixler) Drain subwatershed. Additionally, no ETR animal species were documented during the biotic survey and no listed ETR fauna are included in the IDNR DNP Heritage Database. Since there are no wetlands located near the drain, there will be no impacts to wetlands during the completion of this project. Structure replacement should lead to improved water quality in the stream and in Little Chapman Lake as bank erosion is slowed. Sediment and sediment-attached pollutant loading rates will also be slowed. During construction, excavation and localized disturbance of the riparian zone has the potential to impair both water quality and habitat temporarily. However, these negative impacts will be short lived.

4.3.8 Unusual Physical and Social Costs
Unusual physical costs associated with the construction of the project include: disposal of the old concrete and steel structure and negative impacts to adjacent farm fields. Access areas will be located in areas that will minimize disturbance to the agricultural field. The concrete will be hauled off-site and recycled, if possible.

4.3.9 Opinions of Probable Cost and Proposed Time Line
The opinion of probable cost for the design of the structure replacement project is $18,000 (Stanger Excavating, personal communication). The temporary structural repair was made in the summer of 2005 for $2,500. (See Appendix A for photographs of the site following the repair.) If this repair continues to maintain the structure, then no additional work is recommended for this structure at this time. However, the structure should continue to be inspected on an annual basis and after rain events totaling 1 inch or greater for structural and erosion issues. If the structure does not hold, then the CLF or CLCA should apply for design/build funding through the LARE program.

4.4 Channel Stabilization, Lozier Drain, Gilliam Property

4.4.1 Site Description and Alternatives

The channel stabilization project site is located along the southern side of Little Chapman Lake northwest of the intersection of County Road 200 North and County Road 300 East (Figure 3). Specifically, this project site is located within the agricultural field immediately upstream of the wooded corridor through which the Gilliam Branch of Lozier Drain (northern branch of Lozier Drain; Figure 14) flows. The Gilliam Drain portion of the Lozier Drain subwatershed drains 875 acres (354.1 ha). Lozier (Gilliam) Drain is a legal drain from its headwaters to its intersection with County Road 300 East. This means that the Kosciusko County Surveyor's office can collect ditch assessment fees along this portion of the drain in order to maintain proper drainage. Additionally, any work on this portion of the drain must be completed under the jurisdiction of the Kosciusko County Surveyor.

Figure 14. Aerial photograph of the erosion control structure replacement site, Lozier (Gilliam) Drain.

The reach assessed during the current feasibility study includes approximately 650 lineal feet of Lozier (Gilliam) Drain (Figure 14). The downstream portion of the project site consists of perennial stream channel fed by agricultural drainage tiles upstream and overland flow from 36 acres. Soils nearest the creek are loams and sandy loams. Minor areas of erosion are present along the length of the stream from the culvert to the open drain at the downstream edge of the assessed reach. (Appendix A contains representative photos of the project site.) Also of concern

is the erosion occurring around and downstream of a tile line which delivers water to the mainstem of Lozier (Gilliam) Drain.

There are several alternatives for channel stabilization along this reach of Lozier (Gilliam) Drain. The best and most feasible option includes a combination of the installation of a rock outfall at the culvert outlet at County Road 300 East, a grassed waterway along the length of the open channel, and a rock chute with tile riser at the downstream end of the reach (Figure 15).

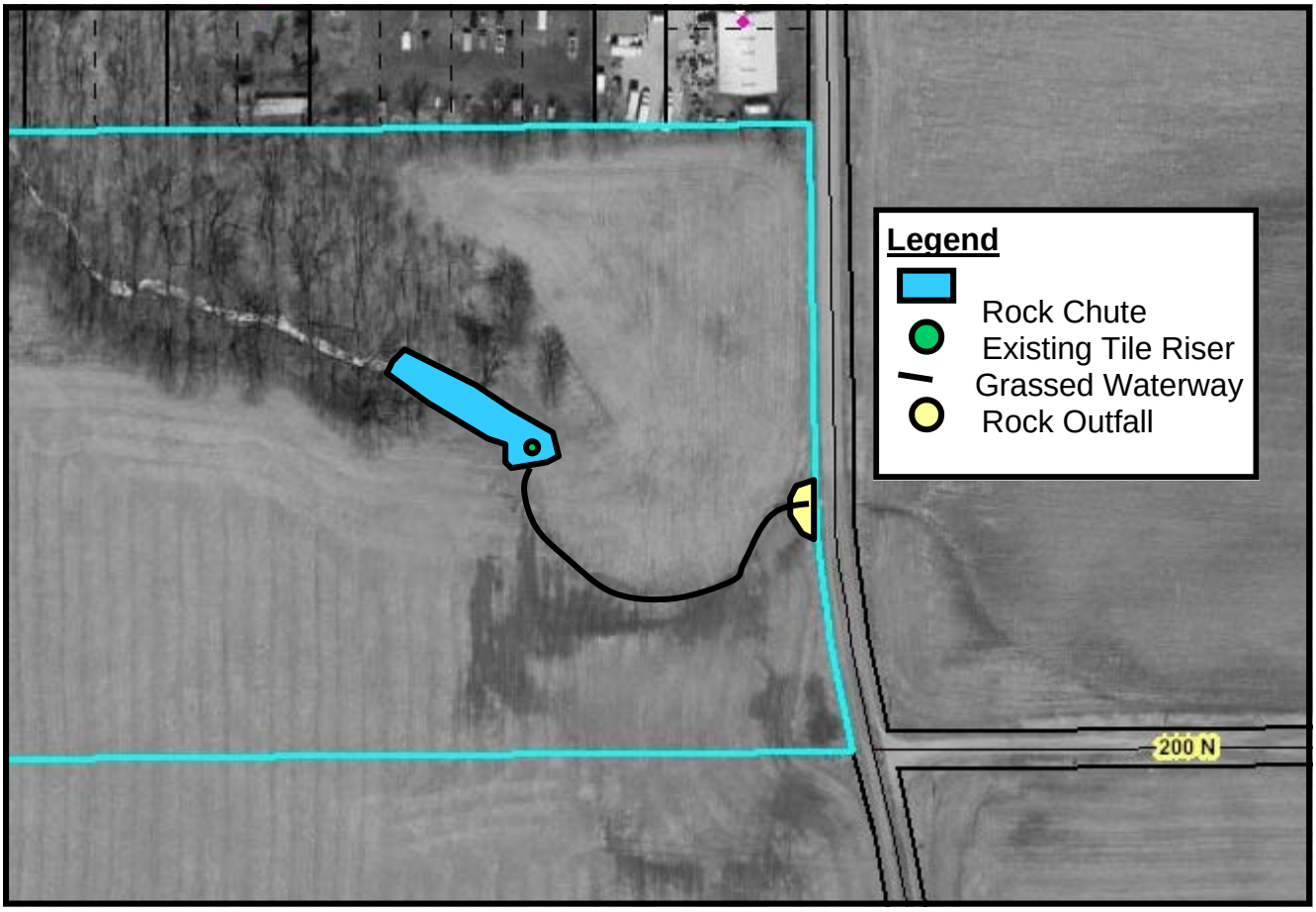

Figure 15. Conceptual design for the channel stabilization project along the Lozier (Gilliam) Drain.

