Little Calumet River, East Branch

Watershed Management Plan

Save the Dunes
444 Barker Rd., Michigan City, IN 46360

October 2015

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ACRONYM LIST

BMP	Best Management Practice
CCAP	Coastal Change Analysis Program
CALM	Consolidated Assessment and Listing Methodology
CCWC	Coffee Creek Watershed Conservancy
CELCP	Coastal and Estuarine Land Conservation Program
CFO	Confined Feeding Operation
CSO	Combined Sewer Overflow
CWP	Center for Watershed Protection
CWS	Comprehensive Wildlife Strategy
CZARA	Coastal Zone Act Reauthorization Amendments
DO	Dissolved Oxygen
DNR	Department of Natural Resources
E. coli	*Escherichia coli* (bacteria)
EAB	Emerald Ash Borer (beetle)
FEMA	Federal Emergency Management Agency
FIRM	Flood Rate Insurance Maps
GIS	Geographic Information System
GLISTEN	Great Lakes Innovative Stewardship Through Education Network
HES	Highly Erodible Soil
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
IC	Impervious Cover
ICM	Impervious Cover Model
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation
INDU	Indiana Dunes National Lakeshore
ISDA	Indiana State Department of Agriculture
IUN	Indiana University Northwest
kg	Kilograms
L	Liters
LCEB	Little Calumet East Branch
lb	Pounds
LTCP	Long Term Control Plan
µg	Microgram
mg	Milligrams
MGD	Million Gallons per Day
NIRPC	Northwestern Indiana Regional Planning Commission
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NTHCS	National Technical Committee for Hydric Soils
NWI	National Wetlands Inventory

NWIPA	Northwest Indiana Paddling Association
PCB	Polychlorinated Biphenyls
ppm	Parts per million
QHEI	Qualitative Habitat Evaluation Index
SHLT	Shirley Heinze Land Trust
SIPES	Social Indicator Planning and Evaluation System
SSURGO	Soil Survey Geographic (database)
SWCD	Soil and Water Conservation District
SWOT	Strength-Weakness-Opportunity-Threat (assessment)
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
USFS	United States Forestry Service
USFWS	United States Fish and Wildlife Service
WASP6	Water Quality Analysis Simulation Program, version 6
WHPA	Well Head Protection Area
WMP	Watershed Management Plan
WWTP	Waste Water Treatment Plant

1.0 Watershed Community Initiative

The Little Calumet River East Branch (LCEB) watershed is located within the Lake Michigan drainage basin. The LCEB is a watershed of interest due to its contribution of nutrients (primarily nitrogen and phosphorus), and potentially dangerous bacteria, *Escherichia coli* (*E. coli*), to the Great Lakes basin. A watershed is the area of land where all the water that drains off it goes to the same place. That drainage place is typically a river, a lake, or the ocean. All activities that take place in a watershed can affect the water quality of the surface and ground waters that drain it. Activities such as building construction, driving cars and trucks, growing crops, and fertilizing lawns can affect local water quality and the natural biological communities that live in our surface waters. A healthy watershed is essential for healthy waterways, enhancing the quality of life in our communities and supporting our local economies. Watershed planning is an important tool for helping communities come together to decide the best ways to preserve ecosystem functions, prevent and/or limit water quality impairments, and promote long-term environmental and economic health.

The LCEB watershed comprises approximately 47,293 acres (19,139 hectares or 74 square miles) and accounts for 12% of Lake Michigan's Little Calumet-Galien watershed that spans across Illinois, Indiana, and Michigan. The LCEB begins in unincorporated LaPorte County and flows west through unincorporated Porter County, the Indiana Dunes National Lakeshore (INDU), the towns of Burns Harbor, Chesterton, Ogden Dunes, Porter, and the City of Portage before converging with the West Branch of the Little Calumet River and discharging into Lake Michigan via the Burns Waterway (Figure 1). The LCEB watershed includes forest, grassland, wetland, agricultural, residential, commercial, industrial, and recreational land uses.

For nearly a decade, the Indiana Department of Environmental Management (IDEM) has reported water quality impairments for portions of the LCEB. The draft 303(d) listing for 2014 states that nearly all stream lengths in the LCEB watershed are impaired. These impairments include: *E. coli*, nutrients, impaired biological communities, chloride, and dissolved oxygen. Water quality impairments are further identified in the Little Calumet and Portage Burns Waterway Total Maximum Daily Load (TMDL) for *E. coli* bacteria (2004) (covering the larger Little Calumet River watershed), and in the Coffee Creek Watershed Management Plan (WMP) (2003), which covers portions of the Coffee Creek subwatershed. More information is necessary to identify pollutant sources and critical areas so that appropriate goals are clarified, which will help prioritize the most appropriate activities for long-term success. The 2004 TMDL states, "The current body of data clearly indicates that the system is impaired by *E. coli*. The indication is that the source of this impairment is from nonpoint sources." The Coffee Creek WMP confirms *E. coli* impairment in Coffee Creek. It also indicates high water temperature in the mainstem, low dissolved oxygen (DO), high total suspended solids (TSS), and impaired biotic community concerns in certain tributaries. While the Coffee Creek WMP provides historic water chemistry and biotic community data specific to Coffee Creek, little consistent, historic data exists related to other LCEB subwatersheds, including Reynolds Creek, Kemper Ditch, and their tributaries.

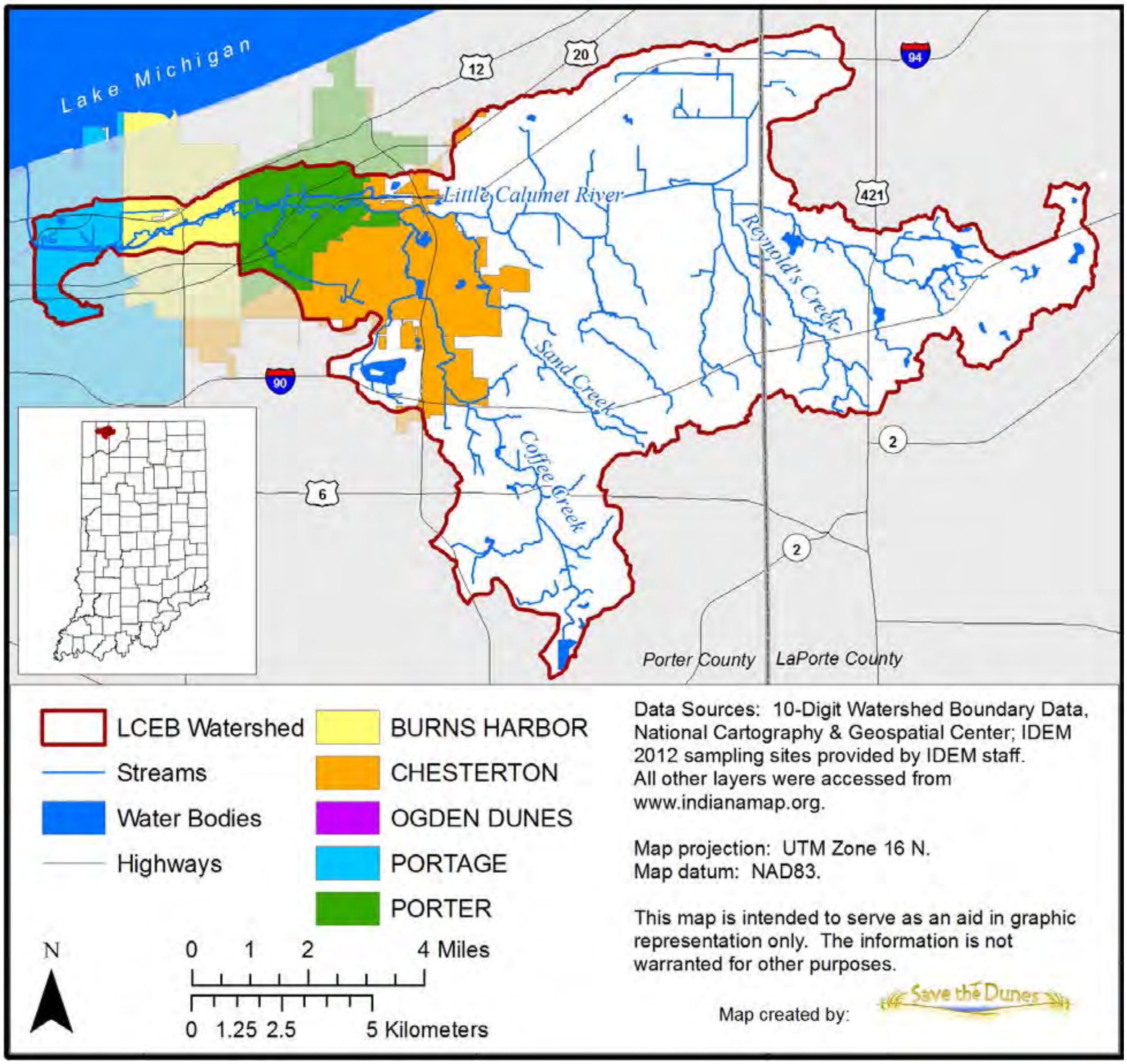

Figure 1. Little Calumet River East Branch watershed

1.1 Stakeholder Involvement

Save the Dunes is a non-profit organization whose mission is to preserve, protect and restore the Indiana Dunes and all natural resources of northwest Indiana's Lake Michigan watershed for an enhanced quality of life. Save the Dunes has coordinated successful watershed planning and implementation efforts in the adjacent Salt and Dunes Creek watersheds. The LCEB watershed is of particular importance to Save the Dunes because a significant stretch of the river flows through the Indiana Dunes National Lakeshore (INDU).

The organization also recognizes that as a major tributary to Lake Michigan, the LCEB has a large impact on Lake Michigan water quality and northwest Indiana's beaches.

Save the Dunes noted interest from northwest Indiana partners and stakeholders in developing the LCEB WMP. Between 2009 and 2011, while developing grant proposals to develop a LCEB WMP, Save the Dunes contacted and engaged many LCEB stakeholders. Stakeholder interest from the 2003 Coffee Creek WMP has remained high. The Town of Chesterton also expressed interest in a LCEB WMP, because much of the town drains to the LCEB. The National Park Service (NPS) acknowledged the impact of the LCEB watershed on INDU and expressed interest in developing a WMP. The NPS has also initiated an environmental assessment for the evaluation of recreation opportunities for parklands in the LCEB watershed. The Northwest Indiana Paddling Association (NWIPA) has begun working to implement Northwestern Indiana Regional Planning Commission's (NIRPC's) Greenways and Blueways Plan, which includes a 16-mile stretch of the LCEB.

Several local agencies and organizations provided letters of support for the grant proposals and committed to serving on a LCEB steering committee. The steering committee was assembled with representatives from local governmental agencies, environmental organizations, recreational organizations, and industry representatives (Table 1).

Stakeholder involvement is essential for the long-term success of the LCEB Watershed Management Plan. The plan ultimately belongs to the stakeholders who live and work in and around the LCEB watershed. To acquire input from the many residents, government agencies, industries, and businesses potentially impacted by the LCEB WMP, stakeholder involvement was generated through various education and outreach efforts. WMP activities, resources, and information were distributed to the public through local media, newsletters, public meetings, and local events. Overall, there were 12 public stakeholder meetings. A social indicator survey was also mailed to residents throughout the watershed. The survey gathered information on local knowledge of water quality issues and views on various water related topics. The survey also helped to inform residents of the WMP development and how to get involved.

Education and outreach events were conducted throughout the development of the WMP. The Watershed Education Unit for Brummitt Elementary School, which was conducted over an entire semester, included both indoor and outdoor activities for kindergarten through fourth grade students. The activities included water quality and macroinvertebrate sampling in the LCEB watershed. This program was well received by students, teachers and the Duneland School Administration. A field-training event was held at Indiana University Northwest. This event introduced IUN environmental science students to the Great Lakes Innovative Stewardship Through Education Network (GLISTEN) Program and the stringent field sampling protocols required for the collection of water quality data. GLISTEN students ultimately assisted with water quality sampling of the LCEB, providing useful data for the WMP. Other education and outreach events included a Day of Leisure and Learning on the Little Calumet River, Get Outdoors Day (hosted by the Dunes Learning Center), and Nature Night at Brummitt Elementary (hosted by the Izaak Walton League)

Table 1. LCEB steering committee members and affiliations

Affiliation	Committee Member
Town of Burns Harbor	Gene Weibel
Town of Chesterton	Jennifer Gadzala
Chesterton/Duneland Chamber of Commerce	Hesham Khalil
Coffee Creek Watershed Conservancy	Katie Rizer
Indiana Department of Natural Resources – Lake Michigan Coastal Program	Dorreen Carey
Indiana University Northwest/GLISTEN	Erin Argyilan
Izaak Walton League	Charlotte Read
LaPorte County Parks	Tim Morgan
LaPorte County Soil and Water Conservation District	Nicole Messacar
National Park Service	Lynda Lancaster
Northwest Indiana Forum	Kay Nelson
Northwestern Indiana Regional Planning Commission	Joe Exl
Northwest Indiana Paddling Association	Daniel Plath
Northwest Indiana Steelheaders	Michael Ryan
Town of Ogden Dunes/Nature Conservancy	Susan MiHalo
City of Portage	Jenny Orsburn
Porter County Planning Commission	Robert Thompson
Porter County Convention Recreation and Visitor Commission	Christine Livingston
Porter County Parks	Walter Lenckos
Porter County Soil and Water Conservation District	Jim Lambert
Town of Porter	Brenda Bruckheimer
Urban Waters Federal Partnership	Natalie Johnson
Shirley Heinze Land Trust	Kris Krouse
US Fish and Wildlife Service	Liz McCloskey

1.2 Stakeholder Concerns

In 2011, Save the Dunes, NPS, and NWIPA partnered to convene meetings of LCEB stakeholders. Initial stakeholder meetings included a Strength-Weakness-Opportunity-Threat (SWOT) assessment to evaluate the viability of the LCEB watershed plan stakeholders as a group. In 2012, Save the Dunes was awarded an IDEM Section 319 grant to coordinate the development of a WMP for the LCEB watershed. Save the Dunes held the first official LCEB WMP stakeholder meeting in February 2012. The meeting included an exercise to elicit stakeholder concerns. All expressed stakeholder concerns are listed in Figure 2.

Figure 2. LCEB stakeholder concerns

Elevated Pathogens

- **Pathogen loading from combined sewer and sanitary sewer overflows**
- **Public health effects from high *E. coli* concentrations**
- **High *E. coli* concentrations increased due to failing septic systems**
- **Pathogen loading polluting groundwater**
- **Integrate 2004 *E coli* TMDL**
- **Not meeting water standards**

Excessive Sediment and Nutrient Loading

- **Streambank erosion and sedimentation**
- **Degraded riparian corridors allow sediment and nutrient loading from runoff**
- **Highly erodible soils on cropland may contribute sediment**
- **Nutrient loading from combined sewer and sanitary sewer overflows**
- **Increased volume and flow causing erosion**
- **Erosion caused by woody debris**

Habitat, Biotic Communities and Hydrology

- **Need to protect fisheries and habitat**
- **Failing to meet water standards**
- **Fish consumption**
- **Need to understand geology and hydrology. Several habitat types in watershed**
- **Need permits for woody debris management and fisheries and habitat protections**
- **Promote conservation easements**
- **Need more environmentally friendly methods for ditch maintenance**
- **Need to protect bottomland, slopes, and highland**
- **Emerald ash borer killing trees, source of debris**
- **Invasive plants impact biodiversity and have impact on water quality/wetlands**
- **Fish habitat and passage for native non jumping fish**
- **Sedimentation in streams has a negative impact on fish habitat**
- **Need to fix tributary ditches environmentally or remove them**
- **Stormwater management, flood prevention efforts need improvement**
- **Methods of dredging ditches are having multiple negative impacts on the LCEB**
- **Increased volume and flow due to altered hydrology (regulated drains, ditches)**
- **LaPorte County Waste Management landfill, closed but may have impact**

Lack of Multijurisdictional Coordination

- Lack of funding to achieve all watershed goals
- Lack of septic system inspection and operation and maintenance programs
- Lack of cooperation between agencies to achieve watershed goals
- Conflicting missions between agencies and organizations
- No long term maintenance plan for watershed goals
- Local government adoption of the plan once complete
- Aging culverts and infrastructure
- Varied waterway use for owners and municipalities creates lack of mutual respect
- Need industry and land owners at the table
- Respect for each perspective. Find mutual benefit through process
- Need robust, long-term, sustained, meaningful monitoring

Public Access

- Lack of safe passage for paddlers due to excessive log jams/woody debris
- Culverts, bridges, beaver dams, and physical features to be addressed
- ADA compliance at existing and future access sites
- No continuous walking trail along LCEB
- Need to respect private property rights, locate access points in easements
- Create incentives and diminish disincentives for private property owners
- Need data and information on positive impact of trails for property owners
- Inventory and identify land owners
- Engage land owners in WMP process and increase communication
- Lack of river access sites – river and tributaries are out of public sight
- Advocating for full body contact despite *E. coli* and contaminants
- Need environmental assessment to evaluate paddling access in INDU
- Acquisition of land from farmers
- Two major branches flow under Highway 421
- Fishermen may be eating fish, despite 303(d) impairment for PCBs in fish tissue

Public Education and Involvement

- Public does not have enough access to information about LCEB or water quality
- Lack of press coverage for LCEB management efforts and water quality
- Not enough private property owners are directly involved in WMP process
- Environmental assessment should have public component
- Dumping of trash

Development of the LCEB WMP was funded in part through a Section 319 grant from IDEM. Public outreach associated with plan development was funded in part through a grant from the Indiana Department of Natural Resources (IDNR) Lake Michigan Coastal Program. IDEM's Watershed Assessment and Planning Branch conducted monthly watershed sampling. Save the Dunes partnered with Great Lakes Innovative Stewardship Through Education Network (GLISTEN) to have Indiana University Northwest (IUN) and Valparaiso University students conduct weekly sampling during the summer recreational period of 2012. A donation from a private donor was used to fund additional weekly sampling.

1.3 Social Indicator Survey

The social indicator survey provides a method to evaluate the attitudes, knowledge, and behavior of the LCEB residents. The LCEB WMP utilized the Social Indicator Planning and Evaluation System (SIPES) for Nonpoint Source Management. A regional team of researchers from University of Illinois, Purdue University, Michigan State University, University of Minnesota, The Ohio State University, and University of Wisconsin developed this system. The survey produced for the LCEB watershed was a subset of relevant questions provided by SIPES. The Social Indicators Data Management and Analysis (SIDMA) tool was also utilized to develop and administer our survey to all residents and landowners in the LCEB watershed. Addresses specific to the watershed were determined using GIS software.

SIPES protocols for constructing and disseminating the surveys were carefully followed. Five separate mailings of the survey were conducted to increase response rates (Dillman 2000). An advance notice letter was sent to potential respondents to inform them of the survey's purpose and to notify them of the survey's future delivery. The response rate for our survey was 28%, which is below the minimum suggested response rate of 40%. Consequently, care should be taken when interpreting the results of this study. Detailed responses to the survey can be found in Appendix 1.

Overall, respondents rated water quality of the LCEB as "okay," with "scenic beauty" as the most important quality related to water quality. "Scenic beauty" was also the most important activity related to water resources. Over 67% of respondents claimed to know where the rainwater goes when it runs off their property. However, it was unclear if those respondents were aware that their runoff eventually flows to Lake Michigan. Attitudes toward local water quality demonstrate that the majority of respondents believe that water quality is important, their actions do have an impact on water quality, and they are responsible for helping to protect the water quality. Respondents indicated they were willing to change certain behaviors (related to water quality), but were less enthusiastic toward paying to help improve water quality. A majority of respondents indicated they were unaware of the current level of water quality impairments in the LCEB. As an average, all identified sources of water pollution were considered a "slight problem" to "moderate problem." The consequences of poor water quality (e.g. contaminated drinking water, beach closures, and eutrophication) were viewed as a "slight" to "moderate" problem.

The most popular practices to improve water quality were proper disposal of household wastes (74%), keeping grass clippings out waterways (65%), and following manufacturer's instructions when fertilizing (56%). Nearly a quarter of respondents were unfamiliar with common non-point source (NPS) best management practices (BMP) such as grass swales (28%), wetland detention (22%), and porous pavement (26%). Constraints for implementing four specific management practices were evaluated. Many respondents were familiar with rain gardens, phosphate-free fertilizer, and rain barrels, yet over a quarter had never heard of the practices. A smaller portion of respondents is currently implementing the practices (11-17%). The majority of respondents (47%) did not consider proper pet waste disposal relevant because they did not have a pet. Respondents were fairly willing to implement the four practices: 29% for rain gardens, 37% for phosphate-free fertilizer, 47% for proper pet waste disposal, and 43% for rain barrels. Constraints for implementing the practices were limited. Only 23% of respondents were willing to participate in a cost-share program to implement the practices, while 46% were unsure.

Nearly half of respondents in the LCEB have a septic system (46%), while 52% have city sewer. The mean septic system is 27 years old and 79% indicated no problems in the past 5 years. Just over half the septic systems (53%) have an absorption field. 40% of respondents do not know if their septic system is designed to treat sewage or to just get rid of waste. Most recognized that slow drains (47%), sewage backups in the house (50%), toilet backups (47%), and bad smells (50%) are indicators of a dysfunctional septic system. Only 23% do not know the symptoms of a poorly functioning septic system. Owners of septic systems do not want maintenance/inspection reminders from their local health department (70%) and nearly half (48%) do not believe a local government agency should handle the inspection and maintenance of septic systems.

The average respondent was a 57-year-old male (57% male, 43% female) who has attended college (54%). More than 99% of respondents own their home, 55% of which are located in a city, town, or village. Total household income is fairly evenly divided from $25,000-to over $100,000. The average time at current residence was 20 years. Most respondents do not use a professional lawn care service (79%). When asked where they are likely to seek information about water quality issues, most respondents identified the internet (46%), and newspapers/magazines (43%). When asked about which information sources were trusted, most respondents indicated only moderate trust in all identified sources.

2.0 Watershed Inventory 1 – Watershed Description

2.1 Geology and Topography

The surficial topography and deposits of the LCEB watershed have been influenced by complex processes associated with glaciation and deglaciation of the region during the Wisconsin glacial stage and the subsequent evolution of the southern shoreline of Lake Michigan. The glacial deposits of the Valparaiso Morainal complex define the southern boundary of the Little Calumet-Galien (Hydrologic Unit Code (HUC - 04040001) watershed and function as the drainage divide with the Kankakee River (HUC- 07120001) watershed to the south.

The LCEB watershed is positioned across two physiographic regions including the Lake Michigan Border and Valparaiso Morainal Complex (Figure 3). The physiographic regions are based on topography and the surficial deposits. The watershed drains from an elevation of 950 feet along the Valparaiso Moraine to a low of 574 feet near Lake Michigan (Figure 4). The Valparaiso Morainal Complex physiographic region forms a 13-20 mile wide area that is characterized by morainal and alluvial deposits that grade to the southeast. Lakes can be found in the depressions of till areas and tunnel valleys formed by meltwater. Few natural lakes exist in the depressions of the alluvial fans because of their sandy nature and low water table. The Lake Michigan Border physiographic region forms a 4 to 11-mile wide area along the southern shore of Lake Michigan that includes a complex of beach ridge, dune, morainal, palustrine and lacustrine deposits (Figure 3).

The surficial sediments of the southern portion of the watershed consist primarily of mixed glacial drift deposits, which have eroded to form the subwatersheds and channels of Sand Creek, Coffee Creek, and Reynolds Creek. The percent slope of the landscape was calculated from the 30-meter resolution elevation data from the National Elevation Dataset and was analyzed using ArcMap 10’s Spatial Analyst. The steepest slopes in the watershed approach nearly 23% and can be found at the headwaters along the Valparaiso Moraine where the clay component of glacial till provides cohesion for surface sediments and also limits the infiltration capacity of the landscape. IDEM's Indiana Storm Water Quality Manual (IDEM 2007) defined steep slopes as those exceeding 15 percent.

The surficial sediments of the northern portion of the basin are a complex of lacustrine silt and clay, shoreline beach and dune deposits, and exposures of clay-rich till deposits of the underlying Lake Border moraine (Figure 5). The main channel of the LCEB flows westward through the lacustrine beach and dune sands until eroding into lake silt, clay and alluvium deposits as the river nears Burns Waterway. The northeast portion of the watershed consists of alluvium and clay-rich deposits associated with exposure of deposits of the Lake Border Moraine.

