

## SECTION 2: IDENTIFY PROBLEMS AND CAUSES

### Stakeholder Concerns

To address the concerns of stakeholders in the Elkhart River Watershed, the Steering Committee identified the major stakeholder groups within the Watershed; named individuals who best represented those stakeholder groups; and identified a current Steering Committee member that would be responsible for presenting individuals a personal invitation to attend a meeting on the Elkhart River Watershed. A list of identified stakeholder groups is included in Appendix F. A representative from each of the stakeholder groups was invited to a meeting August 29, 2005, to discuss the Watershed planning process, to begin gathering information on concerns related to the Elkhart River and its Watershed, and to solicit volunteers to help with different aspects of the planning and implementation process. Over 55 people attended the meeting, in which priority resource concerns were identified and a mission statement was developed.

Following the success of this initial meeting, an open public meeting was held January 24, 2006, to convey this information to all interested stakeholders in the Watershed. At this meeting, stakeholders were informed of the Watershed planning process, updated on where the Steering Committee was in the process, and given the opportunity to evaluate and add to the priority resource concerns identified in the previous meeting. They also approved the mission statement developed in the previous meeting and individuals volunteered for various portions of the planning and implementation process.

Meeting participants also confirmed the need to form the Steering Committee and involve other participants into the Elkhart River Alliance. This alliance of concerned citizens, organizations, government officials, and others would help the Elkhart River Restoration Association develop and implement the Elkhart River WMP. The priority resource concerns that were identified in both of these meetings are listed below. Specific concerns were taken verbatim from the stakeholders and later listed in categories by Steering Committee members to aid understanding of the issues. Information in parenthesis is added for clarification.

#### **Pollution Issues:**

- Excessive Sediment Load. Manifested by problematic siltation issues within the Goshen Dam Pond
- Stream bank deterioration caused by severe erosion. (refers to general observations of erosion, especially along legal drains)
- Non-point source pollution (agricultural runoff & septic)
- Herbicide distribution within lakes to control nuisance weeds, and the concern for responsible vegetation management as it relates to impacts on wildlife
- Phosphorus loading due to the use of lawn fertilizers
- Vegetation growth due to eutrophication within the Goshen Dam Pond
- Illicit Discharge
- Mercury

**Agricultural Issues:**

- Non-point source pollution (agricultural runoff & septic)
- Drainage for agricultural production (both the positive aspect of achieving appropriate drainage for agriculture and the negative aspect of alteration of the hydrologic system were discussed)
- Long-term viability of the Watershed as an irrigation source (both surface and ground water quantity issues)
- Livestock access to surface waters within the Watershed

**Development/Urban Issues:**

- Loss of habitat with increased development
- Rapid increase in impervious surface in the Watershed
- Urban encroachment on the flood plains
- Combined Sewer Overflows – *E. coli* – long term control
- Urban development (whatever anyone wants to do is accepted). Keep a natural buffer along the water. Need proper planning of developments
- Keep sewer development on pace with development

**Wildlife/Habitat Issues:**

- Growing Canada goose population
- Drainage ways that currently have landuses immediately adjacent to their banks would ideally benefit from a vegetated riparian zone buffers (increasing the frequency of filter strips, etc.)
- Preservation of wetlands upstream, to protect flood plain areas
- Blanding's turtles are state endangered, also river otters need protection
- Invasive species
- Fish kills after heavy rains (pollutants in the runoff)
- Greater Redhorse are state endangered and need habitat protection
- Alterations to flood storage and flow conveyance through the impacts of logjams and beaver activities
- Evaluate dam removal or dam modifications to assist with upstream and downstream fish passage

**Fears & Controversy:**

- People are afraid to eat the fish from the river
- Fear of *E. coli*, perception of health of the river (aquatic health concerns). Fish consumption advisories
- No longer feel safe for recreational swimming
- Concerned over attempts to make the Elkhart River a legal drain: concern over drainage policy in general

- Concerned over dam failure and dam maintenance
- Fallen trees impeding navigable passage throughout the waterways. Creating means of access around fallen snags as opposed to removing them in their entirety

## Summary of Information and Data (Establish Baseline)

On November 28, 2007, the Elkhart River Alliance Steering Committee discussed the water quality parameters that were of most concern, and the specific locations that the contributions from these pollutants were most glaring. Nine members of the Steering Committee, two representatives of IDEM and two representatives of V3 evaluated the historic water quality data sets from previous studies performed within the Watershed. The following attributes of the Elkhart River Watershed were presented by V3: significant natural areas, highly erodible lands, potential highly erodible lands, National Wetland Inventory map, fish IBI index map, QHEI map, arsenic concentrations, total barium concentrations, total cadmium concentrations, DO levels, *E. coli* concentrations, total nitrate and nitrite concentrations, pH readings, total phosphorus concentrations, study sampling location exceedances of phosphorus, study sampling location exceedances of DO, study sampling location exceedances of *E. coli*, 303(d) listed stream impaired waterways map, Coliform bacteria load model, total nitrogen load model, total phosphorus load model, and the total suspended solids load model.

In addition to the data presented by V3 to the Steering Committee on November 28, 2007, the windshield survey results were also presented by the Elkhart County SWCD and analyzed by the group. The windshield survey data was collected by members of the Steering Committee and representatives of the Elkhart County SWCD, Kosciusko County SWCD, and LaGrange County SWCD. The windshield survey data collected is located in Appendix G and illustrated in Exhibit G-1 of this WMP.

## Collection and Analysis of Biological, Habitat, and Water-Quality Information

### Evaluation Methods

Five stations within the Elkhart River Watershed were evaluated for macroinvertebrate communities, habitat, and water chemistry. These five sampling stations are located at the mouth of each of the five 11-digit Watersheds that comprise the Elkhart River Watershed. Accessibility and previous water quality stations were considered in determining stations. These stations are shown in Exhibit 13 (see below) and described in Table 21 (Appendix A). Station photographs are located in Appendix H. Macroinvertebrates and habitat were sampled on September 19 and 20, 2007. Water Chemistry was sampled on July 18 and September 19, 2007.

### Biological Evaluation Explanation

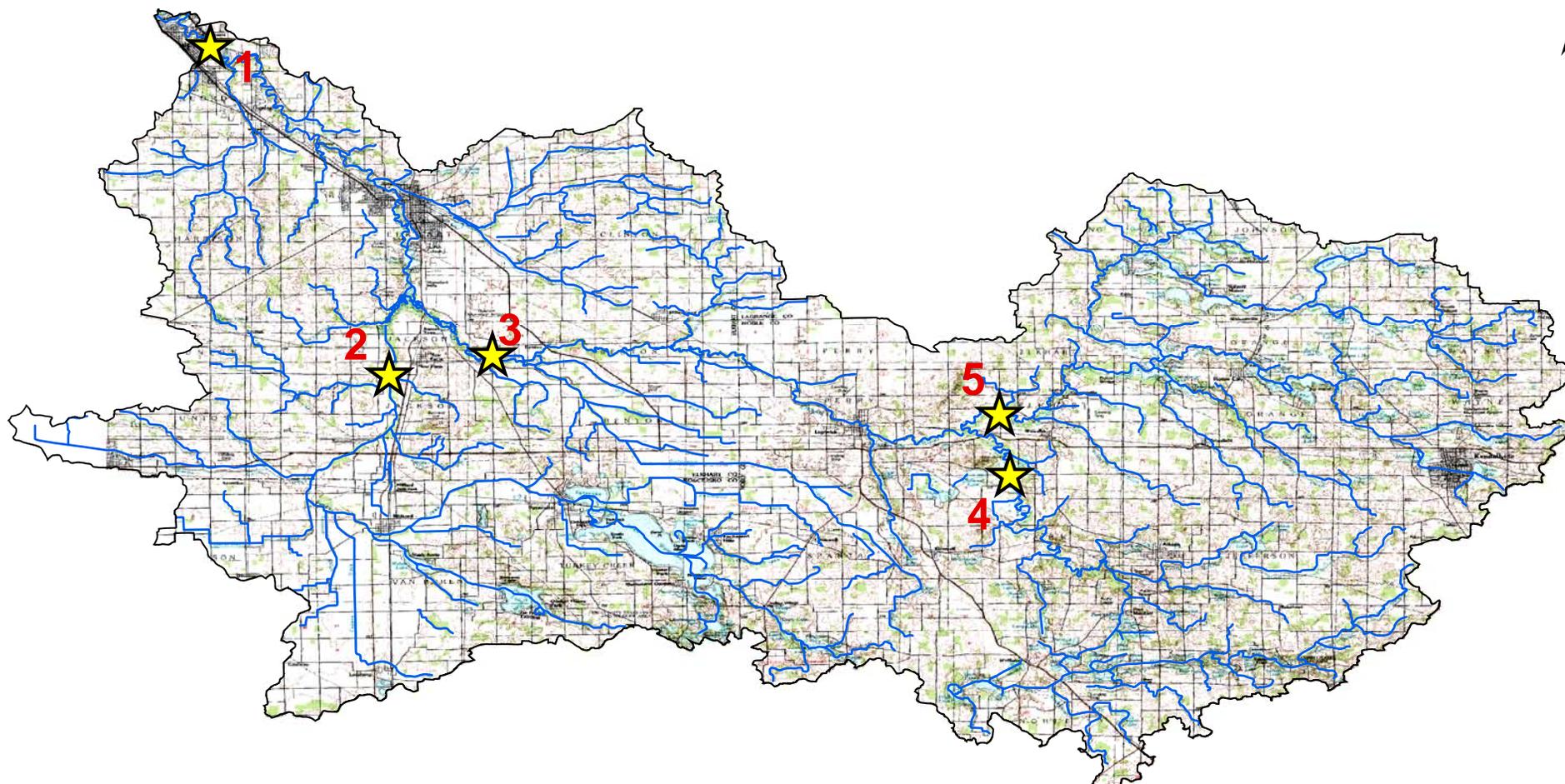
#### Macroinvertebrate Index of Biotic Integrity

Macroinvertebrate monitoring followed IDEM's macroinvertebrate Index of Biotic Integrity (mBI) for the single habitat approach. The single habitat approach involves sampling riffle/run areas within the sampling reach. A composite sample should be made from two kick samples (2 m<sup>2</sup>). The sample is collected by using a one meter wide kick net with 500 μ opening mesh. One person stands downstream of the kick net while holding it, while another person disturbs a 1 m<sup>2</sup> area upstream of the net by using the heel or toe of their boot to dislodge the material in the

streambed. Larger substrate should be picked up and rubbed by hand to dislodge the organisms that are attached to the rocks. All material and organisms that are caught in the net should be collected for a later sub-sample. In the lab a 100 individual sub-sample should be used in order to analyze the data. This is done by spreading the sample in a pan with 25 cm<sup>2</sup> squares. Each square is chosen randomly and all macroinvertebrates are removed from the square. Squares are chosen until the sub-sample reaches 100 individuals. After that there is a 15 minute random grabbing (with forceps) of individuals that are left in the tray to complete the sub-sample. The collected organisms in the sub-sample are identified to the family level using appropriate field guides. In addition, specimens are vouchered and sent to Purdue University to verify that all taxon identifications are correct. The collection procedure provides representative macroinvertebrate fauna from riffle/run substrate in the sampling reach.

IDEM's mIBI uses a multi-metric index to analyze each station and provide a complete assessment of a stream's biological integrity. The mIBI uses ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff Biotic Index), number of taxa, number of individuals, percent dominant taxa, EPT index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. (EPT stands for the *Ephemeropteran*, *Plecopteran*, and *Trichopteran* orders) These metrics are shown in Table 22 (Appendix A). Each metric is scored from 0 – 8 where 8 is the highest quality. All metrics are added together and averaged to get a station score. A final score of 0 – 2 is a severely impaired stream, 2 – 4 is moderately impaired, 4 – 6 is slightly impaired and 6 – 8 is not impaired for biological quality.

# Sampling Station Locations



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

TITLE:	<b>Sampling Station Locations</b>		PROJECT: <b>Elkhart River Management Plan &amp; Implementation</b>		
BASE LAYER:	USGS Topographic Map		PROJECT NO.:	EXHIBIT:	SHEET: 1
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526		07041	13	OF: 1
			QUADRANGLE:	DATE:	SCALE:
			N/A	05/04/07	NTS

An explanation of key benthic macroinvertebrate evaluations is summarized below:

### **Tolerance/Intolerance Measures**

Tolerance/intolerance measures are intended to be representative of relative sensitivity to perturbation. Tolerance is generally non-specific to the type of stressor. However, metrics such as the HBI are oriented toward the detection of organic pollution.

The HBI was developed to detect organic pollution and is based on the family level index developed by William Hilsenhoff in 1988. Pollution tolerance values range from 0 to 10 and increase as water quality decreases. The lower the HBI, the greater the number of pollution intolerant species. A population of benthic macroinvertebrates that poses a lower HBI value is indicative of higher water quality.

### **Richness Measures**

Total number of taxa is a measure of the diversity within the sample. This value generally increases with increasing water quality, habitat diversity, and habitat suitability.

EPT Index summarizes the richness of the benthic macroinvertebrate community within the taxa groups that are generally considered pollution sensitive and will generally increase with increasing water quality. This metric is the total number of distinct taxa within the groups *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and *Trichoptera* (caddisfly).

### **Composition Measures**

Percent Dominant Taxa uses the abundance of the numerically dominant taxa relative to the total number of organisms as an indication of community balance. This value will decrease as water quality, habitat diversity, and habitat suitability improve.

The EPT to Chironomid metric reflects good biotic condition if the sensitive groups (EPT's) demonstrate a substantial representation. If the *Chironomidae* have a disproportionately large number of individuals in comparison to the sensitive groups then this situation is indicative of environmental stress.

### *Index of Biotic Integrity*

The Index of Biotic Integrity (IBI) is composed of 12 different metrics that are used to evaluate the quality of the fish community. The IBI takes into consideration species, trophic composition (feeding and reproductive guilds), and the overall health of the fish community. The total IBI score and associated integrity class help compare the quality of one site to another, and provide a way to categorize the quality of a particular section of the river or stream. Table 23 (Appendix A) shows the IBI scores developed by Karr et al. (1986). Although this evaluation will give you an understanding of the overall health of the aquatic system, it does not indicate the cause or causes of the impairment.

## **Biological Evaluation Results**

### *Macroinvertebrate Index of Biotic Integrity Results*

V3 identified all macroinvertebrate specimens to family level after collecting all of the field data and taking sub-samples. Table 24 (Appendix A) shows how many of each family were found at each station. V3 sent 41 voucher specimens of macroinvertebrates to Purdue University, Department of Entomology to be verified by Arwin Provonsha. Representative photographs of the macroinvertebrates and a copy of the letter sent to Purdue are located in Appendix I. V3 used the mIBI to analyze macroinvertebrates. The data showing the classification score is depicted on Table 22 (Appendix A). Macroinvertebrate data was taken at all stations. The raw macroinvertebrate data and the mIBI scoring for the stations are located in Table 25a and 25b (Appendix A) respectively.

Station 1 (5.6), Station 2 (4.2), and Station 5 (4.8) all had total scores which placed them in the slightly impaired category. Station 3 (3.8) and Station 4 (2.2) had scores which placed them in the moderately impaired category. All stations scored a 0 for Number of Individuals/Number of Squares Sorted so they will not be discussed for each station. A low Number of Individuals/Number of Squares Sorted indicates that density of individuals sampled was not very high in the areas that were sampled.

Station 1 scored a 2 on Percent Dominant Taxa. The dominant taxon for this station was an EPT. Three of the five stations had dominant taxon of an EPT, which most families of EPTs are considered to be indicators of good water quality. All other metrics not mentioned for Station 1 either scored a 6 or 8 indicating that these metrics are in acceptable ranges. Station 2 scored an 8 on Percent Dominant Taxa with only 17.9 percent being from the dominant taxon. Number of Taxa was a 6 with 16 separate taxa present at the station. All other metrics scored a 4 at the station. Station 3 scored a 2 or lower for Percent Dominant Taxa and EPT Index. The dominant taxon for this station was also an EPT. Station 4 scored an 8 on Number of Taxa with 20 different families represented and it also scored a 6 on the Chironomid Count with 13 Chironomids being found. It also had six metrics that scored a 0. This reflects the deep water in this station. Also, very few EPT's were found because of the substrate at this station. At Station 5, one metric scored a 2 or lower, and five metrics scored a 6 or higher.

Several previous macroinvertebrate studies have been conducted within the Elkhart River Watershed. IDEM sampled macroinvertebrates (Table 26, Appendix A) in 1990 and in 2000. In both of IDEM's studies, all of the stations were considered slightly impaired or worse based on the mIBI. Rock Run Creek was the only station sampled in both studies and the mIBI decreased from 4.2 (1990) to 2.4 (2000). This changed the impairment status from slightly impaired to

moderately impaired. In 1990 one station was found to have severe impairment with a score of 1.6 (Dausman Ditch at CR 21). In both years, nine stations were found to have moderate impairment and seven were found to have slight impairment. The highest scoring two metrics for these studies were the HBI and the Chironomid count. The lowest scoring metrics were the number of individuals caught and the ratio of EPT to Chironomids.

Hoosier Riverwatch has data on record from 1999 to 2005 for macroinvertebrates at nine stations (Table 27, Appendix B). Hoosier Riverwatch uses a Pollution Tolerance Score where the range of 0-10 is a poor score, 11 to 16 is a fair score, 17-22 is a good score, and 23 or more is excellent for biological quality. These surveys only found one study location in the poor range, one in the fair score, three in the good range, and 17 in the excellent range. Station 552 at US 33 (in December, 1999) had a score of 5, which is the lowest score.

Overall ratings for V3's data and IDEM's data are similar with the main portion of the stations either being slightly impaired or moderately impaired for macroinvertebrates. V3 had 60 percent of stations rated as slightly impaired and 40 percent were moderately impaired. IDEM had 41 percent of stations rated as slightly impaired and 53 percent of stations were moderately impaired. Both of these data sets are much lower than the statewide average calculated by Hoosier Riverwatch in which 77 percent of the samples ratings are Excellent.

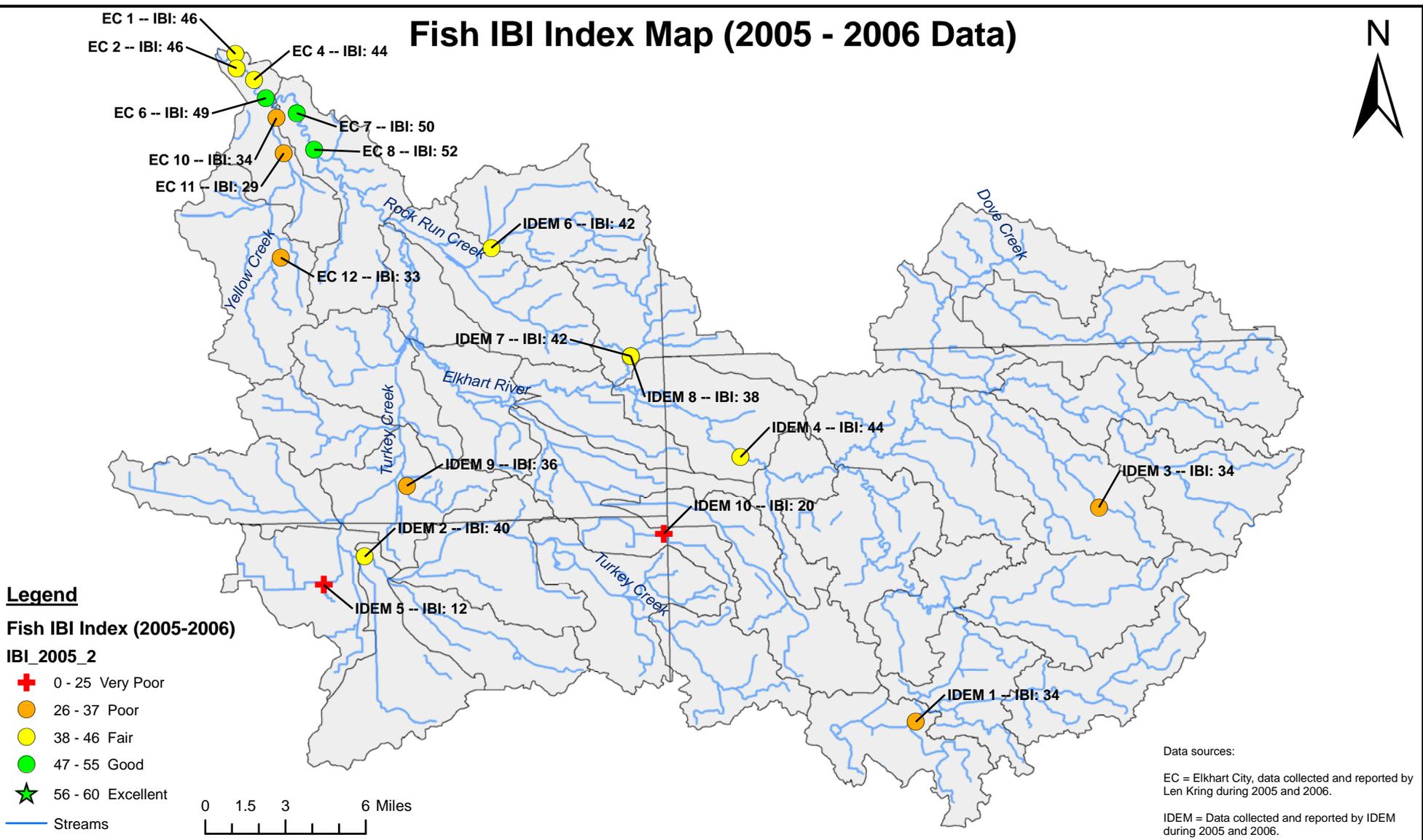
#### *Index of Biotic Integrity Results*

The City of Elkhart conducts sampling along portions of the St. Joseph River and its tributaries in Elkhart and St. Joseph Counties. Annual fish community monitoring reports from 1998 - 2006 were obtained, and available fish community data were evaluated. During this time frame, 16 stations within the Elkhart River Watershed were sampled and evaluated using the fish community IBI (Table 28, Appendix A).

The IBI has stayed relatively consistent at all stations except in Yellow Creek at the U.S. 20 Bypass. In 1999, the IBI was 43 and it decreased to 29 in 2000. The study said that the cause of this drop was unknown (Foy, 2000). From 2002 to 2003 the IBI dropped from 38 to 31. This was caused by stream maintenance (Foy, 2003). The station has since rebounded to 34 in 2005.

IDEM has also studied fish at 15 stations in 2000 and 2006 (Table 29, Appendix A). The data agrees with the City of Elkhart's data. The worst station is located on Omar-Neff Ditch. The IBI score was 12. This can also be explained by having the lowest Qualitative Habitat Evaluation Index (QHEI) score (29) and a DO reading of 3.47. Exhibit 14 (see below) shows IBI scores from the City of Elkhart and IDEM for 2005 and 2006 and shows where the sampling stations are located in the Watershed. Included in Table 28 (Appendix A) is a list of all fish found in the Elkhart River Watershed from 2000 to 2007. Two species of concern were found, the River Redhorse and Greater Redhorse, which were only found in the main stem of the Elkhart River.

# Fish IBI Index Map (2005 - 2006 Data)

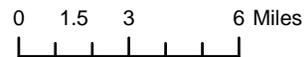


### Legend

### Fish IBI Index (2005-2006)

IBI\_2005\_2

- + 0 - 25 Very Poor
- 26 - 37 Poor
- 38 - 46 Fair
- 47 - 55 Good
- ★ 56 - 60 Excellent



Data sources:  
 EC = Elkhart City, data collected and reported by Len Kring during 2005 and 2006.  
 IDEM = Data collected and reported by IDEM during 2005 and 2006.



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

TITLE: <b>Fish IBI Index Map (2005-2006 Data)</b>		PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A	PROJECT NO.:	EXHIBIT:	SHEET:
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526	07041	14	1 OF: 1
		QUADRANGLE:	DATE:	SCALE:
		N/A	11/15/07	1"=27,500'

## Habitat Evaluation Explanation

Habitat evaluation followed IDEM's Qualitative Habitat Evaluation Index (QHEI) habitat assessment approach. Habitat incorporates all aspects of physical and chemical constituents along with the biotic interactions. Habitat includes all of the instream and riparian habitat that influences the structure and function of the aquatic community in a stream. The QHEI habitat assessment approach was developed to describe the overall quality of the physical habitat. The presence of an altered habitat structure is considered one of the major stressors of aquatic systems. The purpose for evaluating the physical habitat features of the selected locations within the Elkhart River Watershed is to quantify and qualify the condition and quality of the instream and riparian habitat.

The maximum points possible for each of the habitat parameters are as follows: Substrate = 20, In-stream Cover = 20, Channel Morphology = 20, Riparian Zone and Bank Erosion = 10, Pool/Glide Quality = 12, Riffle/Run Quality = 8 and Gradient = 10. The highest score that can be obtained using IDEM's QHEI is a value of 100. A QHEI score of 51 or less indicates a poor habitat (IDEM, 2006).

## Habitat Evaluation Results

V3 had 5 sampling stations during 2007 (Exhibit 15). The results for habitat (Table 30, Appendix A) that V3 analyzed showed that no stations were scored as poor habitat. Stations 2 and 4 had the lowest habitat scores with 61.5 and 55.5 respectively. Both of these stations did not have a riffle in the sampling station. Station 3 had the highest score at 79.

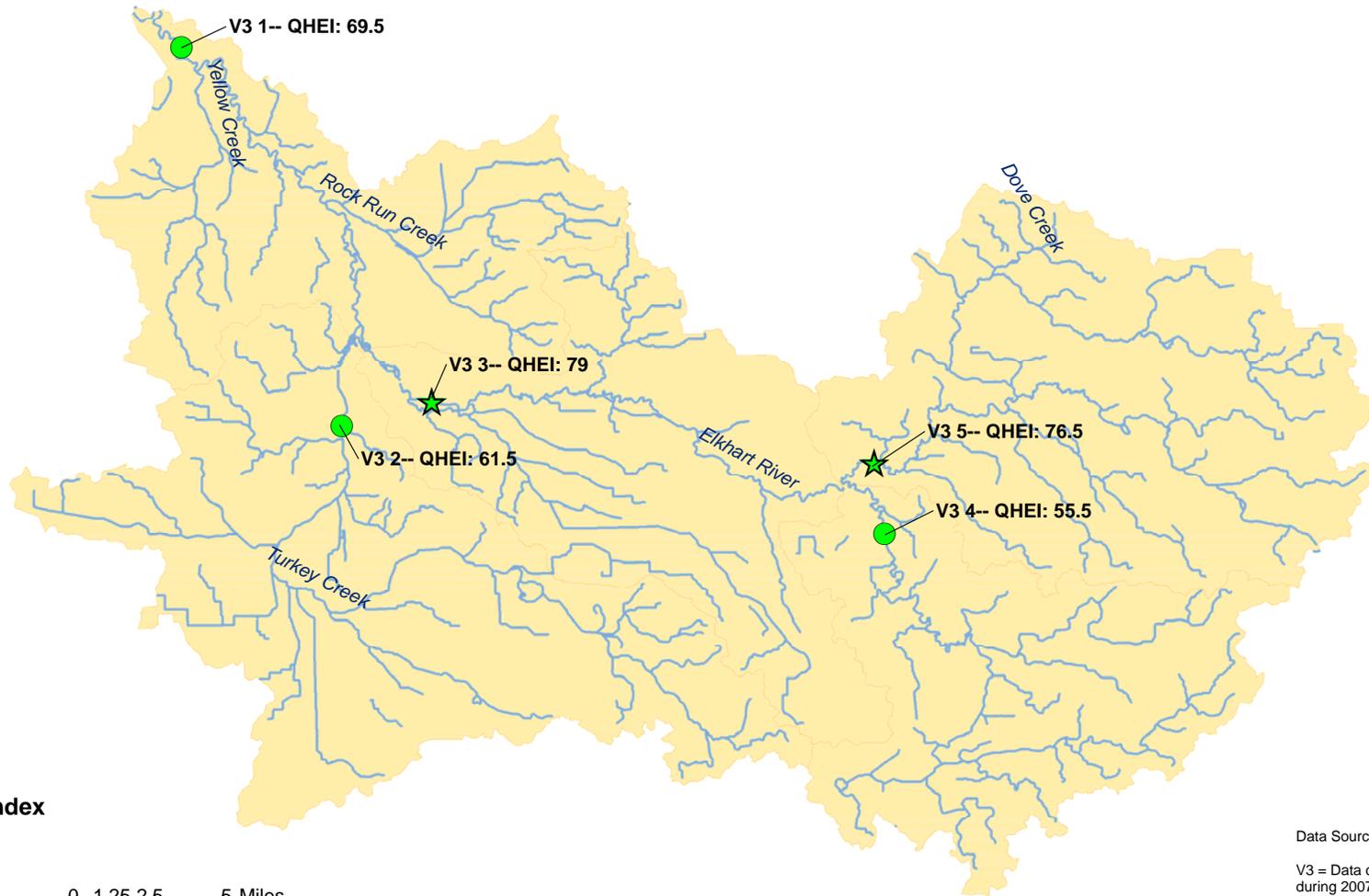
Habitat was surveyed previously by IDEM (Table 26 and Table 28, Appendix A), the City of Elkhart (Table 28, Appendix A), and Hoosier Riverwatch (Table 27, Appendix A). Two separate methods were used while sampling. IDEM and the City of Elkhart used the QHEI and Hoosier Riverwatch used a citizens QHEI (CQHEI). Exhibit 16 (see below) shows IDEM and the City of Elkhart's QHEI scores from 2005 and 2006 and where the sampling stations are located. The City of Elkhart had 16 sampling stations surveyed from 2003 to 2007. IDEM had a total of 25 stations that had QHEI taken during macroinvertebrate and fisheries surveys. Data was taken at 16 stations in 1990 and 2000 during macroinvertebrate surveys and at nine stations in 2005 during fisheries surveys.

Rock Run Creek's QHEI score decreased significantly from 69 in 1990 to 48 in 2000 (IDEM 1990, 2000). There was possibly a physical alteration that occurred at the site because both the in-stream cover score and the substrate score decreased greatly. During the three surveys, 14 stations had a QHEI score of 51 or less which indicates poor habitat (IDEM, 2006). The main metrics that these stations were lacking included: substrate, in-stream cover, channel, pool/glide and riffle/run sections. This indicates that these stations are probably channelized ditches that are almost all run with no true pools or riffle sections.

The City of Elkhart showed that no stations they surveyed had poor habitat from 2004 to 2005. During the 2003 survey, five stations had poor habitat. Three of these stations were on Yellow Creek (CR 40, Concord Mall, and US Bypass 20). Rock Run Creek (SR 4) and Solomon Creek (CR 43) also had poor habitat scores during 2003. More recently, in 2006, CR 13 and CR 15 in Berlin Court Ditch had poor habitat scores (Foy, 2003; Kring, 2005-2006).

The Elkhart River was studied from 2001 to 2005 by Hoosier Riverwatch at three stations. Using their scoring, a habitat score of 60 or less is not conducive to warm water fauna. Only station 844 in Benton (sample taken in 2004) had a score less than 60 with a score of 49 (Hoosier Riverwatch, 2004).

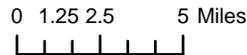
# V3 Habitat QHEI Index Map



## Legend

### Habitat QHEI Index

- 55 - 69
- ★ 70 - 100
- Streams



Data Source:

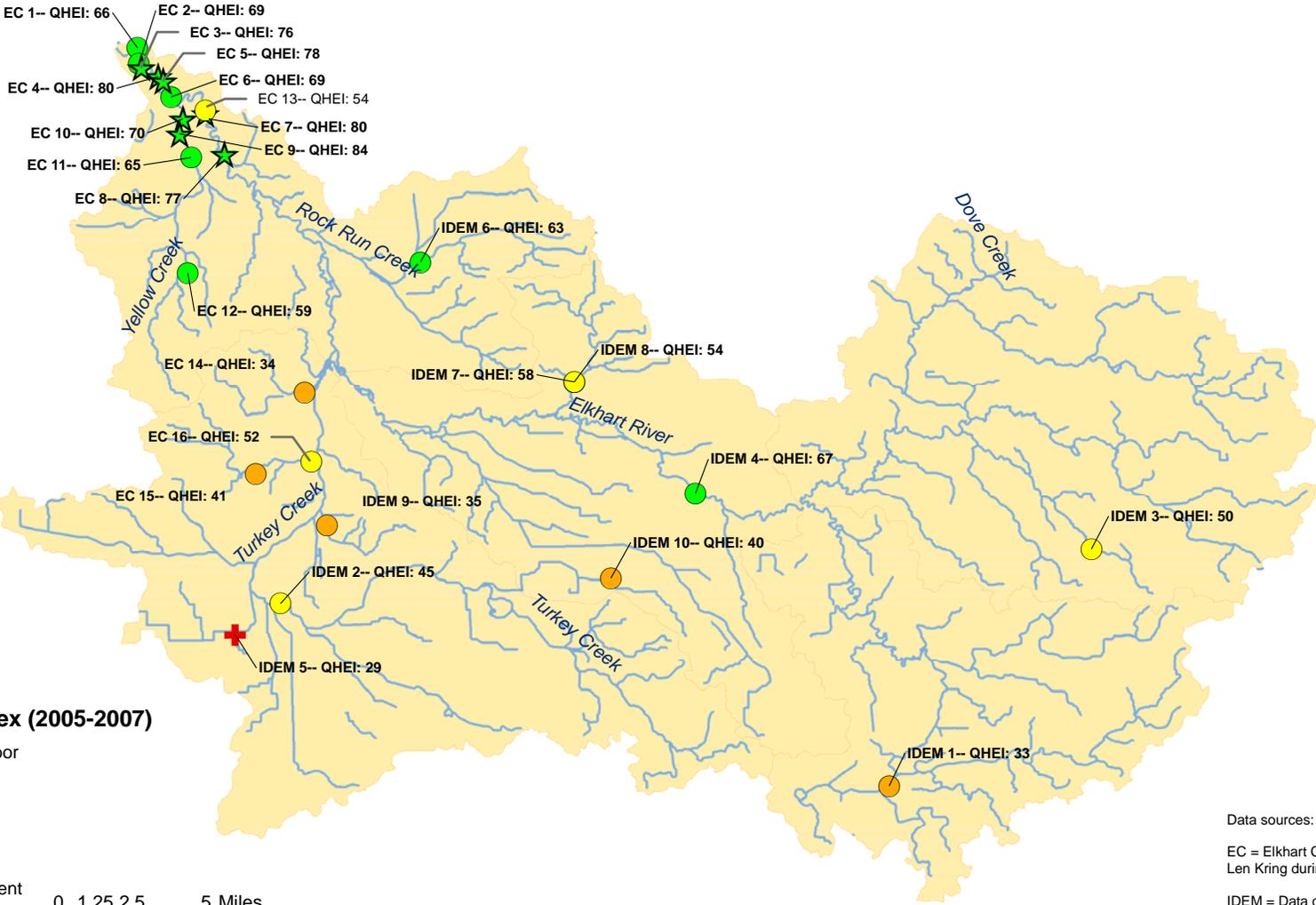
V3 = Data collected and reported by V3 during 2007.



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE:	<b>V3 Habitat QHEI Index Map</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>				
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	15	SHEET: 1 OF 1	
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	2/7/08	SCALE:	1"=27,500'

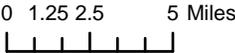
# Habitat QHEI Index Map (2005 - 2007 Data)



**Legend**

**Habitat QHEI Index (2005-2007)**

- + 0 - 30 Very Poor
- 31 - 42 Poor
- 43 - 54 Fair
- 55 - 69 Good
- ★ 70 - 100 Excellent



Data sources:  
 EC = Elkhart City, data collected and reported by Len Kring during 2005 and 2006.  
 IDEM = Data collected and reported by IDEM during 2005 and 2006.



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

TITLE: <b>Habitat QHEI Index Map (2005-2007 Data)</b>		PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER: N/A	CLIENT: Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526	PROJECT NO.: 07041	EXHIBIT: 16	SHEET: 1 OF 1
		QUADRANGLE: N/A	DATE: 11/15/07	SCALE: 1"=27,500'

## Water Quality Evaluation Explanation

Water quality analysis at the five stations monitored by V3 was measured in the field using an YSI Model 63 Handheld pH, Conductivity, Salinity, and Temperature System; YSI Model 55 Dissolved Oxygen Meter; LaMotte 2020 Turbidimeter; and MARSH-McBIRNEY FLO-MATE Model 2000 Portable Flowmeter. V3 performed the water quality measurements for the following parameters: turbidity, flow, temperature, dissolved oxygen (DO), salinity, conductivity, specific conductance, and pH. V3 also collected water samples for water chemistry analysis at EIS Analytical Services Inc. in South Bend, Indiana, for the following parameters: *Escherichia coli* (*E. coli*), Nitrate/Nitrite, Total Phosphate, and Biochemical Oxygen Demand (BOD).

An explanation of key water quality parameters is summarized below:

*Turbidity.* The water's transparency can be affected by two primary factors: algae and suspended particulate matter. An increase in the density of the phytoplankton or total suspended solids (TSS) signifies an increase in the water's turbidity.

*Total Suspended Solids (TSS).* Total suspended solids is a water quality measurement which refers to the portion of total solids retained by a filter, where as total dissolved solids (TDS) refers to the portion that passes through the filter. The principal factors affecting separation of TSS and TDS are the type of filter holder, pore size, porosity, area, and thickness of the filter and the physical nature, particle size, and amount of material deposited on the filter. TSS measurements and modeling are frequently used to represent sediment loading. By the year 2027, surface waters within the Elkhart River Watershed will comply with the Steering Committee's target based on the recommended water quality threshold of 80 mg/L total suspended solids.

*Flow.* Measuring stream flow, or discharge rate, calculates the volume of water that is flowing in a stream. The rate is expressed in cubic feet per second, and is established by multiplying the average width, depth and velocity of the stream. While flow is not a measurement of water quality, knowing the flow rate of a stream provides information on the effect a tributary has on the main stem. Changes in flow rate can also reflect conditions in the Watershed such as drought, storm events, or increased impervious surfaces.

*Temperature.* Temperature affects overall water quality in the stream in several ways. Colder water holds more dissolved oxygen than warmer water. Higher temperatures increase photosynthesis and plant growth, and this increase in organic matter contributes to decomposition and higher biological oxygen demand rates. All aquatic life has a preferred temperature range and temperatures outside of those ranges are detrimental to aquatic life.

*Dissolved Oxygen (DO).* DO is the gaseous form of oxygen and is essential for respiration of aquatic organisms (i.e. fish and plants). DO enters water by diffusion from the atmosphere through riffles, runs, and below dams. It also enters as a byproduct of photosynthesis by algae and other plants. During the day, DO levels increase as a byproduct of photosynthesis, but as plant respiration continues throughout the night, DO levels drop. DO is also consumed during bacterial decomposition of plant and animal matter. Low levels of DO in the water do not provide adequate oxygen for aquatic organisms. High levels of DO in the water could be an indicator of excessive algae growth. Indiana's 305(b) Assessment and 303(d) Listing

Methodology, 2005, designates water quality values for DO which support aquatic life as those values greater than 5.0 mg/L and no greater than 12.0 mg/L.

*Salinity.* Salinity is a measure of the total salts that are dissolved in water, in parts per thousand (ppt). Salinity will be variable from location and time of year. Plants are adversely affected by high salinity, which can cause stunted growth, leaf burn, and defoliation. The most commonly used road salt is sodium chloride (NaCl). NaCl dissociates in aquatic systems into chloride ions (Cl<sup>-</sup>) and sodium cations (Na<sup>+</sup>). This also results in a higher conductivity reading. Elevated sodium and chloride levels create osmotic imbalances in plants, which inhibit water absorption and reduce root growth. Various species of fish, amphibians, and aquatic macroinvertebrates are adversely impacted by increased levels of sodium and chloride.

*Conductivity.* The conductivity of water is the reciprocal of its resistance to electrical flow. The resistance of a water solution to electrical current or electron flow is reduced with increasing content of ionized salt. Distilled water has a conductivity of zero. The purer the water is, the lower its conductivity.

*Specific Conductance.* Specific Conductance is the conductance at 25°C. This reading is important because conductivity readings are directly linked to temperature and can change up to 3% for a change of one degree Celsius.

*pH.* The acidity or alkalinity of water is measured using the pH scale. Water contains both hydrogen ions (H<sup>+</sup>) and hydroxide ions (OH<sup>-</sup>) and the relative concentrations of these ions determine whether it is acidic, neutral, or alkaline. A low pH signifies an acidic medium (lethal effects of most acids begin to appear at a pH of 4.5) while a high pH signifies an alkaline medium (lethal effects of most alkalis begin to appear at a pH of 9.5). Neutral pH is 7. The actual pH of a water sample indicates the buffering capacity of that waterbody. Indiana's 305(b) Assessment and 303(d) Listing Methodology, 2005, designates water quality values which support aquatic life for pH as values between 6 and 9.

*Escherichia coli.* *E. coli* is a member of the fecal coliform group of bacteria. When this organism is detected within water samples, it is an indication of fecal contamination. *E. coli* is an indigenous fecal flora of warm-blooded animals. Contributions of detectable *E. coli* colonies may appear within water samples due to the input from human or animal waste. Human waste can enter a surface water system through combined sewer overflow events or failed septic systems. Common sources of animal waste are livestock operations (pigs, cattle, etc.), pet waste, or wildlife waste (such as raccoons, Canada geese, or gulls). Rain storm events or snow melts frequently wash waste and the associated *E. coli* into surface water systems. The state standard in Indiana for *E. coli* is 235 cfu/100 mL. The measure of cfu per 100 mL refers to the count of colony forming units that exist in 100 milliliters of water.

*Nitrogen.* Nitrogen is another major cellular component of organisms. Nitrogen can enter water bodies from the air "and also through human and animal waste, decomposing organic matter, and runoff of fertilizer from lawns and crops." (Hoosier Riverwatch, 2005). Nitrogen in surface water is used by bacteria, algae and larger plants. By the year 2027, surface waters within the Elkhart River Watershed will comply with the Steering Committee's target based on the

recommended water quality threshold of 10 mg/L of nitrate/nitrite. The four common forms of nitrogen are:

- Nitrite ( $\text{NO}_2$ ) – is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate.
- Nitrate ( $\text{NO}_3$ ) – generally occurs in trace quantities in surface water but may attain high levels in some groundwater. In excessive amounts, it contributes to the illness known as methemoglobinemia in infants. The current USEPA standard of 10 parts per million (ppm) for drinking water is specifically designated to protect infants from this disorder.
- Ammonia ( $\text{NH}_4$ ) – is present naturally in surface waters. Bacteria produce ammonia as they decompose dead plant and animal matter. The concentration of ammonia is generally low in groundwater because it adheres to soil particles and clays and does not leach readily from soils.
- Organic nitrogen (TKN) – is defined functionally as organically bound nitrogen in the tri-negative oxidation state. Organic nitrogen includes nitrogen found in plants and animal materials, which includes such natural materials as proteins and peptides, nucleic acids and urea. In the analytical procedures, Total Kjeldahl Nitrogen (TKN) determines both organic nitrogen and ammonia. Raw sewage will typically contain more than 20 mg/L.

*Phosphorus.* Phosphorus is a major cellular component of organisms. Phosphorus can be found in dissolved and sediment-bound forms. However, phosphorus is often locked up in living biota, primarily algae. In the Watershed, phosphorus is found in fertilizers and in human and animal wastes. The availability of phosphorus determines the growth and production of algae and makes it the limiting nutrient in the system. In this study, water samples were analyzed for dissolved and total phosphate. Dissolved phosphorus is important because it is readily usable by algae and other plants. According to Indiana's 305(b) Assessment, in order to classify a water body impaired by nutrients, measurements of Total Phosphate need to be  $>0.3$  mg/l and it must be combined with another nutrient impairment such as pH, nitrogen, or dissolved oxygen. By the year 2027, surface waters within the Elkhart River Watershed will comply with the Steering Committee's target based on the recommended water quality threshold of 0.3 mg/L of phosphorus.

*Biochemical Oxygen Demand (BOD).* BOD provides a means of determining the relative oxygen requirements of aerobic bacteria in water. The test measures the molecular oxygen utilized during a five-day incubation period for the biochemical degradation of organic material (carbonaceous demand) and the oxygen used to oxidize inorganic material such as sulfides and ferrous iron. High levels of BOD are undesirable as they indicate the presence of large amounts of organic matter in the stream.

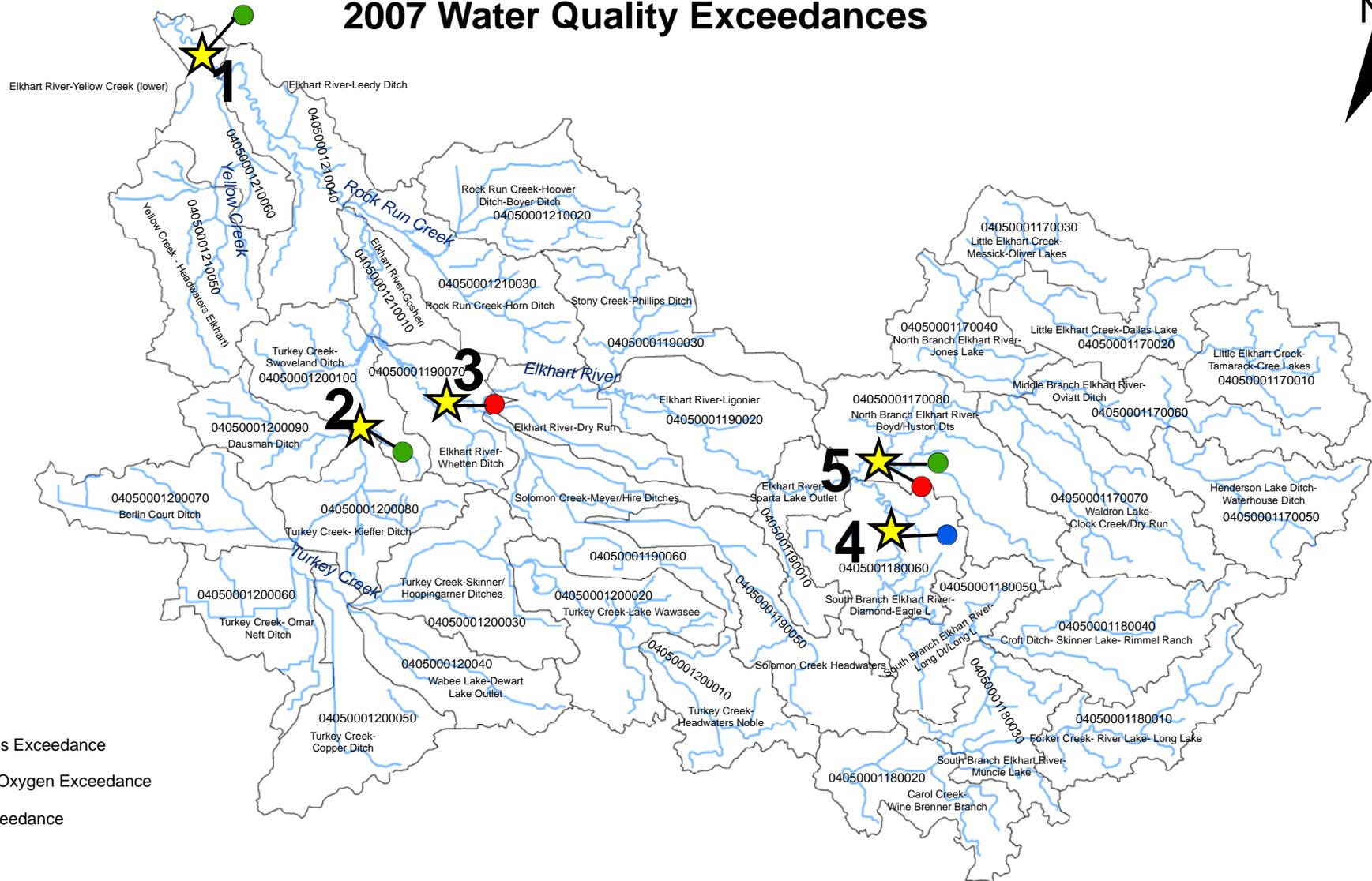
*Heavy Metals.* Historical data included other parameters including heavy metals (arsenic, barium, and cadmium). Heavy metals influence the health of the aquatic ecosystem.

## Water Quality Evaluation Results

Water quality parameter results which demonstrated an impairment or degradation included infractions on limits for phosphorus, DO, and *E. coli*. Interpretation of this data set, shown in Exhibit 17, illustrates how it relates to the historical data set. These test results demonstrate

another means of evaluating the Watershed (Tables 31-34). Further discussion of the importance of this data in identifying critical areas took place at the November 28, 2007, January 3 and January 10, 2008, ERA Steering Committee meetings.

# 2007 Water Quality Exceedances



## Legend

-  Streams
-  Phosphorus Exceedance
-  Dissolved Oxygen Exceedance
-  E. coli Exceedance



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

TITLE:	<b>2007 Water Quality Exceedances</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	17
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	11/15/07
						SHEET:	1
						OF:	1
						SCALE:	1"=27,500'

## Introduction to IDEM data

IDEM data for the Elkhart River Watershed from 1990 through 2005 were obtained and evaluated to determine where water quality problems were noted in the Watershed. Data included field data, general chemistry data, metals data, pesticide data, macroinvertebrate data, fish community data, and habitat quality data. Site locations for the data were spread throughout the Watershed and are shown in Exhibit 18 (see below).

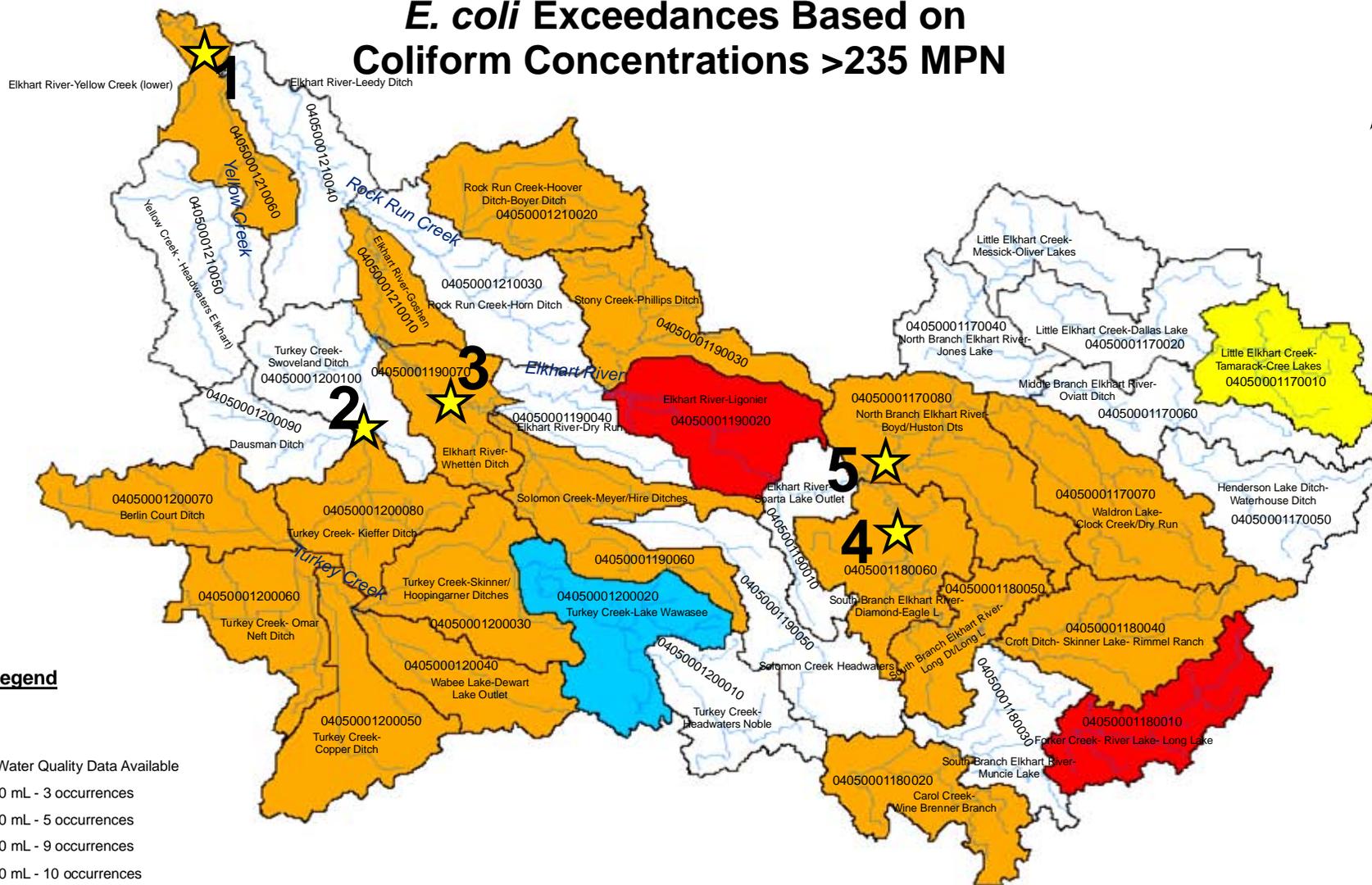
The IDEM Assessment Branch evaluates all the data they collect to develop the 305(b) report, and the 303(d) list. The 305(b) report is a document that summarizes the quality of surface waters throughout Indiana. Evaluations are based on different stream segments or lakes, and are discussed in the context of Watersheds. To complete the evaluation, IDEM considers not only the data they collect, but data collected by other entities as long as that data meets the rigorous quality controls that IDEM uses in the collection and analysis of their own data. Other data that does not meet these standards may be used informally to validate data that does meet the quality controls.

If the data indicates that the State water quality standards (WQS) are being violated, then the waterbody is placed on the Indiana 303(d) list, and will need to have a Total Maximum Daily Load (TMDL) report developed to address the issue. However, if the cause of the problem can be addressed by another program within IDEM, then the waterbody is listed on a different list indicating it is impaired but the problems are being addressed using means other than a TMDL. The 303(d) listed streams for the Elkhart River Watershed are discussed below. IDEM also collects fish tissue data to determine if levels of mercury and PCBs warrant a health advisory. If an advisory is warranted, then an advisory is published. These fish-consumption advisories are discussed later in the report.

*E. coli* has been found to be a persistent problem throughout the entire Watershed. In evaluating IDEM's data, almost every site in the Watershed violated Indiana's standards for *E. coli*. IDEM has set *Escherichia coli* (*E. coli*) compliance with the bacteriological criteria and the application of a single sample maximum limitation of 235 most probable number (MPN) or comparable cfu/100 mL of *E. coli* bacteria to waters of the state. Exhibit 19 illustrates the subwatersheds in which the exceedance of *E. coli* is greater than 235 cfu/100mL based on total coliforms in MPN. In response, many streams within the Elkhart River Watershed are listed on IDEM's 303(d) list of impaired waterbodies (Exhibit 20, see below; Table 35, Appendix A). Because this is such a widespread issue, it must be addressed in many parts of the Watershed.



# E. coli Exceedances Based on Coliform Concentrations >235 MPN



### Legend

- Streams
- E. coli**
- No Historical Water Quality Data Available
- >235 MPN/100 mL - 3 occurrences
- >235 MPN/100 mL - 5 occurrences
- >235 MPN/100 mL - 9 occurrences
- >235 MPN/100 mL - 10 occurrences



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

### TITLE: E. coli Exceedances Based on Coliform Concentrations Greater Than 235 Most Probable Number

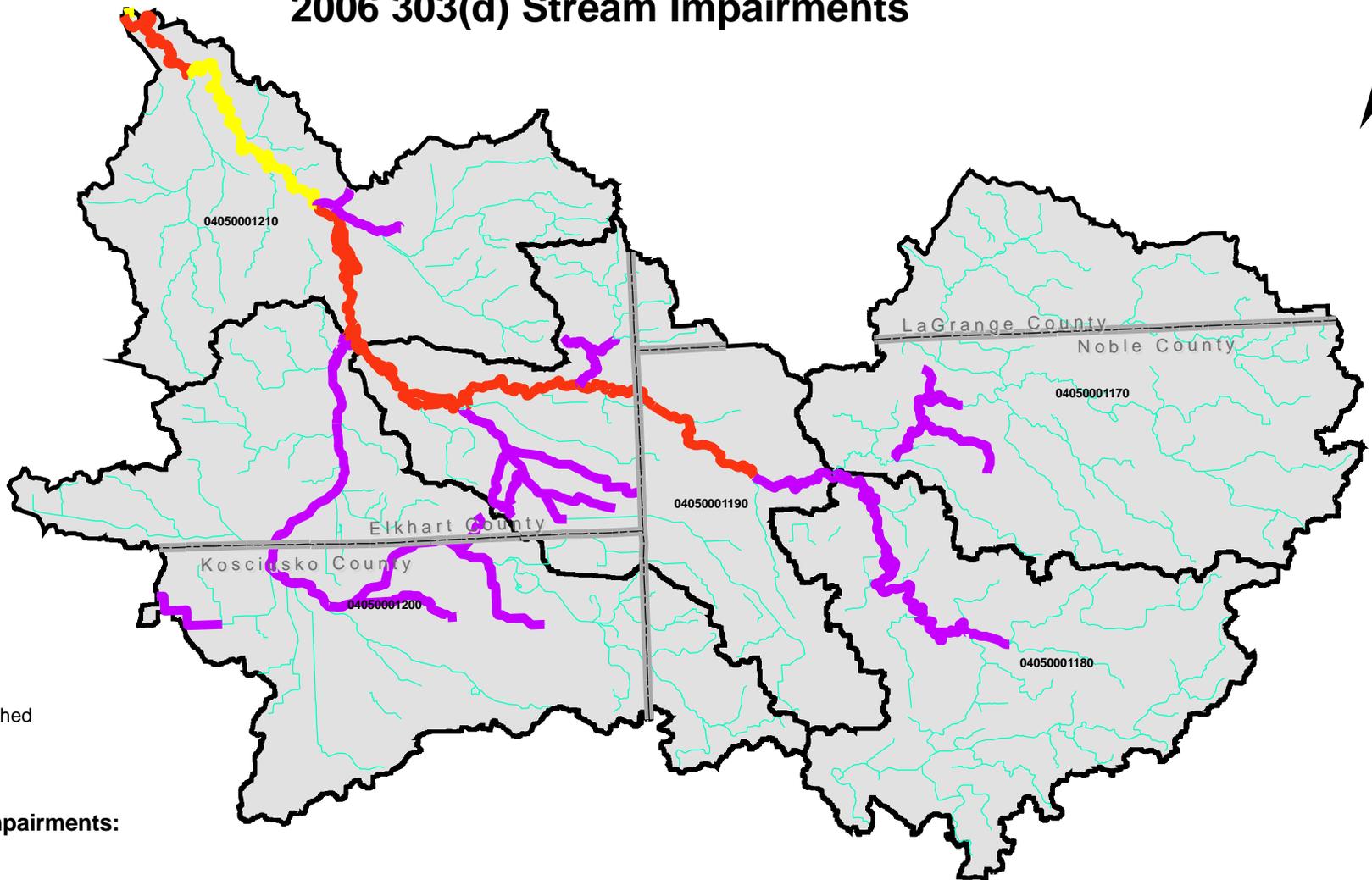
BASE LAYER: N/A

CLIENT: Elkhart River Restoration Association  
305 Carter Road  
Goshen, Indiana 46526

### PROJECT: Elkhart River Watershed Management Plan & Implementation

PROJECT NO.:	EXHIBIT:	SHEET:	OF:
07041	19	1	1
QUADRANGLE:	DATE:	SCALE:	
N/A	2/21/08	1"=27,500'	

# 2006 303(d) Stream Impairments



## Legend

- Elkhart River Watershed
- Counties
- Indiana Streams

## 2006 303(d) Stream Impairments:

- E. coli*
- Fish Consumption Advisory for Mercury, Fish Consumption Advisory for PCBs
- E. coli*, Fish Consumption Advisory for Mercury, Fish Consumption Advisory for PCBs

 <p>V3 Companies 7325 Janes Avenue Woodridge, IL 60517 630.724.9200 phone 630.724.9202 fax www.v3co.com</p>	TITLE: <b>2006 303(d) Stream Impairments</b>		PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
	BASE LAYER: Indiana Department of Environmental Management		PROJECT NO.: 07041	EXHIBIT: 20	SHEET: 1 OF: 1
	CLIENT: Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526		QUADRANGLE: N/A	DATE: 8/6/07	SCALE: NTS

## Analysis of Information Related to the IDEM 303(d) List

Section 303(d) of the 1972 Federal Clean Water Act (CWA) requires each state to identify and list those waters that do not meet the state's WQS for designated uses. For such waters, the state is required to establish total maximum daily loads (TMDLs) to meet the state WQS. To determine if a waterbody should be listed on Indiana's 303(d) list, the IDEM Assessment Branch has developed a surface water quality monitoring strategy to assess the quality of Indiana's ambient waters. The goals of this monitoring strategy are as follows (IDEM 303(d) listing methodology):

1. Measure the physical, chemical, bacteriological, and biological quality of the aquatic environment in all river basins and identify factors responsible for impairment.
2. Assess the impact of human and other activities on the surface water resource.
3. Identify trends through the analysis of environmental data.
4. Provide environmental quality assessment to support water quality management programs.

Once data is collected, waterbodies are evaluated by a team of water quality professionals within IDEM to determine if the waterbodies meet the WQS set by the state, and that all designated uses are met. If a stream fails to meet these requirements, as outlined in the 303(d) listing methodology, the waterbody is considered impaired and must be listed on the 303(d) list, and a TMDL report must be developed to address the problem.

Several waterbodies have been found to be impaired in the Elkhart River Watershed, and are listed in Table 36 (Appendix A) and illustrated in Exhibit 20. The impairments include: 1) rivers and streams impaired for *E. coli* bacteria, 2) rivers, streams, and lakes impaired for Fish Consumption Advisories (FCA) for both Polychlorinated Biphenyls (PCBs) and Mercury, and 3) lakes listed due to impaired biotic communities. The specific methodologies for these listings are identified in the IDEM 303(d) listing methodology and are shown in Table 37 (Appendix A). These data are for *E. coli* impairments (Human Health Recreation Use Support [Swimmable]), Fish Consumption Advisories (Human Health Use Support [Fishable]), and Impaired Biotic Communities (Aquatic Life Use Support).

## Analysis of Information Related to the St. Joseph River TMDL Study

In February of 2004, IDEM released a Total Maximum Daily Load (TMDL) report for *E. coli* for the St. Joseph River in Elkhart and St. Joseph Counties. This TMDL evaluated the data collected on the St. Joseph River and several tributaries, including the Elkhart River, and made recommendations for load reductions to bring the St. Joseph River into compliance with both Indiana and Michigan's WQS.

It was noted in the study that when *E. coli* limits were being surpassed in the St. Joseph River, many of the tributaries, including the Elkhart River were also exceeding the WQS for *E. coli*. Problems, therefore, were not restricted to the St. Joseph River itself, but were being exacerbated by inputs from tributaries. Data from the report indicated several violations in the Elkhart River.

The St. Joseph River TMDL indicated that both point and nonpoint sources of pollution were responsible for the *E. coli* contamination in the St. Joseph River. It was also determined that to meet the State's WQS the target load had to be set at a concentration value of 125 cfu per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over thirty days. This is how the standard is defined in the State's WQS.

Some specific sources indicated in the TMDL include combined sewer overflows (CSOs). The communities named in the TMDL that are part of the Elkhart River Watershed are the cities of Elkhart and Goshen. All of these communities are required to reduce the impact of CSOs by developing Long Term Control Plans (LTCPs) for their CSOs. These plans are approved by IDEM through the National Pollutant Discharge Elimination System (NPDES).

## Analysis of Information Related to the Indiana State Fish Consumption Advisory

Each year the Indiana State Department of Health (ISDH), in conjunction with IDNR and IDEM, publish a fish consumption advisory for Indiana. Advisories are based on actual fish tissue data collected from Indiana's rivers, lakes, and reservoirs. Guidelines are then published so that the public can make informed decisions based on what type of fish they would like to eat and the amount of fish that is safe to consume within a given time period.

Advisories are based on specific contaminants that can bioaccumulate in fish tissue, PCBs, pesticides, and heavy metals such as mercury. Criteria for these advisories were developed by the Great Lakes Sport Fish Advisory Task Force. Advisories fall in one of the five categories listed below (Table 38, Appendix A). Advisories are different for specific high risks groups such as pregnant women and women who are breastfeeding. Advisory information with fish species and specific contaminants for different advisory groups and waterbodies are available (Table 39, Appendix A).

## Analysis of Information Related to the St. Joseph River WMP

In June 2005 the Friends of the St. Joe River Association released a WMP (located at the following web link: <http://www.stjoeriver.net/wmp/wmp.htm>) for the St. Joseph River that was developed through an EPA 319 grant provided through the Michigan Department of

Environmental Quality (MDEQ). As the Elkhart River is part of the St. Joseph River Watershed, it was included in the report.

As a result of their analysis, it was determined that the Elkhart River Watershed was a critical area in need of mitigation to control the impact of agricultural activities especially during storm flows. The report indicated that since the Elkhart River Watershed was extensively used for agriculture, it was a major source of pollution in the form of sediment, nutrients, herbicides, and pesticides. The St. Joseph report praised the effectiveness of BMPs that were being instituted throughout the Elkhart River Watershed, but additional work still needed to be done to achieve the desired results. In order to be effective it is necessary to evaluate the needs of individual agricultural producers. Specific BMPs should be designed and implemented to address the needs of agricultural producers and help assist in meeting pollutant load reductions in order to preserve and protect the aquatic ecosystems throughout the Watershed.

In addition, the Elkhart/Goshen area was identified as a critical area in need of mitigation of urban stormwater impacts to water quality. The report indicated that the Elkhart/Goshen critical area is characterized by extensive impervious surfaces. It has long been known that once impervious surfaces in a watershed area exceed 10%, aquatic health tends to decline. It has also been known that once impervious surfaces exceed 30%, the watershed becomes severely impaired. To address this issue, it is important that specific BMPs be designed and installed in the urban areas of the watershed and that future development and expansion include plans to incorporate appropriate controls (Low Impact Development) and preservation of green space/green infrastructure.

The St. Joseph River WMP lists nutrients as a pollutant that they desire to address. Nutrients of concern include both nitrogen and phosphorus, although phosphorus is the limiting nutrient in most of Indiana's aquatic systems, and is therefore the nutrient of most concern. Stations where phosphorus levels meet or exceed 0.3mg/L include LMJ200-0053 on Berlin Ditch, LMJ190-0028 on Cromwell Ditch, LMJ170-0077 on Gretzinger Ditch, LMJ210-0008 on the Elkhart River, LMJ200-0002 on Omar-Neff Ditch, LMJ200-0003 on Turkey Creek, and LMJ170-0004 on UHL Ditch.

DO levels are used to indirectly assess the impact of nutrients. In the Elkhart River Watershed, many streams have been found to exhibit high DO values. Each of the five major Watersheds which make up the Elkhart River Watershed have had high DO values, indicating that excessive nutrient loading is not restricted to one portion of the Watershed. Sources of the nutrient loading are most likely from both urban and agricultural areas. In addition, two stations that are routinely monitored by IDEM on the Elkhart River have had many instances of high DO values. These stations include LMJ190-0006 just upstream of Goshen, and LMJ210-0008 in the City of Elkhart. Stations where values below 4mg/L have been recorded include LMJ190-0028 on Cromwell Ditch, LMJ200-0051 on Omar-Neff Ditch, and LMJ200-0053 on Berlin Ditch.

Sediment was also indicated as a pollutant of concern in the St. Joseph River WMP. Modeling used in the development of the St. Joseph River WMP, indicated that the Elkhart River was a critical area for sediment. Sediment can smother aquatic habitat and therefore negatively affect the aquatic flora and fauna. Sediment can also transport nutrients, especially phosphorus that tends to adhere to sediment particles causing excess algal growth leading to the large swings in

DO as discussed above. Although erosion and sediment transport are a problem throughout the Elkhart River Watershed, subwatersheds that seem to stand out as being more of an issue include Turkey Creek and the South Branch Elkhart River. However, during rain events, the North Branch Elkhart River is often a problem as well. Stations where high turbidity has been documented by IDEM include LMJ170-0004 on UHL ditch, LMJ200-0002 on Omar-Neff Ditch, and LMJ200-0003 on Turkey Creek.

## **Summary of the Skinner Lake Engineering Feasibility Study Noble County, Indiana**

The Skinner Lake Homeowners Association (SLHOA) received an IDNR Lake and River Enhancement (LARE) grant to complete an engineering feasibility study on lake improvement projects. The goal of the feasibility study was to analyze potential project sites where sources of pollution may exist, suggest projects that may address pollution, and examine the feasibility of project design and construction. The Skinner Lake Watershed encompasses 9,530 acres in central Noble County, Indiana, and is part of the Elkhart River Watershed.

In April of 2007, J.F. New & Associates released an Engineering Feasibility Study for Skinner Lake in Noble County, Indiana. This study examined the feasibility of five projects and sediment mapping within the Skinner Lake Watershed. The projects were: shoreline stabilization along the northern shoreline of Skinner Lake, bed and bank stabilization along the length of Rimmel Ditch, five minor projects within the Rimmel Ditch Watershed, documentation of the serpentine filter's history and identification of potential solutions, and wetland restoration at four potential sites throughout the Watershed. The study revealed that neither the sediment mapping nor the wetland restoration projects were deemed feasible at this time. J.F. New recommended that the Skinner Lake Homeowners Association complete design and construction work on the shoreline stabilization project in 2007 and apply for additional LARE grant funds.

## **Summary of the LARE Funded Whetten Ditch, Solomon Creek, and Dry Run Watersheds Diagnostics Study**

In August of 2002, J.F. New & Associates released a Diagnostic Study for the Whetten Ditch, Solomon Creek and Dry Run Watersheds that was developed through funding from the IDNR-Division of Soil Conservation and the Elkhart County Soil and Water Conservation District. These watersheds are part of the Elkhart River Watershed.

As a result of their analysis their primary recommendation was to apply for LARE Watershed Land Treatment Funds to implement recommended BMPs and projects discussed for the Solomon Creek Subwatershed. The critical areas identified for BMPs within the Solomon Creek Subwatershed are described in Section 4 of this document (Critical Area #'s 20 & 21).

The report indicated that the Solomon Creek Subwatershed's dominant landuse was row crop agriculture, approximately 80%. The majority of the land in the Solomon Creek Watershed is classified as prime farmland by the USDA. The Conservation Reserve Project (CRP) is an environmental improvement program offered by the federal government. The CRP attempts to maximize conservation and economic benefits by focusing on highly erodible land, riparian areas, cropped wetlands, and cropland associated with wetlands.

The Solomon Creek East Subwatershed had the highest HEL:CRP ratio (6,881:1), which means for every 6,881 acres of HEL there is only one acre designated as CRP. Solomon Creek Watershed could benefit from land treatment and BMPs. Some of the BMPs discussed include wetland restoration, filter strip installation, allowing for natural riparian vegetation growth, bank stabilization, livestock fencing, buffer zone establishment, re-vegetation of exposed areas, and grassed waterway construction.

## Summary of the LARE Funded Wawasee Area WMP

In April of 2007, J.F. New & Associates released a WMP for the Wawasee Area. Funding for the WMP was available through the IDNR Division of Fish and Wildlife through the LARE grant program which was obtained by the Wawasee Area Conservancy Foundation as an effort to improve water quality. The Wawasee Area Watershed lies in the headwaters of the Elkhart River Watershed.

The sources identified for nutrient loading in the Wawasee Area Watershed include fertilizers, human and animal wastes, organic materials, soil erosion, and lake sediment. The management goal is to reduce the nutrient load reaching Lake Wawasee by 25% over the next 10 years by techniques such as improving shoreline buffers, livestock exclusion from lakes and streams, and streambank stabilization.

The sources identified for pathogen concentration include human and animal waste. The management goal is to reduce concentration of *E. coli* within the Wawasee Area Watershed so that water meets the state standard for *E. coli*. Potential management techniques include restricting livestock from streams, manure management practices, and septic system maintenance.

The sources identified for sediment loading include streambank erosion, lack of buffers, changes in landuse, and surface runoff from residential areas. The management goal is to reduce the sediment load to the waterbodies within the Wawasee Area Watershed by 50% over the next 5 years. Possible management includes improving shoreline buffers, grassed waterways, and channel stabilization.

## Summary of the Five Lake Engineering Feasibility Study

In July of 2004, J.F. New & Associates released an Engineering Feasibility Study for Witmer, Dallas, Hackenburg, Messick, and Westler Lakes in southern Lagrange and northern Noble Counties, Indiana. Funding for the engineering feasibility study was available through the IDNR Division of Soil Conservation and the Five Lakes Conservation Association. The Five Lakes Watershed covers 37,248 acres and water leaves the Five Lakes via the North Branch Elkhart River flowing northwesterly to the St. Joseph River and Lake Michigan.

The purpose of this study was to determine the feasibility of implementing three projects within the five lakes in order to identify areas of potential water quality improvement. The three projects were installing fencing along J.J. Charles Drain to restrict livestock access to the drain, altering an existing wetland to reduce the nutrient load in an unnamed tributary to Witmer Lake, and a construction of a grade control at the Mill Pond on Little Elkhart Creek to reduce sediment and sediment attached pollutant loading.

This feasibility study included the assessment of several of the Five Lakes tributaries to determine which tributaries contributed the greatest amount of pollutants to the Five Lakes. The water quality assessment portion of this study consisted of water chemistry sampling during a storm water runoff event. All of the samples collected during the storm event exhibited *E. coli* concentrations above the state standard (235 cfu/100 ml). The study concluded that it is likely that Little Elkhart Creek contributes a greater amount of pollutants on a yearly basis compared to the unnamed tributary to Westler Lake. Therefore, projects to improve water quality should be located on Little Elkhart Creek. Future watershed management planning efforts should target the unnamed tributary to Westler Lake and its Watershed.

## Summary of the Pettit Mill Pond Sediment Control Project Design Project

In July of 2004, J.F. New & Associates released a design report for the sediment control project on Pettit Mill Pond. The Five Lakes Conservation Association received funding for the design report through the IDNR LARE program. The design project addressed the problem of accumulation of sediment and sediment-attached pollutants in the Mill Pond and the general state of disrepair of the Mill Pond's failed dam structure pose water quality concerns to Little Elkhart Creek and its receiving waterbody, Witmer Lake.

The project design was to capture sediment and sediment-attached pollutants from the Little Elkhart Creek Watershed and to stabilize the existing Mill Pond structure by installing a grade control structure.

The design recommendations were for the existing failed dam structure at the outlet of the Mill Pond on Little Elkhart Creek to be moved and replaced with a grade control to maintain the Mill Pond at its existing water level. Leaving Mill Pond at the existing water level will prevent the release of sediment and sediment-attached nutrients currently trapped in the Mill Pond. A sediment trap and dewatering basin are included in the design strategy to reduce sediment inputs. Many permits were filed for the construction of the design. Construction was to occur in late 2004 following the removal of crops from the agricultural field where the sediment dewatering basin will be constructed.

## Water Quality Parameters Exceeding Standards

The historical water quality data set that was available, compiled, and evaluated for interpretation during the preparation of this WMP did not include results from more than ten years ago. For the means of comparison, 37 subwatersheds were identified from the 14-digit HUC database. All sampling stations which contributed data within the ten year evaluation period (1997-2007) were linked to the subwatersheds which contained them.

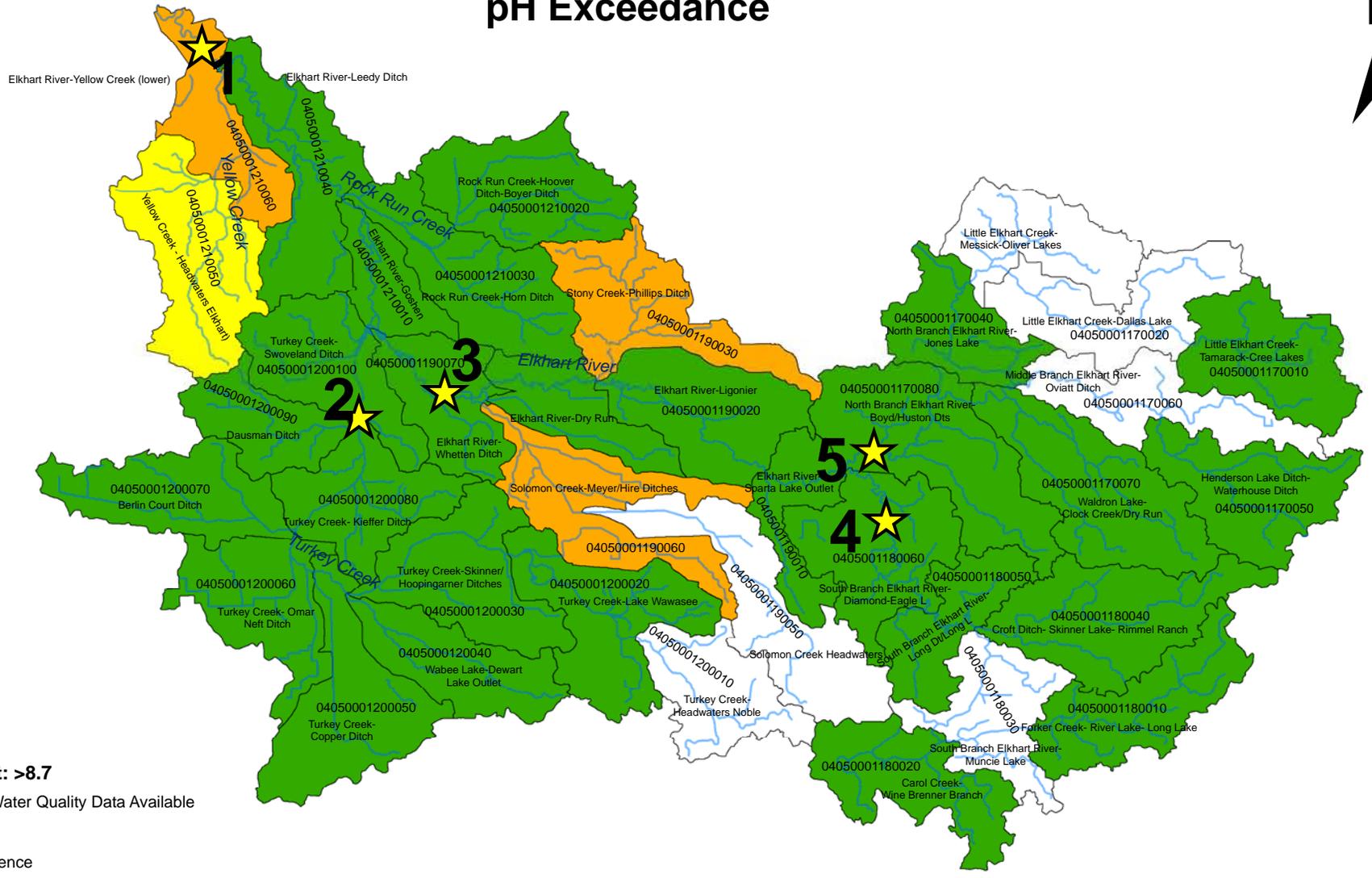
The water quality parameters evaluated from the historical data set that have Indiana State Standard limits include:

- pH (Exhibit 21), values which exceed 8.7 (threshold from Indiana's 305(b) Assessment and 303(d) Listing Methodology, 2005)
- Total Nitrate and Nitrite (Exhibit 22), values which exceed 10 mg/L (recommended water quality threshold)

- DO (Exhibit 23), combined occurrence of values less than the minimum threshold of 5 mg/L and values greater than the maximum threshold of 12 mg/L (threshold from Indiana's 305(b) Assessment and 303(d) Listing Methodology, 2005)
- *E. coli* (Exhibit 24), values greater than 235 cfu/100 mL, comparable IDEM analysis demonstrating likely presence of *E. coli* is shown in Exhibit 19
- Arsenic (Exhibit 25), values greater than 0.5 µg/L
- Total Barium (Exhibit 26), values greater than 200 µg/L
- Total Cadmium (Exhibit 27), values greater than 0.5 µg/L

Exhibits 21-27 show the number of exceedances of the State WQS within each subwatershed. Total Phosphate (Exhibit 28), values which exceed 0.3 mg/L were considered the State WQS when the 303(d) list was compiled. Therefore, it is included here and shows those subwatersheds where exceedances occurred. Six of the 37 subwatersheds were not represented by this evaluation, as depicted in white on Exhibits 21-28 (see below).

# pH Exceedance



## Legend

Streams

## pH

**Exceedance Limit: >8.7**

No Historical Water Quality Data Available

<8.7

>8.7 - 1 occurrence

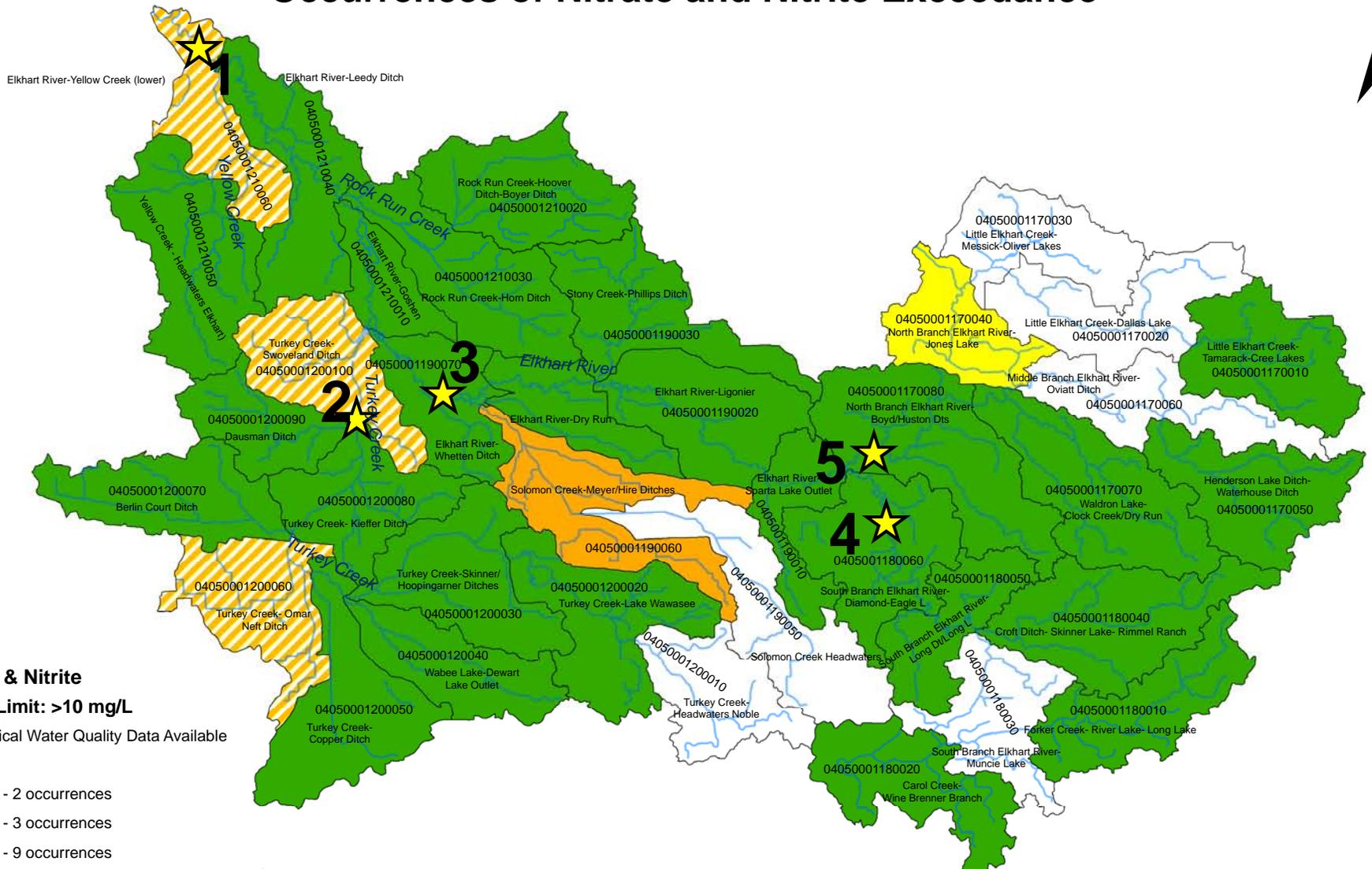
>8.7 - 3 occurrences



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE:	<b>pH Exceedance</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	21
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	11/15/07
						SHEET OF:	1 1
						SCALE:	1"=27,500'

# Occurrences of Nitrate and Nitrite Exceedance



## Legend

Streams

### Total Nitrate & Nitrite

Exceedance Limit: >10 mg/L

No Historical Water Quality Data Available

<10 mg/L

>10 mg/L - 2 occurrences

>10 mg/L - 3 occurrences

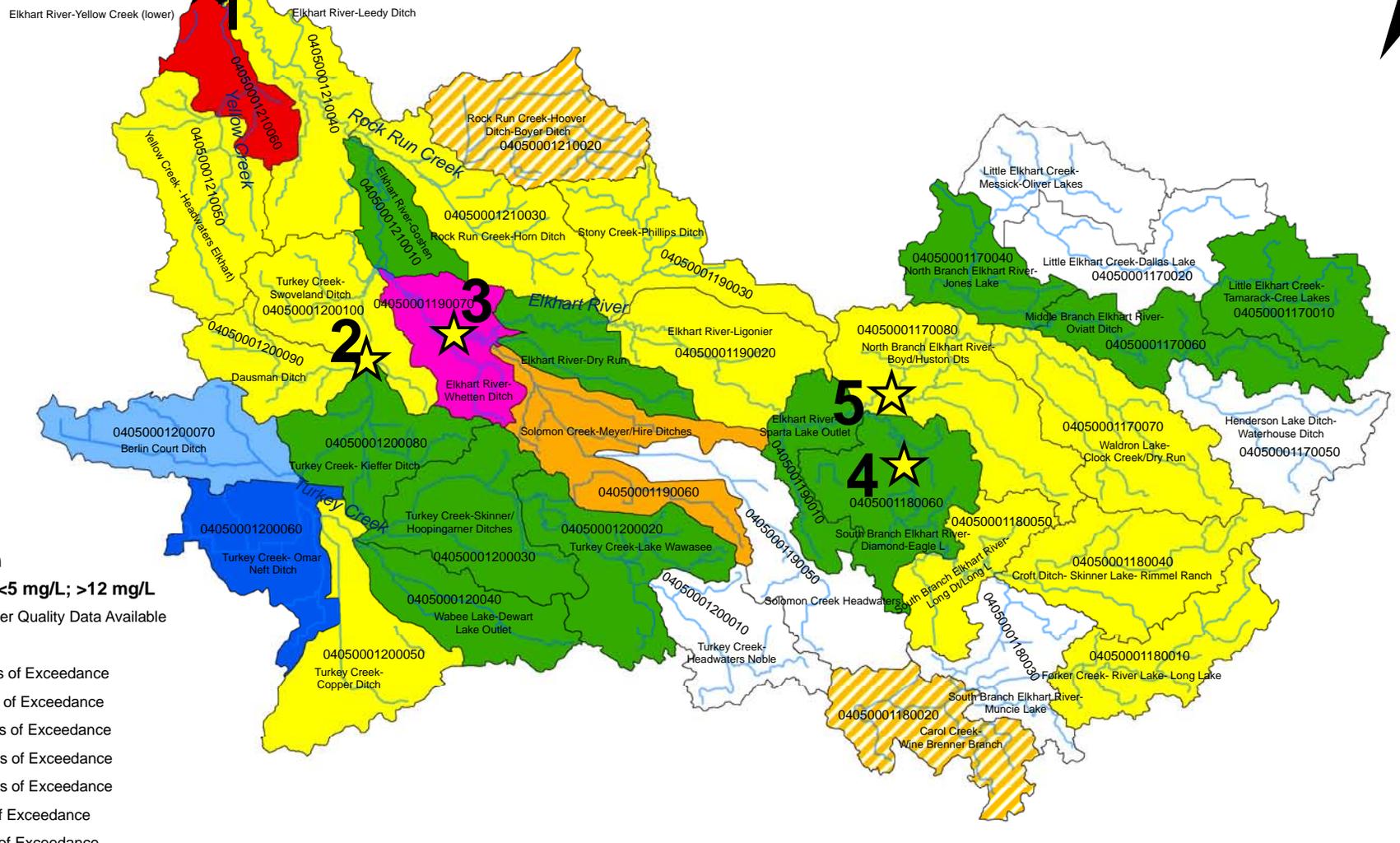
>10 mg/L - 9 occurrences



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE: <b>Occurrences of Nitrate and Nitrite Exceedance</b>	PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER: N/A	PROJECT NO.: 07041	EXHIBIT: 22	SHEET: 1 OF: 1
CLIENT:  Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526	QUADRANGLE:  N/A	DATE:  11/15/07	SCALE:  1"=27,500'

# Dissolved Oxygen Exceedance



## Legend

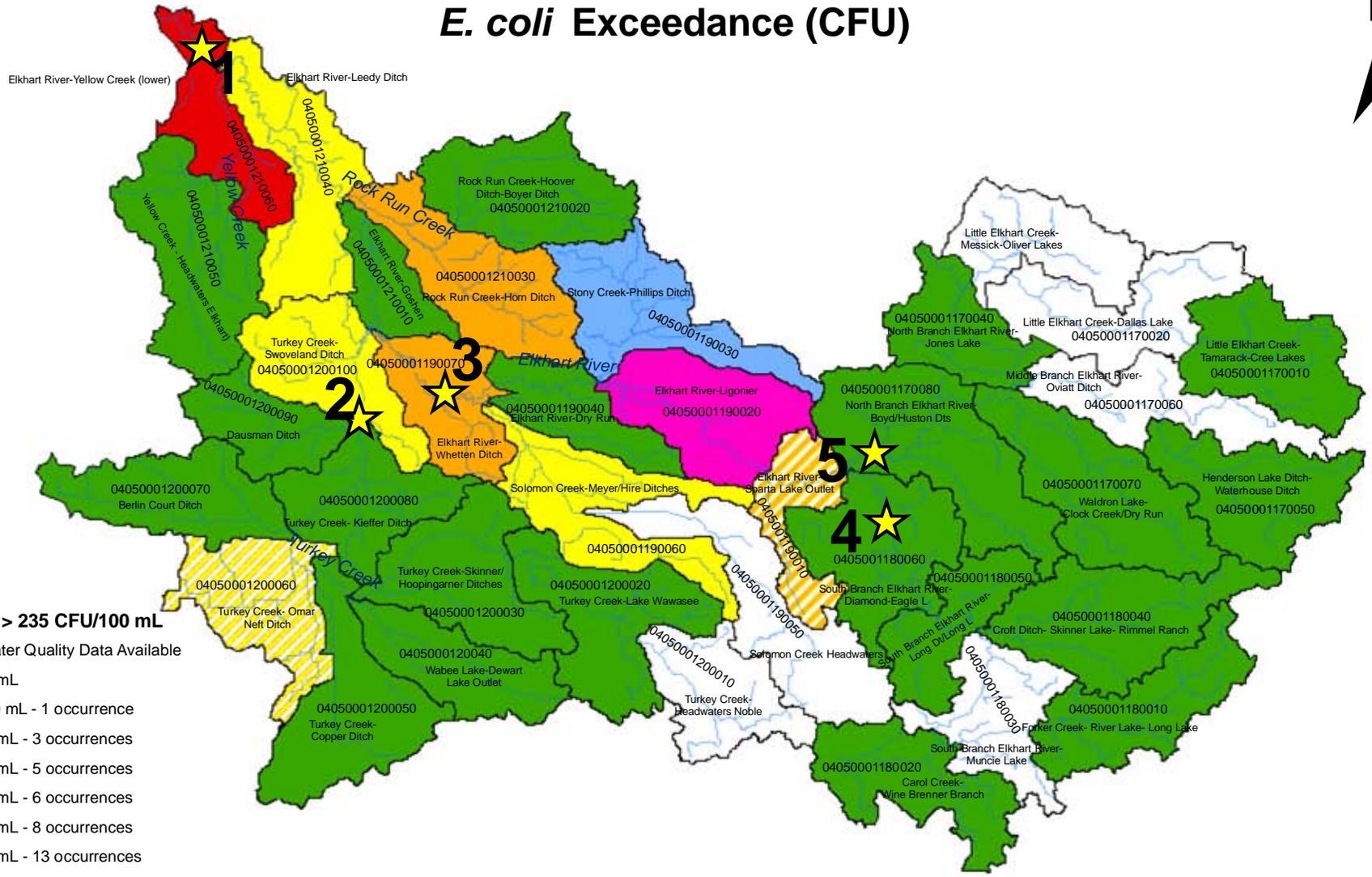
- Streams
- Dissolved Oxygen**
- Exceedance Limit: <5 mg/L; >12 mg/L**
- No Historical Water Quality Data Available
- No Exceedance
- 1 - 5 Occurrences of Exceedance
- 6-10 Occurrences of Exceedance
- 11-15 Occurrences of Exceedance
- 16-20 Occurrences of Exceedance
- 21-25 Occurrences of Exceedance
- 68 Occurrences of Exceedance
- 108 Occurrences of Exceedance



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

TITLE:	<b>Dissolved Oxygen Exceedance</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	23
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	11/15/07
						SHEET:	1
						OF:	1
						SCALE:	1"=27,500'

# E. coli Exceedance (CFU)



## Legend

— Streams

## E. coli

Exceedance Limit: > 235 CFU/100 mL

- No Historical Water Quality Data Available
- < 235 CFU/100 mL
- > 235 CFU /100 mL - 1 occurrence
- > 235 CFU/100 mL - 3 occurrences
- > 235 CFU/100 mL - 5 occurrences
- > 235 CFU/100 mL - 6 occurrences
- > 235 CFU/100 mL - 8 occurrences
- > 235 CFU/100 mL - 13 occurrences
- > 235 CFU/100 mL - 82 occurrences



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

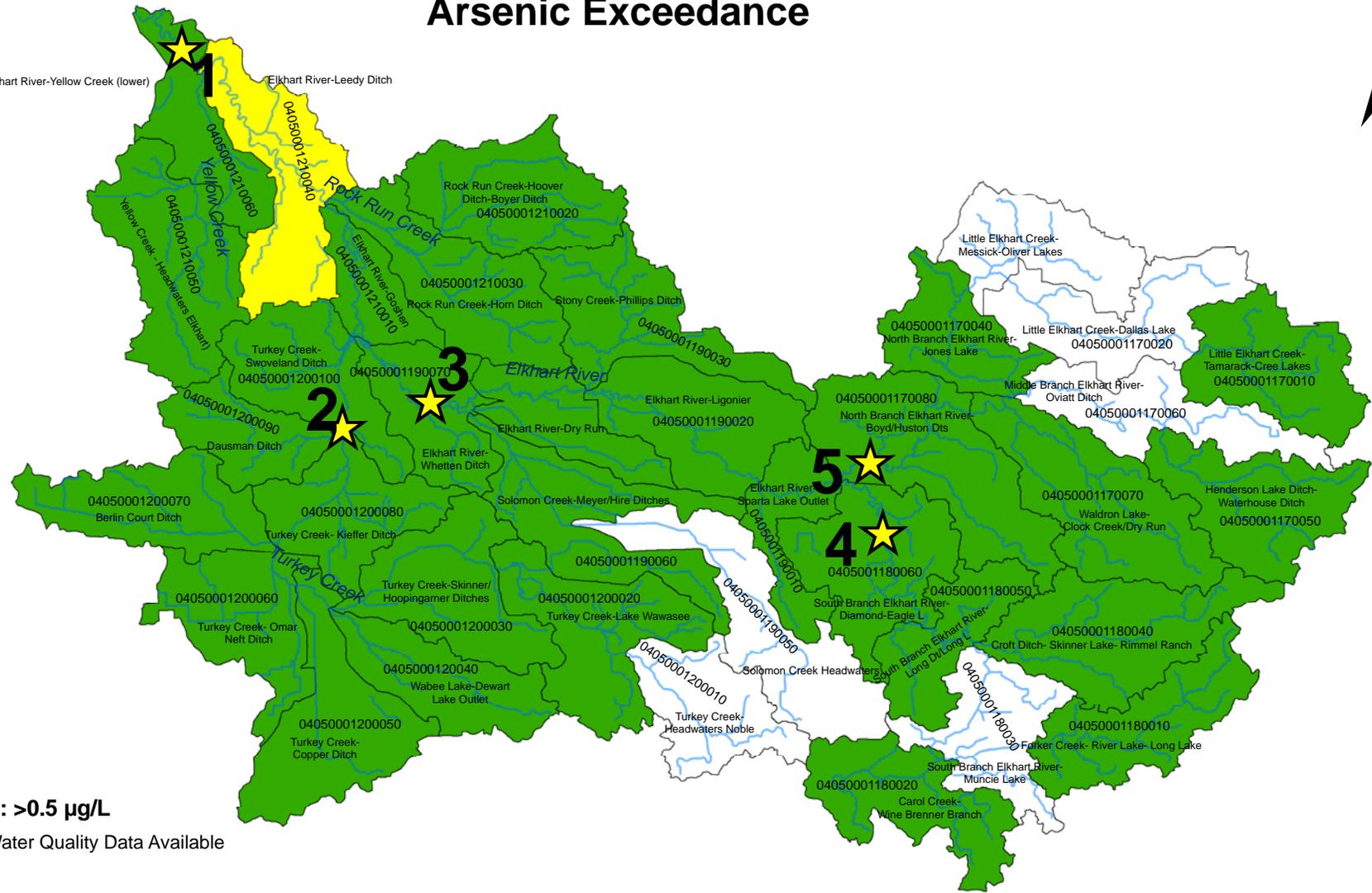
TITLE:	<b>E. coli Exceedance (CFU)</b>
BASE LAYER:	N/A
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526

PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
PROJECT NO.:	EXHIBIT:	SHEET: 1
07041	24	OF: 1
QUADRANGLE:	DATE:	SCALE:
N/A	11/15/07	1"=27,500'

# Arsenic Exceedance



Elkhart River-Yellow Creek (lower)      Elkhart River-Leedy Ditch



## Legend

Streams

## Arsenic

**Exceedance Limit: >0.5 µg/L**

No Historical Water Quality Data Available

< 0.5 µg/L

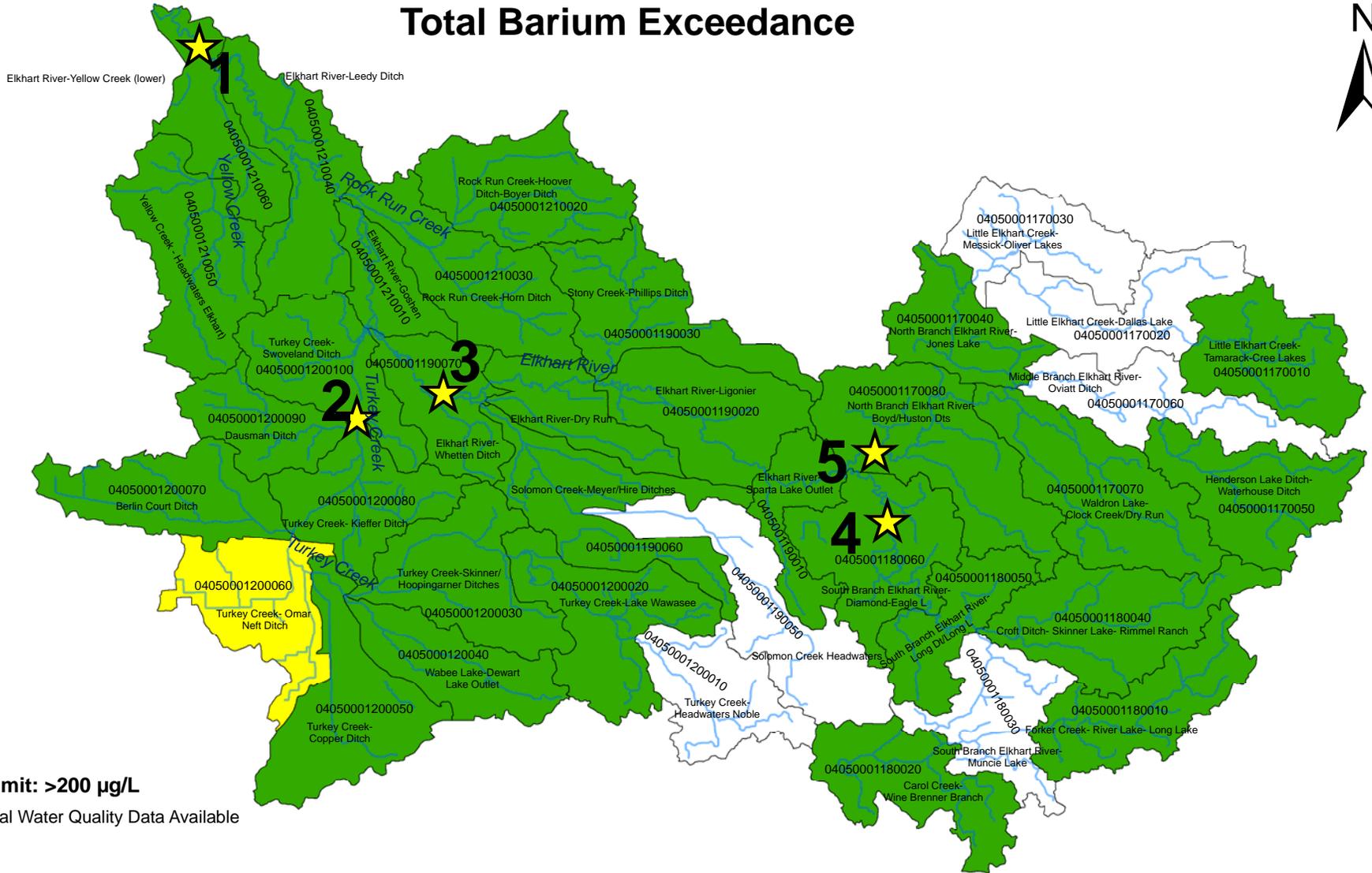
>0.5 µg/L - 1 occurrence



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE:	<b>Arsenic Exceedance</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	25
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	11/15/07
						SHEET OF:	1 1
						SCALE:	1"=27,500'

# Total Barium Exceedance



## Legend

— Streams

## Total Barium

Exceedance Limit: >200 µg/L

□ No Historical Water Quality Data Available

■ < 200µg/L

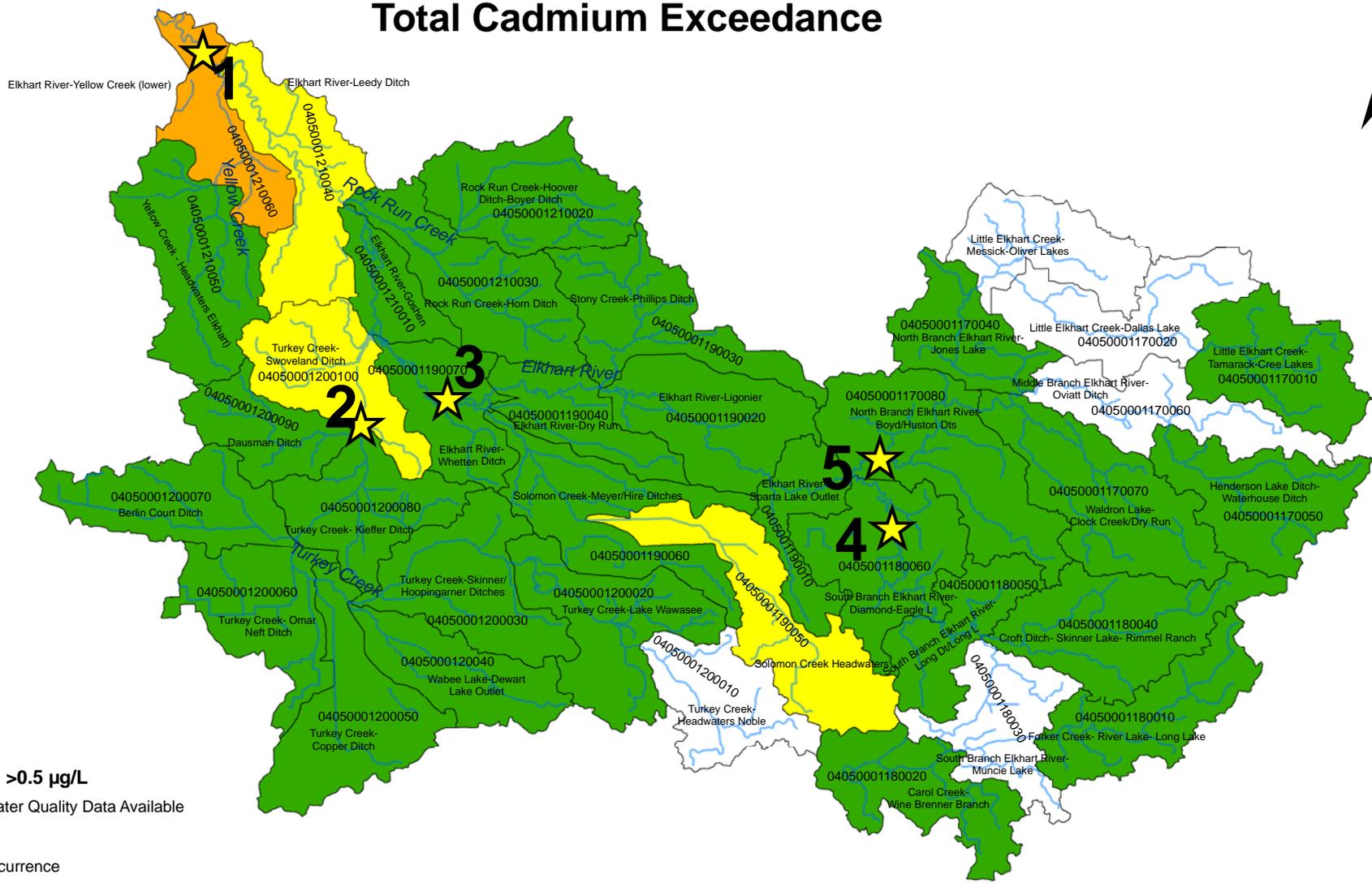
■ >200 µg/L - 1 occurrence



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE:	<b>Total Barium Exceedance</b>			PROJECT:	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER:	N/A			PROJECT NO.:	07041	EXHIBIT:	26
CLIENT:	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			QUADRANGLE:	N/A	DATE:	11/15/07
						SHEET OF:	1 1
						SCALE:	1"=27,500'

# Total Cadmium Exceedance



## Legend

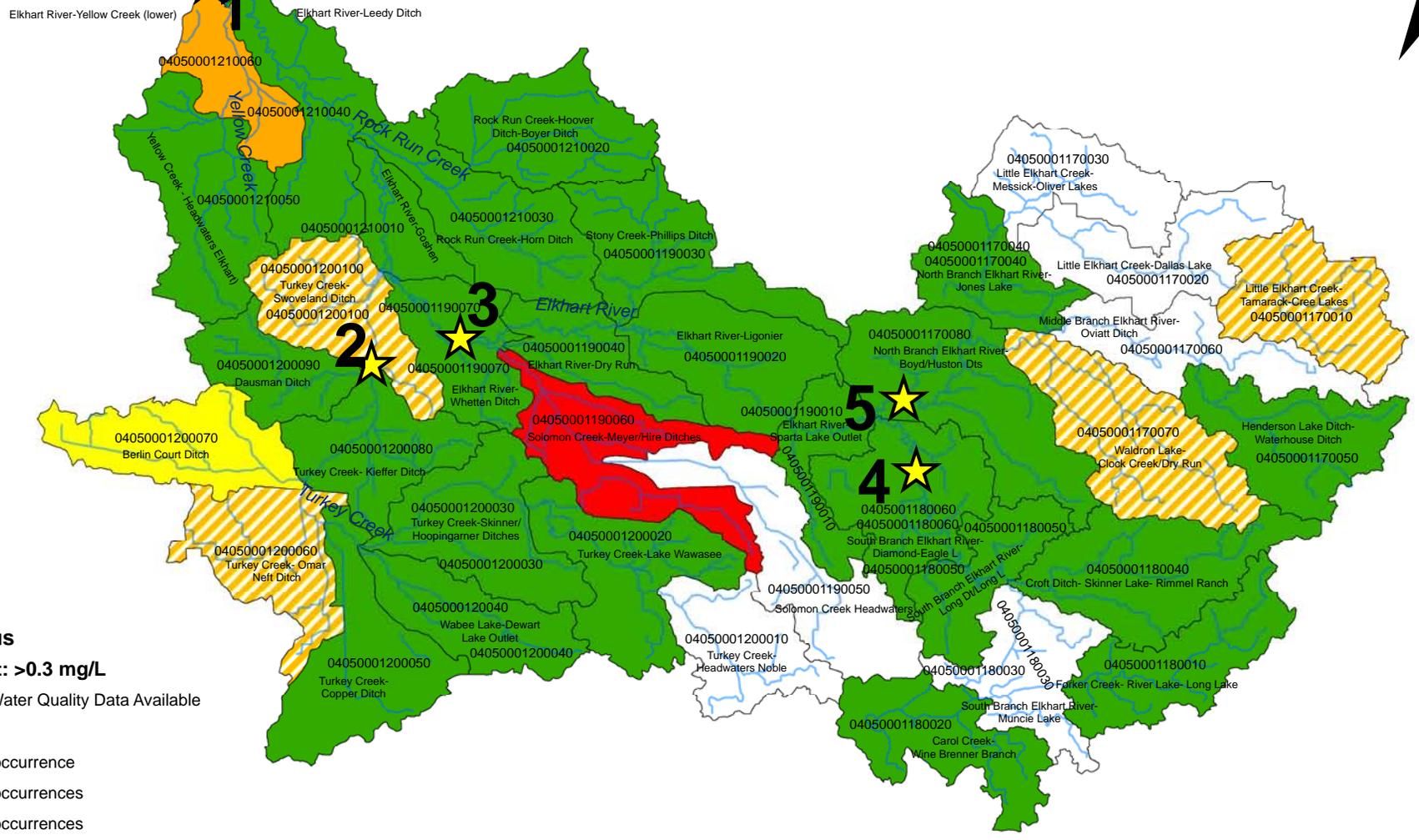
- Streams
- Total Cadmium**
- Exceedance Limit: >0.5 µg/L**
- No Historical Water Quality Data Available
- <0.5 µg/L
- >0.5 µg/L - 1 occurrence
- >0.5 µg/L - 8 occurrences



V3 Companies  
 7325 Janes Avenue  
 Woodridge, IL 60517  
 630.724.9200 phone  
 630.724.9202 fax  
 www.v3co.com

<b>TITLE:</b>	<b>Total Cadmium Exceedance</b>			<b>PROJECT:</b>	<b>Elkhart River Watershed Management Plan &amp; Implementation</b>			
<b>BASE LAYER:</b>	N/A			<b>PROJECT NO.:</b>	07041	<b>EXHIBIT:</b>	27	
<b>CLIENT:</b>	Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526			<b>SHEET:</b>		1 OF 1		
		<b>QUADRANGLE:</b>	N/A	<b>DATE:</b>	11/15/07		<b>SCALE:</b>	1"=27,500'

# Occurrences of Phosphorus Exceedance



## Legend

Streams

### Total Phosphorus

**Exceedance Limit: >0.3 mg/L**

No Historical Water Quality Data Available

<0.3 mg/L

>0.3 mg/L - 1 occurrence

>0.3 mg/L - 3 occurrences

>0.3 mg/L - 4 occurrences

>0.3 mg/L - 9 occurrences



V3 Companies  
7325 Janes Avenue  
Woodridge, IL 60517  
630.724.9200 phone  
630.724.9202 fax  
www.v3co.com

TITLE: <b>Occurrences of Phosphorus Exceedance</b>	PROJECT: <b>Elkhart River Watershed Management Plan &amp; Implementation</b>		
BASE LAYER: N/A	PROJECT NO.: 07041	EXHIBIT: 28	SHEET: 1 OF 1
CLIENT: Elkhart River Restoration Association 305 Carter Road Goshen, Indiana 46526	QUADRANGLE: N/A	DATE: 11/15/07	SCALE: 1"=27,500'

## Windshield Survey Review

A windshield survey is a type of watershed assessment conducted via a motorized vehicle at stream crossings and accessible locations where real time data was collected. During Fall 2007, the Steering Committee volunteers, and employees of the Elkhart, Kosciusko, and LaGrange County Soil and Water Conservation Districts conducted a windshield survey at 107 site locations within the Elkhart River Watershed (See Appendix G; Exhibit G-1).

The field investigation forms suggested noting the following as either existing problems or potential issues to be aware of in future field investigations:

- Log jams (based on the following)
  - inhibits all passage
  - moderately inhibits passage
  - slightly inhibits passage
  - jam located in highly used/visible spot
  - estimated area of jam (square feet)
- Areas worth preserving (based on the following)
  - wetlands
  - wildlife habitat
  - green space
  - cultural/historical site
- Areas under urban pressure and growth
  - likely to be developed
  - under development
- Septic densities
  - estimated size of septic densities (acres)
  - indicators of failure/leakage
- Type of stormwater management
  - combined Sewer Outfall
  - impervious surface (square feet, pavement, buildings, etc.)
  - erosion (rills, gullies, soil transport)
  - pooling of water (estimated acreage)
  - sediment trap
  - curb/gutter
  - detention/retention basin
  - rain garden/rain barrel
- Illegal dumping
  - trash (types, est. area covered)
  - illegal drainage pipes/ outlets
  - dumping into storm drains
- Cropping practices
  - no-till ( $\geq 30\%$  residue)

- reduced-till (15-30% residue)
- conventional tillage
- stream/ditch buffer absent (proximity to stream and est. length of un-buffered land (feet))
- buffer present (estimated width in feet; type (trees, shrubs, grasses; natural, installed); adjacent landuse)
- erosion (rills, gullies, etc.)
- field flooding (estimated % of field)
- grassed waterway - present/absent (estimate of acreage)
- Possible sources of manure and/or feces
  - animal Feeding Operation (number of animals and type)
  - confined Feeding Op. (number of animals and type)
  - hobby farm (number of animals and type)
  - animals in stream (estimated of number and type)
  - manure spreading on bare ground (estimate of acreage)
  - manure storage (uncovered pile, failed tanks, etc.)
- Surface water characteristics
  - un-vegetated banks (estimated area (square feet))
  - undercutting
  - eutrophication (% surface cover)
  - water color (clear, green, brown, murky, oily sheen)
  - water odor (sewage, petro, chemical, other)

## Problems and Causes Identified in the Watershed

At a meeting on November 28, 2007, the Steering Committee studied the original stakeholder concern list, the windshield survey data, and the historical data presented by V3. The Steering Committee identified the three most critical water quality components of degradation to the Elkhart River Watershed as sediment, *E. coli* and nutrients. The Steering Committee then developed the following list of problems and causes identified in the Watershed:

- There is a problem with excessive sediment loading which is causing silt deposits and accelerated eutrophication in the Watershed, especially in the Goshen Dam Pond area. For the purposes of this WMP sediment will be discussed in terms of total suspended solids (TSS) with a concentration target of 80 mg/L. Additional problems identified by the Stakeholders include stream bank erosion, fertilizers and pesticides entering the water through agricultural and urban erosion and runoff. The St. Joseph River WMP indicated that the Elkhart River is a critical area for sediment in that Watershed. The data collected by V3 for this WMP supports that conclusion as shown in Exhibit 29. Sedimentation is the cause of this water quality problem.
- *E. coli* levels are problematic. There is a public concern that the river is not suitable for recreational use because of poor water quality. According to IDEM data studies, almost every site tested in the Watershed violated the state water quality standard for *E. coli*, which is 235 cfu/100mL. In response to this, many streams in the Elkhart River Watershed are listed on IDEM's 303(d) list of impaired waters. Pathogens (*E. coli*) are the cause of the water quality problem.
- There is a problem with excessive nutrient loading which is causing accelerated eutrophication in the Watershed, especially in the Goshen Dam Pond area. Exhibits 22 and 28 show exceedances of nutrient limits in several subwatersheds of the Elkhart River Watershed, and the windshield survey data confirmed there are sources of excess nutrient loading in the Watershed. Nutrient loading is the cause of the water quality problem.
- There is a problem with rapid landuse changes which are causing degradation in the Watershed including: hydrologic modification; loss of wetlands and floodplains; loss of wildlife habitat; spread of invasive species; and conflicts over drainage and recreational uses. Historical and current data shows that the Watershed is undergoing urban development at a more rapid rate than the state average. Landuse planning can result in sustainable growth and development.
- There is a problem with protecting valuable open space and wildlife habitat; protecting threatened and endangered species and their habitat; managing nuisance species; and stopping the introduction and spread of invasive species. State lists, the windshield survey, and public input confirm these concerns. Educating landusers to assist them with proper management can increase preservation, restoration, and appreciation of open space and maintain a proper balance between diverse landuses.

- There are several problems regarding fish populations in the rivers, lakes, and tributaries: degraded fish ladders; fear of eating fish; and fish kills. Many streams in the Elkhart River Watershed are listed on IDEM's 303(d) list of impaired waters, with a fish consumption advisory due to mercury and PCBs. Windshield survey data and public input confirm these other concerns. Habitat degradation and some pollutant concerns will be addressed by the Elkhart River WMP. It is beyond the scope of the Elkhart River WMP to address mercury and PCBs; however, we support additional research into these concerns.
- There are several problems related to lake management, including: herbicide distribution within lakes to control nuisance weeds; responsible vegetation management; boat issues such as wakes, illegal dumping, and transportation of invasive species; and septic systems around lakes. Many lake associations in the Watershed are addressing these concerns in their subwatersheds. The ERA supports their efforts to improve water quality and address lake issues.

The stakeholder concerns that are outside the scope of this WMP include the following:

- Long-term viability of the Watershed as an irrigation source (both surface and ground water quantity issues)
- Combined Sewer Overflows – *E. coli* – long term control
- Keep sewer development on pace with development