4.4.2 Easement and Land Availability Determination

The Lozier (Gilliam) Drain channel stabilization project site is located entirely on the Gilliam property. Mr. Gilliam has verbally agreed to the conceptual plan of installing a rock chute, rock outfall, and grassed waterway on his property. A written agreement will be obtained from Mr. Gilliam prior to any application for grant funding.

4.4.3 Preliminary Design and Conceptual Drawings

Channel stabilization of Lozier (Gilliam) Drain will consist of the installation of a rock outfall, grassed waterway, and rock chute with tile riser. The rock outfall would be sized to dissipate water flow, but maintain its structure. For that reason, 6-inch riprap will be used as an outfall. The rock chute will be constructed from 6-inch riprap placed 1 to 1.5 feet thick along the length

of the existing tile line. Figures 16 and 17 depict a typical cross section and plan view of a rock chute. The surrounding landscape will be regraded to match the new grade of the installed chute, which will confine the flow of the water and eliminate the gully erosion that is now occurring.

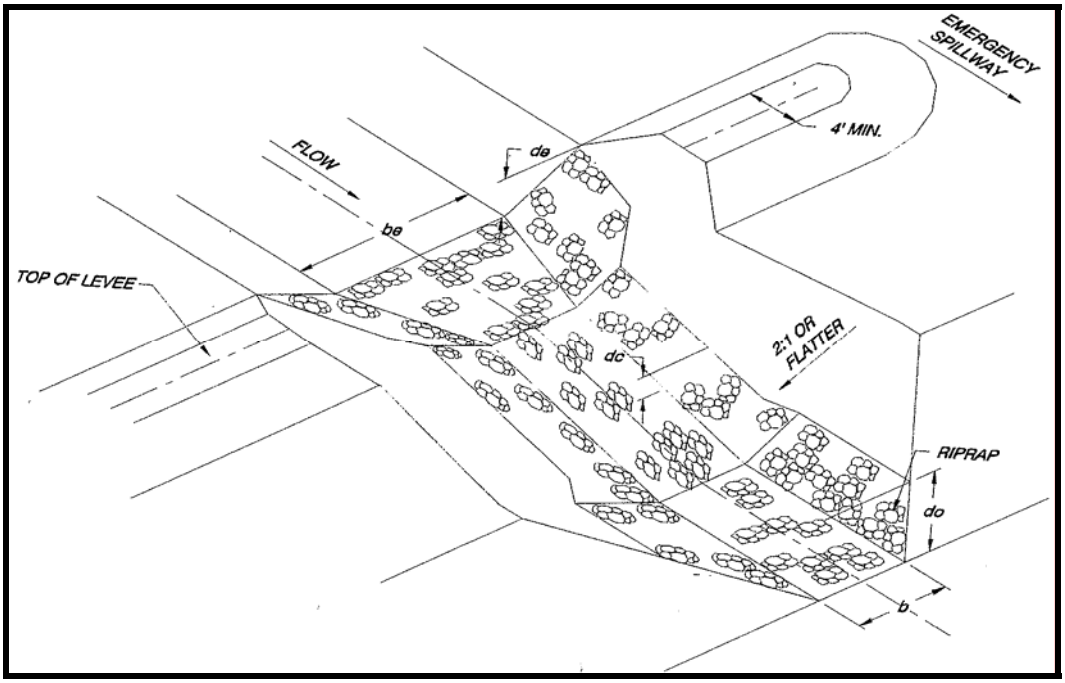

Figure 16. Typical rock chute plan view.

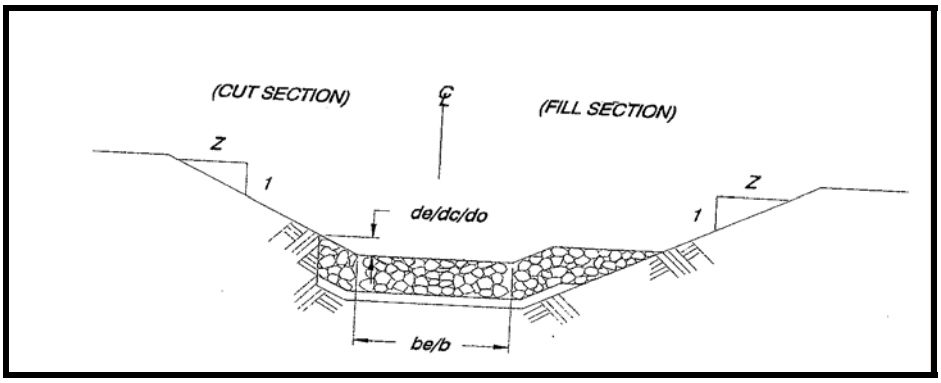

Figure 17. Typical rock chute cross section view.

4.4.4 Permit Requirements

No permits are required for this project.

4.4.5 Wetland Functional Assessment

No wetlands are located within the vicinity of the project site; therefore, no wetland impacts will occur in association with this project.

4.4.6 Biological and Habitat Integrity Survey

On August 1, 2005, JFNew surveyed the macroinvertebrate community of Lozier (Gilliam) Drain using the multihabitat approach detailed in the U.S. Environmental Protection Agency

Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd edition (Barbour et al., 1999). This method was supplemented by qualitative picks from substrate and by surface netting. Using data collected during this survey, JFNew calculated IDEM's macroinvertebrate Index of Biotic Integrity (mIBI) (IDEM, unpublished). IDEM's mIBI is a multi-metric index designed to provide a complete assessment of a stream's biological integrity. Karr and Dudley (1981) define biological integrity as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region."