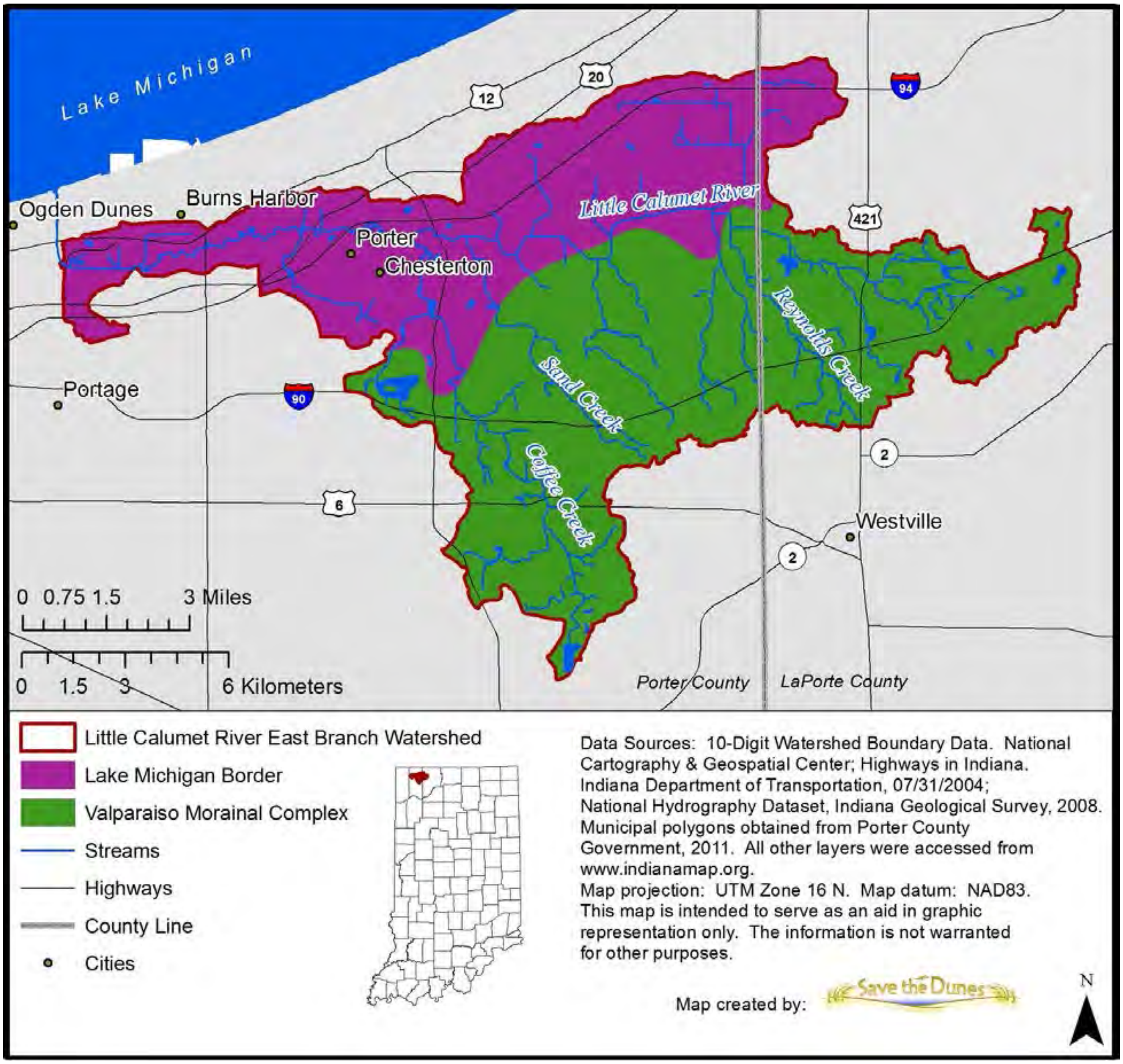

Figure 3. Physiographic regions in the LCEB watershed

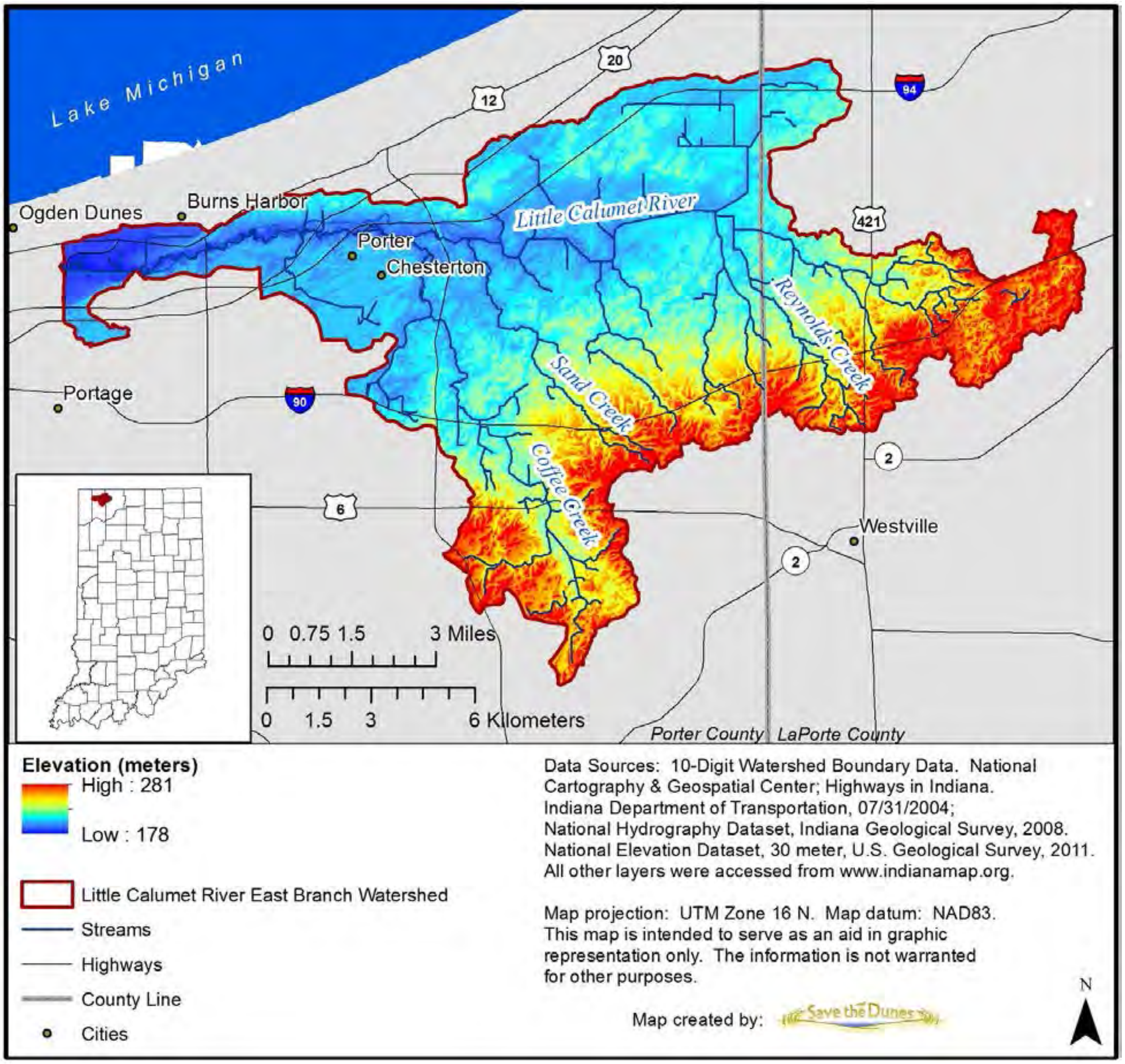

Figure 4. Physiographic relief in the LCEB watershed

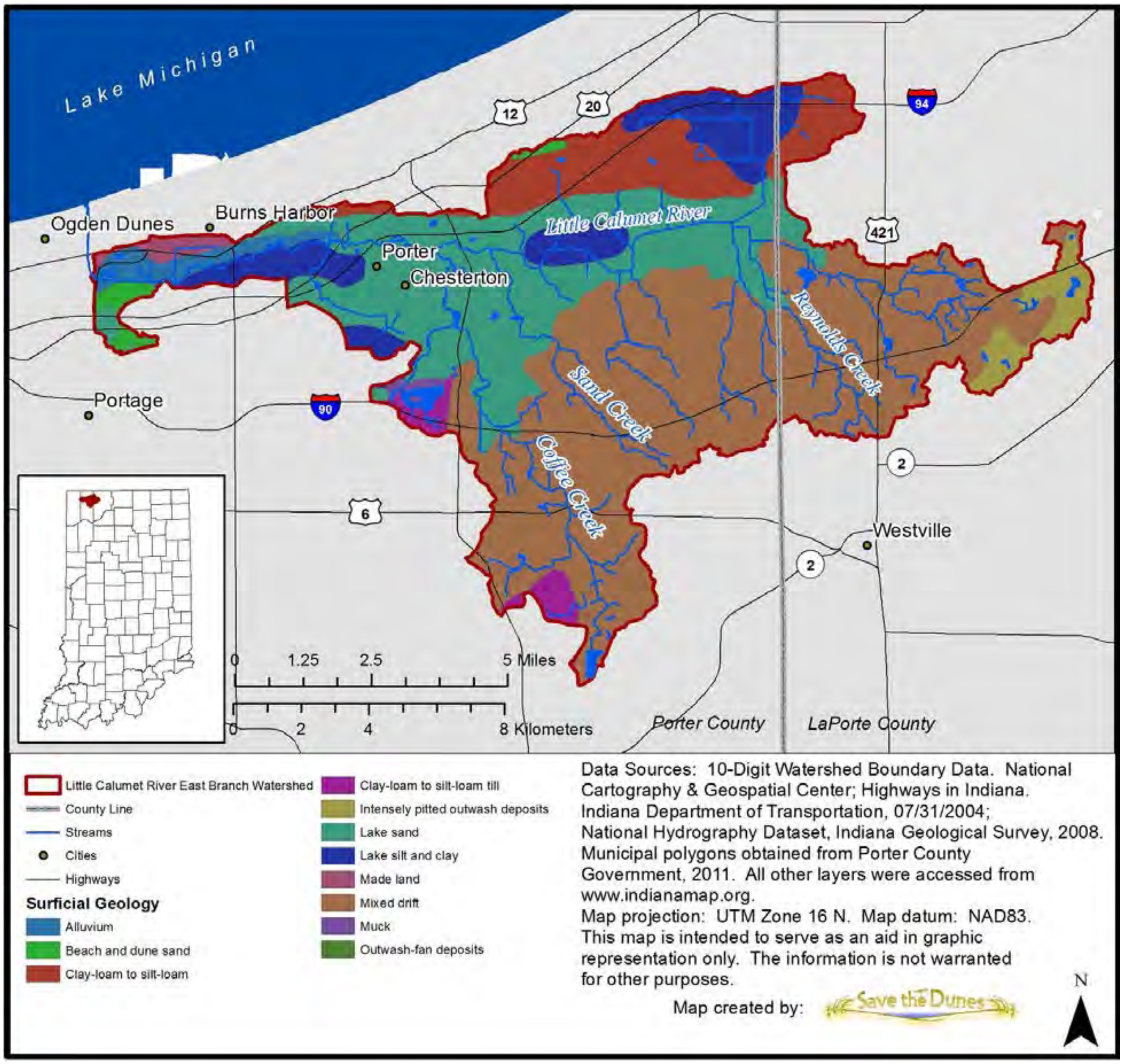

Figure 5. Surficial geology in the Little Calumet River East Branch watershed

2.2 Hydrology

The LCEB watershed (HUC 10 - 0404000104) is a subwatershed of the Little Calumet-Galien watershed (HUC 8 - 04040001). HUCs, or hydrologic unit codes, can be thought of as numeric addresses, or designations, that describe both the size and location of a watershed.

Table 2. Hydrological Unit Code (HUC) designations for the LCEB

HUC 8	HUC 10	HUC 12	Name
04040001			Little Calumet-Galien
	0404000104		Little Calumet-East Branch
		040400010401	Reynolds Creek
		040400010402	Kemper Ditch
		040400010403	Coffee Creek

Watershed HUCs with 8 digits are the largest in Indiana, 10 digit HUCS represent smaller, medium-sized watersheds nested within the 8 digit watersheds (such as the LCEB watershed), and 12 digit HUCs represent even smaller watersheds nested within the 10 digit HUC basins. All of the 10 digit HUCs share the first 8 digits of the larger basin in which they are located, and the 12 digit HUCs share the first 10 digits of the HUC 10 watersheds in which they are located. Within the LCEB watershed, there are three 12-digit HUC subwatersheds: Coffee Creek (HUC 12- 040400010403), Kemper (Carver) Ditch (HUC 12 - 040400010402), and Reynolds Creek (HUC 12 - 040400010401) (Figure 6).

Stream order is a common stream classification system which helps describe a river's size and watershed area; the greater the stream order, the greater the size and watershed area (Allen, 1995). Headwater streams, such as Reynolds Creek, are considered first order. As additional streams join, the order is increased. The LCEB mainstem is a fourth order stream just before it enters Burns Waterway.

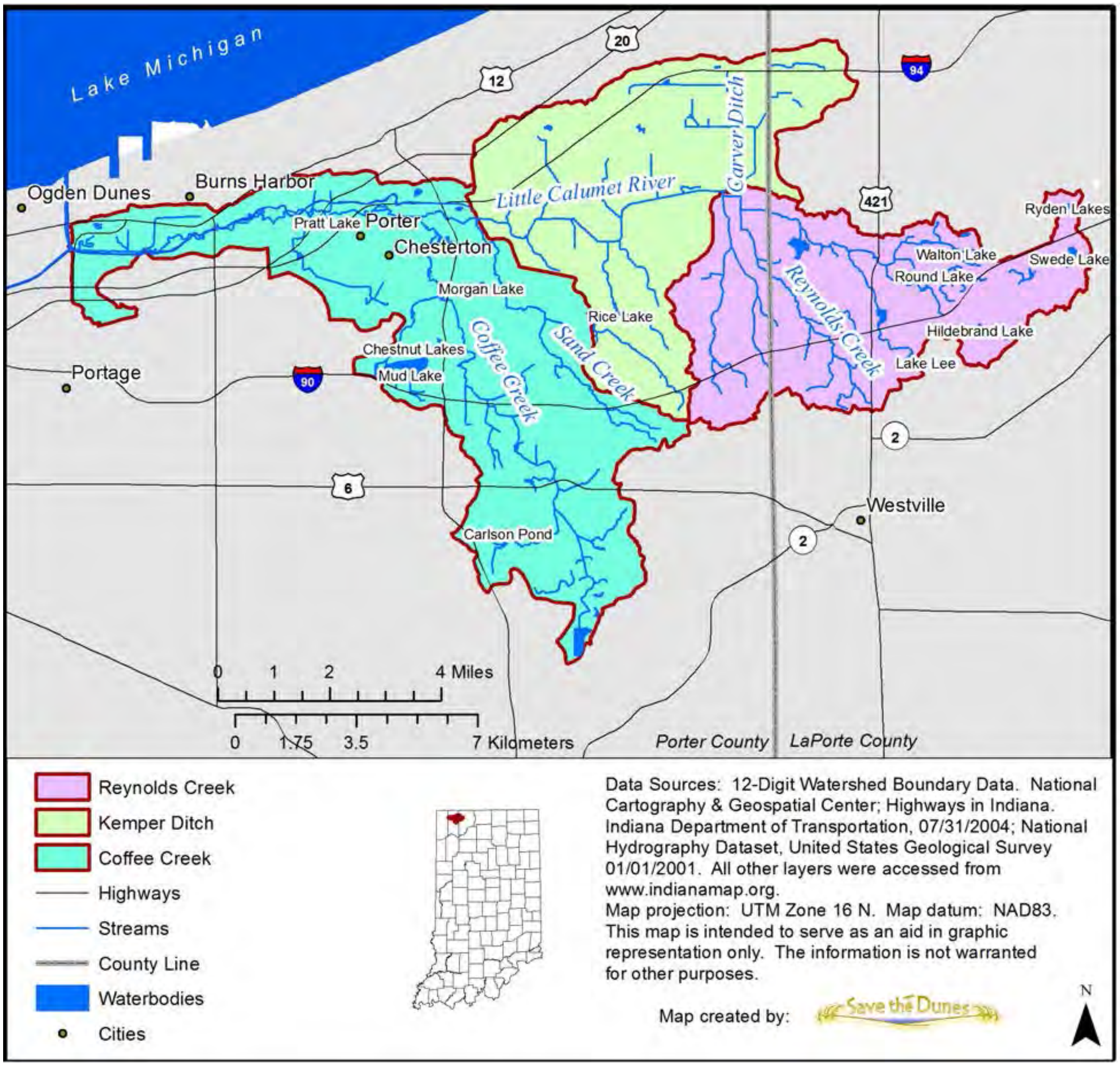

Figure 6. 12-digit hydrologic unit code subwatersheds

Table 3 contains the lengths of streams and areas of lakes in the LCEB watershed.

Table 3. Stream lengths and waterbody areas

	Length (miles)
Artificial Path	15
Canal/Ditch	28
Connector	0
Stream/Rivers	81
Regulated Drains	45
Total	**169**

	Area (acres)	Number
Swamp/Marsh	938	198
Lake/Pond	568	214
Reservoirs	3	11
Total	**1509**	**423**

Regulated Drains

In total, there are over 45 miles of regulated drain within the watershed. This figure is an underestimate, as it shows only the regulated drains that correspond with a stream segment in the National Hydrography Dataset (Figure 7). A regulated drain (legal drain) is an open channel or closed tile/sewer that is subject to the provisions of the Indiana drainage code, I.C.-36-9-27. Under this code, a drainage board has the authority to construct, maintain, reconstruct or vacate a regulated drain. The board can maintain the regulated drain by dredging, clearing, repairing tile, removing obstructions or other work necessary to keep the drain in proper working order based on its original specifications. The LCEB stakeholders noted ditch maintenance and dredging as a watershed concern (Figure 2).

Floodplains

Floodplains are a natural feature of streams and rivers. Flooding is a natural process that is critical to the health of a stream. Floodplains can temporarily store floodwater, dampen peak flows, maintain baseflow, dissipate energy and reduce erosive stress on streambanks. While water is stored in the floodplain, pollutants can settle out or be filtered by vegetation. Development in floodplains can lead to property damage due to flooding and can impair the ability of the floodplain to retain water. Figure 7 shows floodplains created from the Federal Emergency Management Agency (FEMA) 2004 Flood Insurance Rate Maps (FIRM). There are over 4,500 acres of floodplain in the LCEB watershed. The LCEB stakeholders noted flood prevention as a concern (Figure 2).

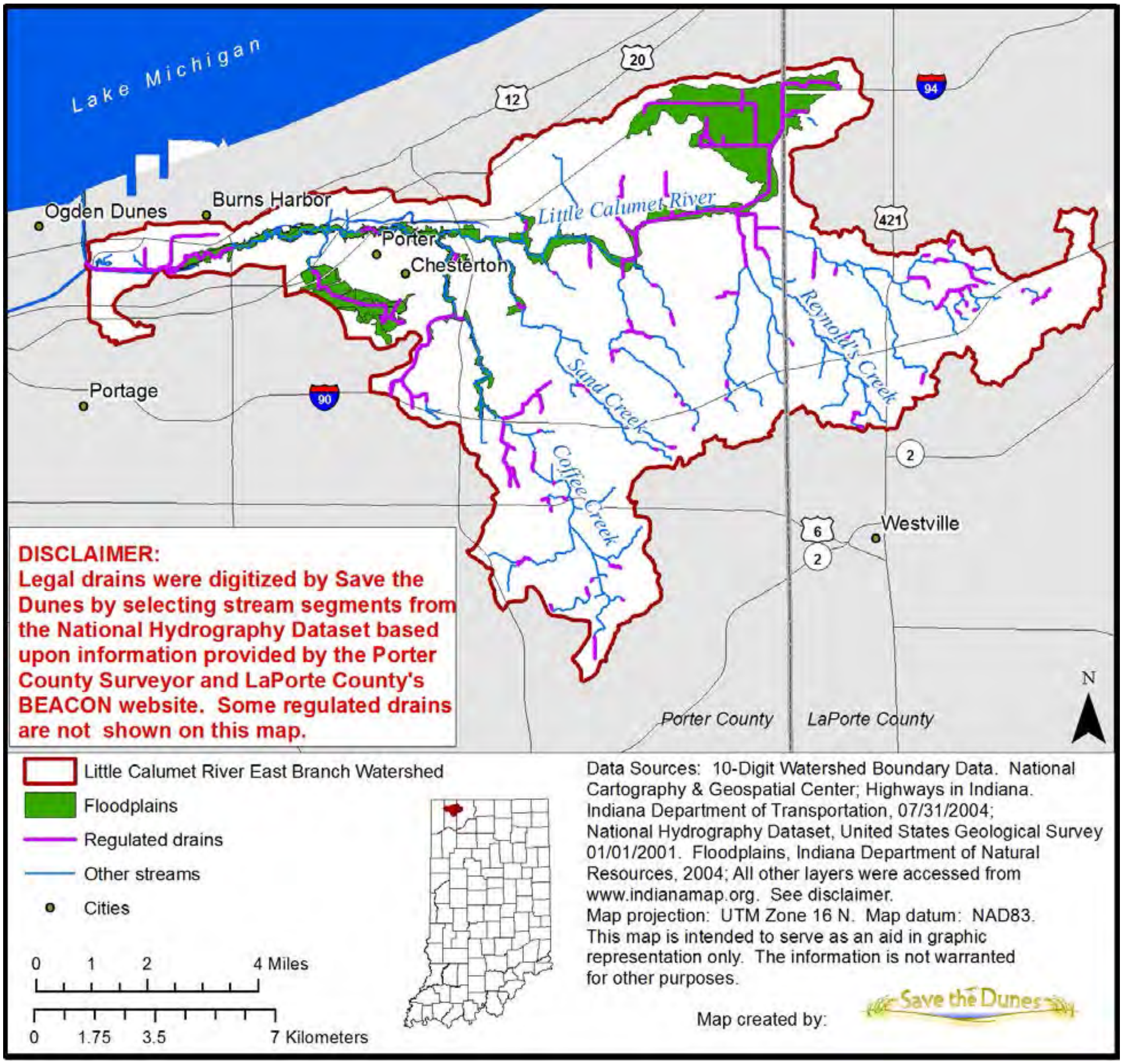

Figure 7. Floodplains and regulated drains in the LCEB watershed

There is one USGS stream gauge (04094000) in the LCEB watershed. Located on the mainstem at US Highway 20 and Mineral Springs Road in Porter, Indiana, this gauge is at the same location as our sampling site 9 (Figure 37). The USGS has recorded flow from this gauge since 1945 to present. Large amounts of historic and current flow data can be used to create a flow duration curve (Figure 8), which can show how current flow rates compare to the long-term flow regime. Load duration curves can also help inform us if pollutants are exceeding water quality targets during low-flow (dry) conditions or high-flow (storm) events, by plotting chemistry data against the flow duration curve. This can be useful during extreme weather years, such as the drought in 2012, because it can help with the interpretation of data collected during extreme conditions. Figure 8 shows the LCEB's historical flow from 1945 to 2011, while Figure 9 shows the LCEB's flow for 2012. The flow for the drought year (2012) does not appear to be substantially different from the long-term flow. Because the flow gage is located at the base of the watershed, it is not unusual that the 2012 drought did not greatly reduce discharge at this site. Many streams in the LCEB are groundwater fed, which would maintain a constant streamflow despite the lack of precipitation. The gage site is also downstream of Chesterton's wastewater treatment plant. Since Chesterton's drinking water is obtained from Lake Michigan, their wastewater did not originate from the LCEB. Therefore, effluent from the wastewater treatment plant supplements the downstream flow. The change in flow due to drought can also be depicted by comparing the mean monthly flows (Figure 10) to the long-term flow duration curve values for high and medium flow rates (Figure 8). The curves shown in Figure 8 and 9 were created using Purdue University's Load Duration Curve Tool.