The mIBI is designed to assess biotic integrity directly through ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff's Family Biotic Index), number of taxa, number of individuals, percent dominant taxa, EPT index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. (EPT stands for the *Ephemeropteran*, *Plecopteran*, and *Trichopteran* orders.) After data from sampling sites have been collected, values for the ten metrics are compared with corresponding ranges and a rating of 0, 2, 4, 6, or 8 is assigned to each metric. The average of these ratings gives a total mIBI score, the best possible of which is 8.0. Macroinvertebrate communities in streams scoring less than 2 are considered severely impaired; these streams are rated by IDEM as non-supporting for their aquatic life use designation. Macroinvertebrate communities in streams scoring from 2 to 4 are considered moderately impaired and the associated streams are rated by IDEM as partially supporting their aquatic life use designation. Macroinvertebrate communities scoring from 4 to 6 and from 6 to 8 are rated as slightly impaired and non-impaired, respectively. These streams are designated as fully supporting of their aquatic life use designation as determined by IDEM.

Table 10 contains data from the biotic assessment of Lozier (Gilliam) Drain conducted on August 1, 2005; data sheets are included in Appendix C. The mIBI score calculated for Lozier (Gilliam) Drain (0.6) indicates that the macroinvertebrate community was severely impaired. Furthermore, the score suggests that IDEM would consider the stream to be non-supporting for its aquatic life use designation at the time of sampling. The most abundant macroinvertebrates at this site were members of the moderately pollution tolerant *Dipteran* family *Chironomidae*. A high HBI score; low density (number of individuals) and diversity (number of taxa); lack of high quality taxa from the mayfly, stonefly, and caddisfly families; and a dominance (61.7%) of the *Dipteran* family *Chironomidae* characterize the macroinvertebrate community along this reach of Lozier (Gilliam) Drain.

Habitat was also evaluated on August 1, 2005 using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin, 1989 and 1995). While the Ohio EPA originally developed the QHEI to evaluate fish habitat in streams, IDEM and other agencies routinely utilize the QHEI as a measure of general "habitat" health. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrate; amount and quality of in-stream cover; channel morphology; extent and quality of riparian vegetation; pool, riffle, and run development and quality; and gradient are the metrics used to determined the

QHEI score. Each metric is scored individually then summed to provide the total QHEI score. QHEI scores typically range from 20 to 100.

Table 9 mIBI Scores for the Lozier (Gilliam) Drain assessment reach as sampled August 1, 2005.

Metric	Value	Metric Score
HBI	5.4	2
Number of Taxa	6.0	0
Number of Individuals	34.0	0
Percent Dominant Taxa	0.6	0
EPT Index	0.0	0
EPT Count	0.0	0
EPT Count/Total Count	0.0	0
EPT Abundance/Chironomid Abundance	0.0	0
Total Number of Individuals per Square Sorted	0.4	0
Chironomid Count	21.0	4
mIBI Score		**0.6**
Integrity Class		**Severely Impaired**

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio indicate that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 typify conditions that have the ability to support exceptional warmwater faunas (Ohio EPA, 1999). IDEM indicates that QHEI scores above 64 suggest that the habitat is capable of supporting a balanced warmwater community; scores between 51 and 64 are only partially supportive of a stream's aquatic life use designation, while scores less than 51 are considered non-supporting for the stream's aquatic life use designation (IDEM, 2000).

QHEI metric scores are listed in Table 11 with datasheets in Appendix C. The Lozier (Gilliam) Drain sampling reach received a QHEI score of 54 indicating that the stream habitat is partially supporting of its aquatic life use designation. The overall QHEI score indicates that habitat may be one factor impairing aquatic life in the creek. The limited pool and riffle development, lack of instream cover, and generally poor substrate characterize the habitat at this reach. Scores for pool development (4 of 12), riffle development (1 of 8), instream cover (11 of 20), and substrate quality (7 of 20) were below those observed in streams with exceptional habitat. This lack of habitat likely contributes to depressed mIBI scores within Lozier (Gilliam) Drain.

Table 10. QHEI Scores for the Lozier (Gilliam) Drain assessment reach as sampled August 1, 2005.

Site	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Score	Total Score
Maximum Possible Score	20	20	20	10	12	8	10	**100**
Lozier (Gilliam) Drain	7	11	18	9	4	1	4	**54**

4.4.7 Environmental Impact Assessment

As already discussed, channel stabilization has been proposed along the mainstem of Lozier (Gilliam) Drain. Environmental considerations relevant to the proposed project include: wetlands; endangered, threatened, and rare (ETR) species; water quality; flooding; stream habitat; and stream biota. Channel stabilization along Lozier (Gilliam) Drain can proceed with minimal impact to environmental factors. Although an endangered species survey was not conducted, the plant species documented in the Lozier (Gilliam) Drain project area did not include any state-listed species. Additionally, the IDNR Division of Nature Preserves (DNP) Natural Heritage Database does not contain documentation of any ETR plant species in the Lozier (Gilliam) Drain subwatershed. Additionally, no ETR animal species were documented during the biotic survey and no listed ETR fauna are included in the IDNR DNP Heritage Database. Since there are no wetlands located near the drain, there will be no impacts to wetlands during the completion of this project. Channel stabilization should lead to improved water quality in the stream and in Little Chapman Lake as erosion and sediment and sediment-attached pollutant loading rates are slowed. During construction, excavation and localized disturbance of the riparian zone has the potential to impair both water quality and habitat temporarily. However, these negative impacts will be short lived.

4.4.8 Unusual Physical and Social Costs

There are no unusual physical or social costs associated with this project.

4.4.9 Opinions of Probable Cost and Proposed Time Line

The opinion of probable cost for the design of the channel stabilization project is $29000 (Table 9).

Table 11Opinion of probable cost for channel stabilization Lozier (Gilliam) Drain project site.

Item	Total Cost
Design fees	$8,000
Mobilization/Demobilization	$2,000
Rock	$6,100
Installation	$5,000
Project management/Administration	$2,100
Subtotal	**$23,200**
Contingency (25%)	$5,800
Total	**$29,000**

The Chapman Lakes Conservation Association should apply for design/build funding through the LARE program in early 2007. If the grant is awarded, services should be contracted for the

design project in late 2007. Design of the project should be completed in the winter of 2007-2008. The project should be completed by early 2008.