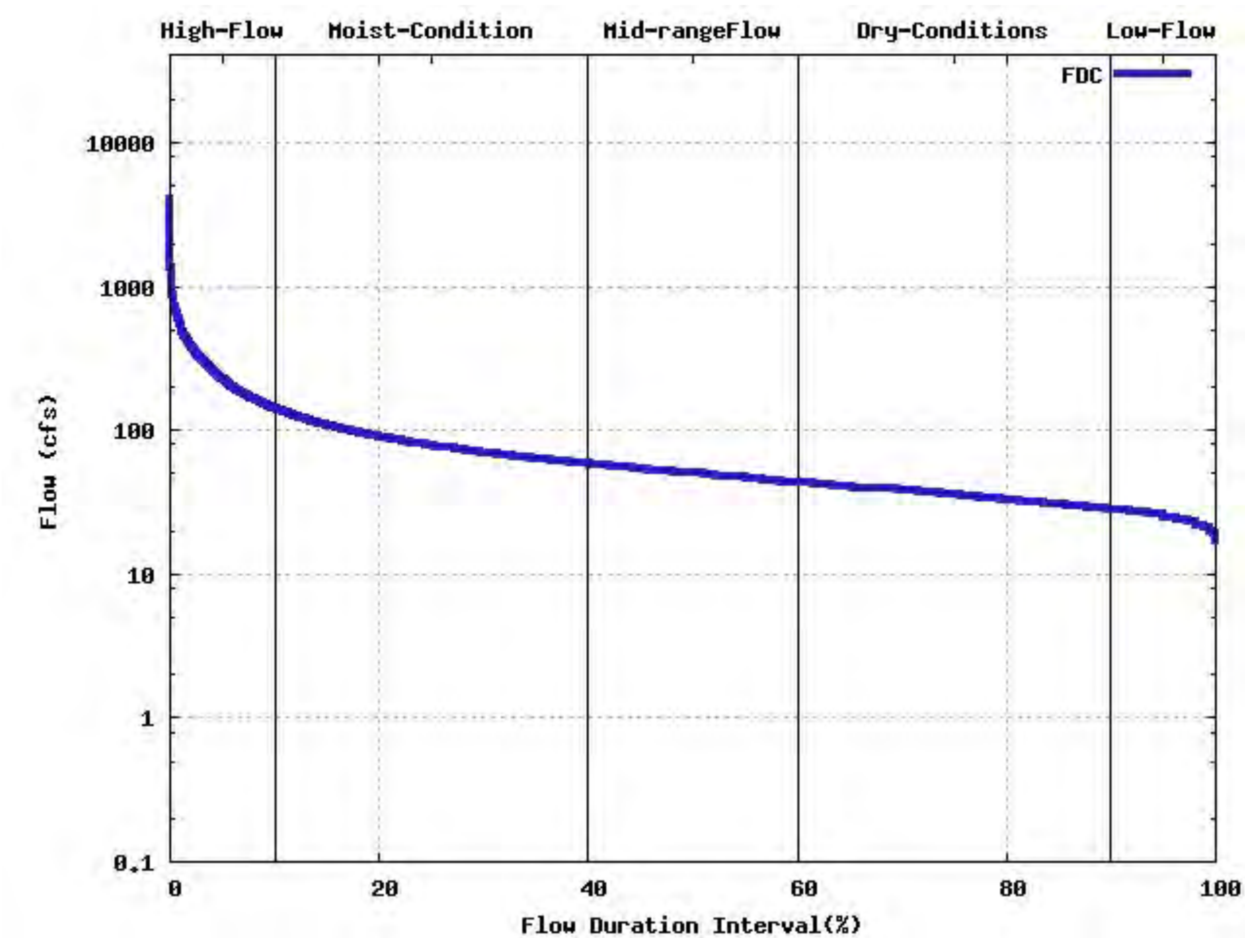

Figure 8. Historical flow duration curve for the LCEB (1945-2011)

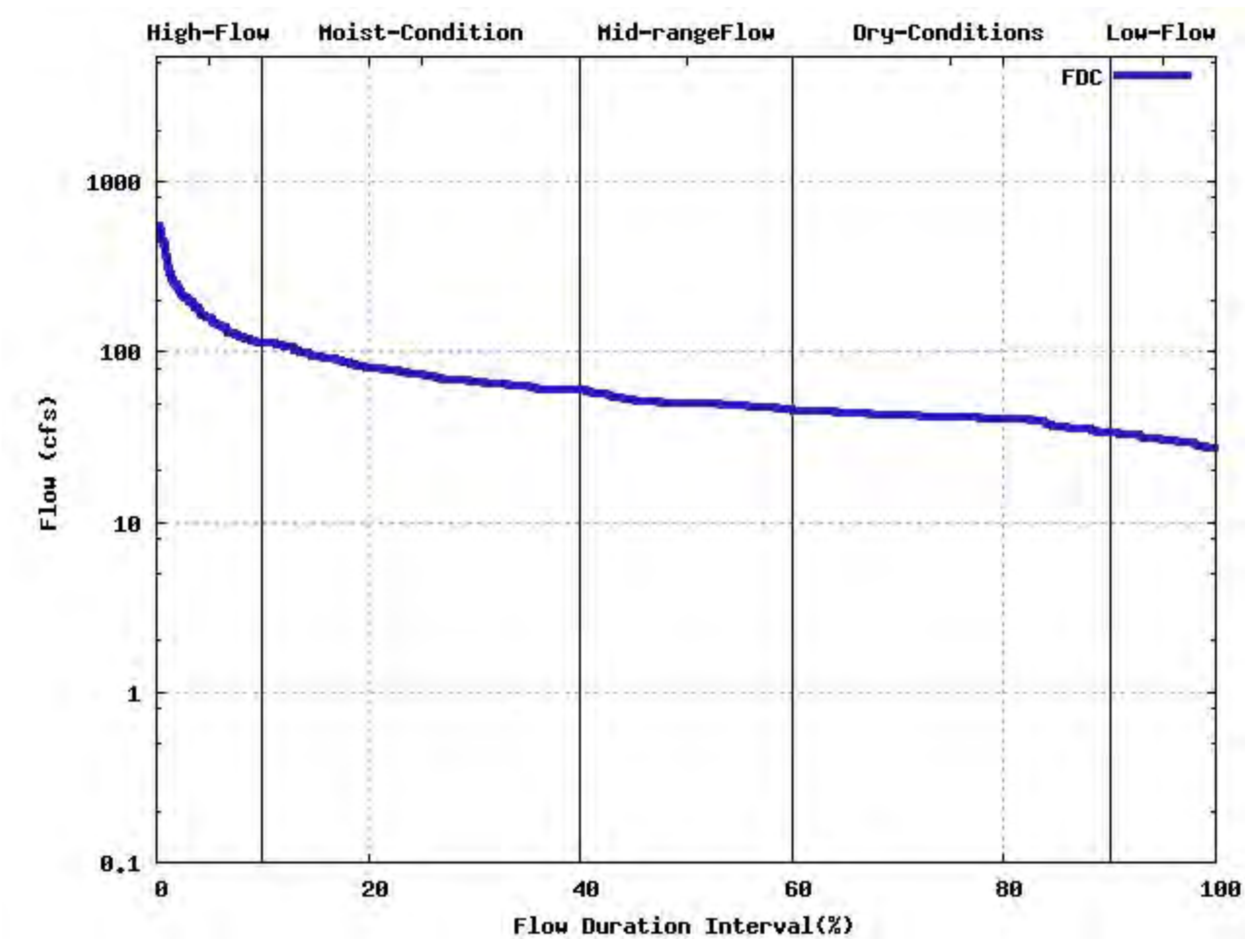

Figure 9. 2012 flow duration curve for the LCEB

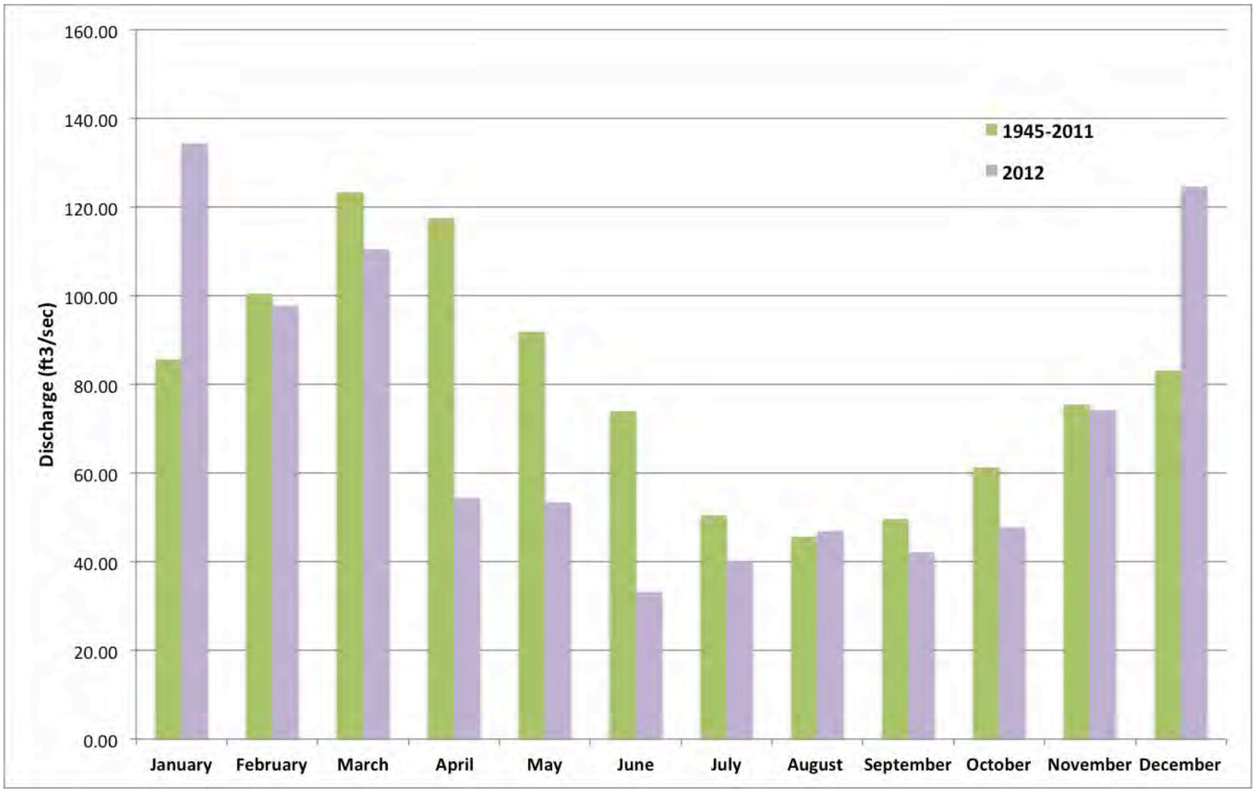

Figure 10. Mean monthly flows in the LCEB (USGS gage 04094000 at Porter, Indiana)

Wetlands

Wetlands provide numerous services, including flood control, plant and wildlife habitat, water filtration, and recreational opportunities. Wetlands function as natural sponges, temporarily storing water and slowly releasing it. This slows the peak volume and velocity of water reaching our streams after a storm, which can reduce streambank erosion and flooding. The slow release of water recharges groundwater and maintains base flow in streams. While water is stored in wetlands, suspended pollutants, such as sediment, settle out of the water column or are filtered by vegetation. Other pollutants, such as nitrogen and phosphorus, also settle to the bottom with the sediment. Wetland plants are then able to acquire these nutrients through their roots. Wetland plants are also able to remove dissolved nutrients directly from the water column. Another important benefit of wetlands is their aptitude for removing nitrogen through denitrification; this process converts nitrate to nitrogen gas. Individual wetlands vary in the functions they perform and how well they perform them. Wetland functions vary based upon soil characteristics, vegetation types, size, depth, location in the watershed, and the quality and quantity of water entering the wetland.

National Wetland Inventory (NWI) wetlands are shown in Figure 11. The NWI is a database of wetlands maintained by the USFWS (United States Fish and Wildlife Service). Aerial photograph interpretation techniques were used to compile the NWI. The NWI was not intended to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys. Boundaries are generalized in most cases. There are over 5,683 acres of wetlands in the LCEB watershed, which is approximately 12% of the watershed. The NWI is a useful tool for reviewing wetlands, but field verification is essential.

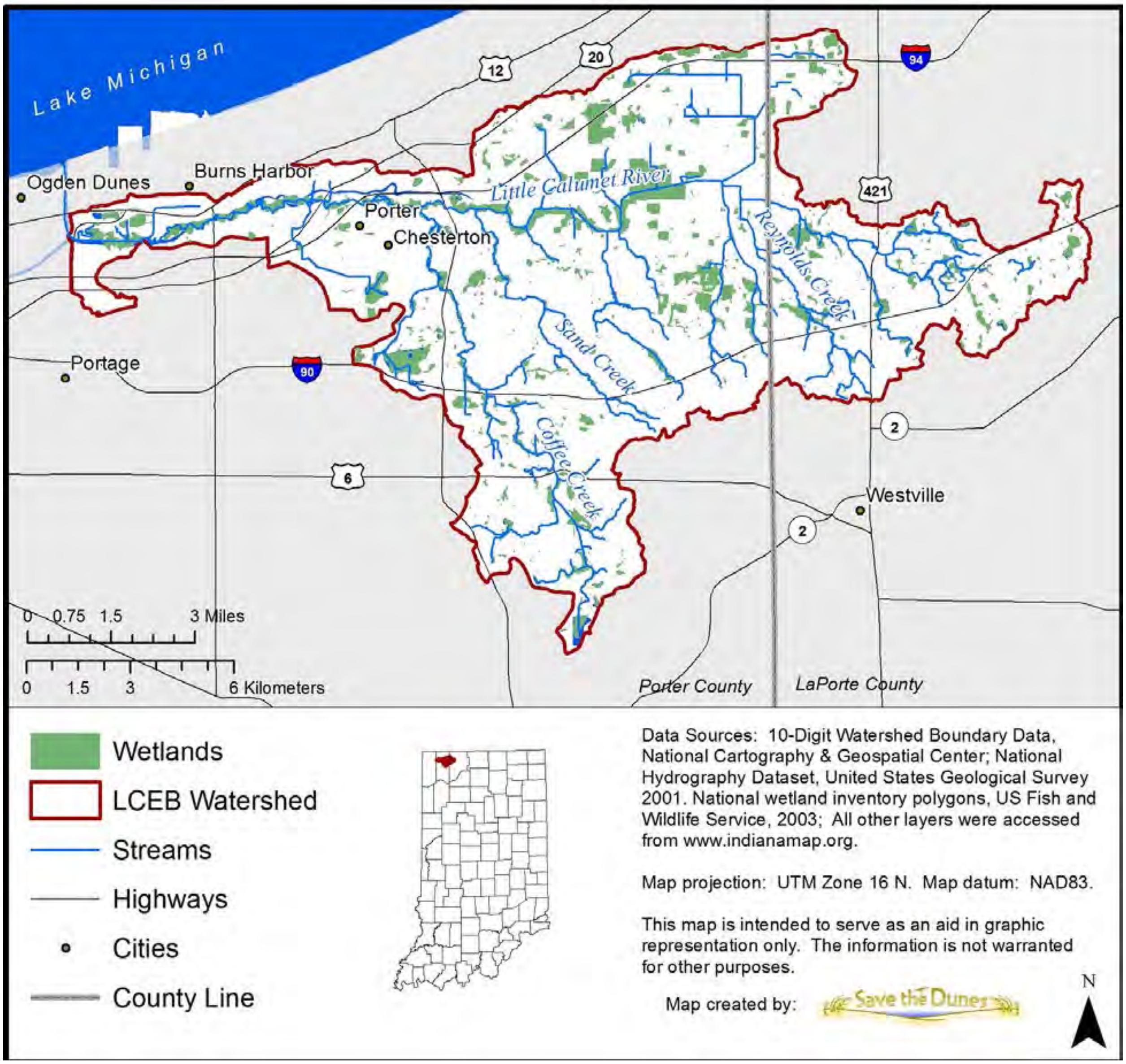

Figure 11. National wetland inventory wetlands in the LCEB watershed

Table 4. Wetland acreage by type

Wetland Type	Acres	Percent of total
Palustrine Forested	3402	60%
Palustrine Emergent	914	16%
Palustrine Unconsolidated Bottom	361	6%
Palustrine Scrub-shrub	211	4%
Palustrine Emergent Forested	193	3%
Palustrine Forested/Scrub-shrub	171	3%
Palustrine Emergent Scrub-shrub	147	3%
Palustrine Aquatic Bed	104	2%
Lacustrine Limnetic	64	1%
Lacustrine Littoral	56	1%
Palustrine Aquatic Bed Scrub-shrub	27	<1%
Riverine Lower Perennial	27	<1%
Palustrine Emergent Dead Forest	6	<1%
Palustrine Unconsolidated Excavated Shore	1	<1%
Total	5683	100%

2.2.a Historic Use and Hydrologic Modification

Hydrology has been extensively modified in the LCEB watershed. Prior to European settlement, Native Americans used the River for navigation and fishing. European explorers first entered the area in the mid-1600s with European settlement beginning in the early 1800s. Tributaries were used for mill power in the 1800s. Today, ten dams exist in the watershed (Figure 12). Commercial navigation plans for the LCEB River were developed as early as 1850s. Historically, the Little Calumet River began in unincorporated LaPorte County, meandered west through Porter and into Lake County, and turned back into Porter County, where it discharged into Lake Michigan. In 1926, the completion of Burns Waterway connected the river to Lake Michigan and split it into the East and West branches. The Towns of Chesterton and Porter developed along the LCEB in the mid-1800s and used the river for drainage and discharge of wastes. Sections of the LCEB were dredged and straightened from Chesterton Wastewater Treatment Plant upstream. Wetlands were once common throughout northwest Indiana, but were drained in the 1800s and early 1900s to allow for agriculture and urban development. Comparing the area of hydric soils to the area of existing wetlands in the NWI can yield an estimation of the area of drained historic wetlands. Using this approach, it was shown that approximately 4,054 acres of wetlands were converted to urban or agricultural land in the LCEB watershed.

Hydrologic modification in the watershed is evidenced by the large amount of ditches and artificial paths (Table 3). Tile drains in agricultural areas and storm drain systems in urban areas also contribute to altered hydrology. Over time, development in the LCEB watershed has increased, which has led to an accumulation of impervious surfaces in the watershed. Increase in development is described in further detail in Section 4 of this document, which discusses land use and land cover in the LCEB watershed. The increase in hard surfaces has reduced infiltration potential in developed areas and has led to increased velocities and volumes of runoff in some areas, which can lead to erosion of stream channels and excess sediment in streams. The increased runoff volume also contributes to nonpoint source pollution in the watershed, as the pollutants present on the land are carried over these impervious areas into receiving rivers and tributaries. Increased amounts of impervious surfaces in natural floodplains also reduce the ability of the floodplains to keep floodwater near the stream, which can lead to increased flooding in developed areas, and reduce the infiltration that those areas would otherwise provide. Increases in impervious surfaces are also associated with increased water temperatures. Pavement, rooftops, and other hard surfaces tend to absorb heat, which warms the runoff that eventually drains into a river, ditch, or storm drain. The LCEB watershed is naturally a cold water aquatic community- a salmonid hydrologic system- that requires much colder temperatures to support the aquatic ecosystem. The LCEB stakeholders noted increased volume and flow due to altered hydrology as well as the need to protect fisheries and habitat as concerns (Figure 2).

Dams

Dams are another common source of hydrological modification in the sub-basin. They were generally built to store and provide water for mechanical power generation (e.g., waterwheels to mill grain) and recreation (e.g., boating and fishing). However, dams can also be associated with a number of negative impacts including changes to hydrology, water quality, habitat, and river morphology. Human activities, such as agricultural and urban land uses, can contribute to contaminant and sediment loads to the impoundments by these dams. There are 10 dams located within the watershed (Figure 12). Drainage area, storage capacity, and hazard potential for each dam are shown in Table 5. Hazard potential refers to the “possible adverse consequences that result from the release of water or stored contents [of a reservoir] due to failure of a dam or mis-operation of the dam (FEMA 2004).” Adverse consequences refer to the risks associated with the failure of a dam, including loss of human life, economic losses (including property damage), lifeline disruption, and environmental impacts. It is important to note that the hazard potential rankings, described below, are not related to the present condition of the dam, including structural integrity, safety, or other factors.

Dam Hazard Potential Classification

1. Low Hazard Potential

Dams assigned the low hazard potential classification are those where failure or mis-operation will result in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

2. Significant Hazard Potential

Dams assigned the significant hazard potential classification are those dams where failure or mis-operation will result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

3. High Hazard Potential

Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

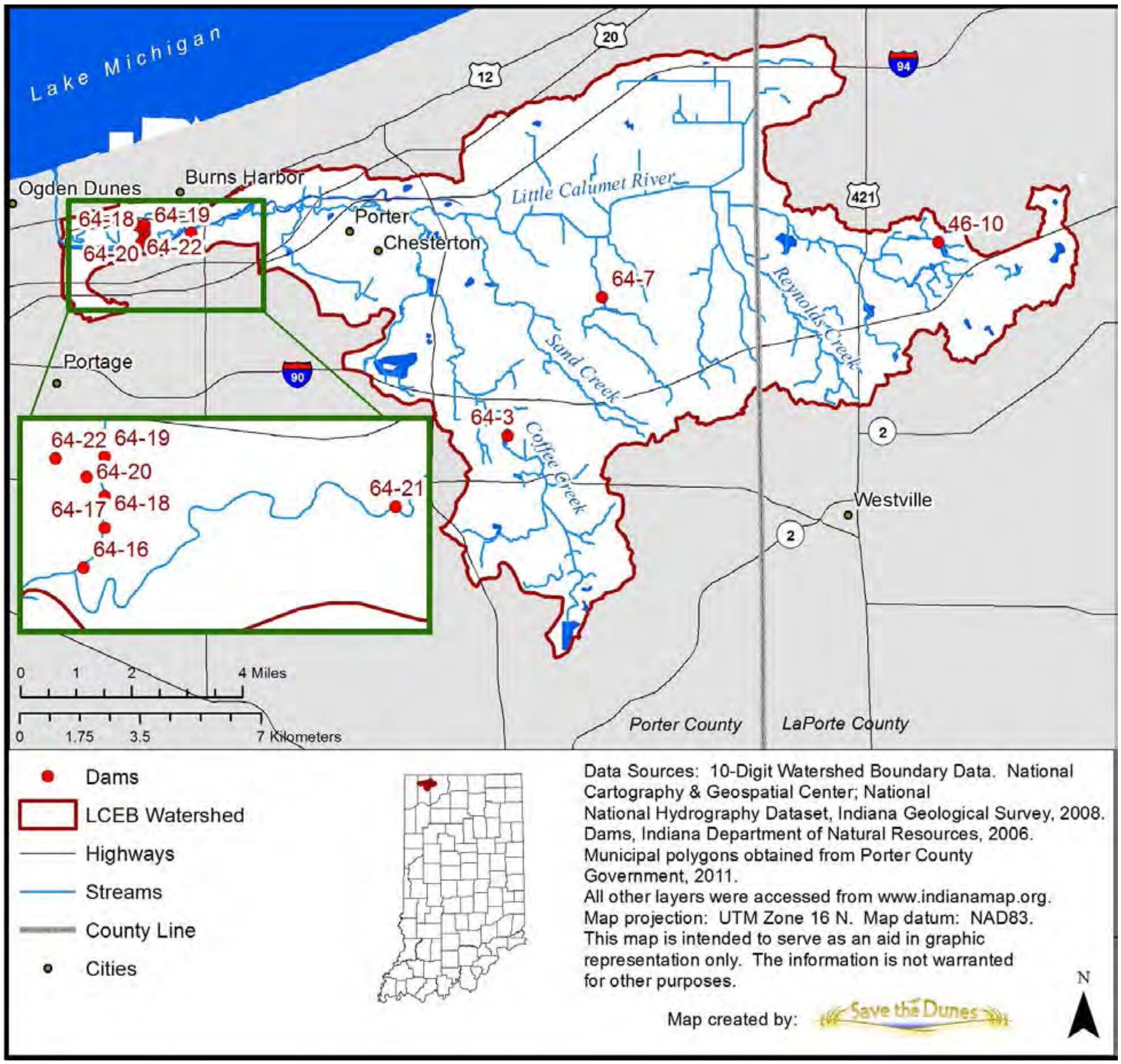

Figure 12. Dams in the LCEB watershed

Table 5. Dams in the LCEB watershed

State ID	Name	Drainage Area (mi²)	Maximum Storage Capacity (Ac-Ft)	Potential Hazard
64-3	Old Longs Mill Dam	7.59	81	Significant
64-7	Rice Lake Dam	2.71	200	Significant
64-16	Bethlehem Steel Check Dam No. 1	2	0	Low
46-10	Walton Lake Dam	0.36	180	Low
64-17	Bethlehem Steel Check Dam No. 2	2	0	Low
64-21	Praxair Dam	70	0	Low
64-18	Bethlehem Steel Check Dam No. 3	2	0	Low
64-20	Bethlehem Steel Check Dam No. 5	0	0	Low
64-22	Bethlehem Steel Check Dam No. 6	0	0	Low
64-19	Bethlehem Steel Check Dam No. 4	2	0	Low

Stakeholders for the Praxair Dam, located on the LCEB mainstem in Burns Harbor, are engaged in ongoing discussions to evaluate the future of this dam. It is too early in this process to declare possible outcomes from these discussions.

2.2.b Current Use and Jurisdictions

Today, the LCEB and its tributaries are used by multiple entities for a number of purposes. The LCEB stakeholders expressed concern over the impacts associated with many of these uses, including dredging regulated drains; woody debris management; agricultural runoff; increased stormwater volumes; and combined sewer overflows (Figure 2). Several sections of the LCEB and its tributaries are designated as legal drains and are regularly maintained by the Porter County Surveyor's Office (Figure 7). The LCEB and its tributaries are extensively used for agricultural drainage, with tile drains and agricultural drainage ditches connecting to tributaries, particularly in the upstream portions in unincorporated LaPorte and Porter counties. Portions of the communities of Burns Harbor, Chesterton, Ogden Dunes, Portage, and Porter are within the watershed. The LCEB and its tributaries flow through these communities and are used for such purposes as recreation, drainage, and acceptance of wastewater treatment outflows. Similarly, industrial users, including ArcelorMittal, use the LCEB to discharge wastewater. Wetlands throughout the watershed are valuable for flood control and wildlife habitat. Due to a prevalence of open lands, hunting and fishing are popular outdoor activities in the LCEB watershed. Game such as waterfowl and fish, including trout and other salmonids are abundant in parts of the LCEB. Forests, grasslands, riparian areas, and wetlands provide appropriate habitat for these populations.

The LCEB and its tributaries are used for recreational purposes, including paddling, fishing, and aesthetic values. Several parks and preserves exist along the LCEB, including Red Mill County Park, Shirley Heinze Land Trust (SHLT) properties, and the INDU Heron Rookery.

The LCEB flows through INDU at its downstream end and ultimately discharges to Lake Michigan via Burns Waterway, near popular swimming beaches. Consequently, the LCEB directly impacts natural resources and recreational uses at INDU. The LCEB and its tributaries also impact aquatic communities in adjacent and connected habitats. All waterways within INDU boundaries, including portions of the LCEB, are designated as Outstanding State Resource Waters. Sections of the LCEB are designated as salmonid streams and are popular locations for fishing. Sections of the LCEB are designated by the State of Indiana as Navigable Waterways.

NWIPA was founded in 2009 as a non-profit organization dedicated to developing the region's paddling resources and opportunities, providing environmental stewardship of the region's waterways, education, and to be a link between the region's paddlers. NWIPA envisions a 16-mile-long water trail along the LCEB, spanning from the Heron Rookery in unincorporated Porter County to Lake Michigan. NWIPA and its volunteers are working to open up the LCEB for kayakers by clearing log jams and organizing trash clean ups. The Portage Public Marina is located on the Burns Waterway and is partially within the LCEB watershed. The Marina facilitates boat launching onto Lake Michigan and fishing from the pier. The LCEB stakeholders expressed concern over facilitating public access, while also respecting private property rights and protecting natural resources (Figure 2).

2.3 Soil Characteristics

Soils can play a large role in the water quality of a watershed. The physical, chemical and biological properties help to determine a soil’s characteristics such as erodibility, water holding capacity, and fertility. Understanding a watershed’s soil properties can assist with identifying the source of water quality pollutants or inform appropriate development/land uses that reduce or eliminate detrimental impacts to water quality. The diversity of soil characteristics present in the LCEB emphasizes the need for variable approaches to reduce nonpoint source water pollution.

Soil Associations

A soil association is a group of soils that are geographically related and located in characteristic repeating patterns across the landscape. The soil series for which the association is named are rarely; if ever, the only soils that exist in the soil association. Soil associations typically contain several different soils of minor extent. Actual soil types may vary widely within a given association, particularly in areas dominated by glacial till soil types, such as the LCEB watershed. Specific soil types will vary within a given parcel. The LCEB watershed is comprised of nine major soil associations, listed below and in Figure 13.

- Blount-Glynwood-Morley
- Blount-Rewamo-Glynwood
- Bourbon-Sebewa-Pinhook
- Coloma-Spinks-Oshtemo
- Houghton-Adrian-Carlisle

- Morley-Markham-Ashkum
- Rensselaer-Darroch-Whitaker
- Riddles-Crosier-Oshtemo
- Tracy-Chelsea-Tyner

Each name in a soil association refers to a specific soil series, which is precisely defined for for taxonomic classification. All soil series named in the above soil associations are described below.

Adrian: The Adrian series consists of very deep, very poorly drained soils formed in herbaceous organic materials over sandy deposits on outwash plains, lake plains, lake terraces, flood plains, moraines, and till plains. Slope ranges from 0 to 1 percent.
Ashkum: The Ashkum series consists of very deep, poorly drained soils on till plains. They formed in colluvial sediments and in the underlying silty clay loam till. Slope ranges from 0 to 3 percent.
Blount: The Blount series consists of very deep, somewhat poorly drained soils that are moderately deep or deep to dense till. Blount soils formed in till and are on wave-worked till plains, till plains, and near-shore zones (relict). Slope ranges from 0 to 6 percent.
Bourbon: The Bourbon series consists of deep, somewhat poorly drained soils that formed in sandy glacial deposits on outwash plains, valley trains and sandy lake plains. Permeability is moderately rapid over rapid. Slopes range from 0 to 2 percent.
Carlisle: The Carlisle series consists of very deep, very poorly drained soils formed in woody and herbaceous organic materials in depressions within lake plains, outwash plains, ground moraines, flood plains and moraines. Slope ranges from 0 to 2 percent.
Chelsea: The Chelsea series consists of very deep, excessively drained soils formed in eolian sand. These soils are on convex summits of interfluves, side slopes, and crests of escarpments, commonly along the eastern side of stream valleys. These soils also occur on dunes on valley trains along the major rivers containing sandy outwash. Slope ranges from 0 to 45 percent.
Coloma: The Coloma series consists of very deep, somewhat excessively drained or excessively drained soils formed in sandy drift. These soils are on moraines, outwash plains, deltas and stream terraces. Slope ranges from 0 to 70 percent.
Crosier: The Crosier series consists of very deep, somewhat poorly drained soils formed in till on till plains and moraines. They are moderately deep to dense till. Slope ranges from 0 to 4 percent.
Darroch: The Darroch series consists of very deep, somewhat poorly drained soils that formed in silty and loamy sediments. Darroch soils are on lake plains, outwash plains, and till plains. Slope ranges from 0 to 3 percent.
Glynwood: The Glynwood series consists of very deep, moderately well drained soils that are moderately deep or deep to dense till. They formed in a thin layer of loess and the underlying till. These soils are on ground moraines and end moraines. Slope ranges from 0 to 40 percent.
Houghton: The Houghton series consists of very deep, very poorly drained soils formed in herbaceous organic materials more than 130 cm (51 inches) thick in depressions on lake

plains, outwash plains, ground moraines, end moraines, and floodplains. Slope ranges from 0 to 2 percent.
Markham: The Markham series consists of very deep, moderately well drained soils on Wisconsin till plains. They formed in a thin layer of loess or silty material and in the underlying silty clay loam till. Slopes range from 0 to 20 percent.
Morley: The Morley series consists of very deep, moderately well drained soils that are moderately deep to dense till. Morley soils formed in as much as 46 cm (18 inches) of loess and in the underlying clay loam or silty clay loam till. They are on till plains and moraines. Slope ranges from 1 to 18 percent.
Oshtemo: The Oshtemo series consists of very deep, well drained soils formed in stratified loamy and sandy deposits on outwash plains, valley trains, moraines, and beach ridges. Slope ranges from 0 to 55 percent.
Pewamo: The Pewamo series consists of very deep, very poorly drained soils formed in till on moraines, near-shore zones (relict), and lake plains. Slope ranges from 0 to 2 percent.
Pinhook: The Pinhook series consists of deep, poorly drain soils on outwash plains. These soils are moderately permeable in the topsoil and rapidly permeable in the subsoil. These soils are formed in shaly glacial outwash sediment. Slopes are 0 to 2 percent.
Rensselaer: The Rensselaer series consists of very deep, poorly drained or very poorly drained soils formed in loamy sediments on till plains, stream terraces, outwash terraces, outwash plains, glacial drainage channels, and lake plains. Slope ranges from 0 to 2 percent.
Riddles: The Riddles series consists of very deep, well drained soils formed in loamy and sandy till on till plains and moraines. Slope ranges from 0 to 35 percent.
Sebewa: The Sebewa series consists of very deep, poorly drained or very poorly drained soils formed in loamy outwash and the underlying gravelly and sandy outwash on outwash plains, valley trains, and stream terraces on terrace landscapes. They are moderately deep to the gravelly and sandy outwash. Slope ranges from 0 to 3 percent.
Spinks: The Spinks series consists of very deep, well drained soils formed in sandy eolian or outwash material. They are on dunes, moraines, till plains, outwash plains, beach ridges, and lake plains. Slope ranges from 0 to 70 percent.
Tracy: The Tracy series consists of deep, well drained soils on outwash plains. These soils are formed in glacial outwash. Slopes range from 0 to 45 percent.
Tyner: The Tyner series consists of deep, somewhat excessively drained soils on outwash plains of uplands. Slope ranges from 0 to 2 percent.
Whitaker: The Whitaker series consists of deep, somewhat poorly drained soils on terraces, lake plains and outwash plains. Slopes are 0 to 2 percent. (USDA, 1981 and 1982)

The soils of the LCEB are diverse due to diverse geology. Nonetheless, there are two dominant soil associations in this watershed: Riddles-Crosier-Oshtemo and Rensselaer-Darroch-Whitaker (Figure 13). The Riddles-Crosier-Oshtemo association is comprised of very deep, well drained to somewhat poorly drained soils. Slopes range from zero to 55 percent. The Rensselaer-Darroch-Whitaker association is comprised of deep to very deep soils that are somewhat poorly drained to very poorly drained. Slopes range from zero to three percent.

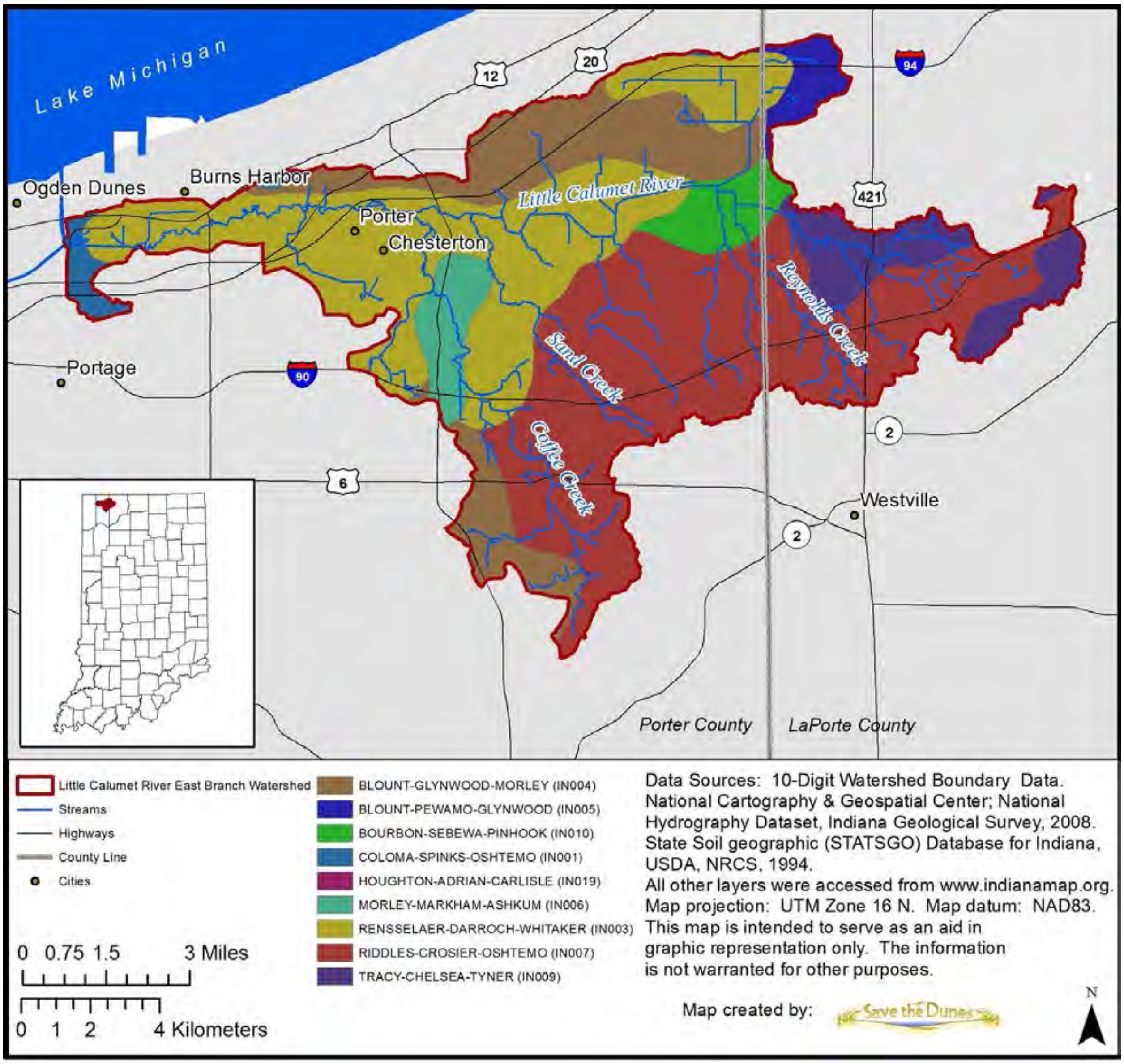

Figure 13. Major soil associations

Hydric Soils

Hydric soils are one of three characteristics used to identify wetlands. The National Technical Committee for Hydric Soils (NTCHS) defines hydric soil as soil that has been formed by saturation, flooding, or ponding for a portion of the growing season that is long enough to develop anaerobic soil conditions. These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the establishment of hydrophilic (water-loving) vegetation. Areas where hydric soils are present but wetlands no longer exist can be useful for identifying potential wetland restoration opportunities. Wetlands provide important ecosystem functions such as flood water storage, increased wildlife habitat, and sediment and nutrient removal. These wetland functions are in line with many stakeholder concerns including stormwater management and flood prevention, increased volume and flow due to altered hydrology, increased volume and flow causing erosion, sedimentation in streams, and failing to meet water quality standards (Figure 2). Hydric soils data from the Natural Resources Conservation Services (NRCS) are displayed for the LCEB watershed in Figure 14. Approximately 24% of the soils in the LCEB watershed are hydric.

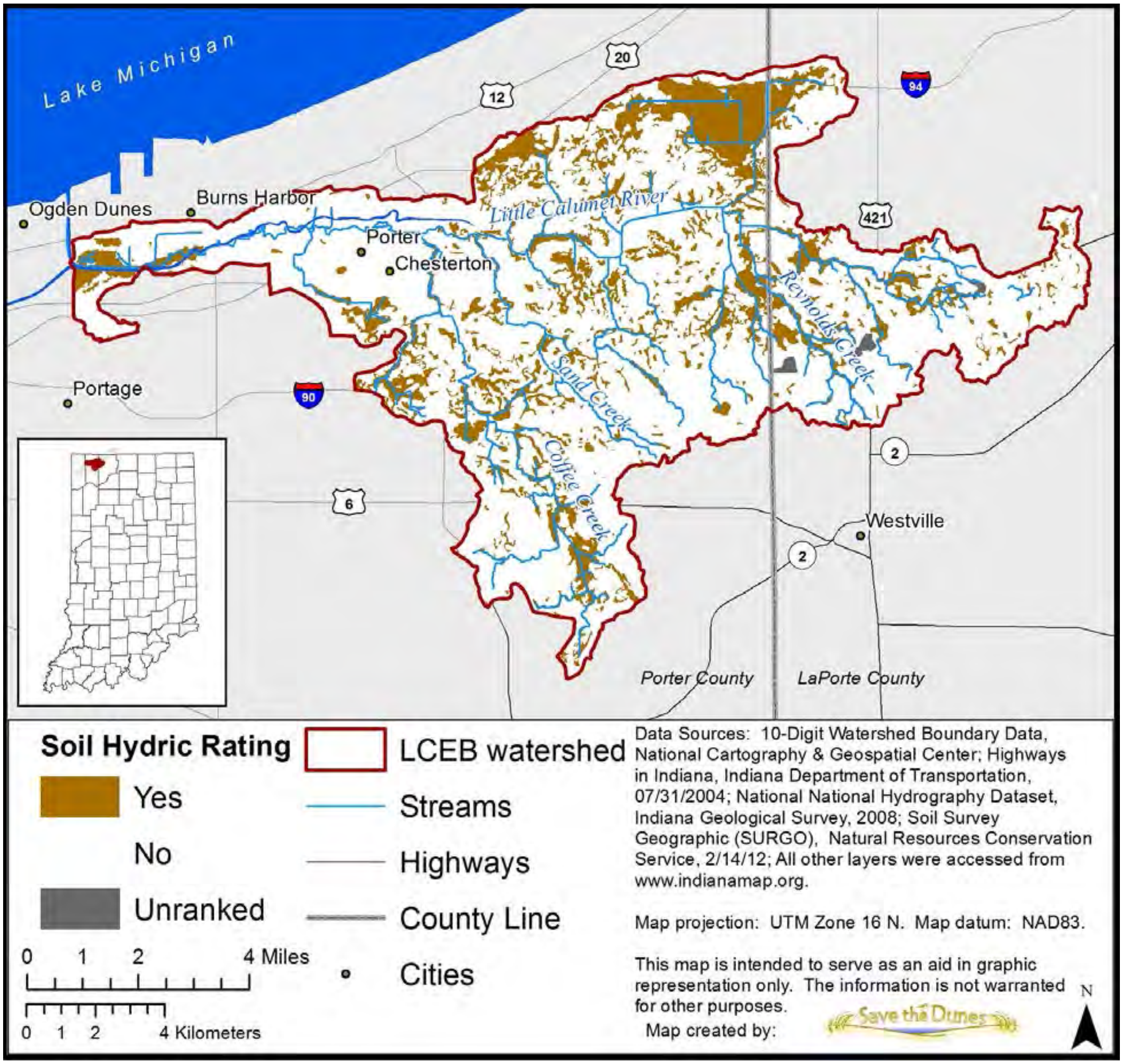

Figure 14. Hydric soils in the LCEB watershed

Soil Hydrologic Groups

A soil hydrologic group, as defined by the NRCS, is a group of soils that have similar runoff potential under similar storm and cover conditions. The influence of ground cover is treated independently and the slope of the soil surface is also not considered in assigning hydrologic soil groups. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. Soils with higher runoff potential (groups C & D) will have increased stormwater flow and velocity, thus increasing stream bank erosion. Elevated concentrations of pollutants from the land are also common from soils with high runoff potential. This information is useful in identifying nonpoint source pollutant contribution areas coupled with land use and prioritizing implementation measures to reduce pollutant loading from runoff. Stakeholder concerns related to soil hydrologic group include: the need to understand watershed geology and hydrology, sedimentation in streams, and increased volume and flow causing erosion (Figure 2).

Of the soils found in the LCEB watershed 2% are of hydrologic group A, 7% are group A/D, 35% are group B, 19% are group B/D, 7% are group C, 24% are group C/D, and 6% are unranked. The hydrologic soil groups found in the LCEB are displayed in Figure 15 and described as follows:

Group A- Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil.

Group B- Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.

Group C- Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.

Group D- Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted.

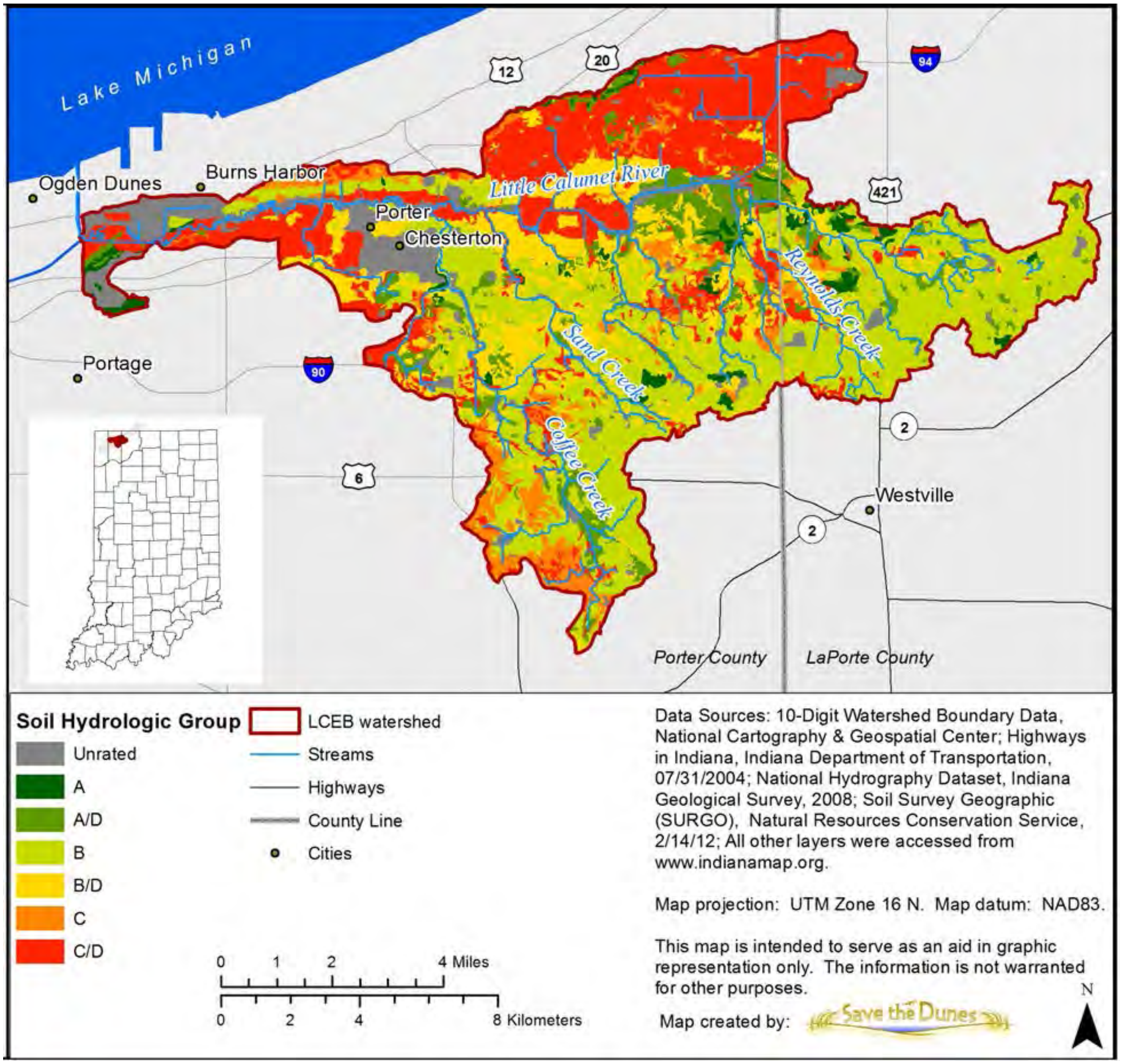

Figure 15. Soil hydrologic groups in the LCEB watershed

Soil Drainage Class

The soil drainage classes identify the natural drainage condition of the soil and refer to the frequency and duration of periods when the soil is free of saturation. Soils that drain poorly will encourage overland runoff, thus increasing the flow of stormwater and nutrients to streams. Likewise, more permeable soils that are well drained may be more susceptible to erosion, contributing to higher sedimentation rates and nutrient concentrations in streams. Stakeholder concerns related to soil drainage classes include: sedimentation in streams and increased volume and flow causing erosion.

Figure 16 displays drainage classes within the LCEB watershed. Of the soils in the LCEB watershed, 13% are very poorly drained, 7% are poorly drained, 30% are somewhat poorly drained, 7% are moderately well drained, 40% are well drained, 2% are excessively well drained, and 1% are unranked.

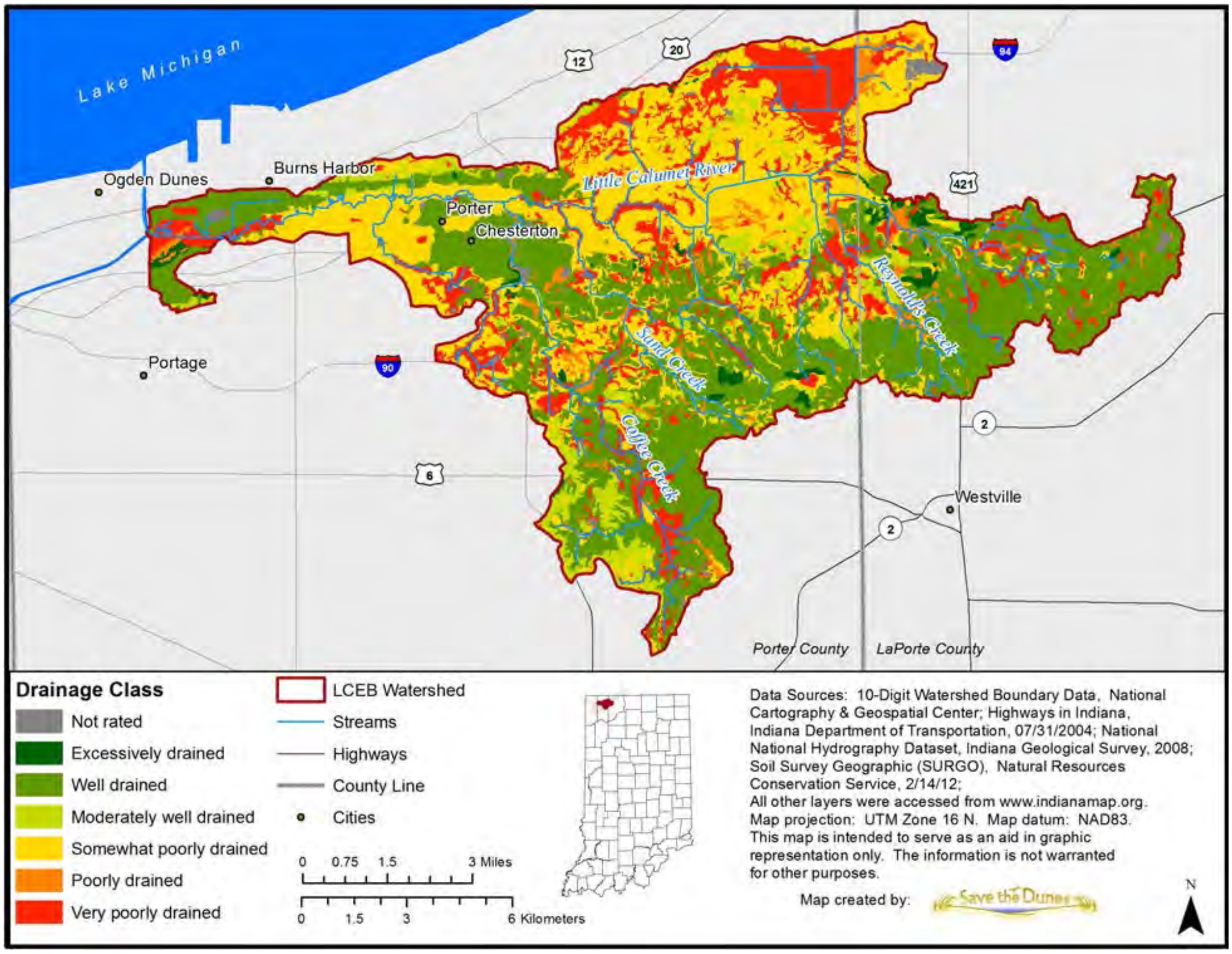

Figure 16. Soil drainage class in the LCEB watershed

Highly Erodible Land

Highly erodible land is a classification used by the NRCS to identify soils that are at highly susceptible to erosion through agricultural activities. The NRCS maintains a list of highly erodible soil units for each county based upon the potential of soil to erode from the land. The classification is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, the maximum annual rate of erosion that could occur without causing a decline in long-term productivity. The NRCS provided the list for Highly Erodible Land (HEL), which was used to generate a map of HEL in the watershed (Figure 17). Approximately 21,721 acres or 46% of the soils in the LCEB watershed are classified as highly erodible and potentially highly erodible. The LCEB stakeholders noted highly erodible soils on cropland as a concern (Figure 2).