5.0 Recommendations

1) Apply for a LARE grant in 2006 for the design and construction of recommended channel stabilization along Highland Drain. Begin construction of the projects in the spring of 2007 or once funding becomes available.

2) Apply for a LARE design grant in January of 2006 for the pond construction project along Lozier (Bixler) Drain. Begin design work in the fall of 2006 and construction in the summer of 2007.

3) Continue to monitor the concrete structure at the Deatsman property to determine its stability. Special attention should be paid to this structure following any rain event of 1 inch or greater. If the structure does not maintain its stability, then apply for design and construction funding through the LARE program to replace this structure.

4) Apply for design and construction funding in 2007 for the channel stabilization project along Lozier (Gilliam) Drain. Begin design work in the fall of 2007 and construction in the summer of 2008.

5) Establish a dialog with the Natural Resources Conservation Service (NRCS) office and the landowners of various parcels where BMPs and wetland restoration were recommended from the watershed tour. A long-term, trusting relationship with these landowners may result in conservation and/or restoration project implementation.

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APPENDIX A

PROJECT PHOTOGRAPHS

LOZIER AND HIGHLAND PARK DRAINS
ENGINEERING FEASIBILITY STUDY

KOSCIUSKO COUNTY, INDIANA

Bank and bed erosion-Slater Property
Lozier/Highland Park Drains Engineering Feasibility Report
Kosciusko County, Indiana

JFNA# 99-04-01-06

Streambank erosion and future pond site-Reiff Property
Lozier and Highland Park Drains Engineering Feasibility Report
Kosciusko County, Indiana

JFNA# 99-04-01-06

Erosion around and adjacent to erosion control structure-Deatsman Property
Lozier and Highland Park Drains Engineering Feasibility Report
Kosciusko County, Indiana

JFNA# 99-04-01-06

APPENDIX B

COMMUNICATION WITH PROPERTY OWNERS

LOZIER AND HIGHLAND PARK DRAINS
ENGINEERING FEASIBILITY STUDY

KOSCIUSKO COUNTY, INDIANA

JFNew
From Native Seed to Ecological Solutions

708 Roosevelt Road
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Fax: 574-586-3446

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Aquatic Ecologist
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Crete, Illinois

Indianapolis, Indiana

Grand Haven, Michigan

Cincinnati, Ohio

Madison, Wisconsin

Native Plant Nursery:
Walkerton, Indiana

www.jfnew.com

6 June 2005

Max Deatsman
1172 E. Armstrong Road
Leesburg, Indiana 46538

Dear Mr. Deatsman:

Please recall your conversation earlier this year with Mr. Wayne Stanger from our office. As Wayne mentioned, JFNew is working with the Chapman Lakes Conservation Association (CLCA) to complete an engineering feasibility study. The purpose of the project is to address the feasibility of implementing erosion control projects in the Lozier Drain and Highland Park Drain Subwatersheds.

As you discussed with Wayne, we are proposing the replacement of the existing concrete drop structure installed by the NRCS in 1990. The existing concrete toe wall drop spillway structure was originally installed to reduce the grade and velocity of runoff and protect the grassed waterway installed upstream of the structure.

Unfortunately, over the past 15 years the structure has fallen into disrepair. The south end of the west sidewall is now 1.2 feet lower than the south end of the right sidewall and the weir which controls the flow of water is now 0.4 feet lower than when it was originally constructed. Additional cracks in the concrete structure and at the joints have likely stressed the steel reinforcement pieces. A large gully has also formed around the west sidewall and gully erosion is beginning to work its way up the grassed waterway upstream of the structure. For these reasons, we are proposing to remove the existing structure and reconstruct it to the correct size and specifications. Please see the enclosed figure for a conceptual design of the new concrete structure.

We also propose the installation of two water and sediment control basins (WASCOB) to reduce erosion from the tile outlets upstream of the structure on your property. WASCOBs are designed to trap sediment and runoff, reduce flooding and gully erosion, and improve the ability to farm the associated field. The enclosed figure provides a conceptual drawing of the WASCOB concept.

If you agree with this concept plan for the structure replacement/WASCOB installation project, then please sign below and return a copy to me in the envelope provided. Signing this supports our efforts to obtain additional grant money for design and construction funding. We do not plan on requesting any financial assistance from you to complete this project. We welcome any suggested changes you might have at this time, so please feel free to write comments on the draft plan and return them to me. Please call me if you have any immediate concerns or questions. Thank you for your consideration.

Thank you for your consideration.

Sincerely,

Sara Peel
Project Manager

Max E. Deatsman
I agree with the above concept plan.

cc. Dan Lee
Don Spitler
JFNew file #99-04-01-06

JFNew
From Native Seed to Ecological Solutions

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3 October 2005

Jim Reiff
2242 N. 650 E.
Warsaw, Indiana 46582

Dear Mr. Reiff:

As requested by your family/Michael Reiff, we investigated the potential for the construction of a pond on this property located upstream of County Road 300 East along the northern branch of Lozier Drain. Based on field borings completed by Ron Eads in July 2005, the area of interest will hold water and a pond could be constructed within this location. Furthermore, a wetland determination completed by JFNew located two wetlands within Lozier Drain's floodplain. However, a water control structure can be placed upstream of these wetlands which will allow for the creation of a pond within property owned by Reiffs. Enclosed is a map which depicts is the proposed location of the water control structure construction and the pond that would result. Also shown on this figure are the locations of wetlands included on the site.

Funding for the final designs would not be available until July 2006. Final design will occur with your consultation between August 2006 and January 2007. Funding for construction would be available on or around July 2007 and construction could occur anytime after September 2007.

If you agree with this concept plan for the pond project, then please sign below and return a copy to me in the envelope provided. Signing this supports our efforts to obtain additional grant money for design and construction funding. We do not plan on requesting any financial assistance from you to complete this project. We welcome any suggested changes you might have at this time, so please feel free to write comments on the draft plan and return them to me. Please call me if you have any immediate concerns or questions. Thank you for your consideration.

Thank you for your consideration.

Jim Reiff
I agree with the above concept plan.