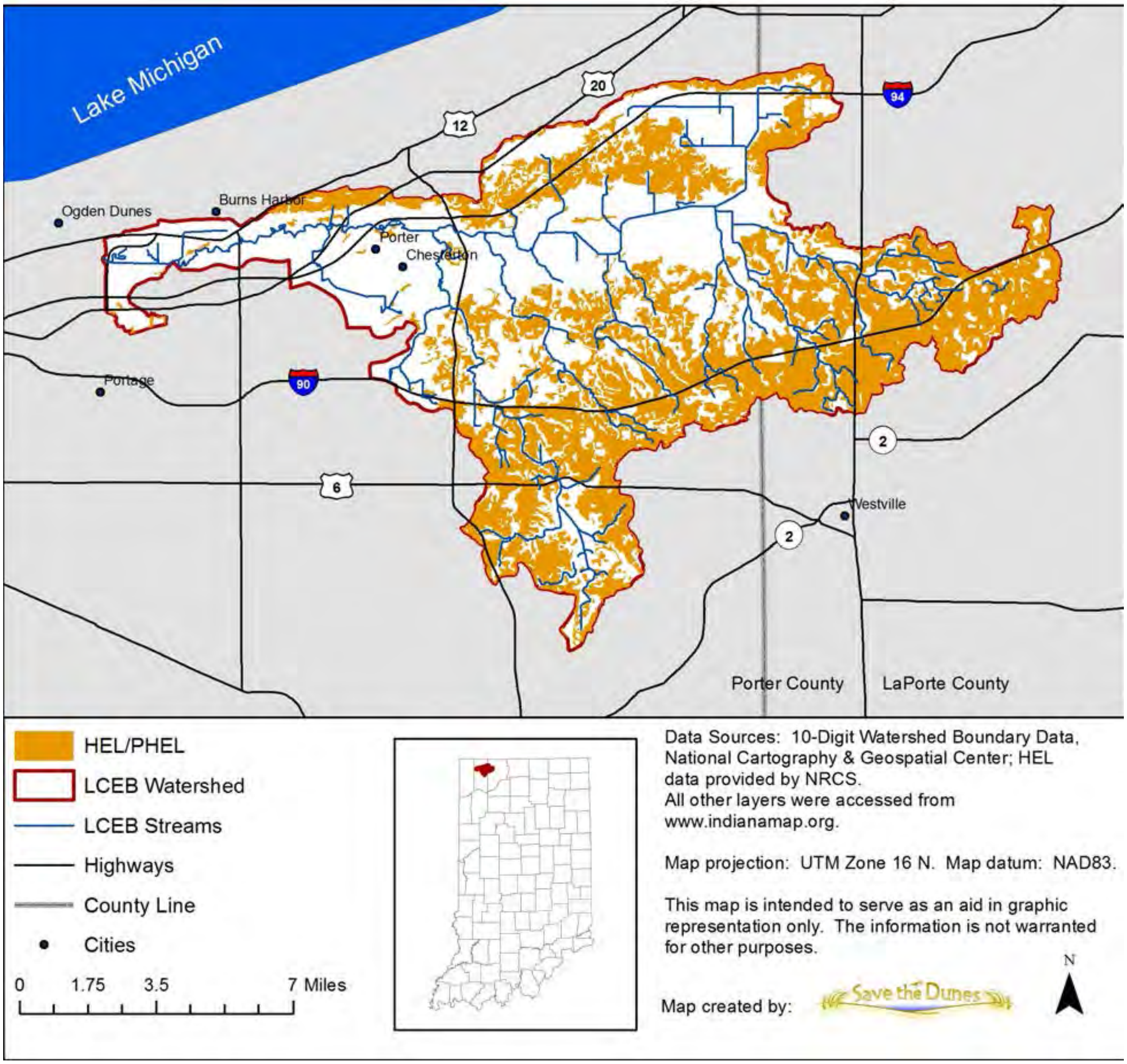

Figure 17. Highly erodible land (HEL) and potentially highly erodible land (PHEL)

Onsite Septic Systems

Conventional onsite sewage disposal systems (a.k.a. septic systems), while common, are not suitable for all areas. Among the limitations that might preclude installation of a conventional system are: high groundwater tables; shallow limiting layers of bedrock or fragipan; very slowly or rapidly permeable soils; topography; and lot size.

Figure 18 shows soil limitations within the LCEB for conventional septic systems that use absorption fields for treatment. Only part of the soil, between depths of 24 and 60 inches, is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. The data used to generate this figure was obtained from the NRCS Soil Survey Geographic Database (SSURGO). This information is not site specific and does not eliminate the need for onsite investigation. The rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. These include:

Not Rated- Soils are highly disturbed, such as in urban areas. These soils account for 6% of the watershed.

Not Limited- Soils have features that are very favorable for the specified use. Good performance and very low maintenance can be expected. This soil rating is not represented in this watershed.

Somewhat Limited - Soils have features that are moderately favorable for the specified use. Limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. These soils account for approximately 11% of the watershed.

Very Limited - Soils have one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected. This soil rating accounts for approximately 83% of the watershed.

Ninety four percent of LCEB soils are either somewhat limited or very limited for onsite septic systems. Likewise, approximately 80 percent of the LCEB is unsewered (Figure 19). The sewered portions of the LCEB are located in the Northwest portion of the watershed in the towns of Chesterton, Porter, Burns Harbor, and Portage. The remainder of the watershed is more sparsely populated and utilizing onsite septic systems. Due to the abundance of unsewered areas on soils that are either somewhat limited or very limited for onsite septic systems, it is likely that septic systems are a significant source of nonpoint source pollution (e.g. *E. coli*, nitrogen, and phosphorus) in the LCEB. Elevated *E. coli* concentration due to malfunctioning septic systems was identified as a stakeholder concern (Figure 2).

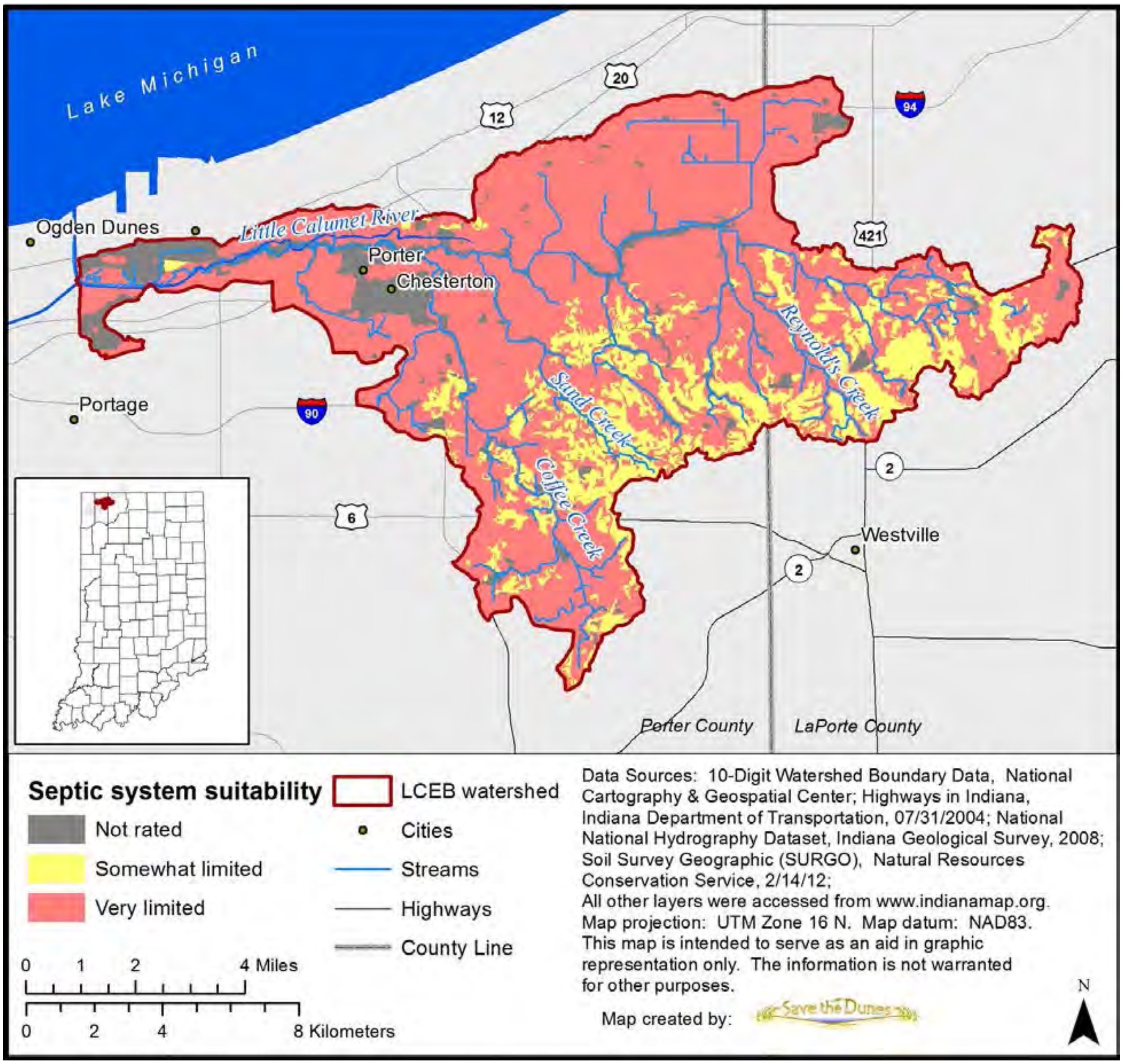

Figure 18. Soil septic system suitability in the LCEB watershed

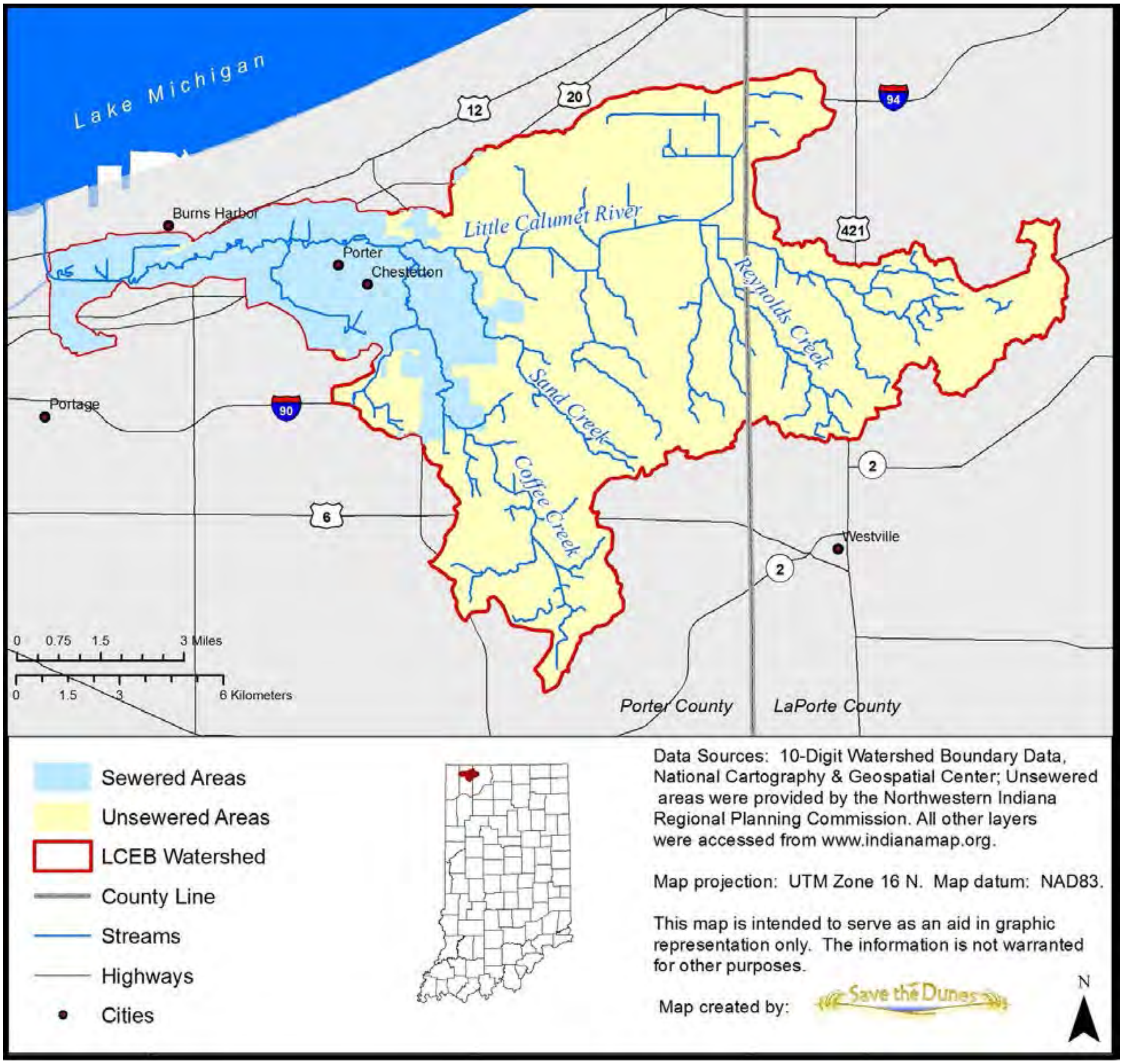

Figure 19. Sewered and unsewered areas

2.4 Land Use

Land use and cover within a watershed can have a profound impact on both water quality and habitat. Natural land cover such as forests, wetlands, and grasslands can protect or improve water quality and aquatic habitats. Alteration of natural land cover for human use typically leads to increased runoff, which can carry pollutants to nearby waterbodies. The pollutants generated are dependent on the land uses within the given watershed. Some of the common pollutants generated in urbanized areas include excess nutrients, sediment, metals, pathogens, and toxins. In agricultural areas common pollutants can include excess nutrients, sediment, pathogens, herbicides and pesticides. For this reason, having an understanding of what land uses are present in a watershed can help determine what factors may be contributing to water quality or habitat problems.

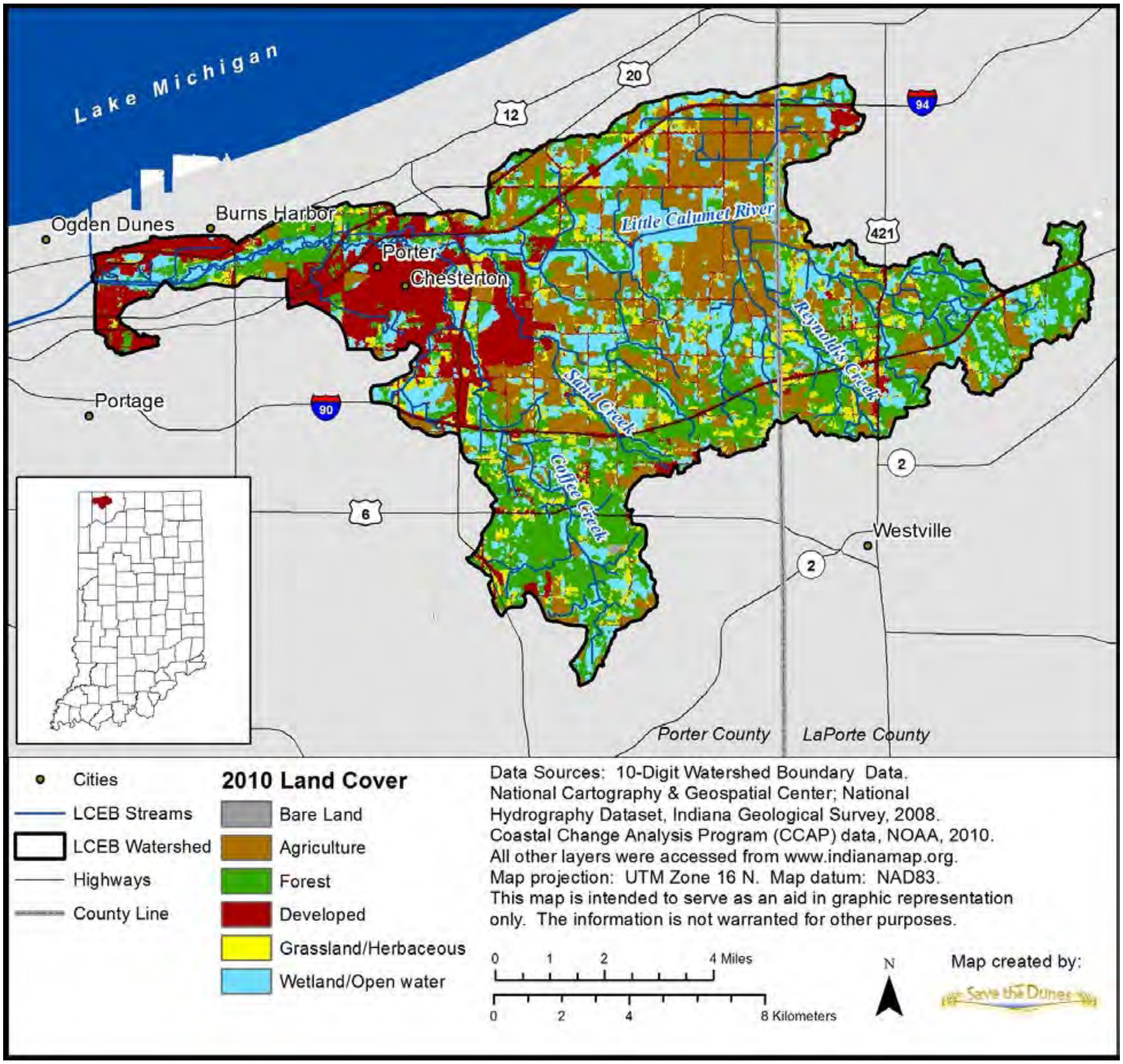

Figure 20. Land cover in the LCEB watershed

Figure 20, Table 6, Figure 21, and Figure 22 were generated using NOAA's Coastal Change Analysis Program (CCAP) data. CCAP produces a nationally standardized database of land cover and land change information for the coastal regions of the United States. It provides inventories of wetlands and adjacent uplands with the goal of monitoring these habitats by updating the land cover maps every five years. Data is developed using multiple dates of remotely sensed imagery and consist of land cover maps, as well as a changes that have occurred between these dates and where the changes were located. CCAP data for Indiana was available for 1996, 2001, 2006, and 2010.

Figure 21 displays the 2010 land cover data as a percentage of the LCEB watershed. Similar cover types have been grouped into generalized cover classes for display purposes. Forest (deciduous, evergreen, mixed, and shrub/scrub) is the dominant land cover type within the watershed, followed by agriculture (cultivated crops and pasture/hay) and developed (high, medium, low, open space). Generally, the greatest concentration of developed land occurs in the western half of the watershed along Coffee Creek and the downstream sections of the LCEB mainstem (Figure 20). Agricultural areas are primarily located in the northern portion of the watershed and forested areas are located in the southern and eastern areas of the watershed along the headwater tributaries.

Table 6. Land cover in the LCEB watershed

Land Cover	% of Watershed in 2010	Area in 2010 (Acres)	Change, 2006 to 2010 (Acres)
Developed, High Intensity	2%	962	+46
Developed, Medium Intensity	8%	4098	+83
Developed, Low Intensity	18%	8918	+446
Developed, Open Space	6%	2963	+196
Cultivated Crops	17%	8600	+63
Pasture/Hay	7%	3706	-212
Grassland/Herbaceous	9%	4243	-263
Deciduous Forest	15%	7363	-175
Evergreen Forest	1%	325	-9
Mixed Forest	<1%	128	-13
Scrub/Shrub	5%	2466	-93
Palustrine Forested Wetland	7%	3468	-26
Palustrine Scrub/Shrub Wetland	2%	478	-9
Palustrine Emergent Wetland	1%	316	-4
Bare Land	<1%	43	+2
Open Water	1%	303	+10

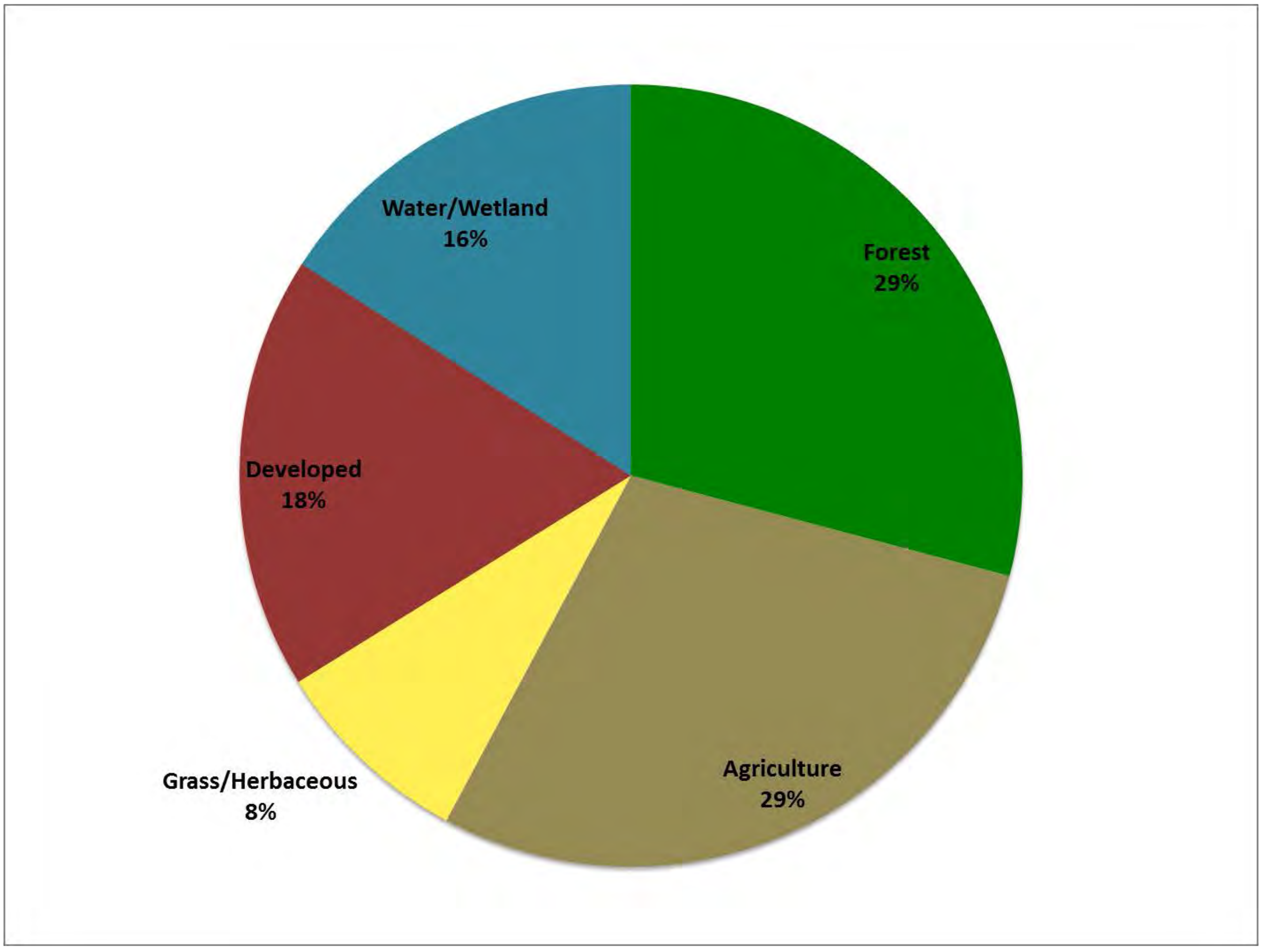

Figure 21. Land cover in the LCEB watershed by percent

Urban/Suburban

An extensive body of literature has been developed to examine the direct impact of urbanization on streams. Much of this research has focused on hydrologic, physical and biological indicators. In recent years, impervious cover (IC) has emerged as a way to explain and sometimes predict how severely these indicators change in response to varying levels of watershed development. The Center for Watershed Protection (CWP), located in Maryland, has integrated research findings into a general watershed-planning model, known as the impervious cover model (ICM). The ICM predicts that most stream quality indicators decline when watershed IC exceeds 10%, with severe degradation expected beyond 25% IC (CWP, 2003). Impervious cover was determined using the L-THIA (Long-Term Hydrologic Impact Assessment) model developed by Purdue University. L-THIA's estimation of impervious cover was based on land use, as determined by the USGS NLCD (National Land Characteristics Data) database and following methods develop by Cappiella and Brown (2001). Impervious cover for the Reynolds Creek and Kemper Ditch subwatersheds is well below 10% (Table 7), therefore, it is unlikely impervious cover plays a significant role in stream degradation of these subwatersheds. Coffee Creek subwatershed has approximately 14% impervious cover with the highest concentration in the northwestern portion of this subwatershed. Consequently, the urban areas of Chesterton, Porter and Burns Harbor may impact water quality in this subwatershed.

Table 7. Impervious cover for LCEB subwatersheds

LCEB Subwatershed	Impervious Cover (acres)	% of Subwatershed
Reynolds Creek	522	4
Kemper Ditch	1,326	5
Coffee Creek	2,905	14

Urban land in the watershed is generally concentrated in and adjacent to the incorporated areas, primarily located within the Coffee Creek subwatershed. According to Chesterton's comprehensive plan, growth of the city will likely take place to the south and southeast of the current city limits. In these urban areas, fertilizer may be over applied to lawns in residential and commercial areas and recreational areas such as golf courses. Pet waste may be contributing *E. coli* in urban areas.

Land cover changes between 1996 and 2006 were primarily due to the conversion of agricultural land to low-intensity developed land in and adjacent to the Town of Chesterton and the City of Portage. Land cover changes between 2006 and 2010 were primarily due to the conversion of pastureland, grassland, and forested land to low-intensity developed land in and adjacent to the Town of Chesterton and the City of Portage (Figure 22, Table 6). Some of this growth is happening in areas that are not connected to a municipal wastewater system, which could pose a risk for *E. coli* loading from septic systems that are on unsuitable soil and/or are not maintained, in addition to other nonpoint source runoff that does not pass through a WWTP. LCEB stakeholders have concerns with pathogen loading from malfunctioning septic systems and combined sewer overflows (Figure 2).

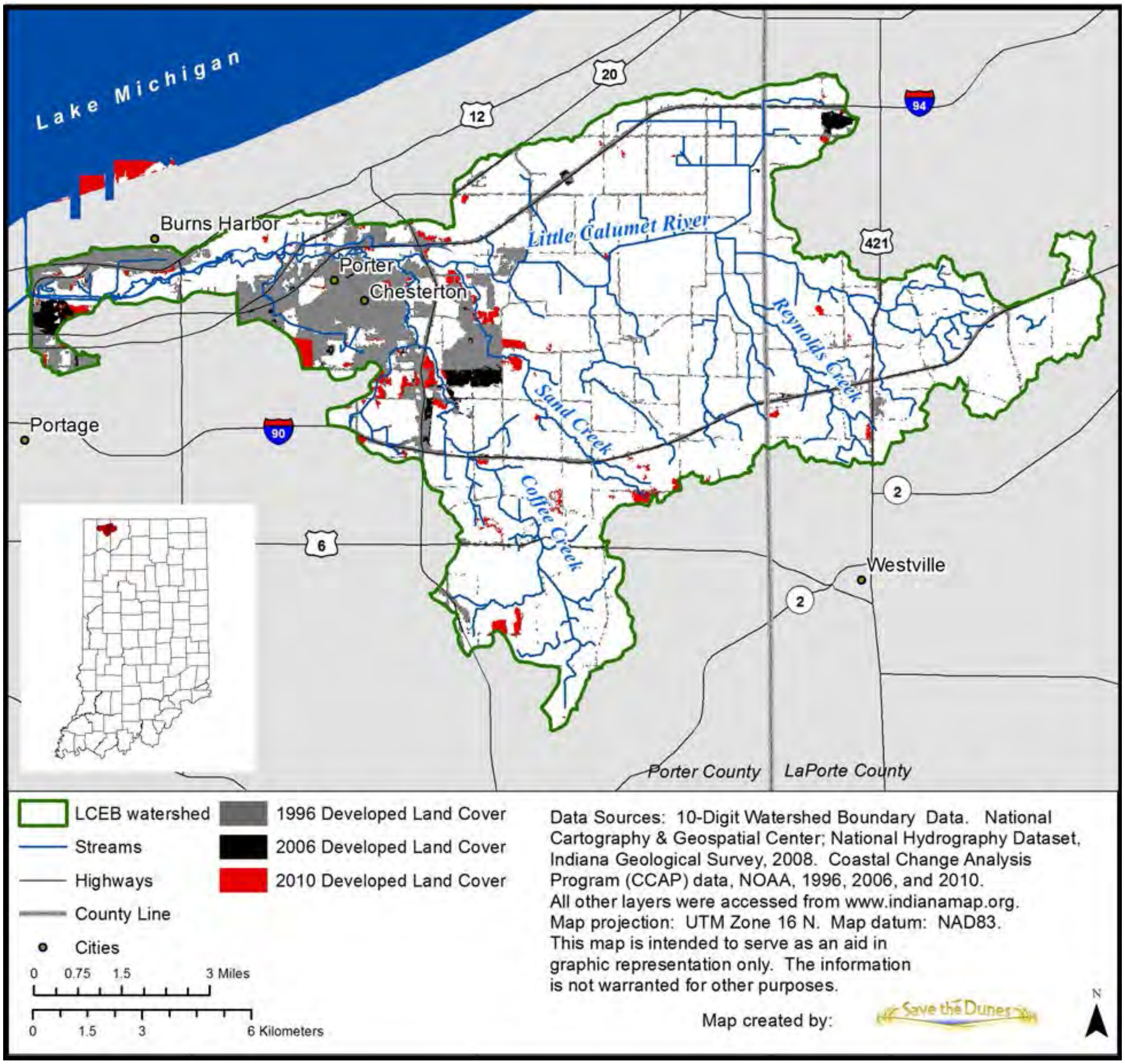

Figure 22. Change in developed land cover from 1996 to 2010.

Agriculture

In 2010, approximately 29% of the watershed was devoted to agriculture, which includes both hobby farms and conventional agriculture. The use of conventional fertilizer on agricultural lands is dominant due to the decreased popularity of animal husbandry in this watershed. Consequently, this reduces the availability of manure for fertilizer. No Confined Feeding Operations (CFOs) are located within the watershed. In cultivated areas, tillage practices can have a major effect on water quality. Conventional tillage leaves the soil surface bare and loosens soils particles making them susceptible to wind and water erosion. Conservation tillage reduces erosion by leaving at least 30% of the soil surface covered with crop residue after harvesting. Residues protect the soil surface from the impact of raindrops and act like a dam to slow water movement. Rainfall stays in the field allowing the soil to absorb it. With conservation tillage, less soil and water leave a field. While there is no data specifically available for conservation tillage practices by Hydrologic Unit Code, the Indiana State Department of Agriculture (ISDA) does provide data by county.

Cropland tillage data for 2011 for both corn and soybean are presented in Figure 23. In Porter County, agricultural management practices for corn are dominated by conventional tillage. However, management practices for corn in LaPorte County is predominantly mulch tillage. For soybeans, conservation tillage is common in both counties.

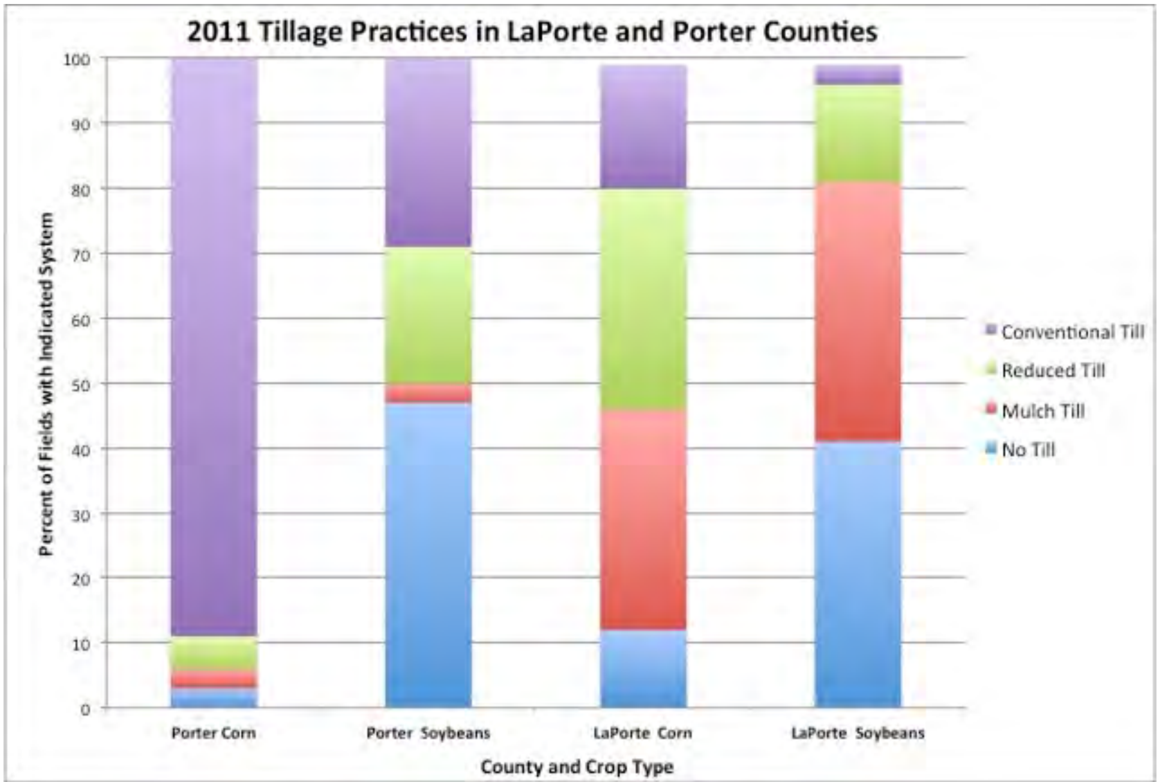

Figure 23. 2011 cropland tillage data for corn and soybeans

Forest and Undeveloped Land

Forests play a critical role in the health of a watershed. Forest cover reduces stormwater runoff and flooding by intercepting rainfall and promoting infiltration into the ground. Trees growing along streams help prevent erosion by stabilizing the soil with their root systems. They help improve water quality by filtering sediment and associated pollutants from runoff and they provide cover for both terrestrial and aquatic life. Forests also reduce summer air and water temperatures and improve regional air quality. Figure 24 shows managed lands in the LCEB watershed. The large amount of forest and undeveloped land in this watershed provides abundant open spaces and places for recreation.

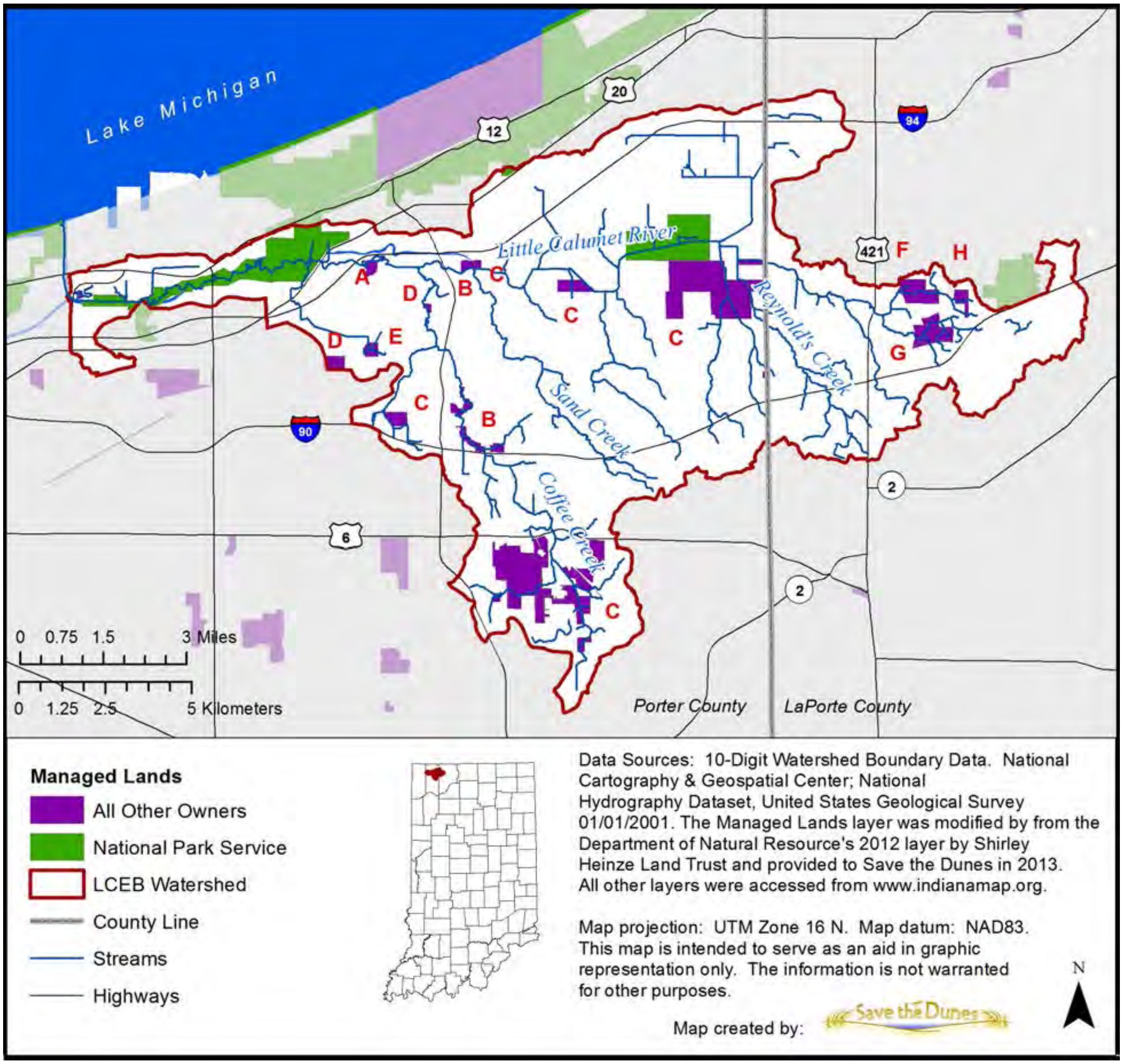

Figure 24. Managed lands in the LCEB watershed

Table 8. Other Land Owners of Managed Lands in the LCEB

Notation in Figure 24	Owner/Manager of Property
A	Town of Porter
B	Coffee Creek Conservancy
C	Indiana DNR
D	Town of Chesterton
E	Porter County Parks Foundation
F	Boy Scouts of America
G	LaPorte County Parks & Recreation
H	Izaak Walton League

The riparian zone refers to the area immediately adjacent to a stream, generally within the floodplain. The term riparian buffer implies a vegetated riparian zone that protects or buffers a stream, lake, wetland or other waterbody. Vegetated riparian buffers can provide many benefits to the water body, including slope and bank stabilization, reducing stormwater velocity, filtering and assimilating pollutants, and shading the waterbody. Riparian buffers vary in width, vegetation, soil type, hydrology, and other factors, all of which can impact the effectiveness of the buffer in protecting the waterbody. Restoring or establishing riparian buffers is a common best management practice (BMP) for controlling nonpoint source pollution; however, protecting existing, natural buffers is generally cheaper and more effective than creating or restoring degraded buffers. Streambank erosion and degraded riparian areas are concerns raised by stakeholders (Figure 2).

The Emerald Ash Borer (EAB) Beetle is an invasive insect from Asia that feeds exclusively on Ash trees. It was first confirmed in Indiana in 2004, and has since spread throughout most of the state. To date, the EAB has infected virtually all of the ash trees in the LCEB watershed. Since treatment of the infected Ash trees on a large scale is not economically feasible, these trees will perish within five years. This has negative implications for the river, since the death of over a thousand trees has the potential to increase temperatures through the removal of shade, to add to log jams that impair recreational access and enjoyment, and to add to the quantity of runoff that is making its way into the LCEB and its tributaries. The massive Ash die off will also remove a large amount riparian vegetation in some areas, which will reduce the abilities of riparian buffers to filter pollution from nonpoint sources. The LCEB watershed group listed the EAB as a concern for the watershed (Figure 2).

2.5 Planning Efforts in the Watershed

The LCEB watershed spans two counties and is within the Lake Michigan drainage basin. Consequently, there are many different planning efforts that may affect water quality in the watershed.

Indiana Coastal Nonpoint Pollution Control Program

The Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) Section 6217 calls upon states with federally approved coastal zone management programs, such as the DNR's Lake Michigan Coastal Program, to develop and implement coastal nonpoint pollution control programs. Indiana's Lake Michigan Coastal Program area includes the LCEB watershed. The Coastal Nonpoint Source Pollution Control Program provides technical assistance to government, regional and nonprofit organizations to implement nonpoint source pollution best management practices. The 2005 Indiana Coastal Nonpoint Pollution Control Program was developed to address water quality issues in coastal waters with a goal to restore and protect coastal waters. Coastal Program Grants has funded several grants in the LCEB that support water quality improvements and public access. Funded projects include: a pedestrian bridge over the LCEB in Porter, the development of Coffee Creek Conservancy's Master Plan, and improved public access and restoration along the Little Calumet River in the City of Portage. Stakeholder concerns addressed by this planning effort include the reduction of nutrient and sediment loading and improved public access.

Watershed Management Plan requirements include compliance with 6217 program requirements from the Indiana Department of Natural Resources Coastal Program. This plan conforms to the needed requirements.

Coastal and Estuarine Land Conservation Program Plan

The Coastal and Estuarine Land Conservation Program (CELCP) Plan was developed by the IDNR Lake Michigan Coastal Program to prioritize land conservation needs and nominate potential projects for federal funding within Indiana's federally approved coastal program boundary. The purpose of the CELCP is to protect important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses. The plan develops a large scale framework for the protection of natural resources at a regional level. The plan also assists local communities with information to assist planning needs. The LCEB is a coastal watershed that lies within the area of interest for this program. As the greater Chicago area population continues to grow, the LCEB watershed will likely face increased development pressures. Conservation of natural lands may play a large role in protecting water quality in this watershed. Stakeholder concerns include the promotion of conservation easements in the LCEB (Figure 2).

Town of Chesterton Combined Sewer Overflow (CSO) Long Term Control Plan

Chesterton's Long Term Control Plan was designed to improve water quality and stream health in the LCEB watershed. Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. During periods of heavy rainfall or snowmelt the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies. These overflows, called combined sewer overflows (CSOs), contain stormwater plus untreated human waste, industrial waste, potentially toxic materials, and debris. CSO communities are required to submit Long Term Control Plans to IDEM as a National Pollutant Discharge Elimination System (NPDES) permit requirement. The Chesterton Wastewater Treatment Plant (WWTP) has submitted a Long Term Control Plan (LTCP). The Chesterton LTCP states, "The town has been aggressive in the separation of combined sewers". The town recently constructed separate storm sewers and connected the older combined sewers to the newly constructed sewers. The town of Chesterton is also constructing a large overflow tank that will be able to hold 1.2 million gallons of wastewater, capturing up to a 10 year, 1 hour storm event. This will reduce the frequency of overflows, which should in turn reduce pathogen loads in the LCEB near the outfall and in downstream areas. The Chesterton WWTP currently processes all wastewater from Chesterton, Porter, and the Indian Boundary Conservancy District, which is a small group of subdivisions and other properties located just outside the Chesterton city limits. Figure 25 shows the service area for the Chesterton WWTP, which is more or less the city limits for Chesterton and Porter. Figure 1 shows the geographic relationship of these municipal areas with the watershed. The LCEB stakeholders noted pathogen loading from combined sewer and sanitary sewer overflows as a concern (Figure 2).

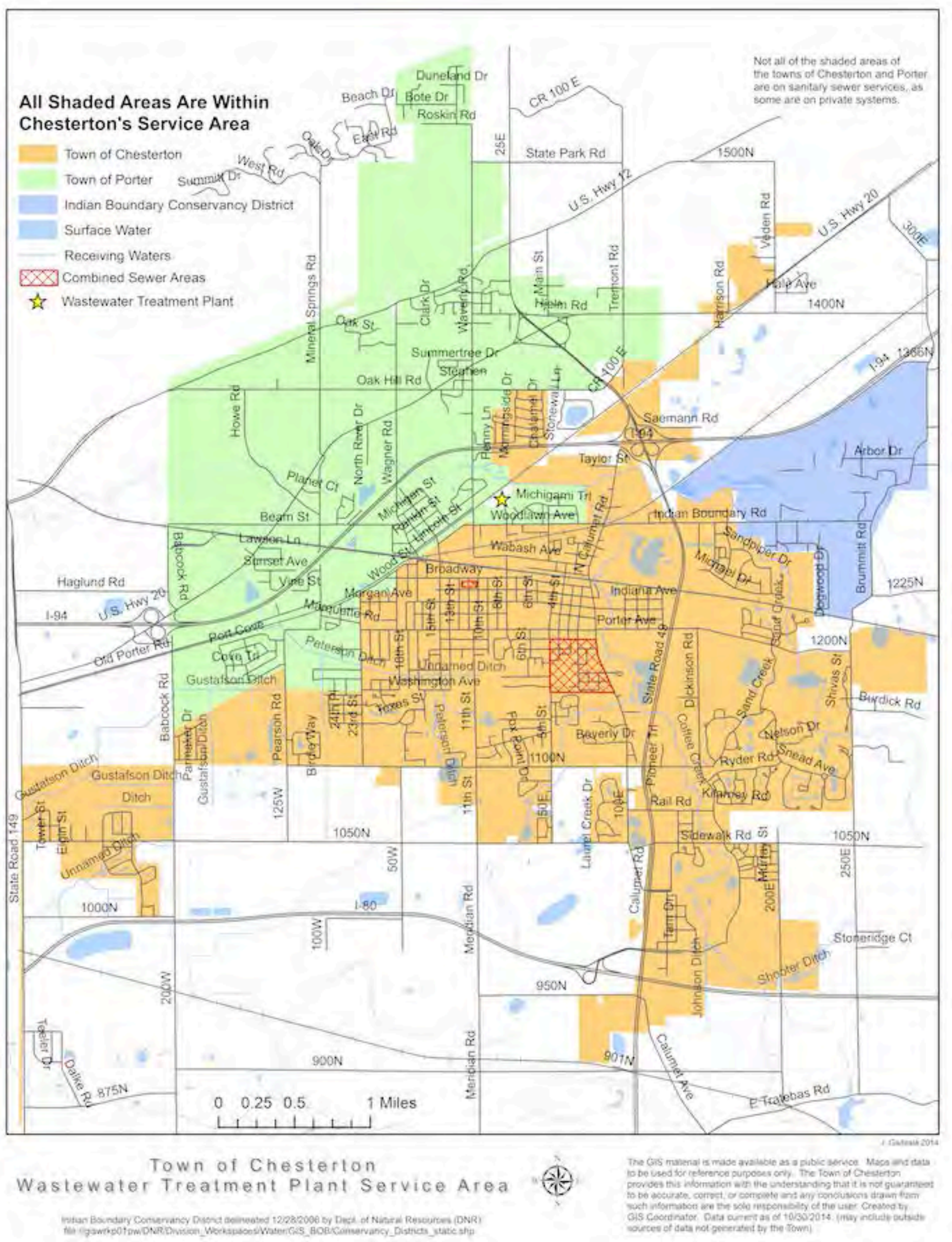

Figure 25. Service area for the Town of Chesterton Wastewater Treatment Plant

Coffee Creek Watershed Management Plan

The Coffee Creek Watershed Conservancy (CCWC), in collaboration with local stakeholders, completed the Coffee Creek WMP in 2003. While the Coffee Creek watershed is a subwatershed within the LCEB watershed, the project area for the Coffee Creek WMP is considerably smaller than the LCEB's Coffee Creek subwatershed (Figure 26). The Coffee Creek WMP serves as the community's road map to achieve the watershed stakeholders' vision for the watershed, which states that Coffee Creek supports a healthy cold-water biological community and provides an attractive resource for citizens. The CCWC has been an important stakeholder in developing the LCEB WMP and is represented on the Steering Committee. Save the Dunes worked closely with the CCWC to ensure that relevant information from the 2003 Coffee Creek WMP was incorporated into the LCEB WMP. The goals listed below played a role in the development of goals for the LCEB WMP.

Water quality improvement and protection goals identified in the Coffee Creek WMP

1. Establish/encourage vegetated streamside buffers along Coffee Creek and its tributaries
2. Encourage the conservation and improvement of forests in the headwater regions
3. Educate stakeholders of the value of Coffee Creek and ways to protect its water quality and aquatic life
4. Improve understanding of *E. coli* sources and improve education to stakeholders for the reduction of bacterial loads
5. Determine the contribution of sediment, nutrients and bacteria from surface and subsurface drains that were not monitored for the 2003 WMP
6. Reduce sediment loads from Pope O'Connor Ditch and Shooter Ditch by 65% and nutrients by 40%

Both the Pope O'Connor Ditch and Shooter Ditch drainage areas were selected as critical areas for the 2003 Coffee Creek WMP. Implementation efforts were conducted in Shooter Ditch. Drainage tiles were broken in a persistently wet agricultural field and a small dam/weir was built to manage the flow from this field. These implementation efforts likely improved water quality in Shooter Ditch.

Information from the Coffee Creek WMP among several other data sources was considered for the selection of critical and protection areas in the LCEB WMP. Ultimately, the Technical Committee decided that empirical data derived from the 2012 Baseline Study was the best indicator of water quality and water pollution. The Pope O'Connor Ditch and Shooter Ditch drainage areas were not selected as LCEB critical areas due to higher water quality than other parts of the LCEB watershed.

Chicago Wilderness Green Infrastructure Vision

This project provides a visionary, regional-scale map of the Chicago Wilderness region that reflects both existing green infrastructure, (forest preserve holdings, natural area sites, streams, wetlands, prairies, and woodlands) as well as opportunities for expansion, restoration, and connection. The broader goal of this effort is to bring the Chicago

Wilderness Biodiversity Recovery Plan to life in a more meaningful, visual, and accessible way for Chicago Wilderness members and outside audiences. For the purpose of this project, green infrastructure is: The interconnected network of land and water that supports biodiversity and provides habitat for diverse communities of native flora and fauna at the regional scale. The LCEB mainstem and Coffee Creek are included in the green infrastructure vision for Chicago Wilderness (Figure 26). To date, no projects for this regional plan have taken place in the LCEB. Stakeholder concerns addressed by this plan include acquisition of land and increased river access (Figure 2).

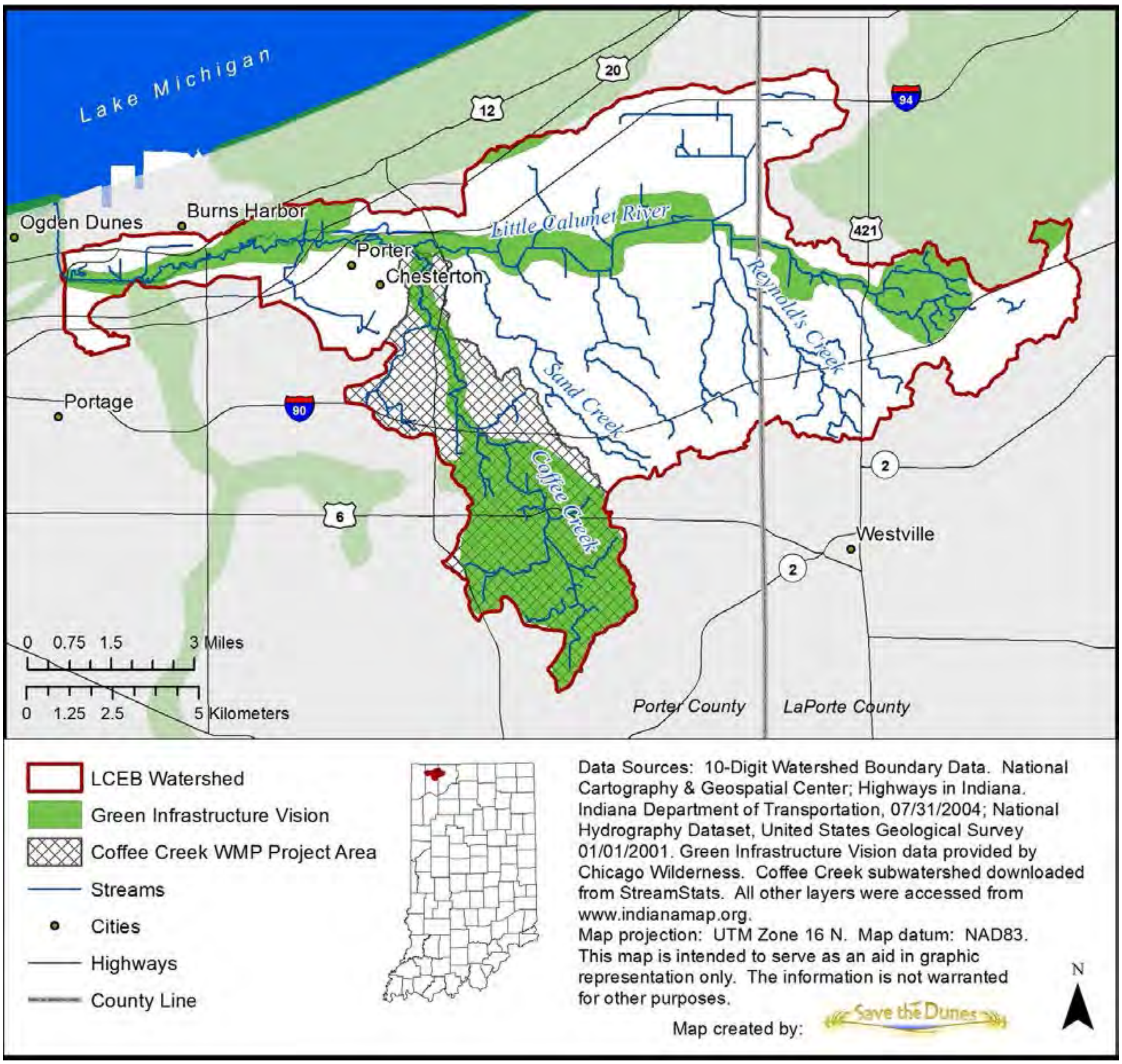

Figure 26. Green Infrastructure Vision and Coffee Creek Watershed Plan area

Indiana Comprehensive Wildlife Strategy

The Indiana Comprehensive Wildlife Strategy (CWS) was developed by the Indiana Department of Natural Resources (IDNR) in coordination with conservation partners across the state to protect and conserve habitats and associated wildlife at a landscape scale. It provides a comprehensive overview of conservation in Indiana and identifies needs and opportunities for helping prevent species from becoming threatened or endangered in the future. The Indiana Comprehensive Wildlife Strategy provides a framework for protecting species diversity (both on land and in water) for the LCEB watershed, which complements efforts to improve water quality in this watershed. Conservation recommendations are not made on a watershed scale, but rather on a regional and ecosystem basis. Recommendations include habitat protection, population management, population enhancement, disease/parasite management, and public education to reduce human disturbance. Due to a diversity of ecosystems in the LCEB and the noteworthy biodiversity of northwest Indiana, this program assists with the development of resources for the LCEB watershed. Information from this program was considered for the designation of protection areas.

Indiana Nonpoint Source Management Plan

The Indiana Nonpoint Source Management Plan, prepared by IDEM's Office of Water Quality, reflects the current goals and direction of Indiana's Nonpoint Source Management Program. It documents the methods Indiana will use to meet the state's long-term goal of measurable improvements in water quality through education, planning, and implementation while also meeting United States Environmental Protection Agency's (U.S. EPA's) criteria. As required by Section 319(h), each state's Nonpoint Source Management Program Plan describes the state program for nonpoint source management and serves as the basis for how funds are spent. The LCEB WMP is being drafted through an IDEM Section 319 grant.

Northwest Indiana Regional Greenways and Blueways Plan

The Greenways and Blueways Plan was developed jointly by NIRPC (Northwestern Indiana Regional Plan Commission) and Openlands. This effort represents a culmination of research, review, and analysis of local, regional, state, federal, and private endeavors that aim to preserve and restore linear open space corridors in the Northwest Indiana landscape. A 16-mile stretch of the LCEB is listed as a Blueway in the plan. NWIPA (Northwest Indiana Paddling Association) is working to implement the Greenways and Blueways plan by removing obstacles (woody debris) to paddling on the LCEB without harming important stream habitat. Increased walking trails, safe passage for recreational paddlers, and the acquisition of land are stakeholder concerns addressed by this plan (Figure 2). The LCEB watershed will benefit from this plan through the preservation of riparian areas, increased access and increased attention toward the restoration of aquatic resources. This plan may be used when assessing public access concerns.

Indiana Wellhead Protection Program

IDEM's Ground Water Section administers the Wellhead Protection Program, which is a strategy to protect ground water drinking supplies from pollution. The Safe Drinking Water Act and the Indiana Wellhead Protection Rule (327 IAC 8.4-1) mandates a wellhead program for all Community Public Water Systems. The Wellhead Protection Program involves the delineation of a Wellhead Protection Area (WHPA), identifying potential sources of contamination, and creating management and contingency plans for the WHPA. There is only one WHPA in the LCEB. Beechwood Mobile Home Park (Public Water Supply Identification Number 5246002) is located within the LCEB watershed in the headwaters of the Reynolds Creek subwatershed (10055 West 50 North, Michigan City, IN 46360). The Beechwood Mobile Home Park Wellhead Protection Plan was approved in October of 2006. Wellhead protection areas cannot be mapped for this WMP due to homeland security safety concerns.

Indiana Dunes National Lakeshore General Management Plan

The 1997 General Management Plan for INDU is a combination of the National Park Service's 1992 West Unit General Management Plan Amendment, 1991 Little Calumet River Corridor Plan, and 1997 East Unit General Management Plan Amendment. It defines the management philosophy and goals for making decisions and solving problems for the next 20 years. There are approximately 12,517 acres of INDU land within the LCEB watershed (Figure 24). This information was considered for the designation of protection and critical management areas, goals, and activities. This plan addresses several stakeholder concerns, including increased public access, continuous walking trails, and ADA compliant access (Figure 2).

Activities such as hiking, birding, and fishing are readily available on NPS lands in the LCEB. However, the 1997 plan does not include river clearing or facilities for paddling. The NPS, in collaboration with the National Forest Service and Urban Waters Initiative, has initiated the planning and environmental assessment (EA) process for a River Use Management Plan for the LCEB River. This plan and EA are currently in progress and will review all impacts and opportunities related to recreational use of the LCEB. The River Use Management Plan and the EA could greatly benefit the LCEB by drawing greater attention to the natural resources of the LCEB yet ensuring minimal harm to the environment.

Indiana Wetlands Conservation Plan

The purpose of the Indiana Wetlands Conservation Plan (IWCP) is to serve as a guide for wetland conservation efforts in the state. The IWCP serves as a framework for discussion and problem solving while establishing common ground on which progress of wetland conservation can be made. It also sets specific actions to achieve progress. While the IWCP does not specifically identify priority areas it does provide recommendations regarding prioritization. These recommendations are a framework of prioritization factors ranking various environmental conditions associated with water quality, flood control and groundwater benefits. This information may be used when designating priority protection areas. Stakeholder concerns addressed by this plan include acquisition of land and lack of cooperation between agencies (Figure 2).

Indiana Statewide Forest Assessment & Strategy

The Indiana Statewide Forest Strategy was developed by the IDNR in coordination with local stakeholders. It recognizes the most important issues that increasingly threaten the sustainability and ecological capacity of Indiana's forests to provide the benefits of clean air, carbon sequestration, soil protection, wildlife habitat, wood products and other values, goods and services. The plan addresses a limited forest base being fragmented or converted to other land uses, like subdivision housing, paved surfaces or row crop agriculture. The forest priority data displayed in Figure 27 was generated by the IDNR as part of the Indiana Statewide Forest Assessment to prioritize and reflect the relative importance of Indiana forest issues. The figure was generated by compositing forest issues and assigning a relative weighting score based on stakeholder feedback. This information was considered for the designation of protection areas.

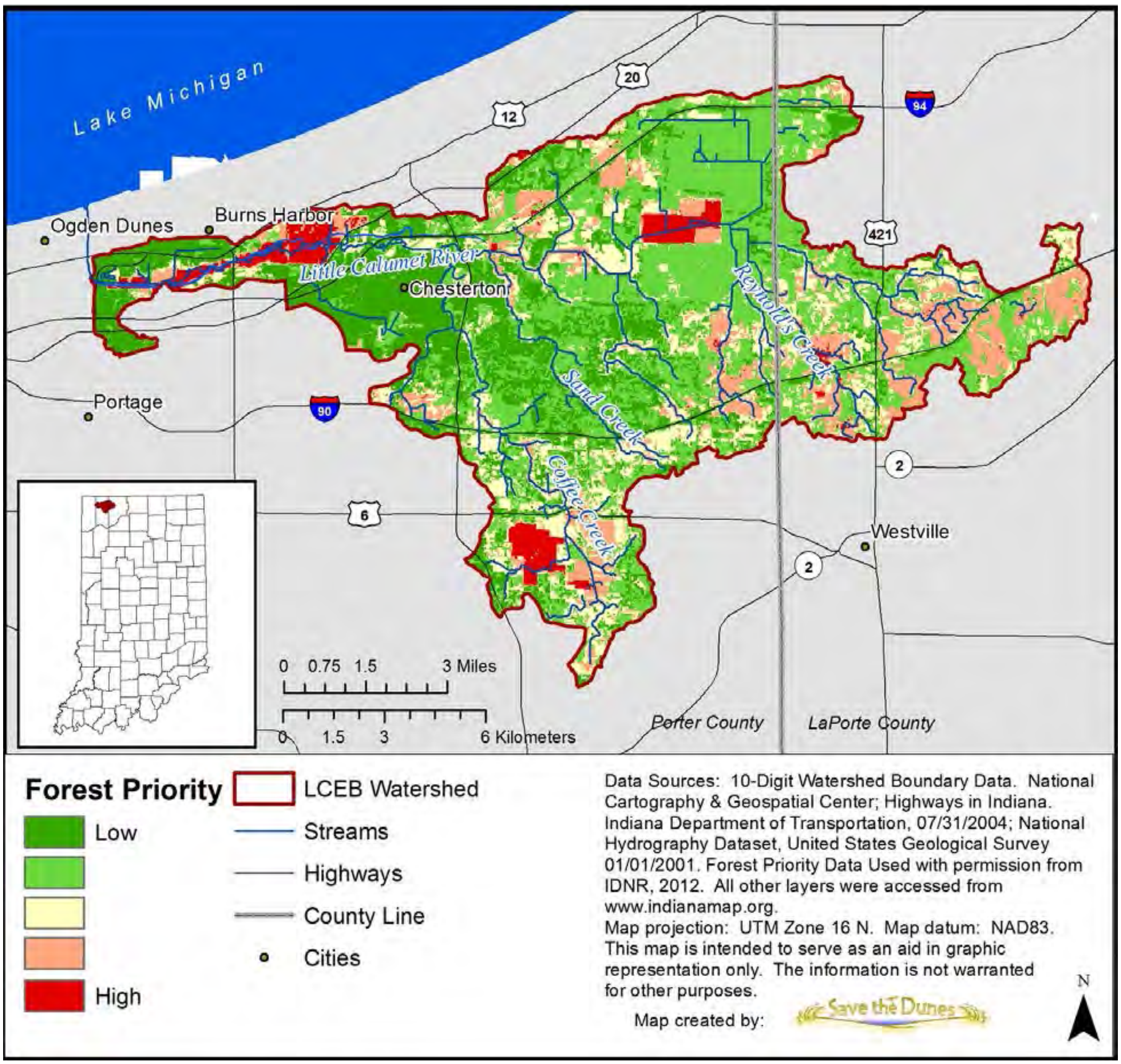

Figure 27. IDNR forest priority data

Little Calumet-Galien/Chicago Watershed Restoration Action Strategy

A Watershed Restoration Action Strategy (WRAS) is a large-scale coordination plan for an eight-digit hydrologic unit watershed. Each WRAS broadly covers an entire watershed; therefore, it is intended to be an overall strategy and does not dictate management and activities at the stream site or segment level. Water quality management decisions and activities for individual portions of the watershed are most effective and efficient when managed through sub-watershed plans, such as the LCEB Watershed Management Plan. Nonetheless, priority issues and management strategies were developed for the Little Calumet-Galien/Chicago watershed: data and information targeting, streambank erosion and stabilization, failing septic systems, water quality, fish consumption advisories, nonpoint source pollution (including an education and outreach component), and point sources. Larger scale efforts to improve water quality, such as this watershed restoration action strategy, play an important role for supporting local restoration activities in the LCEB.

Moraine Forest Conservation Planning Project

The objective and scope of the Moraine Forest Conservation Planning Project is to develop a large-scale comprehensive conservation planning effort for the moraine forest in the southern Lake Michigan watershed. This forested ecosystem is situated on the Valparaiso Moraine. It is characterized by rich mesic soils that support several species of hardwood trees and populations of spring ephemeral wildflowers. The headwaters of several streams that are tributaries of Lake Michigan, including the LCEB, are located within the moraine forest, which is vital to protecting water quality in these watersheds. Wetlands and streams punctuate the tree cover throughout the area and provide crucial habitat for wildlife. The project is a collaboration between four local land trusts (LaPorte County Conservation Trust, Save the Dunes, Woodland Savanna Land Conservancy, and SHLT) that will facilitate efforts to effectively preserve an unprecedented amount of this critical ecosystem in the southern Lake Michigan watershed. GIS data and models are being used to prioritize parcels located between Valparaiso in Porter County and the Michigan/Indiana state line in LaPorte County (Figure 28). Maps and brochures are being developed and used for landowner outreach, guided hikes, and public workshops aimed at protecting high-priority project areas. Three core areas identified through this project are entirely or partially within the LCEB watershed: the Red Mill County Park, the INDU Heron Rookery, and the Moraine Nature Preserve. This information was considered for the selection of protection areas.

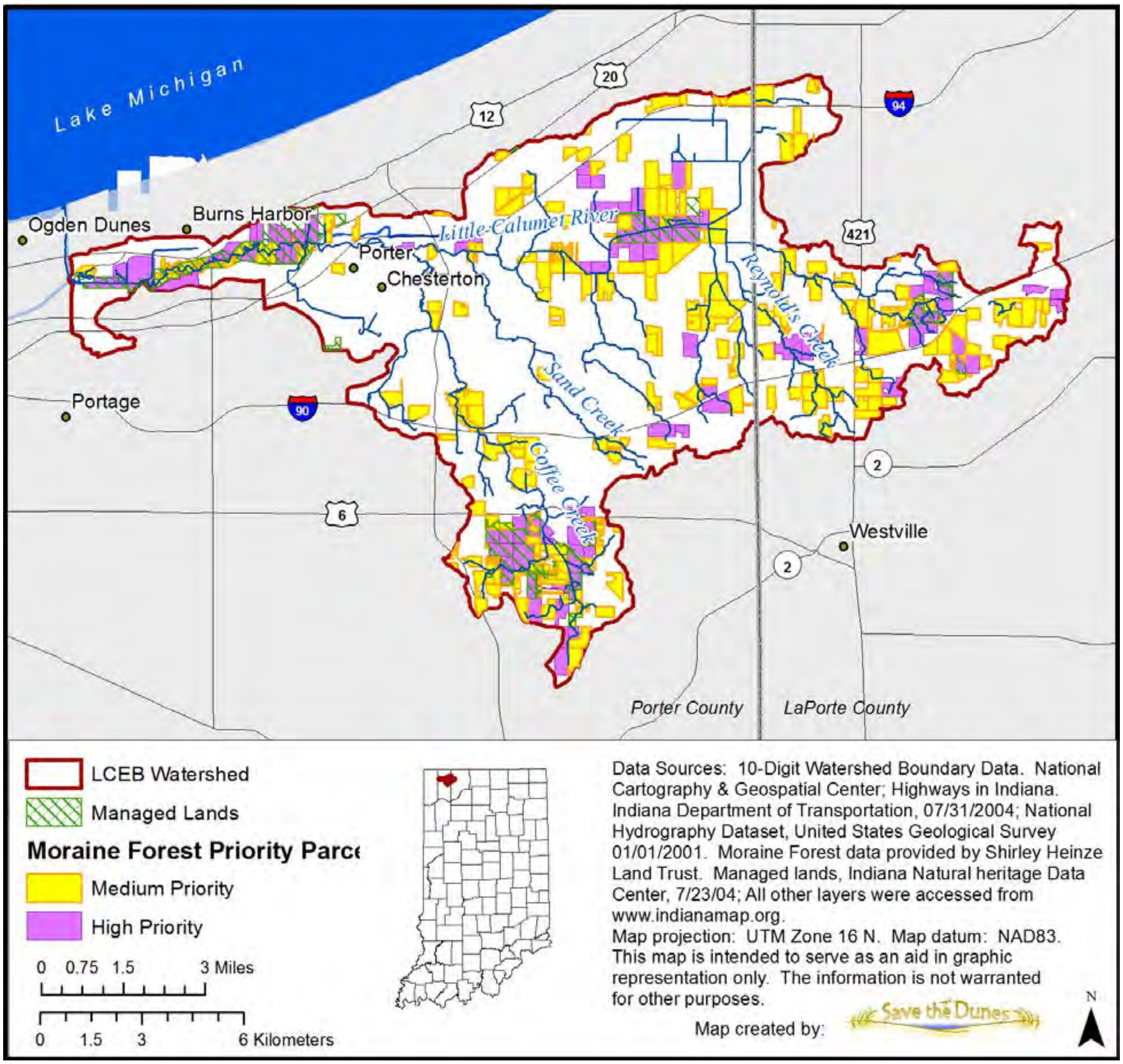

Figure 28. Shirley Heinze Land Trust moraine forest priority parcels

Municipal Separate Storm Sewer System (MS4)

The Clean Water Act requires storm water discharges from certain types of urbanized areas to be permitted under the National Pollutant Discharge Elimination System (NPDES) program. Under Phase II, 327 IAC 15-13 (Rule 13) was written to regulate most MS4 entities (cities, towns, universities, colleges, correctional facilities, hospitals, conservancy districts, homeowner's associations and military bases) located within mapped urbanized areas, as delineated by the United States Census Bureau, or, for those MS4 areas outside of urbanized areas, serving an urban population greater than 7,000 people. MS4s are required to develop and implement a Storm Water Quality Management Plan (SWQMP). One of the most important aspects of MS4 to watershed management practitioners is Part C of the SWQMP. Part C outlines the priorities, goals, and implementation strategies that the MS4 will utilize to improve water quality. LCEB stakeholders reported urban runoff to be a concern (Figure 2).

A review of MS4 entities data from IDEM shows the following designated MS4s partially within the LCEB watershed:

- LaPorte County (Permit Number INR0401070)
- Town of Chesterton (Permit Number INR040036)
- City of Portage (Permit Number INR040090)
- Town of Porter (Permit Number INR040115)
- Porter County (Permit Number INR040140)

The boundaries of each of these municipalities are shown in Figure 29. MS4 actions will improve water quality and address urban runoff to help to further the goals of this WMP.

IDEM has several water pollution reduction programs that appear to overlap. The MS4 Permit Program, the 319 Grant Program, and Rule 5 (Construction/Land Disturbance Storm Water Permitting) seem quite similar in that all programs seek to reduce pollutant loads from stormwater runoff but they actually fulfill quite different roles. The MS4 Permit Program is designed to regulate point source pollution from more populated urban and suburban areas. The 319 Grant Program provides guidance and financial assistance for watershed planning to reduce non-point source pollution. Rule 5 aims to reduce nonpoint source pollution from construction or land disturbing projects and pertains to anyone involved with a construction project that is one acre or larger.

Currently, there is one known development project in the watershed in need of Rule 5 enforcement. It is a 60+ acre home development project in the Chesterton area (Coffee Creek subwatershed) near sampling site 15 at CR 1050 N (see Figure 37). This site is currently in violation of Rule 5 and is being investigated by state and federal agencies. Private citizens are encouraged to report potential Rule 5 violations. Please contact the IDEM Complaint Coordinator at (800) 461-6027 ext. 24464 if a possible violation is identified.

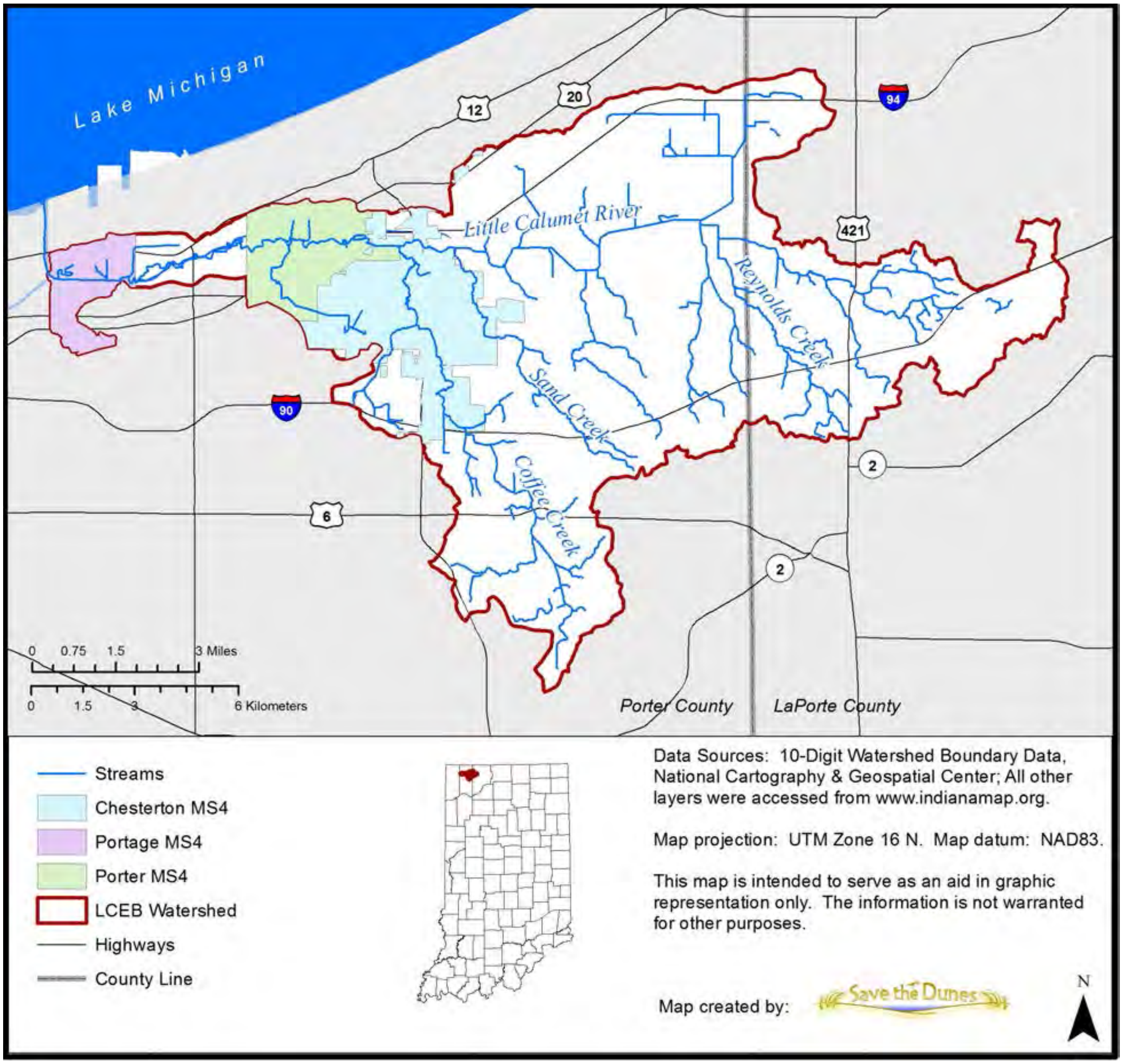

Figure 29. Municipal MS4 permit boundaries within the LCEB watershed

Total Maximum Daily Load (TMDL) Reports

A TMDL represents the maximum capacity of a waterbody to assimilate a pollutant while safely meeting the respective water quality standard. Section 303(d) of the Clean Water Act requires that TMDLs be established for each waterbody in a state that does not meet the water quality standards for the waterbody's designated use. The TMDL for a given waterbody and pollutant is the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels (USEPA, 2001). The sum of the allocations must not result in the exceedance of the water quality standard. In addition, a margin of safety (MOS) must be included in the analysis, either implicitly or explicitly. The margin of safety accounts for any uncertainty in the relationship between loads and conditions in the receiving water and helps to ensure that the water quality standard is met.

The Little Calumet River and Portage Burns Waterway TMDL for *E. coli* was completed in 2004. The TMDL covers the LCEB watershed in addition to the Little Calumet River West Branch. Based on this report, the allowable TMDLs for the Little Calumet – Portage Burns Waterway will require reductions in nonpoint source loads from 34% to 97%. However, there is still uncertainty as to the magnitude that various nonpoint sources of *E. coli* play in the impairment of the Little Calumet and Portage Burns Waterway. Figure 30 was taken from the 2004 Little Calumet –Portage Burns Waterway TMDL.