Sincerely,

Sara Peel
Project Manager

cc. Dan Lee
Don Spitler
JFNew file #99-04-01-06

JFNew
Wise Growth Through Stewardship

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November 11, 2004

Greg Slater
3028 E. 250 N.
Warsaw, Indiana 46580

Dear Greg:

As you are aware, JFNew is working with the Chapman Lakes Foundation (CLF) to complete an engineering feasibility study on the Highland Park Drain subwatershed. The goal of this project is to improve water quality in the Chapman Lakes. We are proposing the use of rock grade controls or check dams to stabilize the stream channel and reduce stream bed and bank erosion. The check dams would cause water to pool behind the dams and reduce the velocity of water moving through the channel. Over time, sediment would be deposited in the pooled areas and reduce the streams gradient along the "nick points". This, in turn, would reduce the erosion that was occurring in the ravine.

If you, the Chapman Lakes Foundation, and the regulatory agencies approve of the concept, the Chapman Lakes Foundation is planning to include your project in the final engineering feasibility study report. Your input would definitely be sought when it comes to the actual design work. If you approve of the conceptual design for the installation of check dams on Highland Park Drain, please sign below and return in the included postage-paid envelope. Upon your approval, the CLF will prioritize the project for final design and construction funding during the next grant cycle.

Please contact me directly should you have any questions pertaining to this project and its scope at (574) 586-3400 or speel@jfnew.com. We are more than happy to address any concerns you might have. Thank you for helping us assist the Chapman Lakes Foundation in their goals to reduce pollutant loading into the Little Chapman Lake.

Thank you for your consideration.

Sincerely,

Sara Peel
Project Manager

cc. Dan Lee, Chapman Lakes Foundation
JFNew file #99-04-01/06

I approve of the conceptual design for the installation of check dams at Highland Park Drain understand that the Chapman Lakes Foundation and/or its contractor will contact me again during the design portion before construction is initiated.

JFNew
From Native Seed to Ecological Solutions

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7 October 2005

Michael Gilliam
2806 E. 175 N.
Warsaw, Indiana 46580

Dear Mr. Gilliam:

Please recall your conversation earlier this year with Mr. Wayne Stanger from our office. As Wayne mentioned, JFNew is working with the Chapman Lakes Conservation Association (CLCA) to complete an engineering feasibility study. The purpose of the project is to address the feasibility of implementing erosion control projects in the Lozier Drain and Highland Park Drain Subwatersheds.

We are proposing to place a rock chute along William Gilliam Drain from the existing tile riser northwest along the existing tile line to the open channel of Lozier Drain. Conceptually, the rock chute would be constructed from 6-inch riprap placed 1 to 1.5 feet thick along the length of the existing tile as indicated on the enclosed drawing. The surrounding landscape will be regraded to match the new grade of the installed chute. This chute would confine the flow of the water and eliminate the gully erosion that is now occurring.

Additionally, we propose the installation of a grassed waterway along the length of the channel. The grassed waterway would extend from the outfall at County Road 300 East to the edge of the new rock chute near the existing tile riser. This will remove some of your farm ground from production; however, the Conservation Reserve Program provides payment of approximately $85 per acre for a minimum 10 year contract. If you would prefer to continue farming this area, we recommend the installation of a rock outfall immediately west of County Road 300 East. This outfall would reduce the velocity of stormwater moving through the drain and across your farm field, thereby limiting the volume of sediment washed off of your field.

If you agree with this concept plan for the rock chute and grassed waterway or rock outfall project, then please sign below and return a copy to me in the envelope provided. Signing this supports our efforts to obtain additional grant money for design and construction funding. We do not plan on requesting any financial assistance from you to complete this project. We welcome any suggested changes you might have at this time, so please feel free to write comments on the draft plan and return them to me. Please call me if you have any immediate concerns or questions. Thank you for your consideration.

Thank you for your consideration.

Sincerely,

Sara Peel
Project Manager

cc. Dan Lee
Don Spitler
→ JFNew file #99-04-01-06

_____
I agree with the above concept plan.

APPENDIX C

BIOTIC ASSESSMENT

LOZIER AND HIGHLAND PARK DRAINS
ENGINEERING FEASIBILITY STUDY

KOSCIUSKO COUNTY, INDIANA

STREAM: Highland Park Drain **RIVER MILE:** _____ **DATE:** 8/1/2005 **QHEI SCORE** 24

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present)

SUBSTRATE SCORE 1

TYPE			POOL	RIFFLE				POOL	RIFFLE
		BLDER/SLAB(10)					GRAVEL(7)		
		BOULDER(9)					SAND(6)	X	X
		COBBLE(8)					BEDROCK(5)		
		HARDPAN(4)					DETRITUS(3)	X	X
		MUCK/SILT(2)					ARTIFIC(0)	X	X

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrat

SUBSTRATE ORIGIN (all)

- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)

- [ ] SILT-HEAVY(-2)
- [ ] SILT-MOD(-1)
- [X] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)

- [ ] EXTENSIVE(-2)
- [ ] MODERATE(-1)
- [X] LOW(0)
- [ ] NONE(1)

COMMENTS:

2) INSTREAM COVER:

COVER SCORE 8

TYPE (Check all that apply)

- [ ] UNDERCUT BANKS(1)
- [X] OVERHANGING VEGETATION(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [ ] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [ ] AQUATIC MACROPHYTES(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- [X] EXTENSIVE >75%(11)
- [ ] MODERATE 25-75%(7)
- [X] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS:

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE)

CHANNEL SCORE 6

SINUOSITY

- [ ] HIGH(4)
- [ ] MODERATE(3)
- [ ] LOW(2)
- [X] NONE(1)

DEVELOPMENT

- [ ] EXCELLENT(7)
- [ ] GOOD(5)
- [ ] FAIR(3)
- [X] POOR(1)

CHANNELIZATION

- [ ] NONE(6)
- [ ] RECOVERED(4)
- [ ] RECOVERING(3)
- [X] RECENT OR NO RECOVERY(1)

STABILITY

- [X] HIGH(3)
- [ ] MODERATE(2)
- [ ] LOW(1)

MODIFICATION/OTHER

- [ ] SNAGGING
- [ ] RELOCATION
- [X] CANOPY REMOVAL
- [ ] DREDGING
- [ ] ONE SIDE CHANNEL MODIFICATION
- [ ] IMPOUND
- [ ] ISLAND
- [ ] LEVEED
- [X] BANK SHAPING

COMMENTS:

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

RIPARIAN SCORE 5

River Right Looking Downstream

RIPARIAN WIDTH (per bank)

L	R	(per bank)
		WIDE >150 ft.(4)
		MODERATE 30-150 ft.(3)
		NARROW 15-30 ft.(2)
X	X	VERY NARROW 3-15 ft.(1)
		NONE(0

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)	L	R	(per bank)
		FOREST, SWAMP(3)			URBAN OR INDUSTRIAL(0)
		OPEN PASTURE/ROW CROP(0)			SHRUB OR OLD FIELD(2)
X	X	RESID.,PARK,NEW FIELD(1)			CONSERV. TILLAGE(1)
		FENCED PASTURE(1)			MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X	X	NONE OR LITTLE(3)
		MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS:

5) POOL/GLIDE AND RIFFLE/RUN QUALITY

NO POOL = 0 **POOL SCORE** 0

MAX.DEPTH (Check 1)

- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- [ ] TORRENTIAL(-1)
- [ ] FAST(1)
- [ ] MODERATE(1)
- [ ] SLOW(1)
- [ ] EDDIES(1)
- [ ] INTERSTITIAL(-1)
- [ ] INTERMITTENT(-2)

COMMENTS: No pools

RIFFLE SCORE 0

RIFFLE/RUN DEPTH

- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [X] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [X] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- [ ] EXTENSIVE(-1)
- [ ] MODERATE(0)
- [ ] LOW(1)
- [ ] NONE(2)
- [X] NO RIFFLE(0)

COMMENTS: No riffles

6) GRADIENT (FEET/MILE): 68 **% POOL** **% RIFFLE** **% RUN** 100% **GRADIENT SCORE** 4

Conducted by: JFNew
Project Number: 99-04-01-06

STREAM: Lozier (Bixler) Drain **RIVER MILE:** _____ **DATE:** 8/1/2005 **QHEI SCORE** 45

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present)

SUBSTRATE SCORE 7

TYPE			POOL	RIFFLE					POOL	RIFFLE
		BLDER/SLAB(10)					GRAVEL(7)			
		BOULDER(9)			X		SAND(6)	X	X	
		COBBLE(8)					BEDROCK(5)			
		HARDPAN(4)					DETRITUS(3)			
	X	MUCK/SILT(2)	X	X			ARTIFIC(0)			

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrat

SUBSTRATE ORIGIN (all)

- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)

- [ ] SILT-HEAVY(-2)
- [ ] SILT-MOD(-1)
- [X] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)

- [X] EXTENSIVE(-2)
- [ ] MODERATE(-1)
- [ ] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER:

COVER SCORE 13

TYPE (Check all that apply)

- [ ] UNDERCUT BANKS(1)
- [X] OVERHANGING VEGETATION(1)
- [X] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [ ] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [ ] AQUATIC MACROPHYTES(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- [X] EXTENSIVE >75%(11)
- [ ] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE)

CHANNEL SCORE 13

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATION/OTHER	
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[X] HIGH(3)	[ ] SNAGGING	[ ] IMPOUND
[X] MODERATE(3)	[ ] GOOD(5)	[X] RECOVERED(4)	[ ] MODERATE(2)	[ ] RELOCATION	[ ] ISLAND
[ ] LOW(2)	[X] FAIR(3)	[ ] RECOVERING(3)	[ ] LOW(1)	[X] CANOPY REMOVAL	[ ] LEVEED
[ ] NONE(1)	[ ] POOR(1)	[ ] RECENT OR NO RECOVERY(1)		[ ] DREDGING	[ ] BANK SHAPING
				[ ] ONE SIDE CHANNEL MODIFICATION	

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

RIPARIAN SCORE 8

River Right Looking Downstream

RIPARIAN WIDTH (per bank)

L	R	(per bank)
		WIDE >150 ft.(4)
X	X	MODERATE 30-150 ft.(3)
		NARROW 15-30 ft.(2)
		VERY NARROW 3-15 ft.(1)
		NONE(0

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)
		FOREST, SWAMP(3)
		OPEN PASTURE/ROW CROP(0)
		RESID.,PARK,NEW FIELD(1)
		FENCED PASTURE(1)

L	R	(per bank)
		URBAN OR INDUSTRIAL(0)
X	X	SHRUB OR OLD FIELD(2)
		CONSERV. TILLAGE(1)
		MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X	X	NONE OR LITTLE(3)
		MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY

NO POOL = 0 **POOL SCORE** 0

MAX.DEPTH (Check 1)

- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [X] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- [ ] TORRENTIAL(-1)
- [ ] EDDIES(1)
- [ ] FAST(1)
- [ ] INTERSTITIAL(-1)
- [ ] MODERATE(1)
- [ ] INTERMITTENT(-2)
- [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE 0

RIFFLE/RUN DEPTH

- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [X] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- [ ] EXTENSIVE(-1)
- [ ] NONE(2)
- [ ] MODERATE(0)
- [ ] NO RIFFLE(0)
- [ ] LOW(1)

COMMENTS: _____

6) GRADIENT (FEET/MILE): 65.7 **% POOL** **% RIFFLE** **% RUN** 100% **GRADIENT SCORE** 4

Conducted by: JFNew
Project Number: 99-04-01-06

STREAM: Lozier (Gilliam) Drain **RIVER MILE:** _____ **DATE:** 8/1/2005 **QHEI SCORE** 54

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present)

SUBSTRATE SCORE 7

TYPE			POOL	RIFFLE				POOL	RIFFLE
		BLDER/SLAB(10)					GRAVEL(7)	X	X
		BOULDER(9)					SAND(6)	X	X
	X	COBBLE(8)	X	X			BEDROCK(5)		
		HARDPAN(4)					DETRITUS(3)		
X		MUCK/SILT(2)	X	X			ARTIFIC(0)		

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrat

SUBSTRATE ORIGIN (all)

- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)

- [ ] SILT-HEAVY(-2)
- [X] SILT-MOD(-1)
- [ ] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)

- [X] EXTENSIVE(-2)
- [ ] MODERATE(-1)
- [ ] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER:

COVER SCORE 11

TYPE (Check all that apply)