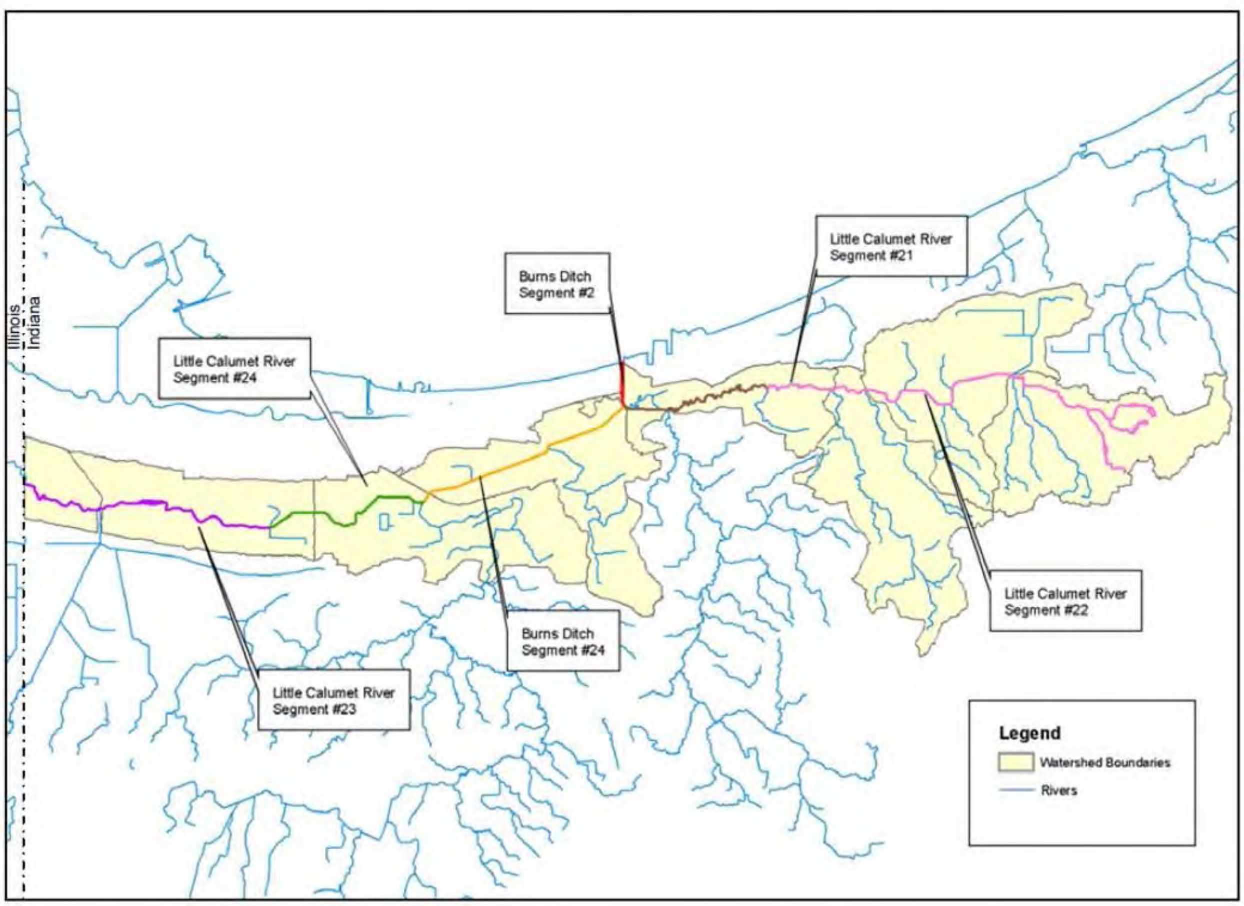

Figure 30. 2004 *E. coli* TMDL coverage area

2040 Comprehensive Regional Plan for Northwest Indiana

The 2040 Comprehensive Regional Plan (CRP) was developed as a comprehensive, citizen based regional vision that will guide the development of land use, transportation, local economies, green infrastructure, and social justice in Northwest Indiana. It is a policy program with strong coordination and implementation elements. The CRP deals largely with multijurisdictional needs and opportunities that no single agency can manage or effect on its own. Goals of the CRP that are in line with this WMP include:

- Protect natural resources
- Minimize impacts to environmental features and watershed
- Manage growth that protects farmland, environmentally sensitive areas, and important ecosystems
- Reduce flooding risks and improve water quality
- Improve green infrastructure

The CRP plays a strong role in the development and protection of the LCEB. Many stakeholder concerns are addressed by the CRP including, pollutant loading from combined sewer overflows and septic systems, stormwater management, and protection of fisheries and other natural habitats.

Local Comprehensive Plans

Indiana Code Section 36-7-4-500 through 512 enables local government to establish comprehensive plans and zoning ordinances. A comprehensive plan must contain at least the following elements:
(1) A statement of objectives for the future development of the jurisdiction.
(2) A statement of policy for the land use development of the jurisdiction.
(3) A statement of policy for the development of public ways, public places, public lands, public structures, and public utilities. The following comprehensive plans have the potential to impact water quality in the LCEB watershed:

- Burns Harbor Comprehensive Plan Place Making 20/20, 2009
- Town of Chesterton Comprehensive Plan, 2011
- LaPorte County Comprehensive Land Development Plan, 2008
- The City of Portage Comprehensive Plan, 2009
- Porter County Land Use and Thoroughfare Plan, 2001
- The Town of Porter Master Plan, 2003

Figure 31 shows the jurisdictions for all the comprehensive development plans in the LCEB.

Burns Harbor Comprehensive Plan Place Making 20/20

This plan provides a framework for the development and redevelopment of Burns Harbor. It outlines issues related to economic development, land use, transportation, and smart growth. The area of interest for this plan is the entire Burns Harbor city limits. Goals of the plan include:

- Preserve open space, natural beauty and critical environmental areas.
- Adopt ordinances to protect and preserve natural resources.
- Require new development to allow green corridors and protect natural resources.
- Remediate and redevelop brownfields.
- Encourage stormwater best management practices.
- Improve access to natural lands such as the Indiana Dunes National Lakeshore.

The Burns Harbor Comprehensive Plan addresses many stakeholder concerns including the remediation of brownfields, improved stormwater management, and improving public access to natural resources.

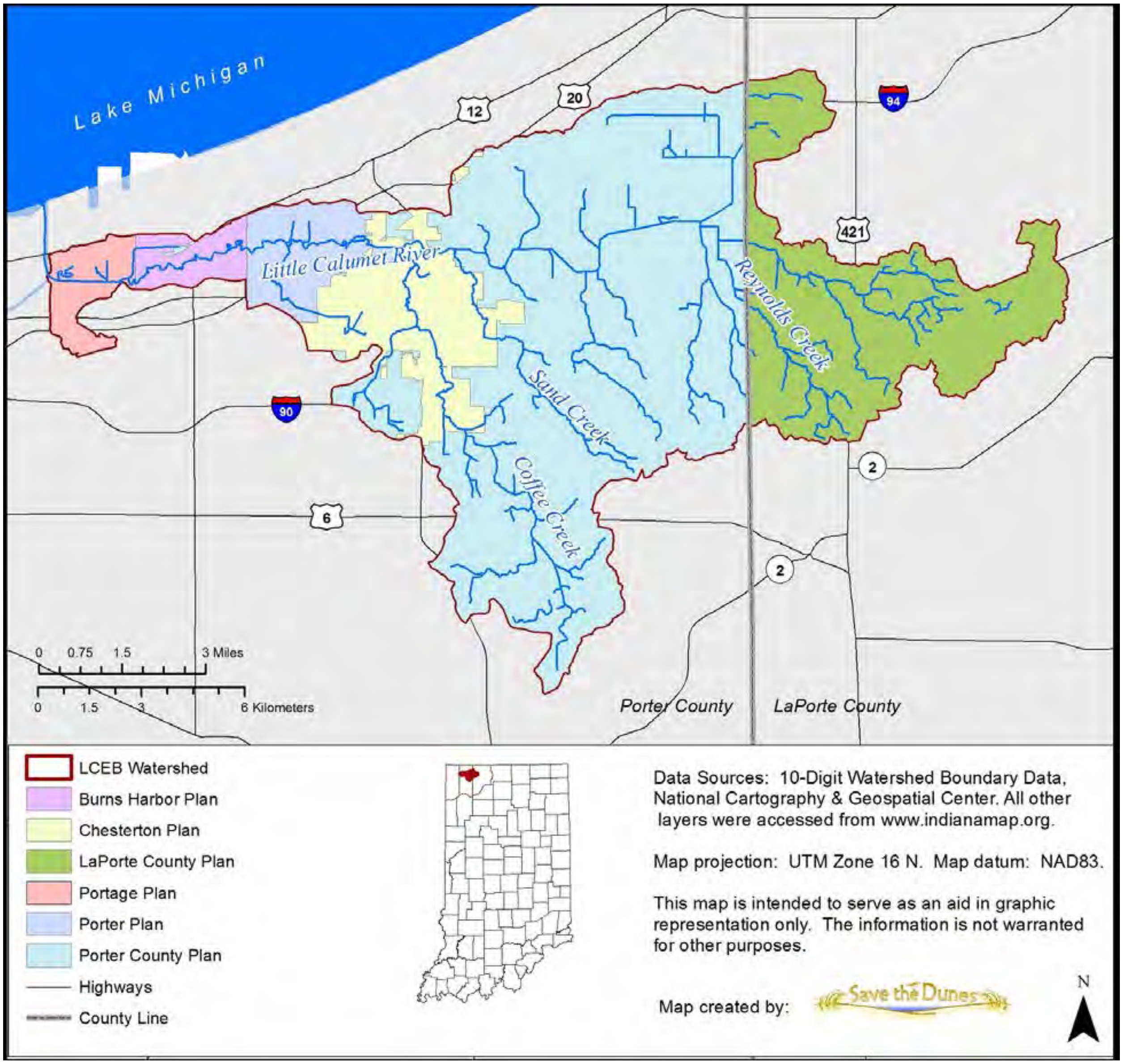

Figure 31. Jurisdictions for regional comprehensive plans

Chesterton, Indiana Comprehensive Plan 2010

The town of Chesterton Comprehensive Plan builds a detailed framework for future development in Chesterton. The plan includes the Chesterton municipal area. The plan's authors anticipate future development to extend approximately 1.5 miles to the south (CR 900 N) and 1 mile to the east (CR 350 E). Chesterton's comprehensive plan includes a detailed list of goals and priorities to guide development decisions. Many of these goals complement the goals for this watershed management plan. The comprehensive plan aims to encourage balanced land use partly by encouraging growth of parks and recreational opportunities. Preserving and enhancing natural resources will be accomplished by providing effective sewage collection, implementing stormwater BMPs and green infrastructure, protecting wetlands and floodplains, and increasing public awareness through education. Sustainable development will be promoted with appropriate zoning encouraging natural corridors, parks and open spaces. LCEB stakeholders have also expressed many of the goals outlined in Chesterton's Comprehensive Plan. Stakeholder concerns addressed by Chesterton's Comprehensive Plan include: improving stormwater management and flood prevention, nutrient and bacterial loading from combined sewers and septic systems, and the promotion of conservation easements and green infrastructure.

The Countywide Land Development Plan: Michigan City, City of LaPorte and All LaPorte County Communities

The LaPorte County comprehensive plan serves as a guide for land development decisions in LaPorte County. The plan covers the entire county, including the municipal areas of Michigan City, LaPorte, and others. The portion of the LCEB that is included in this development plan is very small (Figure 31). This plan addresses economic opportunities, transportation, public utilities, land uses, natural resources, and parks and recreational opportunities. Strategic goals and objectives were established for many topics addressed by this WMP. These goals included: encouraging the implementation of riparian buffers, urban and agricultural nonpoint source pollution BMPs, limiting the need for onsite septic systems, and reducing hydromodifications (stream channelization and stream bank erosion). These goals address several stakeholder concerns: need to restore tributary ditches, need to protect bottomlands and steep slopes, and reduce pollutant loadings from failing septic systems.

Portage, Indiana Comprehensive Plan

The comprehensive development plan for Portage provides a foundation based on existing conditions and guiding principles for future development. This plan covers the entire municipal area of Portage. The LCEB comprises a very small portion of this plan (Figure 31). Goals outlined in this plan that coordinate with the LCEB WMP include the development of trail systems to connect the city with the Indiana Dunes National Lakeshore and Indiana Dunes State Park, and the development and protection of parks and open spaces. This plan also expresses the intent to acquire land along the LCEB River and Salt Creek to establish riparian buffers for the protection of Lake Michigan water quality. The Portage development plan states the need for a comprehensive stormwater management plan. Unfortunately, it does not recommend any green stormwater best management practices or green infrastructure to help alleviate stormwater flow volumes. Stakeholder concerns addressed by this plan include: the need for walking trails and open waterways along the LCEB, and the need to acquire land to improve connectivity and protect natural resources.

Porter County Land Use and Thoroughfare Plan
The Porter County Land Use and Thoroughfare Plan is a comprehensive plan designed to provide guiding principles and objectives toward future development (20 years) in Porter County. The plan addresses the whole county (all unincorporated areas), excluding municipal districts. Consequently, a large portion of the LCEB is covered by this comprehensive plan. Topics such as government, land use, parks and recreation, community services, economic development, natural resources, transportation, and infrastructure are covered by this planning effort. The plan seeks to promote intergovernmental coordination to manage the growth and development of Porter County. Many topics covered by this plan are also stakeholder concerns for the LCEB. The Porter County development plan seeks to preserve, maintain, and enhance natural resources including wetlands, wildlife, and water quality. By reducing pollution and preserving stream corridors, the plan aims to increase recreational opportunities and public access to countywide land and water trails.

The Town of Porter Master Plan
The comprehensive development plan for the Town of Porter is a framework to guide growth and development. This plan outlines development priorities for economic growth, transportation, land use and natural resources. The plan seeks to encourage tourism and the connectivity of downtown Porter to natural resources such as the Indiana Dunes National Lakeshore and the Indiana Dunes State Park. A stormwater management plan was developed that encouraged the use of green infrastructure to reduce the intensity of stormwater flows. The plan also encouraged the protection of open spaces to conserve natural resources and improve water quality. Many topics covered by the Town of Porter Master Plan are also concerns for LCEB stakeholders. These concerns included stormwater volumes creating degraded water quality, the need to protect natural habitats, and encouraging conservation of open spaces.

2.6 Flora and Fauna

2.6.a Endangered, Threatened, and Rare Species

The LCEB watershed is home to a large variety of endangered, threatened, and rare species. The watershed contains many natural areas and a diversity of ecosystems. The LCEB watershed is located just inland of the southern shoreline of Lake Michigan. "The Dunes" (Indiana Dunes National Lakeshore and Indiana Dunes State Park) are to the north and the Valparaiso Moraine is to the south. This places the watershed in an area where northern, eastern, southern, and western ecosystems come together, making for a rich diversity of native habitats. However, these native habitats have been modified, sometimes greatly so, since European settlement began in the 1830s. This has resulted in habitat fragmentation, with rare species distributed within the remaining pieces of natural areas.

The Indiana Natural Heritage Data Center, part of the Division of Nature Preserves (DNP), maintains information about federal and state endangered, threatened, rare, and special concern species, high quality natural communities, and significant natural areas in Indiana. This database assists in documenting the presence of special species and significant natural communities and serves as a tool for setting management priorities for these species and habitats. The database includes both historical and recent records and is based upon reported sightings from biologists and the general public, so it is not all-inclusive; therefore, there may be rare species present in the watershed but not documented.

There are three State Dedicated Nature Preserves in the watershed, all in headwaters areas on the Valparaiso Moraine. Little Calumet Headwaters Nature Preserve comprises 107 acres of wetlands and uplands within Red Mill County Park, LaPorte County. As indicated by the name, it is located within the headwaters of the East Branch Little Calumet River. The other two nature preserves are close together in the upper reaches of Coffee Creek; they are Moraine Nature Preserve and Suman Fen Nature Preserve. A third natural area is the Heron Rookery Unit of the INDU, which sits along both banks of the LCEB about three miles upstream of SR 49 at Chesterton. Most of the rare species are found in these natural areas, with Moraine Nature Preserve being the most important site. Pinhook Bog may also be considered part of the Little Calumet River East Branch watershed, although bogs do not actually drain to the river. It also does not drain to the adjacent Trail Creek Watershed. This bog and its adjacent uplands are a unit of INDU and support many unique species; this site is a National Natural Landmark.

The Coffee Creek Watershed Conservancy (CCWC) also maintains a 167-acre preserve along a middle section of Coffee Creek, south of Chesterton. This preserve contains over 5 miles of walking, hiking, and biking trails that are open to the public. Aside from Coffee Creek, Phillips Pond is also protected within the preserve boundaries, as well as numerous wetlands, upland prairie, and woodland habitats, which contain ecosystems unique to the moraine region in the southern portion of the watershed.

The federal and Indiana endangered Indiana bat (*Myotis sodalis*) has been documented in the watershed at the Heron Rookery Unit of INDU. It is currently the only known federally listed endangered species in the watershed**.** Appendix 2 contains the lists of endangered, threatened, rare, and special concern species known from the watershed. The oldest records are from Dr. Charles C. Deam in 1916 for areas that have since been developed. Some of the species in the database have not been reported for many years; they may or may not still be present, and current observers may not have provided their information to DNP. Because of the disparity in the dates of reported plant species, we have separated the information into historical (1950 and earlier) and current (1951 to present). However, wildlife species lists include both historical and current information because the differences are not as great as for the plants. The lists are for the entire watershed, not specific locations. Therefore, sites where various species were historically present may no longer exist because of development but the species may continue to persist within the watershed at other sites.

2.6.b Invasive Plant Species

Invasive plant species are plants that thrive in a given area, but are not native to the area. They may come from similar climates on other continents where natural predators keep them at non-nuisance levels, may be bred for landscaping purposes, or any number of other sources. These plants have the ability to spread out over large areas quickly and crowd out native plants, which can impact wetlands, floodplains, and other natural water treatment areas. Likewise, some invasive plants can contribute excess nutrients, such as nitrate, to streams, lowering water quality and feeding nuisance algae in waterbodies.

The Coffee Creek Invasive Species Assessment Tool was developed by Save the Dunes for The Nature Conservancy and in collaboration with IDNR (Indiana Department of Natural Resources), Coffee Creek Watershed Conservancy (CCWC), and Shirley Heinze Land Trust (SHLT). The project was developed to assist land managers and other stakeholders easily identify areas in the Coffee Creek subwatershed that are susceptible to invasive plant species. The list below summarizes some of the more common plant invaders in the LCEB watershed.

Reed Canary Grass (*Phalaris arundinacea*) is a highly competitive and aggressively spreading plant that can easily displace native plants and wildlife within wetland areas. It is capable if withstanding periods of flooding and droughts and spreads by seed and rhizome growth. Once established, it can be difficult to control. Early Detection/Rapid Response is critical for removal, along with cleaning equipment and clothing prior to entering wetland sites. The plant can be found throughout the Little Calumet Watershed within roadside ditches and degraded wetlands, with a particularly critical infestation in the headwaters of Coffee Creek.

Cattail (*Typha x glauca*; *Typha angustifolia*) is problematic within many wetlands, particularly those that have been disturbed. Cattails in the LCEB watershed are found in wet areas including the sides of ponds and lakes, ditches, wetlands, and stormwater detention ponds. They are generally not seen in open water like Common Reed and other wetland invaders. The hybridization of the exotic form (*Typha angustifolia*) has essentially eliminated the native cattail (*Typha latifolia*); as a result, management efforts often aim to control the spread of cattails in many wetland areas. Cattails are often controllable with current management techniques. However, large infestations often require several years of consistent treatment to reduce infestation to a manageable level due to a rapid growth rate. Cattails can out-compete native plants, eliminate habitats, and can result in closing of open waterways.

Common Reed (*Phragmites australis*) is an aggressive plant that appears to expanding throughout the LCEB watershed. This plant is found in many wet areas of the watershed, including the open water portion of some lakes and most wetlands, and has also been observed invading open upland areas with disturbed soils and a fair amount of sunlight. Common Reed prevents native plants from establishing, by growing in thick masses and exhibiting allelopathy. Older populations can take several years to remove. *Phragmites* is found mostly in sunlit areas with wet/moist soil conditions and along waterway edges. It can eliminate habitat for juvenile fish and waterfowl and is capable of lowering the water table allowing trees to become established in what would be wetland areas. There are native varieties of this plant, but these are relatively rare and non-invasive. At least one native population exists in the Suman Fen, part of the Moraine Nature Preserve.

Purple Loosestrife (*Lythrum salicaria*) is not terribly widespread in the LCEB watershed but is present in wetlands in the central portion of the watershed and in adjacent watersheds. This plant produces prolific amounts of seed that are easily dispersed by water and can also spread by rhizomes, resulting in vast, dense colonies. Purple Loosestrife can alter native plant communities and change drainage patterns by restricting the flow of water. It is possible to eradicate populations if detect early. However, large infestations can become costly to remove from sites. Large infestations are often treated with the use of *Galerucella spp.* beetles as a biological control.

Oriental Bittersweet (*Celastrus orbiculata*) is commonly found along edges of woodland communities in this watershed. This fast-growing vine prefers sunlit areas and can grow in several habitat types, including open woodlands and edges of streams. Birds consume the fruit and disperse it far from existing populations. Oriental Bittersweet rapidly climbs up trees, "choking" them out and ultimately shading out the understory, preventing any native vegetation from establishing. This vine prefers sunlit areas and can grow in several habitat types, including open woodlands and edges of streams.

Garlic Mustard (*Alliaria petiolata*) is a widespread exotic plant that can be hard to control without constant removal every year. This plant is a fast-growing biennial producing hundreds of seeds. It spreads mainly by either shooting out seeds from matured seed pods, adhering to humans and wildlife, or washing up on embankments from floodwaters. It exhibits allelopathy to inhibit the growth of mycorrhizal fungi, which many native plant species depend on during early stages of growth. This plant is mainly an edge species, but can also be found in floodplains, deciduous forests, and oak savannas. Early Detection/Rapid Response is critical to preventing further spread of this plant.

Canada Thistle (*Cirsium arvense*) is a noxious weed that occurs essentially in all sunlit areas of the watershed. It can produce prolific amount of seeds that are wind dispersed and can also spread by rhizome growth. Mechanical removal will increase spreading by rhizome growth, and would require consistent mowing over multiple times per year for several years to prevent seed dispersal. Chemical treatment can reduce infestation populations, but like mechanical removal it can be costly over time. This may lead to the need of bio-control to maintain more manageable populations. This plant can be found within a wide range of natural habitats, including savannas, sand dunes, wet prairies, and stream embankments. This plant can easily out-compete native plants and exhibits allelopathy chemical to prevent establishment of other plants.

Bush Honeysuckle (*Lonicera spp*.), Multiflora Rose (*Rosa multiflora*), and Autumn Olive (*Eleagnus umbellata*) were introduced simultaneously and historically planted as windbreakers, erosion control, and wildlife forage. Birds will consume the fruits from these shrubs, and disperse the seeds far beyond their existing populations. The shrubs can thrive in open areas and woodland edges, but can be found in forested ravines and woodland interior. They are found widespread throughout the Watershed and surrounding counties. These shrubs will grow in dense colonies preventing any native vegetation from establishing and can increase erosion on slopes and embankments.

Black Locust (*Robinia pseudoacacia*) is another species that was intentionally planted in the past. Black locust produces the highest heat value, fast-growing, and tolerates poor soil quality, which gives landowners a way to derive production from their land. This tree even though native to the United States has the tendency to be invasive to Northwest Indiana. It is particularly invasive in sandy soils within sunlit areas. It very seldom can invade areas with established tree cover, but tends to colonize woodland edges. It appears to occur predominately along the northern portion of the Watershed, especially across the main highways, but can be found throughout the rest of the Watershed. Removal of large mature trees can lead to several years of follow-up treatment of seedlings due to its fast growth rate. It can also fix nitrogen in the soil, even several years after removal, which could promote established of other exotic species.

Potential Expansion of Invasive Plants in Little Calumet Watershed

Japanese Barberry (*Berberis thunbergii*) is a popular shrub in residential landscapes, and has escaped from planting areas presumably by birds. While it has not reached the density of other commonly found invasive shrubs in the watershed, it may increase in expansion with continual use in landscaping and climate change. Its most commonly found within wooded areas.

Burning Bush (*Euonymus alatus*) and Privet (*Ligustrum* spp.) are other popular residential landscaping shrubs, which have also escaped from planting areas within surrounding counties. Continual use in landscaping and climate change may increase expansion.

The Buckthorns (*Frangula alnus, Rhamnu frangula,* and *Rhamnus cathartica*) were not detected in the LCEB. However, buckthorn species are present in the county and surrounding counties and can be expected to expand. The floodplains and mesic woodlands are the most threatened communities. Control is possible with Early Detection/Rapid Response to new populations.

Tree of Heaven (*Ailanthus altissima*) was not detected in the managed nature preserves in the watershed, but probably has sporadic populations since it is found within surrounding counties. This is a fast-growing tree with seeds that are wind dispersed. They can easily become established within any open areas and can be found on a variety of habitats.

Air Potato (*Diascorea bulbifera*) has been detected within one of the managed areas within this Watershed. This vine is a vigorous climber and often forms deep mats over low vegetation. Established populations have proven to be nearly unstoppable in southern Indiana, yet can be controlled with Early Detection/Rapid Response. Its method for dispersal seems to be by following moving water, but the explanation for isolated introductions is elusive.

Other species such as Kudzu, Japanese Knotweed, Black Swallowwort, Mugwort, and Giant Hogweed are also present in surrounding counties and are likely already moving into some parts of the LCEB watershed. These are extremely invasive and will likely spread into the watershed if existing populations are not controlled.

Future management of the invasive plants in the Little Calumet East Branch watershed should not only be direct efforts to limit the expansion of invasive species within protected nature preserves. It should also include requiring management crews, such as highways, railroads, and parks to receive training in the identification and control methods for these plants, proper equipment cleaning techniques, along with preventing use of invasive plants in landscaping.

2.7 Watershed Summary

The LCEB watershed is a diverse watershed with variable soils, land use, and ecosystems supporting both rural, agricultural areas and developed urban areas.

Due to diverse surficial geology developed by glacial deposits and lake development, the LCEB watershed contains a rich diversity of soils ranging from nutrient rich, poorly draining soils to nutrient poor, highly permeable sandy soils. Agricultural lands and forests are the two dominant land uses on these diverse soils. These contrasting soil types nonetheless have a similar defining characteristic. Both soil types are poorly suited to fairly poorly suited for onsite septic systems. One drains too quickly while the other drains too slowly. The majority of the watershed is not serviced by sewer infrastructure; consequently malfunctioning onsite septic systems could produce widespread nonpoint source pollution. Plans for improving water quality will need to consider soil type, adjusting methods or techniques based on the existing soil characteristics.

The diversity of ecosystems in the LCEB have led to an abundance of endangered, threatened or rare (ETR) and invasive species in the watershed. This provides a unique opportunity for management in the watershed because both protection and restoration measures may be needed.

Water quality sampling over time has shown increased impairments throughout the watershed. Nearly every stream in the watershed has been listed on IDEM's 303(d) listing of impaired waters for *E. coli*, nutrients, impaired biotic communities, chloride, and/or PCBs in fish tissue.

Municipalities and other jurisdictions within the LCEB watershed have developed plans for protecting and improving water quality, wildlife, and natural habitats. Some plans identify higher quality lands in need of protection that will increase connectivity of natural landscapes. Other plans encourage the protection of wetlands or the reduction of nonpoint source pollution. Increasing public access to natural lands is common goal that many of the plans share.