- [X] UNDERCUT BANKS(1)
- [ ] OVERHANGING VEGETATION(1)
- [X] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [X] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [ ] AQUATIC MACROPHYTES(1)
- [X] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- [ ] EXTENSIVE >75%(11)
- [X] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE)

CHANNEL SCORE 18

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATION/OTHER	
[X] HIGH(4)	[ ] EXCELLENT(7)	[X] NONE(6)	[X] HIGH(3)	[ ] SNAGGING	[ ] IMPOUND
[ ] MODERATE(3)	[X] GOOD(5)	[ ] RECOVERED(4)	[ ] MODERATE(2)	[ ] RELOCATION	[ ] ISLAND
[ ] LOW(2)	[ ] FAIR(3)	[ ] RECOVERING(3)	[ ] LOW(1)	[ ] CANOPY REMOVAL	[ ] LEVEED
[ ] NONE(1)	[ ] POOR(1)	[ ] RECENT OR NO RECOVERY(1)		[ ] DREDGING	[ ] BANK SHAPING
				[ ] ONE SIDE CHANNEL MODIFICATION	

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

RIPARIAN SCORE 9

River Right Looking Downstream

RIPARIAN WIDTH (per bank)

L	R	(per bank)
	X	WIDE >150 ft.(4)
X		MODERATE 30-150 ft.(3)
		NARROW 15-30 ft.(2)
		VERY NARROW 3-15 ft.(1)
		NONE(0

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)
X	X	FOREST, SWAMP(3)
		OPEN PASTURE/ROW CROP(0)
		RESID.,PARK,NEW FIELD(1)
		FENCED PASTURE(1)

L	R	(per bank)
		URBAN OR INDUSTRIAL(0)
		SHRUB OR OLD FIELD(2)
		CONSERV. TILLAGE(1)
		MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X		NONE OR LITTLE(3)
	X	MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY

NO POOL = 0 **POOL SCORE** 4

MAX.DEPTH (Check 1)

- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [X] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- [X] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- [ ] TORRENTIAL(-1)
- [ ] FAST(1)
- [ ] MODERATE(1)
- [X] SLOW(1)
- [ ] EDDIES(1)
- [ ] INTERSTITIAL(-1)
- [ ] INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE 1

RIFFLE/RUN DEPTH

- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [X] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [X] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- [X] EXTENSIVE(-1)
- [ ] MODERATE(0)
- [ ] LOW(1)
- [ ] NONE(2)
- [ ] NO RIFFLE(0)

COMMENTS: _____

6) GRADIENT (FEET/MILE): 95.8 **% POOL** **% RIFFLE** **% RUN** 100% **GRADIENT SCORE** 4

Conducted by: JFNew
Project Number: 99-04-01-06

Scientific Name	W. Gilliam Drain	W. Bixler Drain
Ephemeroptera		
Potamanthidae		1
Coleoptera		
Dytiscidae	1	
Elmidae	1	9
Diptera		
Chironomidae	21	24
Tipulidae	1	
Other Arthropoda		
Gammaridae	9	
Gastropoda		
Physidae	1	
Platyhelminthes		
Hirudinea		5
Number of Individuals	34	39
Number of Taxa	6	4

William Gilliam Drain

		Metric Score
HBI	5.4	2
No. Taxa (family)	6.0	0
No. Individuals	34.0	0
% Dominant Taxa	0.6	0
EPT Index	0.0	0
EPT Count	0.0	0
EPT Count/Total Count	0.0	0
EPT Abun./Chir. Abun.	0.0	0
No. Indiv. Per Square	0.4	0
Chironomid Count	21.0	4
mIBI Score		0.6

William Bixler Drain

		Metric Score
HBI	5.4	2
No. Taxa (family)	4.0	0
No. Individuals	39.0	0
% Dominant Taxa	0.6	2
EPT Index	1.0	0
EPT Count	1.0	0
EPT Count/Total Count	0.0	0
EPT Abun./Chir. Abun.	0.0	0
No. Indiv. Per Square	0.5	0
Chironomid Count	24.0	4
mIBI Score		0.8

APPENDIX D

WETLAND DELINEATION DATASHEETS

LOZIER AND HIGHLAND PARK DRAINS
ENGINEERING FEASIBILITY STUDY

KOSCIUSKO COUNTY, INDIANA

DATA SHEET:
WETLAND DELINEATION

Project/Site:	Chapman Lake	Date:	9/2/2005
Client:	LARE	County:	Kosiusko
Investigator(s):	KQ, MP	State:	IN

WETLAND

STATION #	A-1	Distance from Stake:	20' north
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Phalaris arundinacea	Herb	FACW+
Impatiens capensis	Herb	FACW

Percent of Species OBL, FACW, FAC (excl. FAC-) 100%

Remarks:
- [x] Meets the hydrophytic vegetation criterion.
- [ ] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	surface

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	x
Saturated <12"	x	Water-stained leaves	
Water marks		Local soil survey data	x
Sediment deposit		FAC- Neutral test	x
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [x] Meets the wetland hydrology criterion.
- [ ] Does not meet the wetland hydrology criterion.
- [ ] Other:

SOILS

Map Unit Name: Washtenaw silt loam (Wc)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 16"	10YR 2/1	none	muck

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	x
Gleyed		National hydric soils list	x
Low Chroma	x	Other (ex. in Remarks)	

Remarks:
- [x] Meets the hydric soil criterion.
- [ ] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	___ No
Wetland hydrology present?	x Yes	___ No
Hydric soils present?	x Yes	___ No

Remarks:
- [x] Qualifies as a wetland.
- [ ] Does not qualify as a wetland.
- [ ] Other:

UPLAND

STATION #	A-1	Distance from Stake:	25' south
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Juglans nigra	Tree	FACU
Sambucus canadensis	Shrub	FACW-
Phalaris arundincacea	Herb	FACW+
Vernonia missurica	Herb	FAC+
Thalictrum dasycarpum	Herb	FACW-
Cinna arundinacea	Herb	FACW

Percent of Species OBL, FACW, FAC (excl. FAC-) 83%

Remarks:
- [x] Meets the hydrophytic vegetation criterion.
- [ ] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	>16"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	
Saturated <12"		Water-stained leaves	
Water marks		Local soil survey data	
Sediment deposit		FAC- Neutral test	x
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the wetland hydrology criterion.
- [x] Does not meet the wetland hydrology criterion.
- [ ] Other:

SOILS

Map Unit Name: Washtenaw silt loam (Wc)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 16"	10YR 3/1, 3/2	none	Clay loam

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	x
Gleyed		National hydric soils list	x
Low Chroma		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the hydric soil criterion.
- [x] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	___ No
Wetland hydrology present?	___ Yes	x No
Hydric soils present?	___ Yes	x No

Remarks:
- [ ] Qualifies as a wetland.
- [x] Does not qualify as a wetland.
- [ ] Other:

DATA SHEET:
WETLAND DELINEATION

Project/Site:	Chapman Lake	Date:	9/2/2005
Client:	LARE	County:	Kosiusko
Investigator(s):	KQ, MP	State:	IN

WETLAND

STATION #	B-1	Distance from Stake:	5' north
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Phalaris arundinacea	Herb	FACW+
Aster novae-angliae	Herb	FACW

Percent of Species OBL, FACW, FAC (excl. FAC-) 100%

Remarks:
- [x] Meets the hydrophytic vegetation criterion.
- [ ] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	>16"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	x
Saturated <12"		Water-stained leaves	
Water marks		Local soil survey data	x
Sediment deposit		FAC- Neutral test	x
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [x] Meets the wetland hydrology criterion.
- [ ] Does not meet the wetland hydrology criterion.
- [x] Other: Soil moist at 10" but not saturated

SOILS

Map Unit Name: Washtenaw silt loam (Wc)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 16"	10YR 3/1, 3/2	7.5YR 4/6	Clay loam

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	x
Gleyed		National hydric soils list	x
Low Chroma	x	Other (ex. in Remarks)	

Remarks:
- [x] Meets the hydric soil criterion.
- [ ] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	___ No
Wetland hydrology present?	x Yes	___ No
Hydric soils present?	x Yes	___ No

Remarks:
- [x] Qualifies as a wetland.
- [ ] Does not qualify as a wetland.
- [ ] Other:

UPLAND

STATION #	B-1	Distance from Stake:	10' south
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Phalaris arundinacea	Herb	FACW+
Urtica procera	Herb	(FAC+)

Percent of Species OBL, FACW, FAC (excl. FAC-) 100%

Remarks:
- [x] Meets the hydrophytic vegetation criterion.
- [ ] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	>16"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	
Saturated <12"		Water-stained leaves	
Water marks		Local soil survey data	
Sediment deposit		FAC- Neutral test	x
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the wetland hydrology criterion.
- [x] Does not meet the wetland hydrology criterion.
- [ ] Other:

SOILS

Map Unit Name: Washtenaw silt loam (Wc)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 16"	10YR 3/1, 3/2	none	Clay loam

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	x
Gleyed		National hydric soils list	x
Low Chroma		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the hydric soil criterion.
- [x] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	___ No
Wetland hydrology present?	___ Yes	x No
Hydric soils present?	___ Yes	x No

Remarks:
- [ ] Qualifies as a wetland.
- [x] Does not qualify as a wetland.
- [ ] Other:

DATA SHEET:
WETLAND DELINEATION

Project/Site:	Chapman Lake	Date:	9/2/2005
Client:	LARE	County:	Kosiusko
Investigator(s):	KQ, MP	State:	IN

WETLAND

STATION #	B-8	Distance from Stake:	5' south
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Cornus amomum	Shrub	FACW+
Phalaris arundinacea	Herb	FACW+
Impatiens capensis	Herb	FACW
Aster novae-angliae	Herb	FACW

Percent of Species OBL, FACW, FAC (excl. FAC-) 100%

Remarks:
- [x] Meets the hydrophytic vegetation criterion.
- [ ] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	11"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	x
Saturated <12"	x	Water-stained leaves	
Water marks		Local soil survey data	x
Sediment deposit		FAC- Neutral test	x
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [x] Meets the wetland hydrology criterion.
- [ ] Does not meet the wetland hydrology criterion.
- [ ] Other:

SOILS

Map Unit Name: Rensselaer loam (Re)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 16"	10YR 2/1	none	Clay loam

HYDRIC SOIL INDICATORS			
Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	x
Gleyed		National hydric soils list	x
Low Chroma	x	Other (ex. in Remarks)	

Remarks:
- [x] Meets the hydric soil criterion.
- [ ] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	___ No
Wetland hydrology present?	x Yes	___ No
Hydric soils present?	x Yes	___ No

Remarks:
- [x] Qualifies as a wetland.
- [ ] Does not qualify as a wetland.
- [ ] Other:

UPLAND

STATION #	B-8	Distance from Stake:	5' north
Normal Circumstances?		Yes/No	Yes
Significantly Disturbed?		Yes/No	No
Potential Problem Area?		Yes/No	No

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Lonicera x bella / muendeniensis	Shrub	NI / UPL
Xanthozyllum americanum	Shrub	(UPL)
Rubus allegheniensis	Herb	FACU+
Toxicodendron radicans	Herb	FAC+

Percent of Species OBL, FACW, FAC (excl. FAC-) 25%

Remarks:
- [ ] Meets the hydrophytic vegetation criterion.
- [x] Does not meet the hydrophytic vegetation criterion.
- [ ] Other:

HYDROLOGY

Field Indicators:

Depth of Surface Water:	none
Depth to Free Water:	none
Depth to Saturated Soil:	>10"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	
Saturated <12"		Water-stained leaves	
Water marks		Local soil survey data	
Sediment deposit		FAC- Neutral test	
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the wetland hydrology criterion.
- [x] Does not meet the wetland hydrology criterion.
- [x] Other: Test pit dug to only 10" due to compaction

SOILS

Map Unit Name: Riddles-Ormas-Kosciusko complex (RxB)

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0 - 10"	10YR 2/2	none	Sandy clay loam

HYDRIC SOIL INDICATORS			
Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	
Gleyed		National hydric soils list	
Low Chroma		Other (ex. in Remarks)	

Remarks:
- [ ] Meets the hydric soil criterion.
- [x] Does not meet the hydric soil criterion.
- [ ] Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	___ Yes	x No
Wetland hydrology present?	___ Yes	x No
Hydric soils present?	___ Yes	x No

Remarks:
- [ ] Qualifies as a wetland.
- [x] Does not qualify as a wetland.
- [ ] Other: