Water Quality
Technical Report

US 51 Study
Jefferson, Washington, Clinton, Marion, Fayette, Shelby, and Christian Counties, Illinois

January 2014

TABLE OF CONTENTS

1. INTRODUCTION 1

2. PROJECT DESCRIPTION....................5

3. METHODOLOGY FOR CHARACTERIZING STREAMS AND WATERSHEDS 9
   - 3.1 Water Quality Data Sources....................9
   - 3.2 Physical Data 10
   - 3.3 Biological Data 10
   - 3.4 Water Quality Standards 13
     - 3.4.1 General Use Water Quality Standards 13
     - 3.4.2 Narrative Water Quality Standards 13
     - 3.4.3 Numeric Water Quality Standards 14
     - 3.4.4 Antidegradation Statement....................16
     - 3.4.5 Stream Segment Ratings 17
   - 3.5 Chemical Data....................17

4. WATER RESOURCE CHARACTERISTICS 18
   - 4.1 Kaskaskia River Watershed Overview 18
   - 4.2 Webster Creek....................34
   - 4.3 Fulton Branch....................35
   - 4.4 Sewer Creek 36
     - 4.4.1 Unnamed Tributary to Sewer Creek 36
   - 4.5 Unnamed Tributary to Crooked Creek #1 and #2....................37
   - 4.6 Crooked Creek 37
   - 4.7 Turkey Creek 38
   - 4.8 Crileys Branch 39
   - 4.9 Unnamed Tributary to Prairie Creek....................40
   - 4.10 Prairie Creek 40
   - 4.11 Unnamed Tributary to Lost Creek #1 and #2 41
   - 4.12 Lost Creek....................41
   - 4.13 Coles Creek....................42
   - 4.14 Unnamed Tributary to East Fork Kaskaskia River #1 and #2 43
   - 4.15 East Fork Kaskaskia River....................43
   - 4.16 Unnamed Tributary to Louse Run #1, #2, and #3....................44
   - 4.17 Louse Run 45
   - 4.18 Deer Creek 45
   - 4.19 North Fork Kaskaskia River 46
   - 4.20 Unnamed Tributary to North Fork Kaskaskia River....................47
   - 4.21 Flat Creek....................47
   - 4.22 Unnamed Tributary to Flat Creek 48
   - 4.23 Steve Creek 48

4.24 Cassar Creek 49
4.25 Unnamed Tributary to Richland Creek #1 and #2 49
4.26 Richland Creek 50
4.27 Hickory Creek 50
4.28 Kaskaskia River 51
4.29 Fish Lake Ditch 52
4.30 Unnamed Tributary to Raccoon Creek #1 53
4.31 Raccoon Creek 53
4.32 Unnamed Tributary to Raccoon Creek #2 54
4.33 Unnamed Tributary to Raccoon Creek #3 54
4.34 Unnamed Tributary to Bear Creek 55
4.35 Bear Creek 56
4.36 Unnamed Tributary to Hurricane Creek 56
4.37 Unnamed Tributary to Vandalia Lake (#1, #2, #3, #4, and #5) 57
4.38 Unnamed Tributary to Kaskaskia River 58
4.39 Unnamed Tributary to Hoffman Creek (#1 and #2) 58
4.40 Hoffman Creek 59
4.41 Unnamed Tributary to Ramsey Creek #1 59
4.42 Ramsey Creek 60
4.43 Unnamed Tributary to Ramsey Creek #2 61
4.44 Ash Creek 61
4.45 Unnamed Tributary to Little Creek 62
4.46 Little Creek 62
4.47 Unnamed Tributary to Matney Branch (#1, #2, and #3) 63
4.48 Matney Branch 63
4.49 Opossum Creek 64
4.50 Ponds and Lakes 64
4.50.1 Ponds 65
4.50.2 Lakes 65
4.50.2.1 Raccoon Lake, Centralia, IL 65
4.50.2.2 Vandalia Lake, Vandalia, IL 66
4.50.2.3 Carlyle Lake, Carlyle, IL 67

5. Potential Stream and Watershed Impacts 71
5.1 Impact Methodology 71
5.1.1 Construction Impacts 71
5.1.2 Operational Impact 72
5.1.3 Maintenance Impacts 74
5.2 Water Quality Impacts by Stream and Watershed 76
5.2.1 Sewer Creek 78
5.2.1.1 Construction Impacts 78
5.2.1.2 Operational Impacts 79
5.2.1.3 Maintenance Impacts 79
5.2.2 Crooked Creek 79
5.2.2.1 Construction Impacts 79
5.2.2.2 Operational Impacts 80

5.2.2.3 Maintenance Impacts 80
5.2.3 Prairie Creek 80
5.2.3.1 Construction Impacts 80
5.2.3.2 Operational Impacts 81
5.2.3.3 Maintenance Impacts 81
5.2.4 Lost Creek 81
5.2.4.1 Construction Impacts 81
5.2.4.2 Operational Impacts 82
5.2.4.3 Maintenance Impacts 82
5.2.5 East Fork Kaskaskia River 82
5.2.5.1 Construction Impacts 82
5.2.5.2 Operational Impacts 83
5.2.5.3 Maintenance Impacts 83
5.2.6 North Fork Kaskaskia River 83
5.2.6.1 Construction Impacts 83
5.2.6.2 Operational Impacts 84
5.2.6.3 Maintenance Impacts 84
5.2.7 Hickory Creek 84
5.2.7.1 Construction Impacts 84
5.2.7.2 Operational Impacts 84
5.2.7.3 Maintenance Impacts 85
5.2.8 Kaskaskia River 84
5.2.8.1 Construction Impacts 85
5.2.8.2 Operational Impacts 85
5.2.8.3 Maintenance Impacts 85
5.2.9 Ramsey Creek 85
5.2.9.1 Construction Impacts 86
5.2.9.2 Operational Impacts 86
5.2.9.3 Maintenance Impacts 86
5.2.10 Webster Creek 86
5.3 Lakes and Ponds 87
5.4 Highly Erodible (HEL) Soils 87
5.5 Impact Minimization, Best Management Practices, and Mitigation 88
5.5.1 Minimization/Mitigation of Construction Impacts 88
5.5.2 Minimization/Mitigation of Operational Impacts 88
5.5.3 Minimization/Mitigation of Maintenance Impacts 88
5.6 Indirect and Cumulative Impacts 89

References 91

FIGURES

Figure 1-1 Location of Surface Water Resources....2
Figure 2-1 Project Alternatives....6
Figure 4-1 Summary of Mean Habitat Assessment Scores....33
Figure 4-2 Summary of Mean IBI Scores....34

TABLES

Table 1-1 Major Sources of Highway Pollutants....4
Table 2-1 Description of Build Alternatives....8
Table 3-1 Biological Stream Rating for Diversity and Integrity....11
Table 3-2 Biological Interpretation of IDNR Stream Rating compared to IEPA Stream Rating....12
Table 3-3 Aquatic Habitat Assessment Using Hilsenhoff Index. 13
Table 3-4 Calculated General Use Water Quality Standards....15
Table 3-5 IEPA Dissolved Oxygen Standards....16
Table 3-6 AWQMN Stations Within Study Area....17
Table 4-1 Physical Characteristics of Streams within the U.S. 51 Corridor....19
Table 4-2 Biological Characteristics of Streams in the U.S. 51 Corridor....23
Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor....25
Table 4-4 2014 Use Support and Classification of Streams in the U.S. 51 Corridor....30
Table 4-5 Ponds and Lakes in the U.S. 51 Study Area....64
Table 4-6 Aquatic Insects of Vandalia, Fayette County, Illinois from INHS Collection Database....66
Table 4-7 Illinois EPA Impairments and Causes for Vandalia Lake (IL_ROD), 2014…....67
Table 4-8 Fish of Carlyle Lake Reservoir, Clinton County, Illinois from INHS and IDNR Record....68
Table 4-9 Aquatic Insects of Clinton County, IL Near Carlyle Lake....69
Table 5-1 Model Input Variables....73
Table 5-2 Summary of Median Storm Water Runoff Concentrations....73
Table 5-3 Construction Impacts for Special Designation Streams....77
Table 5-4 Results of Pollutant Loading Analysis for Special Designation Streams..78
Table 5-5 Highly Erodible (HEL) Soils....88

APPENDICES

Appendix A Photographs of Collecting Stations, Biological Summaries
Appendix B Pollutant Loading Estimates
Appendix C Construction Impacts Table
Appendix D Highly Erodible Soils

WATER QUALITY TECHNICAL REPORT

1. Introduction

This report summarizes the characteristics of the streams in the study area and evaluates both construction impacts and operating impacts based upon the proposed build alternatives.

The study area consists of 60 miles of US Route 51 (US 51) in south central Illinois. The study area is within Jefferson, Washington, Clinton, Marion, Fayette, Shelby, and Christian Counties. The project's southern terminus is south of the city of Centralia, and its northern terminus is north of the city of Oconee.

The surface water resources in the US 51 study area include streams and their tributaries within the Kaskaskia River Drainage basin. The watersheds vary in size from 11.6 to 465 square miles and include two Biologically Significant Streams, Ramsey Creek and Lost Creek. Figure 1-1 depicts the location of surface water resources in the US 51 study area.

Pollutant contributions associated with runoff from roadway operations can affect the water quality of receiving streams. Table 1-1 summarizes the major sources of highway pollutants and a range of concentrations that have been monitored in highway runoff. Particulates are a primary pollutant; however, heavy metals and organic matter are also associated with roadway operations. The following factors have a major influence on pollutant concentrations: traffic volume, atmospheric deposition (wet and dry) and site specific characteristics, such as land uses, highway surface, and highway maintenance. In addition, there are potential impacts associated with typical roadway construction activities, such as grading, filling, vegetation removal, and excavation. There may also be temporary disturbances caused by bridge, culvert, or roadway approach construction. Water quality impacts associated with pollutants generated during construction, operation, or maintenance of the proposed alternatives are described in this report. Methods for estimating the impacts are based upon studies performed and methodologies developed by the Federal Highway Administration, the US Geological Survey and the best management practices of several states.

Figure 1-1: Location of Surface Water Resources (Page 1 of 2)

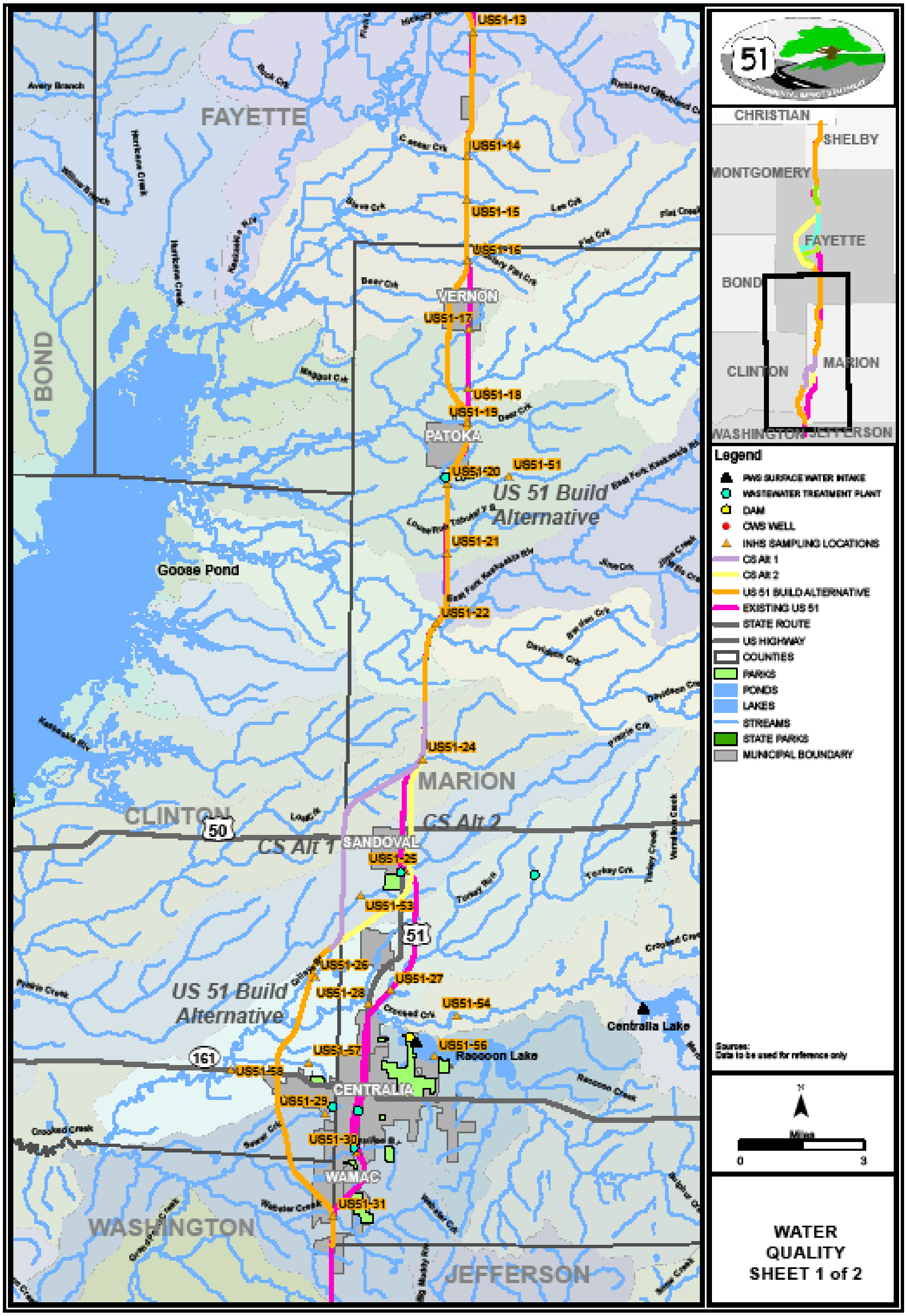


Figure 1-1: Location of Surface Water Resources (Page 2 of 2)

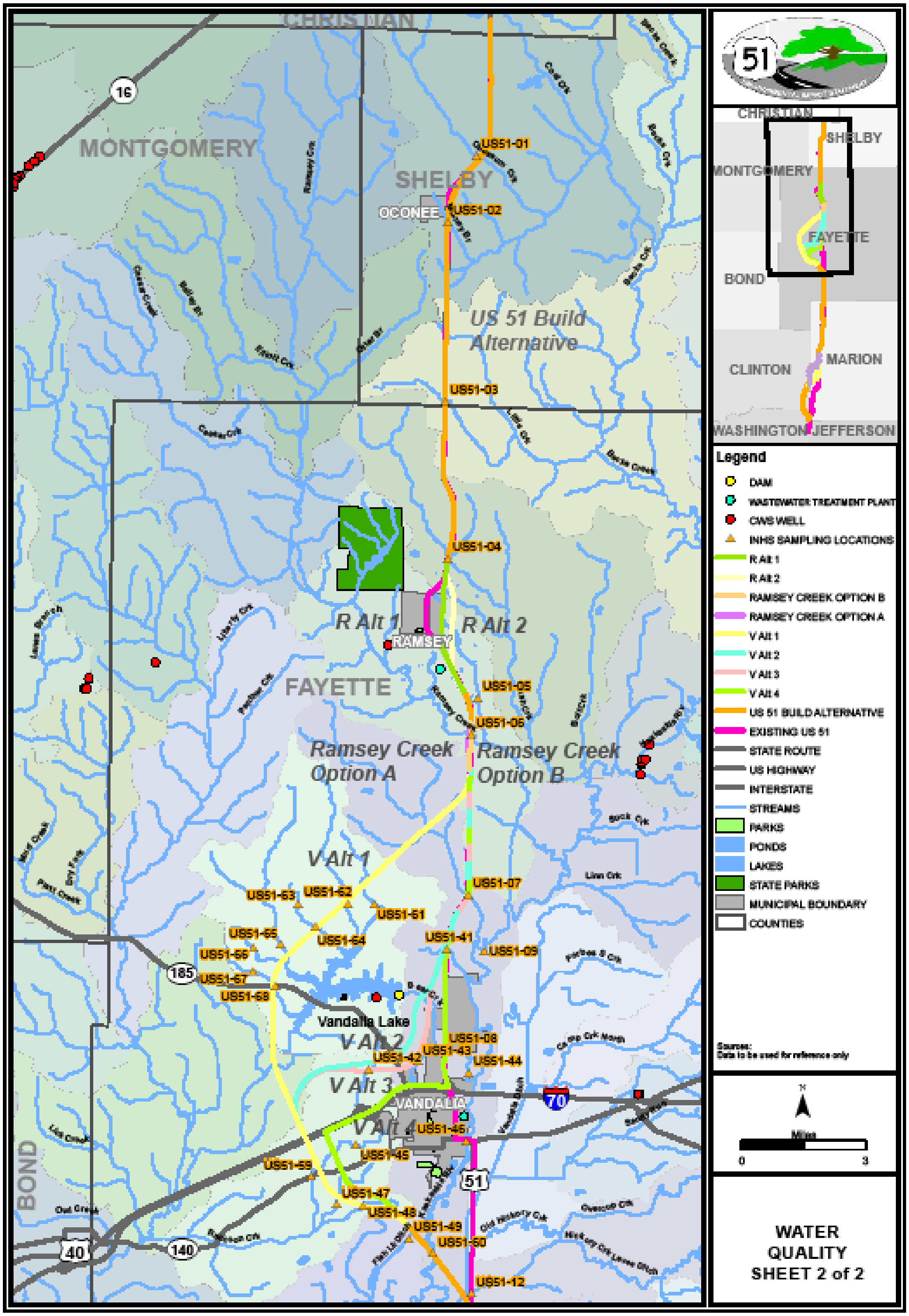


Table 1-1
Major Sources of Highway Pollutants

Pollutant Groups	Examples	Sources	Parameters [a]	Concentrations (mg/L)	
				Mean	Range
Particulates	Dust and dirt, stones, gravel, grain, glass, plastics, metals, fine, residues	Tire, brake, and pavement wear, car, exhaust, mud and dirt accumulated on vehicles	TS	1147	145-21640
			TVS	242	26-1522
			TSS	261	4-1656
			VSS	77	1-837
Heavy metals	Lead, zinc, iron, copper, nickel, cadmium, mercury	Use of leaded fuels, tire and brake wear, motor oil, additives, rust	Pb	0.96	0.02-13.1
			Zn	0.41	0.01-3..4
			Fe	10.3	0.1-45.0
			Cu	0.103	0.01-0.88
			Ni	9.92	0.1-49.0
			Cd	0.04	0.01-0.40
			Cr	0.04	0.01-0.14
Organic matter	Vegetation, dust and dirt humus, oils, fuels	Vegetation, litter, animal droppings, motor fuels and oils	BOD_5	24	2-133
			TOC	41	5-290
			COD	14.7	5-1058
			Oil and grease	9.47	1-104
Pesticides/ Herbicides	Weed killers	Right-of-way maintenance	Dieldrin (µg/L)	0.005	0.002-0.007
			Lindane (µg/L)	0.04	0.03-0.05
			PCBs (µg/L)	0.33	0.02-8.89
Nutrients	Nitrogen, phosphorus	Fertilizers	TKN	2.99	0.1-14.0
			NO_2+NO_3	1.14	0.01-8.4
			PO_4	0.79	0.05-3.55
Pathogenic bacteria (indicators)	Coliforms	Soil, litter, excreta, bird and animal droppings	TC		
			FC		

Source: Driscoll et al 1990.

Notes:

[a] TS – Total solids; TVS – Total Volatile Solids; TSS – Total Suspended Solids; VSS - Volatile Suspended Solids; Pb – Lead; Zn – Zinc; Fe – Iron; Cu – Copper; Ni – Nickel; Cd – Cadmium; Cr – Chromium; BOD_5 – Biological Oxygen Demand, 5 days; TOC – Total Organic Carbon; COD – Chemical Oxygen Demand; PCB – Polychlorinated biphenyl; TKN – Total Kjeldahl Nitrogen; NO_2+NO_3 – Nitrogen Dioxide + Nitrogen; PO_4 – Phosphate; TC – Total Coliform; FC – Fecal Coliform.

2. Project Description

The proposed US 51 transportation improvement project will improve the connections within the region and enhance the highway system continuity of the US 51 corridor in south central Illinois. The project area includes Jefferson, Washington, Clinton, Marion, Fayette, Shelby, and Christian counties. The project area's southern terminus is south of the city of Centralia and the northern terminus is north of the city of Oconee. Within the project limits, US 51 is the only two-lane highway link in the four-lane north-south regional transportation network, comprised of I-39, US 51, I-64, and I-57.

The US 51 project includes one No Build Alternative and multiple Build Alternatives. Figure 2-1, Project Alternatives, depicts the existing US 51 and the proposed Build Alternatives and includes the communities of Centralia, Sandoval, Patoka, Vernon, Vandalia, and Ramsey.

The No Build Alternative for the US 51 project is the continued use of the existing US 51 two-lane highway corridor in the study area. The No Build Alternative does not provide improved capacity or continuity to the US 51 roadway, but includes routine maintenance of US 51.

The Build Alternatives are divided into sections to provide a clear comparison of Build Alternative options near communities. Where only one Build Alternative is considered, the Build Alternative is named "US 51 Build Alternative". This "Build" Alternative includes sections near Centralia, Vernon, and Patoka, as well as sections of US 51 where widening will occur adjacent to existing US 51. Where multiple Build Alternative options are considered, the Build Alternative sections are named correspondingly to nearby cities or features. This includes alternatives near Sandoval, Vandalia, and Ramsey. Table 2-1, Description of Build Alternatives, identifies the Build Alternative sections within the project area. The majority of the Build Alternatives are two-way, four-lane highways with the exception of the Ramsey Creek area, where a pair of one-way, two-lane highways are evaluated in addition to a two-way, four-lane highway.

Figure 2-1: Project Alternatives (Page 1 of 2)

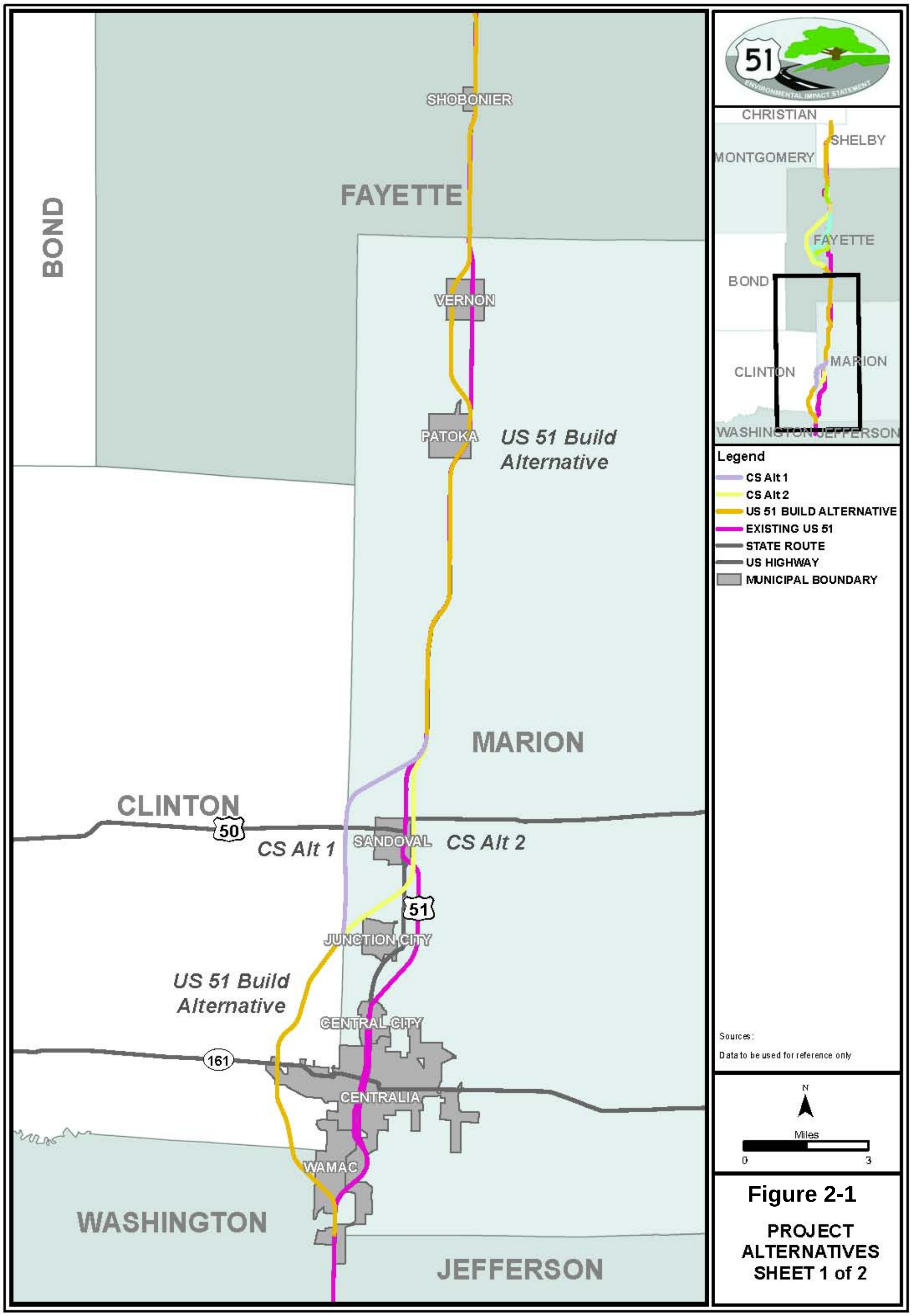


Figure 2-1: Project Alternatives (Page 2 of 2)

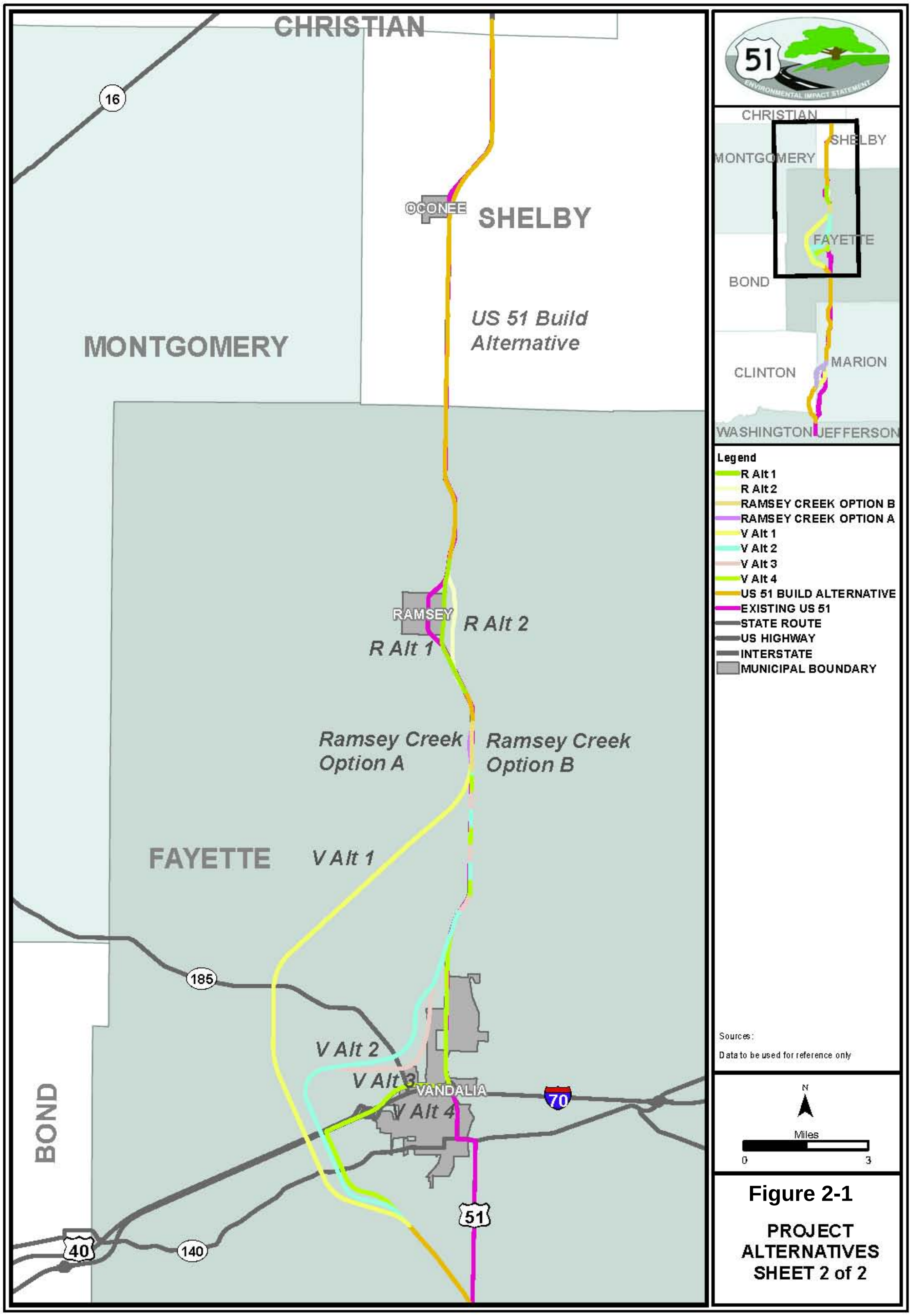


TABLE 2-1. DESCRIPTION OF BUILD ALTERNATIVES

	BUILD ALTERNATIVE NAME	BUILD ALTERNATIVE DESCRIPTION
SOUTH END OF PROJECT ↑ *Wamac, Centralia, Central City*	**US 51 Build Alternative**	**Western bypass of Wamac and Centralia**
Junction City	**CS Alt 1**	**Western bypass of Sandoval**
Sandoval	**CS Alt 2**	**Eastern bypass of Sandoval**
Patoka, Vernon, Shobonier	**US 51 Build Alternative**	**Expansion of existing US 51 alignments and western bypass of Vernon**
	V Alt 1	**Western bypass of Vandalia, west of Vandalia Lake**
Vandalia	**V Alt 2**	**Western bypass of Vandalia, north of Airport Road (CH 50)**
	V Alt 3	**Western bypass of Vandalia, along Airport Road (CH 50)**
	V Alt 4	**Western bypass of Vandalia, with 2.9 miles of dual marking on I-70 and collector-distributor system**
	Ramsey Creek Option A	**Two-lane, one-way paired roadways across Ramsey Creek**
	Ramsey Creek Option B	**Four-lane, two-way roadway across Ramsey Creek, an expansion of the existing US 51 alignment**
	R Alt 1	**Eastern bypass of Ramsey, 0.4 miles east of the existing US 51 alignment**
Ramsey	**R Alt 2**	**Eastern bypass of Ramsey, 0.7 miles east of the existing US 51 alignment**
Oconee ↓ NORTH END OF PROJECT	**US 51 Build Alternative**	**Expansion of existing US 51 alignment**

3. Methodology for Characterizing Streams and Watersheds

3.1 Water Quality Data Sources

Stream quality is assessed through physical, biological, and chemical data. Literature sources and agency reports provided the source of data for the physical, biological, and chemical characteristics for the streams and rivers included in the project area for US 51. The sources include the following:

- Illinois Natural History Survey – Wetzel, Mark J. and Christopher A. Phillips, Editors. *An Assessment of the Biological Resources Associated with the IDOT U.S. Route 51 Study Area in Clinton, Fayette, Jefferson, Marion, Shelby, and Washington Counties, Illinois – 2008.* Illinois Natural History Survey. Champaign IL. INHS Technical Report 2009 (16). 12 June 2009
- Illinois Natural History Survey – Wetzel, Mark J., Editor. *An Assessment of the Biological Resources Associated with the IDOT U.S. Route 51 2009 Study Area in Christian, Clinton, Fayette, Marion, Shelby, and Washington Counties, Illinois.* Illinois Natural History Survey. Champaign IL. INHS Technical Report 2010 (10). 15 February 2010
- Illinois Natural History Survey – Wetzel, Mark J., et al. *A Limited Assessment of Aquatic Resources (Fishes, Freshwater Mussels, other Aquatic Macroinvertebrates, and Water Quality) Associated with the Kaskaskia River in the IDOT U.S. Route 51 (2010) Study Area, Fayette County, Illinois.* Illinois Natural History Survey. Champaign IL. INHS Technical Report 2010 (39). 30 September 2010
- Illinois Natural History Survey – Wetzel, Mark J., et al. *A Limited Assessment of Aquatic Resources (Fishes, Unionid Mussels, other Aquatic Macroinvertebrates, and Water Quality) Associated with Streams in the IDOT US 51 Addendum B Project Area*, January 2012, revised March, 2012.
- *Illinois Integrated Water Quality Report and Section 303(d) List* (IEPA, 2014)
- *Integrating Multiple Taxa in a Biological Stream Rating* (IDNR 2008)
- *River Mileages and Drainage Areas for Illinois Streams* – Volume 2, Illinois River Basin (Healy, 1979)
- National Wild and Scenic River System Components list (U.S. Department of Interior)
- USEPA STORET Database
- Illinois State Water Survey *7-Day 10-Year Low Flow Maps* (ISWS, 2003)
- Smogor, R. 2000. (draft, annotated 2006) *Draft Manual for Calculating Index of Biotic Integrity Scores for Streams in Illinois.* Illinois EPA.
- United States Geological Survey (USGS) topographic maps, 1:24,000 scale
- Buckler, Denny and Gregory Granato. *Assessing biological effects from highway-runoff constituents.* U.S. Geological Survey. Report 99-240. 1999.
- Field Review

3.2 Physical Data

The INHS recorded the physical conditions of the streams at or near crossing sites during the 2008, 2009, 2010 and 2012 collection of biological and chemical data, (Wetzel and Phillips, Editors 2009, Wetzel, Editor 2010, Wetzel, et al. 2010, Wetzel, et al. 2012). Physical conditions include the measurement of stream width, depth, substrate types, and flows characteristics. In addition, the adjacent land uses and riparian vegetation were noted by the INHS during their field visits.

The INHS used *Mean Habitat Assessment* scoring for habitat quality that is based on an Illinois *Stream Habitat Assessment Protocol* methodology. The Mean Habitat Assessment assigns a value to 12 physical parameters of streams, such as channel structure/alteration, flow, deposition, bottom substrate/instream cover, pool variability, riparian vegetation zone width, and bank stability. Two people complete the evaluation. The numerical values are summed then averaged to obtain a mean habitat assessment score. The habitat assessments for US 51 were conducted from 2008 to 2010 Habitat scores greater than 130 indicate excellent conditions; 129.9 to 110 good conditions; 109.9 to 80 fair conditions; and below 80 poor conditions.

3.3 Biological Data

Biological surveys for fish, mussels, and aquatic macroinvertebrates were conducted in 2008, 2009, 2010 and 2012 (Wetzel, M.J. and Phillips, C.A., Editor, June 2009; Wetzel, M.J., Editor, February 2010; Wetzel, M.J. et al., September, 2010; and Wetzel, M.J., Editor, March 2012). The biological survey data also include physical and habitat data at the collection sites. In addition, some water quality (chemical) data were also collected. Several sampling events took place during the spring and/or summer of 2008, 2009, 2010 and 2012. Sampling sites were chosen within the project corridor to assess the stream conditions in or near the project crossing. See Figure 1-1.

Biological data from multiple taxa are combined to determine a Biological Stream Rating (BSR). The BSR is a multiple taxa stream rating system based on the attributes of fish, mussel, and macroinvertebrate communities that can be combined to rate stream quality by the diversity, integrity, or significance of the stream communities (IDNR, 2008). From the IBI, further explained below, a five category stream classification (Class A through E) was developed. Table 3-1 presents a narrative description of the rankings for Biological Stream Ratings (BSR) for Diversity and Integrity. Biologically Significant Streams (BSS) are not ranked by letters A-E, but are determined from the highest ranked streams for Diversity and Integrity. These are assigned the BSS designation.

One of the predominant stream quality indicators used in the BSR process is the Index of Biotic Integrity (IBI). The IBI is, comprised of 10 metrics, which form a basis for describing the health or integrity of the fish community. The fish IBI is not a static index because the IEPA designated pollution tolerance of fish species and the significance of certain fish species have changed over the last ten years. The IDNR continues to evaluate the fish communities included in the IBI calculation. The IBI value can change for a stream due to changes in the computation of the fish

IBI, even though the fish composition may remain constant. While IBI scores were once the sole basis for judging stream quality, the BSR now couples the IBI with other taxa metrics.

TABLE 3-1.
BIOLOGICAL STREAM RATINGS (BSR) FOR DIVERSITY AND INTEGRITY

STREAM CLASS	BSR CATEGORY	BIOTIC RESOURCE QUALITY DESCRIPTION	
A	Unique Aquatic Resource	Excellent	Comparable to the best situations with minimal disturbance
B	Highly Valued Aquatic Resource	Good	Some components of the fauna may be reduced due to disturbance
C	Moderate Aquatic resource	Fair	Trophic structures are skewed with increased numbers of tolerant species
D	Limited Aquatic resource	Poor	Trophic structures skewed; almost exclusively tolerant species present.
E	Restricted Aquatic resource	Very Poor	Few to no taxa present and all taxa are tolerant species

Source: IDNR 2008 Integrating Multiple Taxa in a Biological Stream Rating System.

Macroinvertebrates and indicator species, such as native mussels (Unionidae) are incorporated in the BSR whenever data are available. Macroinvertebrates are the small aquatic invertebrate animals that are visible to the eye and form a major part of the food chain that fish rely upon to survive. The macroinvertebrate metrics are described by the Macroinvertebrate Biotic Index (MBI), or the Macroinvertebrate Index of Biotic Integrity (mIBI). Mayfly, stonefly, and caddisfly data in the form of the Ephemoptera, Plecoptera, and Trichoptera (EPT) species richness may be included in the MBI index from the Critical Trends Assessment Program administered by the Illinois Department of Natural Resources (IDNR). Other sensitive aquatic species information is used in the BSR, based upon crayfish, reptile, and amphibian data when such data are available.

The BSR provides a uniform process of characterizing streams statewide and is used by a variety of sources for stream protection, restoration, and planning efforts. It is a key component for defining Illinois stream quality and for informing IDNR decisions. Some of the same metrics used in the BSR have a role in the development and implementation of biocriteria by the Illinois EPA. The ongoing activities of the BSR Work Group constitute an integral element of stream assessment and protection efforts in Illinois.

The BSR categorizes streams for biotic integrity, diversity, and significance:

- Biotic Integrity ratings categorize streams for how close they may be to being in relatively unchanged condition.
- Diversity Ratings categorize streams by how many different organisms are present.
- *Biologically Significant Stream* (BSS) designations are determined by the IDNR. BSS designations are based on the stream's integrity and diversity ratings as well as the presence of sensitive species.

For fish and mussel metrics, a five category stream classification rating system (Class A through E) was developed. Streams that are rated as Class A or B are considered to be high quality streams.

IEPA designations do not recognize a five tiered system of rating, and prefer to utilize a three tiered system that designates aquatic resources as *Poor, Fair*, or *Good.* Table 3-2, *Biological Interpretation of IDNR Biological Stream Ratings (BSR) Compared to IEPA Stream Rating*, presents the interpretation of comparative rankings.

TABLE 3-2. BIOLOGICAL INTERPRETATION OF IDNR BIOLOGICAL STREAM RATINGS (BSR) COMPARED TO IEPA STREAM RATING

BSR Stream Class	BSR Quality Descriptor for Stream Class	BSR Descriptor for Diversity and Integrity	BSR Designation as a Biologically Significant Stream	IEPA Agency Descriptor	IEPA Designation
A	Excellent	Unique Resource	Yes	Good	Supporting [a]
B	Good	Highly Valued Resource	Possible		
C	Fair	Moderate Resource	No	Fair	Not Supporting [b]
D	Poor	Limited Resource	No	Poor	
E	Very Poor	Restricted Resource	No		

Source: IDNR 2008 and IEPA 2010.
Notes:
[a] Supporting means the resource meets its use designation for aquatic life.
[b] Non Supporting means the resource is not meeting its use designation for aquatic life.

Support is a designation used by the USEPA to monitor the condition of streams within the U.S. The IEPA annually assesses the use support for; aquatic life use, fish consumption, swimming use, drinking water supply use, and secondary contact use for two possible use-support levels: Full Supporting (also referred to as Good resource quality) or Non Supporting (also referred to as Fair, Poor or Impaired resource quality). Full Supporting means the designated use is attained and Non Supporting means the designated use is not attained.

Further habitat assessment was accomplished, by the Illinois Natural History Survey (INHS), using the Mean Family Level Index also known as the Hilsenhoff Index (Hilsenhoff, 1988). This index utilizes the mean family level IBI score for macroinvertebrates to interpret the degree of organic pollution the stream may be facing. Macroinvertebrates are identified to the family level of classification, and numeric scores are assigned to each group of organisms based on their numbers collected. Table 3-3, titled *Aquatic Habitat Assessment Using Hilsenhoff Index,* summarizes the interpretation of these scores.

TABLE 3-3. AQUATIC HABITAT ASSESSMENT USING HILSENHOFF INDEX

SCORE	DESCRIPTOR	CONDITION
0.00-3.75	Excellent	Organic Pollution Unlikely
3.76-4.25	Very Good	Possible slight organic pollution
4.26-5.00	Good	Some Organic Pollution Probable
5.01-5.75	Fair	Fairly substantial Pollution likely
5.76-6.50	Fairly Poor	Substantial Pollution Likely
6.51-7.25	Poor	Very substantial Pollution Likely
7.26-10	Very Poor	Severe Organic Pollution Likely

Source: Hilsenhoff, 1988.

3.4 Water Quality Standards

The Illinois Environmental Protection Agency (IEPA) prepares an *Illinois Water Quality Report* every two years as required by the Federal Clean Water Act. The reports follow the United States Environmental Protection Agency (USEPA) guidelines for reporting water quality in terms of degree of use support for streams, lakes, and groundwater assessments. The most recent *Illinois Water Quality Report* was issued in 2014.

Illinois has established narrative and numeric water quality standards for numerous chemical and physical parameters of surface waters as described in the following subsections. The water quality standards and stream use descriptions are taken from the Illinois Integrated Water Quality Report and Section 303 (d) List-2014 Draft (IEPA, 2014). All the surface waters in the project area are under the IEPA's *General Use* standards.

3.4.1 General Use Water Quality Standards

General Use Water Quality Standards are intended to protect aquatic life, fish consumption, aesthetic quality, primary contact (swimming), and secondary contact (boating). The standards are designed to protect human health from disease or other harmful effects that could occur from ingesting aquatic organisms taken from public surface waters (IEPA, 2014).

3.4.2 Narrative Water Quality Standards

Designated Uses assessed under the General Use Water Quality Standards include aquatic life, fish consumption, primary contact, secondary contact, and aesthetic quality. The IEPA determines the resource quality of each stream segment by determining the level of support (attainment) of each applicable designated use. There are two possible use support levels, Fully

Supporting (attains the designated use) or Not Supporting (the use is not attained). Uses determined to be Not Supporting are called “impaired,” and a water body that has at least one use assessed as Not Supporting is also called “impaired.” For each impaired use in each water body, IEPA attempts to identify potential causes and sources of the impairment. In this document, the designated uses, the level of use support, and impairments are taken from the IEPA 2014 Draft Illinois Integrated Water Quality Report and Section 303(d) List.

3.4.3 Numeric Water Quality Standards

The majority of the Illinois water quality standards are in the form of numeric criteria. The criteria consist of specific parameters (for example; chloride, total dissolved solids, etc.) that have a specific concentration that is allowed in an individual water body. For example, chloride concentrations up to 500 mg/L are allowable. However, if concentrations are above that level, the water body would be considered as not meeting the standard. Extensive tables in the IEPA 2014 Draft Illinois Integrated Water Quality Report and Section 303(d) List identify these parameters and concentration levels. Metallic elements dissolved in water often have their toxicity to aquatic life based upon the chloride concentration of the water and chloride concentrations are evaluated in order to set standards for specific water bodies. Chloride concentrations are based on the IEPA General Use water quality standard of 500 mg/L that is not to be exceeded at any time. Water quality standards for select chemical constituents, such as heavy metals, are derived from mathematical equations that include chloride concentrations as specified in Section 302.208 of Illinois Administrative Code Title 35.

Since highways contribute storm water runoff to adjacent streams heavy metals (lead, zinc, and copper) typically associated with transportation sources were analyzed. These projected concentrations were then compared to General Use Water Quality Standards. Table 3-4, *Calculated General Use Water Quality Standards*, presents the three heavy metal water quality standards where sufficient information regarding water hardness is available for the calculation, as that is one of the variables affecting the toxicity of various dissolved metals. The water quality standards for copper, lead, and zinc include an acute standard (AS) and a chronic standard (CS). The AS shall not be exceeded at any time in the stream. The CS shall not be exceeded by the arithmetic average of at least four consecutive samples collected over any period of at least four days. The copper, lead, and zinc standards are based on the hardness of water. The toxicity of the metals decreases as the hardness level increases.

Dissolved oxygen (DO) is a basic requirement for aquatic life and the IEPA (2014) sets minimum standards for DO levels in waterways. The DO levels are allowed to vary seasonally. Table 3-5 summarizes the IEPA dissolved oxygen standards as they apply to the project area.

TABLE 3-4. CALCULATED GENERAL USE WATER QUALITY STANDARDS

STREAM	HARDNESS, MG/L[a]	COPPER, MG/L		LEAD, MG/L		ZINC, MG/L	
		ACUTE	CHRONIC	ACUTE	CHRONIC	ACUTE	CHRONIC
Webster Creek (US 51-31)	165	0.028	0.018	0.181	0.038	0.187	0.049
Fulton Branch (US 51-30)	162	0.028	0.018	0.177	0.037	0.184	0.048
Sewer Creek (US 51-29)	242	0.041	0.025	0.295	0.062	0.258	0.067
Crooked Creek (US 51-28)	129	0.023	0.015	0.132	0.028	0.258	0.039
Crooked Creek (US 51-54)	165	0.028	0.018	0.181	0.038	0.187	0.049
Crooked Creek (US 51 -58)	219	0.037	0.023	0.260	0.055	0.237	0.062
Prairie Creek (US 51-53)	209	0.036	0.022	0.245	0.051	0.228	0.059
Turkey Creek (US 51-27)	145	0.025	0.016	0.154	0.032	0.167	0.043
East Fork Kaskaskia (US 51-22)	138	0.024	0.016	0.144	0.030	0.161	0.042
Louse Run Tributary (US 51-21)	198	0.034	0.021	0.228	0.048	0.218	0.057
Louse Run (US 51-51)	139	0.024	0.016	0.146	0.031	0.162	0.042
Deer Creek (US 51-19)	149	0.026	0.017	0.159	0.033	0.171	0.044
North Fork Kaskaskia	111	0.020	0.013	0.109	0.023	0.134	0.035
Flat Creek (US 51-16)	210	0.036	0.022	0.246	0.052	0.229	0.059
Cassar Creek (US 51-14)	219	0.037	0.023	0.260	0.055	0.237	0.062
Richland Creek (US 51-13)	213	0.036	0.023	0.251	0.053	0.232	0.060
Kaskaskia River (US 51-09)	169	0.029	0.019	0.187	0.039	0.191	0.050
Kaskaskia River (US 51-46)	215	0.0365	0.0227	0.2536	0.0532	0.2337	0.0606
Kaskaskia River (US 51-60)	215	0.037	0.023	0.254	0.053	0.234	0.061
Raccoon Creek (US 51-47)	199	0.034	0.021	0.230	0.048	0.219	0.057
Unnamed Tributary to Raccoon Creek #2 (US 51-59)	289	0.048	0.029	0.370	0.078	0.300	0.078
Unnamed Tributary to Kaskaskia River (US 51-48)	278	0.0464	0.0283	0.3518	0.0738	0.2906	0.0754
Bear Creek (US 51-44)	324	0.054	0.032	0.428	0.090	0.331	0.086
Hoffman Creek (US 51-07)	250	0.0420	0.0259	0.3073	0.0644	0.2656	0.0689
Ramsey Creek (US 51-06)	278	0.046	0.028	0.352	0.074	0.291	0.075
Ramsey Creek Tributary (US 51-05)	208	0.035	0.022	0.243	0.051	0.227	0.059
Ash Creek (US 51-04)	250	0.042	0.026	0.307	0.064	0.266	0.069

Source: 35 Ill. Adm. Code 302, 2008.
[a] Standards calculated from formulas in 35 Ill. Adm. Code 302.208. Values calculated from hardness values analyzed in 2008 and 2009.

TABLE 3-5. IEPA DISSOLVED OXYGEN (DO) STANDARDS (2010)

Measurement Interval	Minimum DO Standard mg/L	
	August - February	March - July
At Any Time	3.5	5.0
7 Day Average	4.0	6.0
30 day Average	5.5	N.A.

3.4.4 Antidegradation Statement

The Illinois Administrative Code defines antidegradation regulations as protecting "*existing uses of all water of the State of Illinois, maintaining the quality of waters with quality that is better than water quality standards, and prevent unnecessary deteriorations of waters of the State*" (IAC, 2002).

The Illinois Environmental Protection Agency (IEPA) requires an analysis of water quality impacts in an antidegredation assessment for projects where an individual water quality certification is required. An individual 401 water quality certification is required when an individual Section 404 permit is needed from the US Army Corp of Engineers due to wetlands and waters of the US impacts. The IEPA considers many factors including suspended solids during the antidegradation assessment. Total suspended solids include all particles suspended in water which will not pass through a filter. Suspended solids are present in sanitary and industrial wastewater. Suspended solids are also present in runoff water due to soil erosion from agricultural fields and construction sites. As levels of total suspended solids increase, a water body begins to lose its ability to support a diversity of aquatic life.

Illinois has not established a General Use water quality standard for total suspended solids (TSS); however, information regarding TSS effects is available from other scientific studies such as Buckler and Granato (1999). High concentrations of TSS are known to adversely affect fish and fish food populations by:

1. Acting directly on fish and possibly killing them, or reducing their growth rate, resistance to the disease, etc.
2. Preventing the successful development of fish eggs and larvae,
3. Modifying natural movements and migration of fish, or
4. Reducing the abundance of food available to the fish.

The sensitivity to suspended solids varies with the aquatic species, as described below:

> "Chronic adverse effects are observed in aquatic resources when ambient suspended solids levels range from 100 to 500 ppm; acute effects are observed in aquatic resources when ambient suspended solids levels exceed 3,000 ppm. Benthic populations are adversely affected by suspended solids levels of 100 to 500 ppm. Macroinvertebrate benthic populations are adversely affected by suspended solids levels of 200 to 6,000 ppm. Submerged aquatic vegetation is adversely affected by suspended solids levels of 100 to 5,000 ppm. Finfish populations are adversely affected by suspended solids levels in excess of 100 ppm." (Watson and Der, 1986).

3.4.5 Stream Segment Ratings

The IEPA divides streams and rivers into segments for identification and sampling purposes. Each segment is given a unique code consisting of several letters and numbers. Generally, a new segment is designated when the first segment is joined by another perennial stream. Based upon biological and chemical sampling, each segment may be rated for designated uses as well as for sources and causes of any impairment. See Table 4-4, *Use Support and Classification of Streams in the US 51 Corridor*, which provides the IEPA segment codes, use designations and IDNR ratings for the streams in the corridor.

3.5 Chemical Data

The water quality constituents associated with highway runoff include suspended solids, hardness, temperature, pH, chloride, copper, lead and zinc. Chemical data are available from IEPA monitoring stations and through sampling by the INHS. The IEPA collects water samples from the Ambient Water Quality Monitoring Network (AWQMN) sampling stations as part of the on-going water quality assessment. Water quality data for the pollutants typically associated with transportation sources have been obtained from the IEPA STORET system for four streams (Crooked Creek, North Fork Kaskaskia River, East Fork Kaskaskia River, and Kaskaskia River) near the project area. See Table 3-6, *AWQMN Stations within the Study Area*, below.

TABLE 3-6. AWQMN STATIONS WITHIN THE STUDY AREA

STREAM	IEPA STATION NUMBER
Crooked Creek[1]	OJ-07
North Fork Kaskaskia River	OKA-01
East Fork Kaskaskia River	OK-01
Kaskaskia River	O-08
Ramsey Creek	OO-01

Source: STORET Data 2013.
[1]No ambient water quality monitoring data within the project area on Crooked Creek was available; however, upstream of the project area water quality data was available at Crooked Creek (OJ-07).

The INHS collected chemical data at or near where the proposed US 51 alignment would cross select streams during 2008 to 2012. Thirty-one streams were sampled for water quality over the four-year period.

4. Water Resource Characteristics

Water resource types in the project corridors consist of riverine systems, lakes, and ponds, all of which are contained within the Kaskaskia River watershed. The riverine types include permanent and intermittent flow streams, creeks, and rivers. The surface water resources in the project area include 65 streams of varying sizes as well as a total of 74 ponds and four lakes. Figure 1-1 depicts the locations of the streams in the study area.

Tables 4-1, 4-2, 4-3, 4-4 present the physical, biological, chemical, and use designations of the streams in the study area respectively. The Illinois Natural History Survey (INHS) collected information at 52 sampling sites in the study area. Figure 1-1 identifies these sampling locations.

4.1 Kaskaskia River Watershed Overview

All of the streams affected by the proposed US 51 improvements occur in the middle portion of the Kaskaskia River Watershed. The Kaskaskia River watershed is the largest in Illinois at 4.4 million acres. The Kaskaskia River flows to the Mississippi River in Randolph County, in southwestern Illinois. The Kaskaskia River watershed is 5,801 square miles, encompassing 22 counties. There are 292 miles of main stem and 8,680 miles of tributaries. It is also the most diverse watershed for land cover types. The Kaskaskia River watershed is the second most urbanized watershed in Illinois, but also contains the largest tract of interconnected floodplain forest, wetlands and flatwood forests (Miller 2001, IDNR 2001). Thirty-seven unnamed tributaries are associated with the 28 named streams crossed by US 51.

The Kaskaskia River watershed includes Illinois Natural Areas Inventory (INAI) sites (Vandalia Geologic Area, Ramsey Lake Railroad Prairie, Burnside Forest, and Ramsey Creek), and one Nature Preserve, the Ramsey Railroad Prairie Nature Preserve. The Kaskaskia River is a navigable river used for recreational boating; it also provides habitat for aquatic species.

Table 4-1 contains the physical characteristic, riparian vegetation, and mean habitat score of the streams at each sampling location. Woody riparian habitats provide cover for fish and other wildlife, keep streams cool, slow erosion and stream flow, and add organic material to the aquatic food chain. Woody riparian habitat is a key requirement for healthy streams and aquatic communities. Many of the stream crossings in the project area have a non-woody riparian corridor composed of grasses and forbs. Photographs of the sample stations are included in Appendix A.

The general condition of the streams assessed in the US 51 study area can be described by the water quality metrics of mean habitat assessment, mean Family Level IBI, and presence of intolerant fish species. Figure 4-1 summarizes the habitat assessment scores for the 52 stream sites INHS sampled. Bear Creek was the only stream with “Good” habitat quality; five stream sites were associated with “Fair” habitat and the remaining streams had “Poor” habitat. Habitat is based upon 12 physical parameters, including bank stability, bottom substrate, flow, and riparian vegetation zone width. The five stream sites with fair habitat were Ramsey Creek and Ash Creek and three unnamed tributaries to Vandalia Lake.

Table 4-1 Physical Characteristics of Streams within the U.S. 51 Corridor

INHS Station Number	Stream	Length (miles)	Drainage[1]		Flow Characteristics	Stream Bottom	Stream Width (feet)[1]	Stream Depth (feet)[1]	Riparian Vegetation	Habitat Assessment[2]	Surrounding Land Use
			Total Area (square miles)	Upstream Area (sq. miles)							
US51-31	Webster Creek	8.9	11.4	5.74	perennial	sand, silt, clay, gravel	11.5	3.6	trees, grasses	poor	Industrial, forest
US51-30	Fulton Branch	5.3	3.88*	3.88	perennial	sand, silt, gravel	9.9	3.9	trees, grasses, herbaceous vegetation	poor	residential, industrial, forest
US51-29	Sewer Creek	5.4	22.3*	3.57	perennial	gravel, sand, cobble, silt, boulder	11.5	1.6	trees, herbaceous vegetation	poor	industrial, residential, field/pasture, forest
US51-57	Unnamed Tributary of Crooked Creek #1	2.9	2.6[3]	1.01	perennial	silt, boulder, sand, cobble	12.1	1.0	trees, herbaceous vegetation	poor	field/pasture, forest, residential
US51-28	Crooked Creek	72.7	465	173	perennial	gravel, sand, cobble, silt	55.8	8.2	trees	poor	industrial, residential, field/pasture, forest
US51-54	Crooked Creek	72.7	465	173	perennial	silt, sand, gravel	49.2	2.6-4.9	trees, grasses	poor	row crop agriculture, forest
US51-58	Crooked Creek	72.7	465	173	perennial	sand, silt, gravel	16.4	5.9	trees, grasses, herbaceous vegetation	poor	forest
US51-27	Turkey Creek	12.1	21.1	Not crossed	perennial	sand, silt, gravel, cobble, boulder	26.2	4.9	trees	poor	field/pasture, residential, forest
US51-26	Crileys Branch	2.3	1.2[3]	0.73[3]	seasonal	silt, sand	2.3	0.7	grasses, trees, herbaceous vegetation	poor	field/pasture, forest, row crop agriculture
US51-25	Prairie Creek	21.9	30.7	8.17	perennial	sand, silt, gravel	13.1	2.0	trees, grasses	poor	industrial, residential, field/pasture
US51-53	Prairie Creek	21.9	30.7	10.7	perennial	sand, silt, gravel	9.9	1.6	trees, grasses	poor	agricultural, forest
US51-24	Lost Creek	25.8	78.5	6.45	perennial	sand, silt, gravel	11.5	3.3	trees, grasses	poor	forest, agricultural, field/pasture
US51-22	East Fork Kaskaskia River	43.3	128	112.2	perennial	sand, silt, gravel	14.7	4.9	trees, herbaceous vegetation	poor	forest, agricultural
US51-21	Unnamed Tributary of Louse Run #1 (south)	5.4	8.73*	0.35	perennial	sand, silt, gravel	7.5	2.1	trees, grasses	poor	row crop agricultural, residential

Table 4-1 Physical Characteristics of Streams within the U.S. 51 Corridor

INHS Station Number	Stream	Length (miles)	Drainage[1]		Flow Characteristics	Stream Bottom	Stream Width (feet)[1]	Stream Depth (feet)[1]	Riparian Vegetation	Habitat Assessment[2]	Surrounding Land Use
			Total Area (square miles)	Upstream Area (sq. miles)							
US51-20	Louse Run #1	12.1	>13.7	3.024	perennial	sand, silt, gravel	9.9	2.6	trees, grasses, herbaceous vegetation	poor	forest, field/pasture, livestock agricultural
US51-51	Louse Run #2	12.1	>13.7	5.4	perennial	silt, sand	4.6	0.7	trees, grasses,	poor	forest, residential, agriculture
US51-19	Deer Creek	5.36	5.8[3]	4.88	perennial	sand, silt, gravel	11.5	5.0	trees, grasses	poor	forest
US51-18	North Fork Kaskaskia River	27.1	77.6	39.6	perennial	sand, silt, gravel	55.8	9.9	trees, herbaceous vegetation	poor	forest, agricultural, field/pasture, residential
US51-17	Unnamed Tributary of North Fork Kaskaskia River	3	2.5[3]	1.03	seasonal	silt, clay, boulder	4.9	1	grasses	poor	industrial, row crop agriculture
US51-16	Flat Creek	17.4	>21.5	19.9	perennial	sand, silt, clay, gravel	23	1.5	trees, grasses	poor	forest, agricultural
US51-15	Steve Creek	5.95	4.2[3]	0.64	seasonal	sand, silt, clay	4.9	1.0	grasses	poor	row crop, agricultural
US51-14	Cassar Creek	11.1	11.3[3]	5.96	perennial	sand, silt, gravel, clay	13.1	2.3	trees, grasses	poor	agricultural, forest, residential
US51-13	Richland Creek	7.9	14.2	12.6	perennial	sand, silt, gravel	14.8	2.0	trees, grasses	poor	agricultural, residential
US51-12	Hickory Creek	24.3	142	85.3	perennial	sand, silt, clay	42.7	9.9	trees	poor	forest, row crop agricultural
US51-09	Kaskaskia River	295.1	5801	1944	perennial	sand, silt, clay	98.5	13.1	trees, grasses	poor	forest, row crop agricultural, residential
US51-46	Kaskaskia River	295.1	5801	1944	perennial	silt, sand	82.1	13.1	trees	poor	row crop agriculture, forest, urban, residential
US51-60	Kaskaskia River	295.1	5801	1944	perennial	silt, clay, sand	141	> 10	trees	poor	field/pasture, agricultural
US51-49	Fish Lake Ditch	5.3	7.3[3]	0.07	perennial	silt, sand	0.32	0.16	grasses, trees	poor	forest, row crop agricultural
US51-48	Unnamed Tributary of Raccoon Creek #1	2.3	1.2	0.94	perennial	silt sand	1	0.32	grasses, herbaceous vegetation	poor	row crop agriculture
US51-47	Raccoon Creek	10.5	19.4	5.56	perennial	silt, sand, clay, gravel	2.6	0.33	grasses, trees	poor	row crop agriculture
US51-45	Unnamed Tributary of	4	6.27*	0.71	seasonal	silt, sand	0	0	grasses	N/A	row crop agriculture

Table 4-1 Physical Characteristics of Streams within the U.S. 51 Corridor

INHS Station Number	Stream	Length (miles)	Drainage[1]		Flow Characteristics	Stream Bottom	Stream Width (feet)[1]	Stream Depth (feet)[1]	Riparian Vegetation	Habitat Assessment[2]	Surrounding Land Use
			Total Area (square miles)	Upstream Area (sq. miles)							
	Raccoon Creek #2										
US51-59	Unnamed Tributary of Raccoon Creek #2	4	6.27*	0.71	perennial	sand, gravel, silt	6	2	trees, grasses, herbaceous vegetation	poor	field/pasture, forest, livestock, agriculture
US51-42	Unnamed Tributary of Raccoon Creek #3	1.8	1.2[3]	0.45	seasonal	silt, sand	0	0	grasses, small trees	N/A	row crop agriculture
US51-43	Unnamed Tributary of Bear Creek #1	1.1	0.89*	0.75	perennial	sand, silt, gravel	5	1	grasses	N/A	forest, row crop agriculture, residential
US51-44	Bear Creek	11.7	30	28.5	perennial	silt, sand	23	6.7	trees, grasses, herbaceous vegetation	poor	row crop agriculture, forest
US51-08	Bear Creek	12.7	30	28.5	perennial	sand, silt	29.5	5.6	trees, grasses	poor	agricultural, field/pasture, forest,
US51-68	Unnamed Tributary of Vandalia Lake #1	2.9	1.4[3]	0.97	intermittent	sand, gravel, silt	4.9	0.7	trees, grass	fair	agriculture, field/pasture, residential
US51-67	Unnamed Tributary of Vandalia Lake #1	2.9	1.4[3]	0.97	intermittent	silt, sand, clay	2	0.2	grass	poor	agriculture, residential
US51-66	Unnamed Tributary of Vandalia Lake #2	5.3	1.3[3]	0.93	intermittent	gravel, sand, silt	2	0.2	grass, herbaceous vegetation, trees	fair	agriculture, forest, residential
US51-65	Unnamed Tributary of Vandalia Lake #3	2.4	5.4[3]	5.38	intermittent	gravel, sand	5.6	0.2	trees, grass, herbaceous vegetation	fair	forest, field/pasture, agriculture
US 51-41	Unnamed Tributary of Kaskaskia River	2.4	0.89*	0.89	perennial	sand, silt, gravel, clay	6	0.1	trees, grasses, herbaceous vegetation	fairly poor/poor	field/pasture, agricultural
US51-64	Unnamed Tributary of Vandalia Lake #4	2.9	1.9[3]	1.3	intermittent	Silt, sand	3.3	0.7	trees, grass, herbaceous vegetation	poor	cattle lot, forest, field/pasture
US51-63	Unnamed Tributary of Vandalia Lake #4	2.9	1.9[3]	1.3	intermittent	no stream	N/A	N/A	grass, herbaceous vegetation	N/A	agriculture

Table 4-1 Physical Characteristics of Streams within the U.S. 51 Corridor

INHS Station Number	Stream	Length (miles)	Drainage[1]		Flow Characteristics	Stream Bottom	Stream Width (feet)[1]	Stream Depth (feet)[1]	Riparian Vegetation	Habitat Assessment[2]	Surrounding Land Use
			Total Area (square miles)	Upstream Area (sq. miles)							
US51-62	Bear Creek	12.7	>24.3	3.75	intermittent	sand, gravel, silt	5.7	0.7	trees, grass, herbaceous vegetation	good	forest agriculture
US51-61	Unnamed Tributary of Vandalia Lake #5	3.2	3.7[3]	0.98	intermittent	sand, gravel, silt, cobble	2.5	0.2	grass, trees	poor	agricultural, field/pasture
US51-07	Hoffman Creek	7.9	11.6	7.16	perennial	sand, gravel, silt	23	3.3	trees	fairly poor/poor	agricultural, forest
US51-06	Ramsey Creek	21.6	106	95.9	perennial	sand, gravel, boulders, bedrock	36.1	4.9	trees	fair	forest, agricultural
US51-05	Unnamed Tributary of Ramsey Creek #2	4.9	3.3[3]	0.73	perennial	sand, gravel	10.7	3.9	trees, grasses, herbaceous vegetation	poor	field/pasture, forest
US51-04	Ash Creek	8.7	15.3	6.63	perennial	sand, gravel	11.5	4.9	trees	fair	field/pasture, forest
US51-03	Unnamed Tributary of Little Creek	5.1	4.8[3]	2.13	perennial	silt, sand, gravel	9.8	2.3	trees, grasses, herbaceous vegetation	poor	agricultural, field/pasture
US51-02	Matney Branch	4.4	8.9[3]	2.05	perennial	sand, silt, clay, gravel	7.2	1.6	trees, grasses, herbaceous vegetation	poor	row crop agricultural
US51-01	Opossum Creek	14.4	43.7	10.9	perennial	sand, silt, gravel	13.1	5.7	trees, grasses, herbaceous vegetation	poor	field/pasture, forest

Source: USGS 2002, USGS, 1979, Wetzel & Phillips, Editors,2009, Wetzel, Editor 2010, Wetzel et al. 2010, Wetzel et al. 2012.
[1]U.S. Geological Survey, 1979. River Mileages and Drainage Areas for Illinois Streams, Volume I, Illinois Except Illinois River Basin. * Drainage area upstream of Build Alternative crossing.
N/A Drainage area not available.
[2]Habitat classification is based on habitat assessment scores. Habitat assessment score labels: "Excellent" is ≥ 130, "Good" is 110-129.9, "Fair" is 80-109.9, "Poor" is < 80). † = estimated.

[3]USGS. 2014. USGS StreamStats, Illinois. http://water.usgs.gov/osw/streamstats/illinois.html

N/A = Analyses not available because surveys were not conducted at these sites. Classifications furnished by INHS 2008.

Table 4-2: Biological Characteristics of Streams Within the U.S. 51 Corridor

INHS Station Number	Stream	Number Fish Species Present	Number Intolerant Fish Species	Dominant Fish Species	Benthics Mean Taxa Richness	Mean Family Level IBI Score[1]	Dominant Mussel Species	Number Mussel Species
US51-31	Webster Creek	8	0	bluegill (59.0%)	15.7	6.95	--	--
US51-30	Fulton Branch	9	0	bluegill (63.7%)	10.7	6.96	Fat mucket (relic)	1
US51-29	Sewer Creek	4	0	blackstripe topminnow (86.3%)	10.3	7.57	--	--
US51-28	Crooked Creek	24	1	gizzard shad (15.3%), red shiner (15.0%), bullhead minnow (14.6%), bluntnose minnow (14.3%)	12.3	6.87	Giant floater	8
US51-54	Crooked Creek	14	0	green sunfish (36%), bluegill (24.5%)	11.3	6.63	Giant floater	8
US51-58	Crooked Creek	7	0	largemouth bass (71.0%)	8.7	6.47	Giant floater (dead) & fat mucket (relic)	2
US51-27	Turkey Creek	15	1	bluegill (28.9%), green sunfish (19.3%), blackstripe topminnow (13.4%)	12.0	6.64	Pondhorn	4
US51-53	Prairie Creek	11	0	redfin shiner (47.0%), golden shiner (12%)	10.5	8.26	Giant floater, pondhorn, lilliput	4
US51-22	East Fork Kaskaskia River	21	1	redfin shiner (31.7%), bluntnose minnow (24.4%)	12.3	4.77	Fat mucket	9
US51-51	Louse Run	5	0	slough darter (43%), creek chub (35.1%)	10.7	6.89	Pondhorn	1
US51-19	Deer Creek	7	0	pirate perch (25.0%), golden shiner (16.7%), creek chub (16.7%), green sunfish (16.7%)	14.0	6.63	--	--
US51-18	North Fork Kaskaskia River	12	0	largemouth bass (35.7%), bluegill (23.8%)	--	--	Giant floater	4
US51-14	Cassar Creek	7	0	creek chub (29.0%), orangethroat darter (22.6%)	9.9	6.81	Pondhorn (relic)	1
US51-12	Hickory Creek	19	1	red shiner (43.1%), bluegill (17.8%)	7.5	6.78	Giant floater (relic)	1
US51-9	Kaskaskia River	18	0	red shiner (59.3%)	--	--	historic data only[2]	0
US51-46	Kaskaskia River	11	1	red shiner (48%), freckled madtom (19.4%)	15.3	5.36	historic data only[2]	0

Table 4-2: Biological Characteristics of Streams Within the U.S. 51 Corridor

INHS Station Number	Stream	Number Fish Species Present	Number Intolerant Fish Species	Dominant Fish Species	Benthics Mean Taxa Richness	Mean Family Level IBI Score[1]	Dominant Mussel Species	Number Mussel Species
US51-60	Kaskaskia River	20	1	channel catfish (47.8%), gizzard shad (18.5%)	5.0	3.09	pink papershell	11
US51-47	Raccoon Creek	2	1	mosquitofish (83.0%)	11.0	6.79	--	--
US51-59	Unnamed Tributary of Raccoon Creek #2	16	1	bluegill (30%), johnny darter (18.4%), bluntnose minnow (9.2%)	17.3	6.37	giant floater	1
US51-44	Bear Creek	16	0	red shiner (37.0%), green sunfish (14.9%)	11.0	6.62	mapleleaf	2
US51-68	Unnamed Tributary of Vandalia Lake #1	1	0	bluegill (100%)	7.67	6.93	--	0
US51-66	Unnamed Tributary of Vandalia Lake #2	1	0	bluegill (100%)	5.67	6.83	--	0
US51-65	Unnamed Tributary of Vandalia Lake #3	3	0	creek chub (47.1%), bluegill (47.1%)	7.0	6.44	--	0
US51-41	Unnamed Tributary of Kaskaskia River	7	0	orangethroat darter (48%), mosquitofish (15%), central stoneroller \(15%)	15.5	6.21	--	--
US51-62	Bear Creek	5	0	bluegill (62%)	7.67	6.91	--	0
US51-07	Hoffman Creek	15	0	red shiner (23.6%), silverjaw minnow (20.3%), central stoneroller (19.5%)	18.2	6.47	--	--
US51-06	Ramsey Creek	16	0	bluntnose minnow (>63.2%)	9.0	5.56	mapleleaf	8
US51-05	Unnamed Tributary of Ramsey Creek #2	17	1	central stoneroller (25.7%), bluntnose minnow (25.1%)	15.7	6.52-	--	--
US51-04	Ash Creek	15	0	silverjaw minnow (23.9%), orange-throat darter (23.9%), central stoneroller (14.5%)	10.7	6.65	fat mucket (relic)	1

Source: Wetzel & Phillips, Editors,2009, Wetzel, Editor 2010, Wetzel et al. 2010, Wetzel et al. 2012.

[1]Water quality based on Hilsenhoff's (1988) family level biotic index (cutoff points are: 0.00-3.75, Excellent-Organic pollution unlikely; 3.76-4.25, Very good-Possible slight organic pollution; 4.26-5.00, Good -Some organic pollution probable; 5.01-5.75, Fair-Fairly substantial pollution likely; 5.76-6.50, Fairly Poor- Substantial pollution likely; 6.51-7.25, Poor-Very substantial pollution likely; 7.26-10.00, Very Poor-Severe organic pollution likely; NA = Not Available)

[2] Historical record taken from Illinois Natural History Survey Mollusk Collection database

Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor

INHS Station Number	Stream	Sample Date	pH	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Sulfate (mg/L)	Dissolved Zinc (mg/L)	Total Dissolved Solids (mg/L)	Water Temp (°C)	Hardness (mg/L)	Turbidity (FTU)
US51-31	Webster Creek													
		21-Apr-2008	7.61	11.88	<0.1	20.3	0.0012	<0.041	184.0	0.1533	376	16.4	223	4
		7-Jul-2008	7.31	5.62	<0.1	12.0	0.0018	<0.041	109.0	<0.0073	272	25.3	153	12
		21-Sep-2008	7.20	5.05	0.05	11.3	0.0044	<0.041	63.2	0.0178	204	20.5	119	5
		Average			0.05	14.5	0.0025	0.021	118.7	0.0583	284	20.8	165	7
US51-30	Fulton Branch													
		21-Apr-2008	7.79	13.10	<0.1	28.1	0.0018	<0.041	105.0	<0.0073	304	25.1	187	4
		7-Jul-2008	7.35	6.00	0.02	12.3	0.0021	<0.041	59.9	<0.0073	256	23.7	138	15
		21-Sep-2008	7.95	6.70	0.11	17.1	0.0042	<0.041	72.3	0.0127	304	20.5	162	4
		Average			0.06	19.2	0.0027	0.021	79.1	0.0067	288	23.1	162	8
US51-29	Sewer Creek													
		21-Apr-2008	8.37	18.00	<0.1	111.0	0.0014	0.047	144.0	0.0073	448	18.7	280	3
		7-Jul-2008	7.69	5.45	0.03	85.4	0.0013	<0.041	135.0	0.0082	576	23.5	312	2
		21-Sep-2008	7.84	5.40	0.07	65.8	0.0079	<0.041	50.9	0.0390	284	20.8	135	7
		Average			0.05	87.4	0.0035	0.029	110.0	0.0182	436	21.0	242	4
US51-58	Crooked Creek													
		9-Jun-2009	7.34	4.86	<0.01	53.2	0.0110	<0.041	77.8	<0.0073	376	21.7	226	10
		18-Aug-2009	7.33	3.66	0.06	81.9	0.0052	<0.041	51.9	0.0168	340	25.3	174	12
		20-Oct-2009	6.70	7.93	0.08	21.8	0.0036	<0.041	43.5	0.0631	200	10.7	256	22
		Average			0.06	52.3	0.0066	0.021	57.7	0.0279	305	19.2	219	15
US51-54	Crooked Creek													
		9-Jun-2009	7.58	7.64	0.04	39.5	0.0098	<0.041	61.6	<0.0073	332	21.7	199	21
		18-Aug-2009	7.73	4.23	0.09	71.9	0.0021	<0.041	66.8	<0.0073	328	24.9	193	12
		20-Oct-2009	6.46	8.72	0.06	23.1	0.0035	<0.041	50.3	<0.0073	224	10.4	102	20
		Average			0.06	44.8	0.0051	0.021	59.6	0.0037	295	19.0	165	17
US51-28	Crooked Creek													
		21-Apr-2008	7.98	11.64	<0.1	34.7	0.0028	0.041	117.0	0.0075	356	19.6	206	14
		7-Jul-2008	7.24	4.22	0.02	20.5	0.0031	<0.041	39.9	<0.0073	192	26.1	95	41
		21-Sep-2008	7.67	4.70	0.09	18.9	0.0058	<0.041	32.9	<0.0073	152	20.9	86.7	20
		Average			0.05	24.7	0.0039	0.027	63.3	0.0049	233	22.2	129	25
US51-27	Turkey Creek													

Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor

INHS Station Number	Stream	Sample Date	pH	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Sulfate (mg/L)	Dissolved Zinc (mg/L)	Total Dissolved Solids (mg/L)	Water Temp (°C)	Hardness (mg/L)	Turbidity (FTU)
		21-Apr-2008	8.26	11.89	<0.1	25.6	0.0025	<0.041	103.0	<0.0073	300	19.2	207	12
		8-Jul-2008	7.36	4.72	0.23	19.8	0.0026	<0.041	57.4	<0.0073	228	23.9	137	19
		22-Sep-2008	7.72	5.33	0.15	12.0	0.0054	<0.041	26.8	<0.0073	164	18.9	90.8	9
		Average			0.14	19.1	0.0035	0.021	62.4	0.0037	231	20.7	145	13
US51-53	Prairie Creek													
		9-Jun-2009	7.60	4.41	0.28	48.8	0.0041	<0.041	67.1	0.0741	408	20.2	243	7
		18-Aug-2009	7.62	6.00	0.60	58.8	0.0036	<0.041	74.2	0.0207	432	23.7	264	3
		20-Oct-2009	6.95	7.91	0.19	19.0	0.0076	<0.041	49.1	0.4530	256	11.9	119	19
		Average			0.36	42.2	0.0051	0.021	63.5	0.1826	365	18.6	209	9
US51-22	E. Fork Kaskaskia River													
		21-Apr-2008	7.87	11.08	<0.1	19.2	0.0022	<0.041	92.8	<0.0073	276	18.6	207	10
		8-Jul-2008	7.57	5.45	<0.1	31.1	0.0021	<0.041	39.1	<0.0073	236	25.2	138	7
		22-Sep-2008	7.41	5.36	0.08	10.6	0.0076	<0.041	12.6	0.0080	116	19.5	69.8	23
		Average			0.06	20.3	0.0040	0.021	48.2	0.0051	209	21.1	138	13
US51-21	Louse Run Tributary													
		21-Apr-2008	7.66	9.98	<0.1	43.2	0.0022	<0.041	102.0	<0.0073	344	21.4	198	49
		8-Jul-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		22-Sep-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		Average			0.05	43.2	0.0022	0.021	102.0	0.0037	344	21.4	198	49
US51-51	Louse Run													
		8-Jun-2009	7.47	3.57	0.11	31.7	0.0175	<0.041	35.3	<0.0073	324	20.7	185	6
		18-Aug-2009	7.22	3.17	0.06	49.5	0.0023	<0.041	17.0	0.1300	252	23.2	161	10
		20-Oct-2009	6.84	6.47	0.05	12.2	0.0096	<0.041	14.5	0.1990	160	10.5	71.7	54
		Average			0.07	31.1	0.0098	0.021	22.3	0.1109	245	18.1	139	23
US51-19	Deer Creek													
		21-Apr-2008	9.02	15.89	<0.1	51.4	0.0033	<0.041	43.8	<0.0073	256	23.0	149	10
		8-Jul-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		22-Sep-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		Average			0.05	51.4	0.0033	0.021	43.8	0.0037	256	23.0	149	10
US51-18	N. Fork Kaskaskia River													
		21-Apr-2008	7.53	9.33	<0.1	19.9	0.0016	<0.041	75.3	<0.0073	248	16.5	120	13

Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor

INHS Station Number	Stream	Sample Date	pH	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Sulfate (mg/L)	Dissolved Zinc (mg/L)	Total Dissolved Solids (mg/L)	Water Temp (°C)	Hardness (mg/L)	Turbidity (FTU)
		8-Jul-2008	7.80	7.56	<0.1	23.9	0.0024	<0.041	32.1	0.0195	316	24.5	154	9
		22-Sep-2008	7.60	4.62	0.08	5.8	0.0053	<0.041	5.2	0.0170	96	20.1	59.8	23
		Average			0.06	16.5	0.0031	0.021	37.5	0.0134	220	20.3	111	15
US51-16	Flat Creek													
		22-Apr-2008	NC	NC	<0.1	22.1	0.0026	<0.041	59.0	0.0091	296	16.4	210	3
		8-Jul-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		22-Sep-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		Average			0.05	22.1	0.0026	0.021	59.0	0.0091	296	NA	210	NA
US51-14	Cassar Creek													
		22-Apr-2008	7.95	10.50	<0.1	36.7	0.0019	<0.041	56.4	<0.0073	280	15.1	200	1
		8-Jul-2008	7.58	3.84	<0.1	48.5	0.0019	<0.041	40.4	0.0144	364	23.5	238	2
		22-Sep-2008	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		Average			0.05	42.6	0.0016	0.021	48.4	0.0090	322	19.3	219	1
US51-13	Richland Creek													
		22-Apr-2008	8.01	10.60	<0.1	21.7	0.0017	<0.041	47.5	<0.0073	244	15.8	217	1
		8-Jul-2008	7.67	6.16	<0.1	20.5	0.0025	<0.041	49.4	<0.0073	392	25.5	243	4
		22-Sep-2008	7.94	6.55	<0.1	15.7	0.0050	<0.041	29.8	<0.0073	248	19.5	178	3
		Average			0.05	19.3	0.0031	0.021	42.2	0.0037	295	20.3	213	2
US51-47	Raccoon Creek													
		9-Jun-2009	7.60	6.30	0.03	41.8	0.0073	<0.041	53.6	0.0143	452	20.4	362	5
		18-Aug-2009	7.14	3.68	0.07	33.9	0.0023	<0.041	46.9	<0.0073	308	25.3	263	6
		20-Oct-2009	6.96	7.81	<0.01	41.2	0.0030	<0.041	49.0	0.1940	316	13.8	243	8
		Average			0.05	39.0	0.0042	0.021	49.8	0.0707	359	19.8	289	6
US51-59	Unnamed Tributary to Raccoon Creek #2													
		9-Jun-2009	7.63	7.63	<0.01	44.6	0.0011	<0.041	56.7	<0.0073	400	17.2	383	3
		18-Aug-2009	7.39	7.74	0.07	41.4	0.0022	<0.041	64.0	<0.0073	404	23.9	333	2
		20-Oct-2009	7.09	8.64	0.03	41.8	0.0208	<0.041	51.2	0.0193	328	14.2	256	3
		Average			0.05	42.6	0.0080	0.021	57.3	0.0089	377	18.4	324	3
US51-09	Kaskaskia River													
		22-Apr-2008	8.06	10.60	<0.1	27.2	0.0030	<0.041	25.0	<0.0073	280	13.8	229	2

Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor

INHS Station Number	Stream	Sample Date	pH	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Sulfate (mg/L)	Dissolved Zinc (mg/L)	Total Dissolved Solids (mg/L)	Water Temp (°C)	Hardness (mg/L)	Turbidity (FTU)
		8-Jul-2008	7.96	6.24	<0.1	13.4	0.0025	<0.041	12.6	<0.0073	256	26.5	124	62
		22-Sep-2008	8.25	7.25	<0.1	14.6	0.0068	<0.041	13.5	0.0090	168	23.2	153	8
		Average			0.05	18.4	0.0037	0.021	17.0	0.0054	235	21.1	169	24
US51-46	Kaskaskia River													
		9-Jun-2009	7.99	7.85	<0.01	23.5	0.0074	<0.041	21.3	<0.0073	332	20.8	262	4
		18-Aug-2009	7.60	7.61	<0.01	16.1	0.0021	<0.041	15.0	<0.0073	252	25.8	205	14
		20-Oct-2009	7.44	10.91	<0.01	18.4	0.0048	<0.041	20.6	0.1860	216	13.0	177	9
		Average			0.05	19.3	0.0048	0.021	19.0	0.0644	267	19.9	215	9
US51-60	Kaskaskia River													
		9-Jun-2009	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		18-Aug-2009	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		20-Oct-2009	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
		8-Aug-2010	8.60	7.77	0.18	18.9	0.0036	<0.041	15.2	0.0111	219	28.6	199	15
US51-41	Kaskaskia River Tributary													
		9-Jun-2009	8.04	8.30	<0.01	29.9	0.0021	0.044	55.7	<0.0073	476	17.6	305	4
		18-Aug-2009	7.93	9.43	0.09	35.2	0.0021	<0.041	55.9	0.0085	440	23.4	283	3
		20-Oct-2009	7.53	9.64	<0.01	41.3	0.0034	<0.041	57.9	0.1420	380	14.7	245	2
		Average			0.06	35.5	0.0025	0.0160	56.5	0.0514	432	18.6	278	3
US51-44	Bear Creek													
		9-Jun-2009	7.39	5.57	<0.01	30.1	0.0103	<0.041	27.9	<0.0073	320	20.6	237	6
		18-Aug-2009	7.47	7.89	0.06	39.2	0.0036	<0.041	34.1	0.0074	336	24.8	272	7
		20-Oct-2009	7.22	9.65	<0.01	16.7	0.0044	<0.041	16.4	0.1800	168	14.1	114	8
		Average			0.05	28.7	0.0061	0.021	26.1	0.0637	275	19.8	208	7
US51-68	Unnamed Tributary of Vandalia Lake #1													
		13-Jun-2011	7.49	8.47	0.15	9.8	0.0022	<0.041	12.7	0.1310	132	20.3	79	15
US51-66	Unnamed Tributary of Vandalia Lake #2													
		13-Jun-2011	7.35	7.23	0.59	9.6	0.0051	<0.041	13.4	0.0951	151	20.1	82	40
US51-65	Unnamed Tributary of Vandalia Lake #3													
		13-Jun-2011	7.63	8.30	0.26	7.6	0.0023	<0.041	16.5	0.0614	216	18.9	173	32
US51-62	Bear Creek													

Table 4-3 Water Quality Concentrations of Streams within U.S. 51 Corridor

INHS Station Number	Stream	Sample Date	pH	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Dissolved Copper (mg/L)	Dissolved Lead (mg/L)	Dissolved Sulfate (mg/L)	Dissolved Zinc (mg/L)	Total Dissolved Solids (mg/L)	Water Temp (°C)	Hardness (mg/L)	Turbidity (FTU)
		13-Jun-2011	7.65	9.54	0.11	12.6	0.0038	<0.041	23.7	0.1250	281	18.0	219	7
US51-07	Hoffman Creek													
		22-Apr-2008	8.17	12.35	<0.1	12.5	0.0026	<0.041	56.7	<0.0073	252	14.6	227	1
		8-Jul-2008	7.91	7.11	0.03	17.3	0.0014	<0.041	62.6	<0.0073	408	25.5	263	2
		22-Sep-2008	8.37	8.61	<0.1	12.8	0.0086	<0.041	57.1	<0.0073	296	19.6	261	2
		Average			0.04	14.2	0.0044	0.021	58.8	0.0037	319	19.9	250	2
US51-06	Ramsey Creek													
		22-Apr-2008	8.11	11.68	<0.1	16.1	0.0020	<0.041	98.7	0.0693	340	16.5	297	1
		8-Jul-2008	8.18	8.18	0.03	16.8	0.0020	<0.041	67.9	<0.0073	416	28.0	289	6
		22-Sep-2008	8.41	9.55	<0.1	13.5	0.0048	<0.041	70.8	0.0123	328	20.9	317	2
		Average			0.04	15.5	0.0031	0.021	79.1	0.0284	361	21.8	301	3
US51-05	Unnamed Tributary to Ramsey Creek #2													
		22-Apr-2008	10.72	10.72	<0.1	7.9	0.0018	<0.041	61.3	0.2209	240	14.5	219	4
		8-Jul-2008	8.09	7.94	0.02	10.1	0.0024	<0.041	33.7	<0.0073	304	25.9	208	5
		22-Sep-2008	8.11	6.55	0.02	7.3	0.0054	<0.041	49.5	0.1960	288	20.5	278	2
		Average			0.03	8.4	0.0034	0.021	48.2	0.1402	277	20.3	235	4
US51-04	Ash Creek													
		22-Apr-2008	7.98	11.44	<0.1	14.6	0.0033	<0.041	119.0	0.2571	364	15.1	293	1
		8-Jul-2008	7.76	6.24	0.05	16.3	0.0029	<0.041	103.0	<0.0073	464	23.7	330	4
		22-Sep-2008	8.13	7.43	0.04	14.2	0.0054	<0.041	86.0	0.1960	364	19.7	289	3
		Average			0.05	15.0	0.0039	0.021	102.7	0.1523	397	19.5	304	3

Source: INHS 2008

Notes:

NC = Site not collected on that date

Highlighted parameters exceed General Use Water Quality Standard

Table 4-4. 2014 Use Support and Classification of Streams in the U.S. 51 Corridor

Stream	IEPA Segment ID	Designated Use						Causes for Impairment	Sources of Impairment	Biological Stream Ratings (2008)	303(d)	Biologically Significant Stream
		Fish Consumption	Aquatic Life	Primary Contact	Secondary Contact	Aesthetic Quality	Public/Food Processing Water Supplies					
Sewer Creek	OJBC 19	NA	Not Supporting	NA	NA	NA	NA	Sedimentation/Siltation, Total phosphorus	Municipal Point Source Discharge, Crop Production, Urban Runoff/Storm Sewer	--	Yes	--
Crooked Creek	OJ 07	NA	Not Supporting	NA	NA	NA	NA	Manganese, Total phosphorus	Municipal point source discharges, Crop production	C - Diversity* B - Integrity*	Yes	--
Prairie Creek	OJBA	NA	Not Supporting	NA	NA	NA	NA	Dissolved Oxygen, Total Phosphorus	Loss Riparian Habitat, Streambank Modification/Destabilization, Livestock, Crop Production, Agriculture, Pesticide Application, Urban Runoff/Storm Sewer	--	Yes	—
Lost Creek	OJB 04	NA	Not Supporting	NA	NA	NA	NA	Dissolved Oxygen, Sedimentation/Siltation, Total Phosphorus	Loss Riparian Habitat, Crop production, Agriculture	C - Diversity C - Integrity	Yes	Yes
East Fork Kaskaskia River	OK 01	NA	Fully Supporting	Not Supporting	NA	NA	NA	Fecal coliform	Source Unknown	C - Diversity C - Integrity	Not this segment	--
North Fork Kaskaskia River	OKA 02	NA	Not Supporting	NA	NA	NA	NA	Manganese, Dissolved Oxygen, pH, Total Phosphorus	Impacts from abandoned mine lands (inactive), Surface Mining, Source Unknown, Crop Production	C - Diversity C - Integrity	Yes	--
Richland Creek	OZT	NA	NA	NA	NA	NA	NA	--	--	B - Diversity C - Integrity	--	--
Hickory Creek	ON 01	NA	Fully Supporting	Not Supporting	NA	NA	NA	Fecal coliform	Source unknown	B- Diversity C - Integrity	Yes	--

Table 4-4. 2014 Use Support and Classification of Streams in the U.S. 51 Corridor

Stream	IEPA Segment ID	Designated Use						Causes for Impairment	Sources of Impairment	Biological Stream Ratings (2008)	303(d)	Biologically Significant Stream
		Fish Consumption	Aquatic Life	Primary Contact	Secondary Contact	Aesthetic Quality	Public/Food Processing Water Supplies					
Kaskaskia River	O 08	Not supporting	Not Supporting	Not Supporting	Not Supporting	Not Supporting	Not Supporting	Dissolved Oxygen, Total Suspended Solids, pH, Total Phosphorus, Mercury, Manganese, Fecal Coliform	Source Unknown , Crop production (crop land or dry land), Atmospheric deposition - toxics	D - Diversity C - Integrity	Yes	--
Ramsey Creek	OO 01	NA	Fully Supporting	NA	NA	NA	NA	--	--	A - Diversity B - Integrity	--	Yes
Opossum Creek	OQC 01	NA	Fully supporting	NA	NA	NA	NA	--	--	--	--	--

Source: IEPA , IDNR 2008.

NA = Not Assessed.

*Downstream from Build Alternative crossing

Figure 4-2 summarizes the mean Family Level IBI information contained in Table 4-2. The Family Level IBI is based on Hilsenhoff's family level biotic index which describes the biological diversity and level of pollution present. One stream site, the Kaskaskia River (US 51-60), rated "excellent"; one stream, East Fork Kaskaskia River (US-51-22), was rated "good", and two sites (Kaskaskia River (US-51-46) and Ramsey Creek- US51-06)) were rated "fair". The remaining streams with a measured Family level IBI index were rated "fairly poor" to "very poor".

The water quality and biological diversity can be impacted by features, such as dams and wastewater treatment plants. Figure 1-1 depicts the location of dams and wastewater treatment plants in the study area. The only dams are associated with Vandalia Lake, Raccoon Lake, and Carlyle Lake. Wastewater treatment plants are located on the following streams:

- Sewer Creek (Centralia)
- Kaskaskia River (Vandalia)
- Prairie Creek (Sandoval)
- Turkey Creek (Village of Odia)
- Tributary to Ramsey Creek (Ramsey)
- Fulton Branch (Wamac)
- Tributary to Louse Run (Patoka)
- Crooked Creek (Central City)

Water quality sampling at 31 sites provided information on the stream concentrations for various pollutants. A variety of metals and inorganic parameters were analyzed; however, the primary pollutants associated with roadway runoff include three heavy metals (copper, lead, and zinc) as well as chlorides. Other important indicators of stream health are DO, pH, phosphorus, and dissolved solids. Eleven stream sites only exceeded the chronic zinc General Use Water Quality standards, two (Prairie Creek, and Louse Run) sites exceeded the acute zinc standard, and one stream site exceeded chronic copper General Use Water Quality standard. The only other parameter that exceeded water quality standards was DO. Sampling conducted in 2008 and 2009 indicated that five streams did not meet the seasonal DO standard. These streams were Crooked Creek, Turkey Creek, Prairie Creek, Louse Run and Cassar Creek. Some of these streams are receiving effluent from wastewater treatment plants which may contribute to these DO conditions.

IEPA has only rated stream uses for 10 streams in the study area and only four of these are rated as "full support." Table 4-4 provides information on these streams. The streams fully supporting aquatic life include the East Fork of the Kaskaskia River, Hickory Creek, Ramsey Creek, and Opossum Creek. The remaining streams are listed as "impaired" and appear on the 303(d) list. The impaired streams include Sewer Creek, Crooked Creek, Prairie Creek, Lost Creek, North Fork Kaskaskia River, Hickory Creek, and the Kaskaskia River.

Figure 4-1. Summary of Mean Habitat Assessment Scores

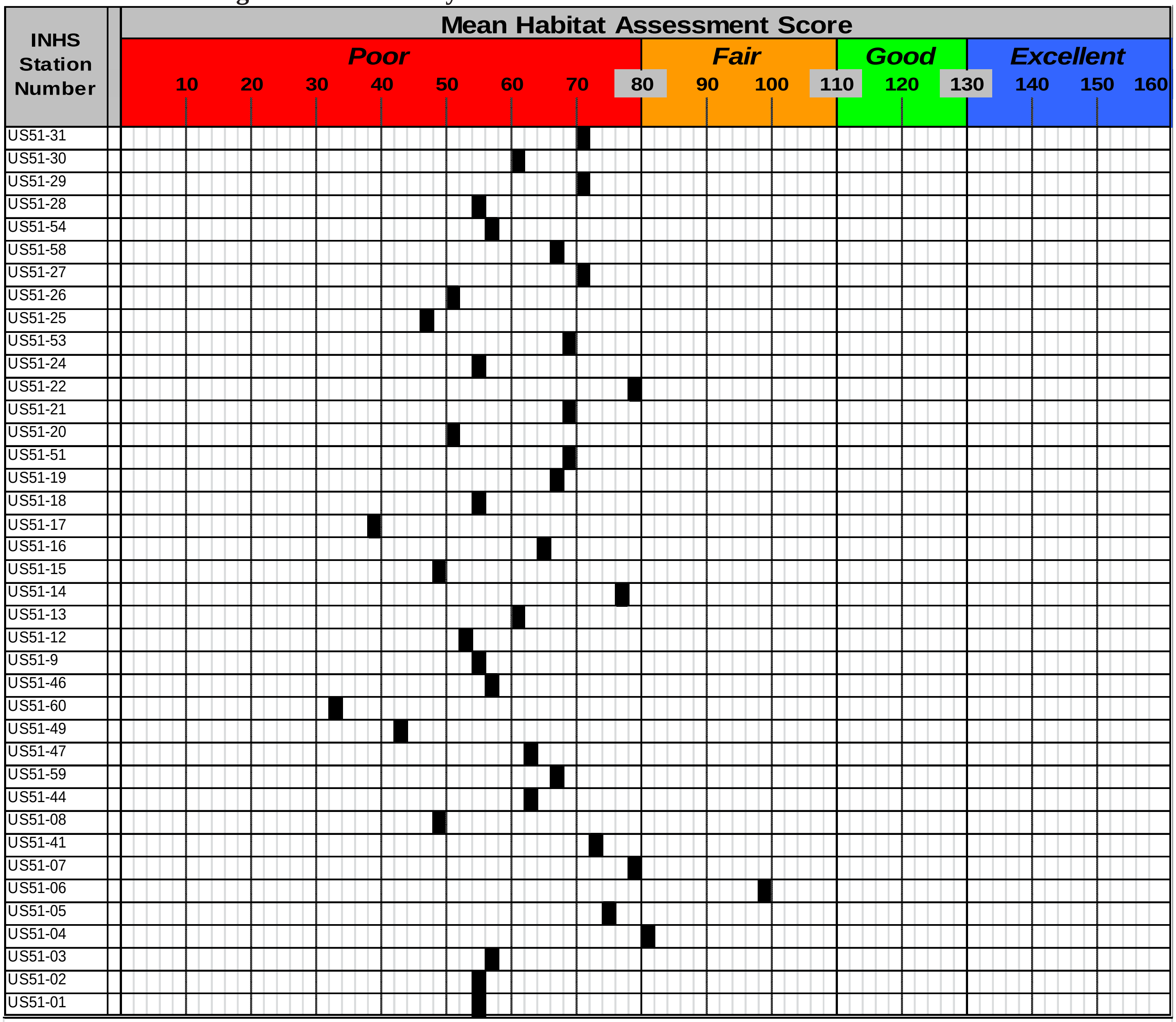
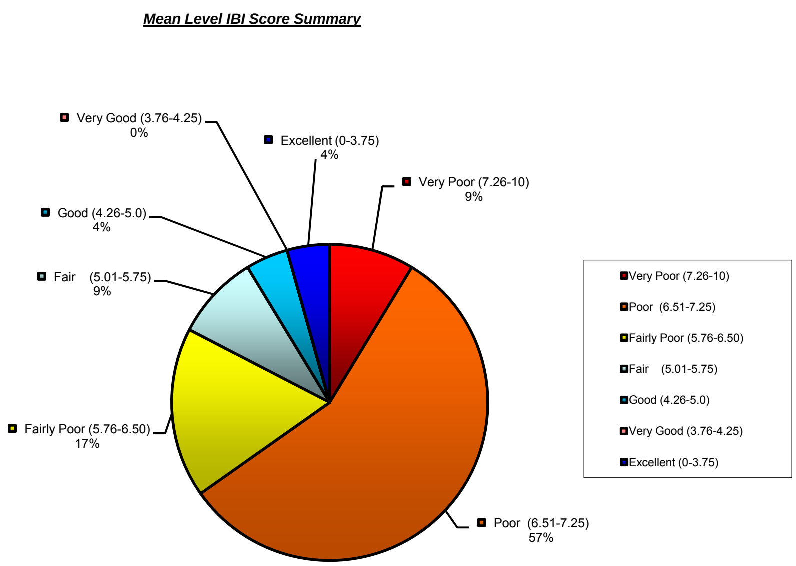


Figure 4-2. Summary of Mean IBI Scores



Source: Wetzel & Phillips, Editors,2009, Wetzel, Editor 2010, Wetzel et al. 2010)
1Water quality based on Hilsenhoff's (1988) family level biotic index (cutoff points are: 0.00-3.75, Excellent-Organic pollution unlikely; 3.76-4.25, Some organic pollution probable; 5.01-5.75, Fair-Fairly substantial pollution likely; 5.76-6.50, Fairly Poor- Substantial pollution likely; 6.51-7.25, Poor-Very substantial pollution likely; 7.26-10.00, Very Poor; Severe organic pollution likely; NA = Not Available)

The presence of intolerant fish species also provides an indication of existing water quality and habitat conditions. Intolerant fish species were collected at 9 of the 29 stream sites assessed.

4.2 Webster Creek

Webster Creek is located in Washington and Marion Counties. Webster Creek headwaters begin south of the City of Centralia from which it flows 8.9 miles southwest miles to its confluence with Sewer Creek west of the Wamac IL. Webster Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Map updated 2002).

Webster Creek was assessed upstream of the existing US 51 bridge over Webster Creek (INHS US 51-31) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Webster Creek consists of sand, silt, clay and gravel. Webster Creek has a measured width of 11.5 feet wide and a depth of 3.6 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is industrial and forest. The habitat assessment for Webster Creek is classified as poor. (See Table 4-1)

Fish, mussels, and macroinvertebrates were sampled at Webster Creek in 2008 (Wetzel and Phillips, Editors, 2009). Eight species of fish were collected with bluegills dominating 59% of the collection. The mean Family Level IBI was 6.95, indicating the stream has “poor” water quality with very substantial pollution likely. No intolerant fish species were collected in Webster Creek. Mussel collection efforts yielded no live specimens (Wetzel & Phillips, Editors, 2009). The IDNR has not assessed Webster Creek for diversity, integrity or biological significance.

Designated stream uses of Webster Creek, stream segment OJCC, were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Webster Creek. Three water quality samples were collected at one sampling location (US 51-31) on Webster Creek during 2008 (Wetzel & Phillips, Editors, 2009). The dissolved zinc concentration for one sample exceeded the chronic water quality standard. Chloride levels ranged from 11.3 mg/L to 20.3 mg/L, achieving the General Use Water Quality standards.

4.3 Fulton Branch

Fulton Branch is located in Washington and Marion Counties. The headwaters of Fulton Branch originate north of Wamac, Illinois, from which it flows approximately 5.3 miles west to its confluence with Sewer Creek. Fulton Branch in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day, 10-year low flow value for this stream is zero (1988. Singh et al. 1988, Maps updated 2002). The Wamac wastewater treatment plant outfall is located 1.24 miles due west of existing US 51.

The proposed US 51 corridor crosses Fulton Branch at one location within Wamac. Fulton Creek was assessed upstream of the existing US 51 bridge over Fulton Creek (US 51-30) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Fulton Branch consists of sand, silt, and gravel. Fulton Branch has a measured width of 9.9 feet and a depth of 3.9 feet. Riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is residential, industrial, and forest. The habitat assessment for Fulton Branch is classified as poor. (See Table 4-1)

Fish, mussels, and macroinvertebrates were sampled at Fulton Branch in 2008. The collection of nine species of fish was dominated by bluegills at 64% of the collection. The mean Family Level IBI was 6.96 indicating the stream has "poor" water quality with very substantial pollution likely. No intolerant fish species were collected in Fulton Branch. Mussel collection efforts yielded one relic species, the fatmucket, a widespread species in Illinois (Wetzel & Phillips, Editors, 2009). The IDNR has not assessed Fulton Branch for diversity, integrity or biological significance.

Designated stream uses of Fulton Branch were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Fulton Branch. Three water quality samples were collected at sampling station US 51-30 on Fulton Branch during 2008 (Wetzel & Phillips, Editors, 2009). Chloride levels ranged from 12.3 mg/L to 28.1 mg/L. All water quality parameters met the General Use Water Quality Standards.

4.4 Sewer Creek

Sewer Creek is located in Washington and Marion Counties. The headwaters of Sewer Creek begin in Centralia, approximately one half mile west of US 51 and one half mile south of Illinois Route 161, from which it flows west for approximately 5.4 miles to its confluence with Grand Point Creek. Sewer Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day, 10 year low flow value for this stream is approximately 1.6 cfs (Singh et al. 1988, Maps updated 2002). A City of Centralia wastewater treatment plant outfall is located near South Cherry Street, approximately 0.46 mile west of existing US 51. A strong odor of chlorine was present during the 2008 assessment which may have been caused by a treatment plant upstream of the sample station.

Existing US 51 does not cross Sewer Creek; however, the proposed US 51 Build alignment crosses the creek just west of Centralia. Sewer Creek was assessed at Brookside Avenue in southwestern Centralia (US 51-29) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Sewer Creek consists of sand, silt, gravel, cobble, and boulder. Sewer Creek has a measured width of 11.5 feet wide and a depth of 1.6 feet. The riparian vegetation consists of trees and herbaceous vegetation. The surrounding land use is industrial, residential, field/pasture, and forest. The habitat assessment for Sewer Creek is classified as poor. (See Table 4-1)

Fish, mussels, and macroinvertebrates were sampled at Sewer Creek in 2008 (Wetzel and Phillips, Editors, 2008). Four species of fish were collected, dominated by the blackstripe topminnow at 86% of the total catch. No intolerant fish species were collected in Sewer Creek. The invertebrate mean taxa richness was 10.3; the mean family level IBI is 7.57, indicating the stream has “very poor” water quality with severe organic pollution likely. This was the only stream where there was a complete absence of EPT taxa. The EPT taxa represent macroinvertebrates sensitive to pollution. Mussel collection efforts yielded no live specimens (Wetzel & Phillips, Editors, 2009). The IDNR has not assessed Sewer Creek for diversity, integrity or biological significance.

Sewer Creek stream segment OJCB 19 is not supporting for aquatic life due to sedimentation/siltation and total phosphorus. This stream is listed as a 303(d) stream with sources of impairment, including municipal point source discharges, crop production, and urban runoff/storm sewers (IEPA, 2014). No historic water quality data were available on the IEPA STORET database for Sewer Creek. Three water quality samples were collected at one sampling location (US 51-29) on Sewer Creek during 2008 (Wetzel & Phillips, Editors, 2009). Chloride levels ranged from 65.8 mg/L to 111 mg/L; these concentrations meet the General Use Water Quality standard of 500 mg/L but are indicative of wastewater discharges. General Use Water Quality standards were achieved with the exception that one dissolved zinc concentration exceed the chronic water quality standard.

4.4.1 Unnamed Tributary to Sewer Creek

An unnamed Tributary to Sewer Creek is crossed by the US 51 Build alignment. This intermittent stream has adjacent land uses similar to Sewer Creek. There is no available information regarding water quality or biological characteristics for this stream.

4.5 Unnamed Tributary to Crooked Creek #1 and #2

Two unnamed tributaries to Crooked Creek (#1 and #2) are located within Clinton County. These streams begin north of Centralia and flow west to their confluence with Crooked Creek. Unnamed Tributary to Crooked Creek #1 in the project area is a perennial stream while Unnamed Tributary #2 is smaller and intermittent in nature; the 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 alignment crosses Unnamed Tributary to Crooked Creek #1 just north of Centralia. The Unnamed Tributary to Crooked Creek #1 was assessed at Joliff Bridge Road/County Road 2930E Bridge (US 51-57) during 2009 (Wetzel, Editor, 2010). Substrate in Unnamed Tributary to Crooked Creek #1 consists of silt, boulder, sand, and cobble. Unnamed Tributary to Crooked Creek #1 has a measured width of 12.1 feet wide and a depth of 1.0 feet. The riparian vegetation consists of trees and herbaceous vegetation. The surrounding land use is field/pasture, forest, and residential for Unnamed Tributary #1. Land uses are similar for the Unnamed Tributary #2 also.

The IDNR has not assessed these two unnamed tributaries to Crooked Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates, or mussels collections were conducted.

Designated stream uses of the unnamed tributaries to Crooked Creek were not assessed by the IEPA; no historic water quality data were available on the IEPA STORET database.

4.6 Crooked Creek

Crooked Creek is located within Marion and Clinton Counties, and is the largest stream flowing into the Kaskaskia River. Its headwaters begin northeast of Central City, Illinois from which it flows westerly 72.7 miles to its confluence with the Kaskaskia River. Crooked Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is 2 cubic feet per second (Singh et al. 1988, Maps updated 2002). A wastewater treatment plant outfall is located on Crooked Creek at Central City approximately 0.38 mile west of existing US 51.

Existing US 51 crosses Crooked Creek immediately north of Central City. The US 51 Build alignment also crosses Crooked Creek at one location west of Central City. Crooked Creek was assessed at three locations; 1) upstream of the existing US 51 bridge over Crooked Creek, at the northern edge of Central City (US 51-28); 2) at the Norton Road bridge over Crooked Creek, approximately 1.9 miles east of Central City (US 51-54); and downstream of the IL 161 bridge over Crooked Creek, approximately 3.9 miles west of Centralia (US 51-58). Substrate in Crooked Creek consists of gravel, sand, cobble, and silt. Crooked Creek has a measured width of 49.2 feet and 16.4 feet at US 51-54 and US 51-58, respectively. The riparian vegetation consists of trees. The surrounding land use is industrial, residential, field/pasture, and forest. The habitat assessment for Crooked Creek as described in Table 4-1 is poor (Wetzel & Phillips, Editors, 2009; Wetzel, Editor, 2010).

The number of fish species increased at downstream stations as the stream size increased. At station US 51-28, 24 species of fish were collected. Dominant fish species were gizzard shad and red shiner comprising 15% as well as bluntnose minnows and bullhead minnows comprising 14% of the catch, respectively. One intolerant fish, the spotted sucker, was present, comprising 0.06 % of the total catch. At station US 51-54, 14 species of fish were collected; green sunfish was the dominant species representing 36% of the catch. No intolerant fish were present. At station US 51-58, seven species of fish were collected. The dominant fish species was the largemouth bass at 71% of the catch. No intolerant fish were present at station US 51-58.

The benthic invertebrate Mean Family IBI score for stations US 51-28 was 6.87 indicating the stream has “poor” water quality with very substantial pollution likely.

Mussel collection efforts yielded eight species at US 51-28 and US 51-54. The live collections were dominated by the giant floater. Mussel collection efforts at US 51-58 yielded no live individuals. All mussel species collected at US 51-28 except the rock pocketbook are common and widely distributed. The rock pocketbook is not designated as threatened or endangered in Illinois but is considered a “Species in Greatest Need of Conservation” (IDNR 2005).

Crooked Creek has been assessed by IEPA (2014) and is found to be not supporting aquatic life use and is listed as a 303(d) stream. Impairments for Crooked Creek are manganese and phosphorus (Total). Sources of the impairments are listed by the IEPA as municipal point source discharges and crop production (crop land or dry land). No other uses other than aquatic life have been assessed by the IEPA for Crooked Creek. A portion of Crooked Creek just upstream of the proposed and existing US 51 crossings has been rated by the IDNR as C for diversity and B for integrity. Crooked Creek is not considered a biologically significant stream by the IDNR.

Nine water quality samples were collected at three sampling locations on Crooked Creek during 2008 (Wetzel & Phillips, Editors, 2008) and 2009 (Wetzel & Phillips, Editors, 2009; Wetzel, Editor, 2010). The dissolved zinc concentration in one sample exceeded the chronic General Use Water Quality standard. Chloride levels ranged from 18.9 mg/L to 81.9 mg/L at the three stations. All chloride values met the water quality standard of 500 mg/L. The dissolved oxygen level of 4.22 mg/L (at US 51-28) and 4.86 mg/L (at US 51-58) did not achieve the General Use Water Quality standard. These samples were collected in July 2008 and June 2009, respectively.

4.7 Turkey Creek

Turkey Creek is located in Marion County. Its headwaters commence northeast of Junction City and from which it flows southwesterly approximately 12.1 miles to its confluence with Crooked Creek. Turkey Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is 0.09 cfs at the Village of Odin, which is located approximately 6.9 miles upstream of existing US 51. (Singh et al. 1988, Maps updated 2002). A wastewater treatment plant outfall is located approximately 6.9 miles upstream of existing US 51 on the South Fork Turkey Creek at the Village of Odin, IL.

The existing US 51 corridor crosses Turkey Creek at three locations between Junction City and Central City, however, the proposed US 51 does not cross Turkey Creek. Turkey Creek was assessed downstream of the existing US 51 Bridge over Turkey Creek, approximately 2.9 miles north of Centralia, Illinois (US 51-27) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Turkey Creek consists of sand, silt, gravel, cobble, and boulder. Turkey Creek has a measured width of 26.2 feet and a depth of 4.9 feet. The riparian vegetation consists of trees; and, surrounding land use is field/pasture, residential, and forest. The habitat assessment as described in Table 4-1 is poor. (Wetzel & Phillips, Editors, 2009)

Fish, mussels, and macroinvertebrates were sampled at Turkey Creek in 2008. Fifteen species of fish were collected at station US 51-27, dominated by bluegill and green sunfish, which comprised 28.9% and 19.3 % of the catch. The Mean Family Level IBI was 6.64, indicating "fairly poor" water quality with substantial organic pollution likely. Mussel collection efforts at US 51-27 yielded three live species and one relic species present as dead shell material. The live mussel collection was dominated by the pondhorn at 81% of the collection. The pondhorn mussel has a spotty distribution in Illinois but where it is found it may be locally abundant. The IDNR has not assessed Turkey Creek for diversity, integrity, or biological significance.

Designated stream uses of Turkey Creek were not assessed by IEPA. No historic water quality data were available on the IEPA STORET database for Turkey Creek. Three water quality samples were collected at one sampling location (US 51-27) on Turkey Creek during 2008 (Wetzel & Phillips, Editors, 2009). The dissolved oxygen level of 4.72 mg/L did not achieve the General Use Water Quality standard in July 2008. Chloride levels ranged from 12.0 to 25.6 mg/L during the sampling period.

4.8 Crileys Branch

Crileys Branch is located in Clinton County. Its headwaters begin west of Junction City, Illinois from which it flows southwest approximately 2.3 miles to its confluence with Crooked Creek. Crileys Branch in the project area is depicted on the USGS topographic map as intermittent stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Crileys Branch at one location west of Junction City. Crileys Branch was assessed south of Felton Road, just west of Joliff Bridge Road (US 51-26) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Crileys Branch consists of silt and sand. Crileys Branch has a measured width of 2.3 feet and a depth of 0.7 feet. The riparian vegetation consists of grasses, trees, and herbaceous vegetation. The surrounding land use is field/pasture, forest, and row crop agriculture.

The IDNR has not assessed Crileys Branch for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates, or mussels were collected in Criley's Branch.

Designated stream uses of Crileys Branch were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Crileys Branch. No water quality samples were collected on Crileys Branch.

4.9 Unnamed Tributary to Prairie Creek

Unnamed Tributary to Prairie Creek is located within Marion County. Its headwaters begin southeast of Sandoval, Illinois from which it flows west approximately 1.3 miles to its confluence with Prairie Creek. Unnamed Tributary to Prairie Creek in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002). .

The proposed US 51 corridor crosses Unnamed Tributary to Prairie Creek at one location just southeast of Sandoval. The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is row crop agricultural and residential.

The IDNR has not assessed Unnamed Tributary to Prairie Creek for diversity, integrity or biological significance. No fish, macroinvertebrates, or mussels were collected.

Designated stream uses of the Unnamed Tributary to Prairie Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Prairie Creek. No water quality samples were collected on Unnamed Tributary to Prairie Creek.

4.10 Prairie Creek

Prairie Creek is located in Marion and Clinton Counties. Its headwaters begin northeast of Sandoval, Illinois from which it flows southwesterly for approximately 21.9 miles to its confluence with Lost Creek. Prairie Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is 0.07 cubic feet per second at Sandoval, IL (Singh et al. 1988, Maps updated 2002). The Sandoval wastewater plant outfall is located on Prairie Creek at existing US 51.

The proposed US 51 corridor crosses Prairie Creek at two locations; 1) southwest of Sandoval, and 2) just outside the southeast boundary of Sandoval. Field surveys were conducted on Prairie Creek at the existing old US 51 bridge over Prairie Creek, at the southeast corner of the Sandoval municipal boundary (US 51-25) (Wetzel & Phillips, Editors, 2009) and at Barton Road Bridge southwest of Sandoval (US 51-53) in 2009 (Wetzel, Editor, 2010). Substrate in Prairie Creek consists of sand, silt, and gravel. The width of Prairie Creek varies from 9.9 to 13.1 feet at the two sites with a depth of 1.6 to 2.0 feet. The surrounding land use is industrial, residential, field/pasture, agricultural, and forest. The habitat assessment for Prairie Creek is classified as poor. (See Table 4-1) (Wetzel, Editor, 2010).

Fish, mussels, and macroinvertebrates were sampled at Prairie Creek (INHS station US 51-53) in 2009. Eleven species of fish from Prairie Creek were collected. The dominant fish species was the redfin shiner at 47% of the catch. No intolerant fish species were collected in Prairie Creek (Wetzel, Editor 2010). The IDNR has not assessed Prairie Creek for diversity, integrity or biological significance.

Mussel collection efforts yielded three live species, the pondhorn, lilliput and giant floater. According to the INHS, the Mean Family Level IBI was 8.26 at station US 51-27, indication of a "very poor" water quality with substantial organic pollution likely. The stream is not rated under the IEPA BSC System.

Prairie Creek has been assessed by IEPA (2014) and is found to be not supporting aquatic life use. IEPA has included this stream on the 303(d) list of impaired waterways. Impairments for Prairie Creek are listed as dissolved oxygen, and phosphorus (Total). Sources of the impairments are listed by the IEPA as loss of riparian habitat, streambank modifications/ destabilization, livestock (grazing or feeding operations), agriculture, pesticide application, and urban runoff/storm sewers. No other uses other than aquatic life have been assessed by the IEPA for Prairie Creek.

No historic water quality data were available on the IEPA STORET database for Prairie Creek. Three water quality samples were collected at one location (US 51-53) on Prairie Creek during 2009 (Wetzel, Editor 2010). The dissolved zinc concentration for one sample exceeded the chronic and acute water quality standard; the dissolved oxygen concentration of 4.41 mg/L in June 2009 did not meet General Use Water Quality standards. All other water quality parameters met the General Use Water Quality Standard.

4.11 Unnamed Tributary to Lost Creek #1 and #2

Two unnamed tributaries to Lost Creek are located within Marion County. Both commence north of Sandoval, Illinois and flow northwest approximately 0.7 miles to their confluence with Lost Creek. Both tributaries are intermittent streams with a 7-day, 10-year low flow of zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 crosses Unnamed Tributary to Lost Creek #1 at one location just northwest of Sandoval. The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is row crop agricultural.

The IDNR has not assessed these tributaries to Lost Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected.

The designated stream uses of the unnamed tributaries to Lost Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database; no water quality samples were collected on these unnamed tributaries to Lost Creek.

4.12 Lost Creek

Lost Creek is located in Marion and Clinton Counties. Its headwaters begin northeast of Sandoval, Illinois from which it flows southwesterly for 25.8 miles to its confluence with Crooked Creek. Lost Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is not assigned by the ISWS (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Lost Creek at one location north of Sandoval. Lost Creek was assessed at the existing US 51 Bridge over Lost Creek, 2.2 miles northeast of Sandoval (US 51-24) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Lost Creek consists of sand, silt, and gravel. Lost Creek has a measured width of 11.5 feet and a depth of 3.3 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is forest and agricultural. The habitat assessment for Lost Creek is classified as poor (See Table 4-1).

The IDNR designates Lost Creek within the project area as C for diversity and integrity. Lost Creek is also rated by the IDNR as a Biologically Significant Stream (BSS) within the proposed project corridor. Thirty species of fish were collected by the IDNR in 2002 and 2007 with an Index of Biotic Integrity of 47 and 40, respectively, yielding a rating of *Good.* No threatened, endangered, or intolerant fish species were collected in Lost Creek during 2009 through 2012 surveys. The designation as a BSS is based upon comparisons of at least two different groups of organisms, such as fish and mussels to those groups found in the best quality streams of similar size in the region. If the stream is of the best quality for its size in its region, the creek may be designated as a BSS. The BSS classification applies for the entire stream segment for Lost Creek including US 51-24.

Lost Creek has been assessed by IEPA (2014) and is found to be not supporting aquatic life use. This stream as been identified as a 303(d) stream by IEPA due to impairments of dissolved oxygen, sedimentation/siltation, phosphorus (Total), and aquatic algae. Sources of the impairments are listed by the IEPA as loss of riparian habitat, crop production (crop land or dry land), and agriculture. No other uses other than aquatic life have been assessed by the IEPA for Lost Creek. No historic water quality data were available on the IEPA STORET database for Lost Creek. No water quality samples were collected on Lost Creek by the INHS.

4.13 Coles Creek

Coles Creek is located within Marion and Clinton Counties. Its headwaters begin approximately 3 miles north of Sandoval, Illinois and 0.25 miles west of existing US 51. Coles Creek flows westerly approximately 8.7 miles to its confluence with Carlyle Lake. Coles Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002). South Shore State Park at Carlyle Lake is near the confluence of Cole Creek, 8.7 miles west of existing US 51.

The proposed US 51 corridor crosses Coles Creek at one location north of Sandoval. The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is row crop agricultural and residential.

The IDNR has not assessed Coles Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertabrates or mussels were collected from Coles creek.

Designated stream uses of Coles Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Coles Creek. No water quality samples were collected on Coles Creek.

4.14 Unnamed Tributary to East Fork Kaskaskia River #1 and #2

There are two unnamed tributaries to East Fork Kaskaskia River crossed by the US 51 Build alternative. One begins northeast of Junction City, Illinois, flowing southerly approximately 4.3 miles to its confluence with the East Fork of the Kaskaskia River. The second tributary originates south of Patoka, flowing 1.5 miles before merging with the East Fork Kaskaskia River. Both are intermittent streams with a 7-day, 10-year low flow of zero (Singh et al. 1988, Maps updated 2002).

The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is row crop agriculture and residential.

The IDNR has not assessed these tributaries to East Fork Kaskaskia River for diversity, integrity or biological significance. No fish, aquatic macroinvertabrates or mussels were collected.

Designated stream uses of the unnamed tributaries (#1 and #2) to East Fork Kaskaskia River were not assessed by the IEPA. No water quality data are available for these tributaries.

4.15 East Fork Kaskaskia River

The East Fork Kaskaskia River is located in Marion and Clinton Counties. Its headwaters begin west of Alma, Illinois from which it flows westerly for 43.3 miles to its confluence with the Kaskaskia River. The East Fork Kaskaskia River in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is not given by the ISWS (Singh et al. 1988, Maps updated 2002). There are no dams or state parks within the East Fork Kaskaskia River watershed; one wastewater treatment plant is located approximately 20 miles upstream of the project area.

The East Fork Kaskaskia River was assessed at the existing US 51 Bridge over the East Fork Kaskaskia River, 4.5 miles south of Patoka (US 51-22) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in the East Fork Kaskaskia River consists of sand, silt, and gravel. The East Fork Kaskaskia River has a measured width of 14.7 feet and a depth of 4.9 feet. The riparian vegetation consists of trees and herbaceous vegetation. The surrounding land use is forest and agricultural. The habitat assessment for the East Fork Kaskaskia River is classified as poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish, mussels, and macroinvertebrates were sampled at the East Fork Kaskaskia River in 2008. Twenty-one species of fish were collected at INHS station US 51-22 dominated by the redfin shiner at 32% of the collection. No threatened or endangered fish species were collected in the East Fork Kaskaskia River and one intolerant species (spotted sucker) was collected. Benthic invertebrates collected at the East Fork Kaskaskia River had a mean taxa richness of 12.3 and the mean family IBI score was 4.8 rating as *Good.* The stream supports a diversity of species which is associated with good water quality and habitat. Mussel collection efforts yielded nine species, of which eight were live. The dominant mussel was the fatmucket which comprised 58% of the collection. None of the mussel species are protected or intolerant species. The IDNR has assessed the East Fork Kaskaskia River within the project area as C for diversity and integrity.

The East Fork Kaskaskia River segment OK-02 has been assessed by IEPA (2014) and is found to be not supporting aquatic life use. Segment OK-02 is listed on the 303(d) list as impaired; however, segment OK-01 where US 51 crosses is not. Impairments for the East Fork Kaskaskia River (OK-01) are listed as dissolved oxygen, and phosphorus (Total). Sources of the impairments are listed by the IEPA as source unknown and livestock (grazing or feeding operations). No other uses other than aquatic life and primary contact have been assessed by the IEPA for the East Fork Kaskaskia River. Segment OK-01 has been designated as supporting aquatic life and not supporting primary contact. This segment (OK-01) is downstream of the stream segment (OK-02) where dissolved oxygen problems have been identified.

Limited water quality data from 2005 were available on the IEPA STORET database for the East Fork Kaskaskia River. All water quality parameters met the general use water quality standard throughout the sampling period. Three water quality samples were collected at one sampling location (US 51-22) on the East Fork Kaskaskia River during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard throughout the sampling period.

4.16 Unnamed Tributaries to Louse Run (#1, #2, and #3)

The unnamed tributaries to Louse Run are located within Marion County. Headwaters for these streams occur southeast, south, and west of Patoka. All three unnamed tributaries to Louse Run are depicted on the USGS topographic map as intermittent streams. The 7-day, 10-year low flow value for these streams is zero (Singh et al. 1988, Maps updated 2002)

The proposed US 51 corridor crosses Unnamed Tributary to Louse Run #1 at one location, south of Patoka. The Unnamed Tributary to Louse Run #1 was the only tributary assessed (US 51-21) (Wetzel & Phillips, Editors, 2009). The substrate of Unnamed Tributary to Louse Run #1 consists of sand, silt, and gravel with a measured width of 7.5 feet and a depth of 2.1 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is row crop agriculture. The habitat assessment for the Unnamed Tributary to Louse Run #1 is classified as poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

No fish or mussel collections were made by the INHS. Macroinvertebrates were sampled at the Unnamed Tributary to Louse Run #1 in 2008. A mean taxa richness for macroinvertebrates was 7.3 and the mean family IBI score was 6.67, rating as *Poor*. The IDNR has not assessed any of the unnamed tributaries to Louse Run for diversity, integrity or biological significance.

Designated stream uses of the three unnamed tributaries to Louse Run were not assessed by the IEPA. No historic water quality data were available for these streams. One water quality sample was collected at one sample location (US 51-21) on Unnamed Tributary to Louse Run #1 during

2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard.

4.17 Louse Run

Louse Run is located in Marion and Clinton Counties. Its headwaters begin east of Patoka, Illinois from which it flows west for 12.1 miles to its confluence with the North Fork Kaskaskia River. Louse Run in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002). There is one permitted industrial water outfall near the headwaters of Louse Run approximately 6 miles upstream of existing US 51.

The proposed US 51 corridor crosses Louse Run at one location south of Patoka. Louse Run has been assessed at two locations; 1) upstream of the existing US 51 bridge over Louse Run (US 51-20) during 2008 (Wetzel & Phillips, Editors, 2009); and 2) at the Farthing Road bridge over Louse Run (US 51-51) during 2009 (Wetzel, Editor 2010). Substrate in Louse Run consists of sand, silt, and gravel at US 51-20 and silt and sand at US 51-51. Louse Run has a measured width of 9.9 and 4.6 feet and a depth of 2.6 and 0.7 feet at US 51-20 and US 51-51 respectively. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is forest, field/pasture, livestock, and agricultural. The habitat assessment for Louse Run is classified as poor (See Table 4-1) (Wetzel, Editor, 2010).

Fish, mussels, and macroinvertebrates were only sampled at INHS station US 51-51 Louse Run in 2009. Five species of fish were collected dominated by the slough darter at 43% of the collection. No threatened, endangered, or intolerant fish species were collected in Louse Run. The macroinvertebrate mean taxa richness was 10.7 at Louse Run with a mean family IBI score of 6.89. Mussel collection efforts yielded one live species, the pondhorn. The IDNR has not assessed Louse Run for diversity, integrity or biological significance.

Designated stream uses of Louse Run were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Louse Run. Three water quality samples were collected at one sampling location on Louse Run during 2009 (Wetzel, Editor, 2010). The dissolved oxygen levels were below the General Use Water Quality standard for spawning periods in the June and August sample. The dissolved copper concentration for one sample exceeded the chronic water quality standard. The dissolved zinc concentration exceeded the chronic water quality standard in two samples. All other water quality standards were achieved.

4.18 Deer Creek

Deer creek is located within Marion County. Its headwaters begin northwest of Patoka, Illinois from which it flows west for approximately 5.36 miles to its confluence with the North Fork Kaskaskia River. Deer Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Deer Creek at one location just outside the northeast corner of Patoka. Deer Creek was assessed downstream of the existing US 51 bridge over Deer Creek (US 51-19) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Deer Creek consists of sand, silt, and gravel. Deer Creek has a measured width of 11.5 feet and a depth of 5.0 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is forest. The habitat assessment for Deer Creek is classified as poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish and macroinvertebrates were sampled at Deer Creek in 2008. Seven species of fish were collected and the pirate perch was the most abundant species at 25% of the collection. All fish species are intermediate and common inhabitants in south-central Illinois creeks. No threatened, endangered, or intolerant fish species were collected in Deer Creek. Deer Creek macroinvertebrate collections yielded a mean taxa richness of 14.0 and the mean family IBI score was 6.63 which rates as *Poor*. The IDNR has not assessed Deer Creek for diversity, integrity or biological significance.

Designated stream uses of Deer Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Deer Creek. One water quality sample was collected at one sampling location (US 51-19) on Deer Creek during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard.

4.19 North Fork Kaskaskia River

The North Fork Kaskaskia River is located in Marion and Fayette Counties. Its headwaters begin northwest of Patoka, Illinois from which it flows southwest for 27.1 miles to its confluence with the Kaskaskia River. The North Fork Kaskaskia River in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses the North Fork Kaskaskia River at one location north of Patoka. The North Fork Kaskaskia River was assessed upstream of the existing US 51 bridge over the North Fork Kaskaskia River (US 51-18) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in the North Fork Kaskaskia River consists of sand, silt, and gravel. The North Fork Kaskaskia River has a measured width of 55.8 feet and a depth of 9.9 feet. The riparian vegetation consists of trees and herbaceous vegetation. The surrounding land use is forest, agricultural, field/pasture, and residential. The habitat assessment for the North Fork Kaskaskia River is assessed as poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish and mussels were sampled at station US 51-18 on the North Fork Kaskaskia River in 2008. Twelve species of fish were collected with largemouth bass as the most abundant species comprising 36% of the collection. No threatened, endangered, or intolerant fish species were collected in the North Fork Kaskaskia River. Mussel collection efforts yielded four species, of which two were live. The two mussels collected on the North Fork Kaskaskia were the giant floater which comprised 97% of the catch and the white heelsplitter, both common and widespread species in Illinois. The IDNR has assessed the North Fork Kaskaskia River within the project area as C for diversity and integrity. The IDNR has not designated the North Fork Kaskaskia River as a biologically significant stream.

US 51 crosses the OKA-01 segment just west of where stream segment OKA-02 starts. The North Fork Kaskaskia River, segment IL_OKA-01, has been assessed by IEPA (2014) and is found to be not supporting aquatic life use. This stream segment is listed on the 303(d) list for impairments of atrazine, terbufos and phosphorus (Total).

The North Fork Kaskaskia River, segment IL_OKA-02, has been assessed by IEPA and is found to be not supporting aquatic life use. Causes for segment IL_OKA-02 of the North Fork Kaskaskia River to be impaired include manganese, dissolved oxygen, pH, and phosphorus (Total). This segment appears on the 303(d) list for only phosphorus (Total). Sources of the impairments are listed by the IEPA as impacts from abandoned mine lands (Inactive), surface mining, source unknown, and crop production (crop land or dry land). No other uses other than aquatic life have been assessed by the IEPA for segment IL_OKA-02 of the N Fork Kaskaskia River. Limited historic water quality data were available on the IEPA STORET database for the North Fork Kaskaskia River. Three water quality samples were collected at one sampling location (US 51-18) on the North Fork Kaskaskia River during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard.

4.20 Unnamed Tributary to North Fork Kaskaskia River

Unnamed Tributary to North Fork Kaskaskia River is located in Marion County. Its headwaters begin just west of Vernon, Illinois from which it flows southwest for approximately 3 miles to its confluence with the North Fork Kaskaskia River.

Existing US 51 crosses Unnamed Tributary to North Fork Kaskaskia River at one location south of Vernon. The proposed US 51 corridor crosses Unnamed Tributary to North Fork Kaskaskia River at one location, south of Vernon. The Unnamed Tributary to North Fork Kaskaskia River was assessed downstream of the existing US 51 bridge over the stream (US 51-17) (Wetzel & Phillips, Editors, 2009). Substrate in Unnamed Tributary to North Fork Kaskaskia River consists of silt, clay, and boulders. The stream has a measured width of 4.9 feet and a depth of 1.0 feet with riparian vegetation consisting of grasses. The surrounding land use is industrial and row crop agricultural. The habitat assessment for Unnamed Tributary to North Fork Kaskaskia River poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed the Unnamed Tributary to North Fork Kaskaskia River for its biological diversity integrity or significance. No fish, aquatic macroinvertebrates or mussels were collected.

Designated stream uses of the Unnamed Tributary to North Fork Kaskaskia River were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database and no water quality samples were collected.

4.21 Flat Creek

Flat creek is located in Marion and Fayette Counties. Its headwaters begin northeast of Vernon, Illinois from which it flows west for 17.4 miles to its confluence with Wildcat Ditch. Flat Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Flat Creek at one location north of Vernon. Flat Creek was assessed downstream of the existing US 51 bridge over Flat Creek (US 51-16) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Flat Creek consists of sand, silt, clay, and gravel. Flat Creek has a measure width of 23 feet and a depth of 1.5 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is forest and agricultural. The aquatic habitat for Flat Creek is classified as poor (Wetzel & Phillips, Editors, 2009).

Fish and mussels were not sampled by the INHS but macroinvertebrates were sampled at Flat Creek in 2008. The INHS found the mean taxa richness was 9.3 and the mean family IBI was 6.97 or *Poor* for Flat Creek. The IDNR has not assessed Flat Creek for diversity, integrity or biological significance.

Designated stream uses of Flat Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Flat Creek. One water quality sample was collected at one sampling location (US 51-16) on Flat Creek during 2008 (Wetzel & Phillips, Editors 2009). All water quality parameters met the General Use Water Quality standard.

4.22 Unnamed Tributary to Flat Creek

Unnamed Tributary to Flat Creek is located in Marion and Fayette Counties. Its headwaters begin north of Vernon, Illinois from which it flows south for approximately 0.8 miles to its confluence with Flat Creek. Unnamed Tributary to Flat Creek in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Unnamed Tributary to Flat Creek at one location north of Vernon. The riparian vegetation consists of trees. The surrounding land use is forest, residential, and agricultural.

The IDNR has not assessed Unnamed Tributary to Flat Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from the creek.

Designated stream uses of the Unnamed Tributary to Flat Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database and no water quality samples were collected.

4.23 Steve Creek

Steve Creek is located in Fayette County. Its headwaters begin north of Vernon, Illinois from which it flows west for approximately 5.95 miles to its confluence with Wildcat Ditch. Steve Creek is considered an intermittent stream.

The proposed US 51 corridor crosses Steve Creek at one location north of Vernon. Steve Creek was assessed for habitat quality downstream of the existing US 51 bridge over Steve Creek (US 51-15) (Wetzel & Phillips, Editors, 2009). Substrate in Steve Creek consists of sand, silt, and clay. Steve Creek has a measured width of 4.9 feet and a depth of 1.0 feet. The riparian vegetation consists of grasses. The surrounding land use is row crop agricultural. The habitat assessment for Steve Creek is poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed Steve Creek for biological integrity, diversity or significance. No fish, aquatic macroinvertebrates or mussels were collected from Steve Creek

Designated stream uses of Steve Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Steve Creek. No water quality samples were collected on Steve Creek.

4.24 Cassar Creek

Cassar Creek is located in Fayette County. Its headwaters begin southwest of Shobonier, Illinois from which it flows 11.1 miles to its confluence with Wildcat Ditch. Cassar Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).
The proposed US 51 corridor crosses Cassar Creek at one location south of Shobonier. Cassar Creek was assessed downstream of the existing US 51 bridge over Cassar Creek (US 51-14) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Cassar Creek consists of sand, silt, gravel, and clay. Cassar Creek has a measure width of 13.1 feet and a depth of 2.3 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is agricultural, and residential. The habitat assessment for Cassar Creek is poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish, mussels, and macroinvertebrates were sampled by the INHS at Cassar Creek in 2008. Seven species of fish were collected with the most abundant species (creek chub) comprising 29% of the collection. No threatened, endangered, or intolerant fish species were collected in Cassar Creek. Cassar creek macroinvertebrates yielded a mean taxa richness of 9.9 and a mean family IBI of 6.81 or *Poor.* Mussel collection efforts yielded no live species only one dead. The IDNR has not assessed Cassar Creek for diversity, integrity or biological significance.

Designated stream uses of Cassar Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Cassar Creek. Two water quality samples were collected by the INHS at one sampling location (US 51-14) on Cassar Creek during 2008 (Wetzel & Phillips, Editors, 2009). The dissolved oxygen level was below the General Use Water Quality standard for spawning periods in the July sample.

4.25 Unnamed Tributary to Richland Creek (#1 and #2)

There are two unnamed tributaries to Richland Creek crossed by proposed US 51 alignments. The headwaters for these streams begin north of Shobonier, Illinois and flow northwest to their confluence with Richland Creek. Both streams are depicted on the USGS topographic map as intermittent; the 7-day, 10-year low flow is zero (Singh et al. 1988, Maps updated 2002.

The proposed US 51 corridor crosses these tributaries to Richland Creeknorth of Shobonier. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is agricultural, forest, and residential.

The IDNR has not assessed these unnamed tributaries to Richland Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected.

IEPA has not assessed the designated stream uses of these tributaries to Richland Creek. No water quality data were available for these tributaries.

4.26 Richland Creek

Richland Creek is located in Fayette County. Its headwaters begin northeast of Shobonier, Illinois and south of Vandalia, Illinois, from which it flows west for 7.9 miles to its confluence with the Kaskaskia River. Richland Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Richland Creek at one location north of Shobonier and south of Vandalia. Richland Creek was assessed downstream of the existing US 51 bridge over Richland Creek (US 51-13) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Richland Creek consists of sand, silt, and gravel. Richland Creek has a measured width of 14.8 feet and a depth of 2.0 feet. The riparian vegetation consists of trees and grasses. The surrounding land use is agricultural, forest, and residential.

The IDNR has not assessed Richland Creek for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected in Richland Creek.

Designated stream uses of Richland Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Richland Creek. Three water quality samples were collected at one sampling location (US 51-13) on Richland Creek during 2008 (Wetzel & Phillips, Editors 2009). All water quality parameters met the General Use Water Quality standard.

4.27 Hickory Creek

Hickory Creek is located in Fayette County. Its headwaters begin northeast of Shobonier, Illinois and south of Vandalia, Illinois, from which it flows southwest for 24.3 miles to its confluence with the Kaskaskia River. Hickory Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

Existing US 51 crosses Hickory Creek at one location north of Shobonier and south of Vandalia. Hickory Creek was assessed at this crossing (US 51-12) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Hickory Creek consists of sand, silt, and clay. Hickory Creek has a measured width of 42.7 feet and a depth of 9.9 feet. The riparian vegetation consists of trees. The surrounding land use is forest and row crop agriculture. The habitat assessment for Hickory Creek is poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish, mussels, and macroinvertebrates were surveyed at station US 51-12, Hickory Creek in 2008. Nineteen species of fish were collected with red shiner comprising 43% of the collection. No threatened or endangered fish were collected and one intolerant species the slenderhead darter was collected in Hickory Creek. The fish fauna present is not indicative of a high quality habitat. Macroinvertebrates collected by the INHS in Hickory Creek yielded a mean taxa richness of 7.5 with a mean family level IBI of 6.78 (*Poor*). Mussel collection efforts yielded no live species and one relic species, the giant floater. The IDNR has assessed Hickory Creek as B for Diversity and C for integrity.

Hickory Creek has been assessed by IEPA (2014) and is found to be fully supporting aquatic life use. Impairments for Hickory Creek are listed as fecal coliform bacteria. Sources of the impairments are listed by the IEPA as unknown sources. No other uses other than aquatic life have been assessed by the IEPA for Hickory Creek. No water quality samples were collected on Hickory Creek.

4.28 Kaskaskia River

The Kaskaskia River is located in Randolph, St. Clair, Washington, Clinton, Bond, Fayette, Shelby, Moultrie, Coles, Douglas, Piatt, and Champaign, County. Its headwaters begin southwest of Tolono, Illinois from which it flows southwest for 279.9 miles to its confluence with the Mississippi River. The Kaskaskia River in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream varies by location from 24 cubic feet per second (cfs) several miles upstream of Ash Creek to 28 cfs several miles downstream of Richland Creek confluence (Singh et al. 1988, Maps updated 2002). There are dams, wastewater plants and parks within the study area as shown on Figure 1-1.

Existing US 51 crosses the Kaskaskia River at one location, just outside the southeast corner of Vandalia. The proposed US 51 Build alignment crosses the Kaskaskia River at one location south of Vandalia. The Kaskaskia River was assessed at three locations; 1) at County Road 2000N over the Kaskaskia River, 4 miles north of Vandalia (US 51-09) (Wetzel & Phillips, Editors, 2009); 2) at the public boat ramp at the southeastern edge of Vandalia (US 51-46) (Wetzel, Editor, 2010); 3) approximately 2.8 miles south of Vandalia (US 51-60) (Wetzel, Editor, 2010). Substrate in the Kaskaskia River consists of sand, silt, and clay. The Kaskaskia River is approximately 13 feet deep and has a measured width of 98.5 feet, 82.1 feet, and 141.0 feet at US 51-09, US-46, and US 51-60, respectively. The riparian vegetation consists of trees and grasses. The surrounding land use is forest row crop agriculture, residential, urban, and field/pasture. The habitat assessment for the Kaskaskia River is poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009; Wetzel, Editor, 2010).

The Kaskaskia River was sampled for fish and in 2008; fish, mussels, and macroinvertebrates were sampled in 2009 and 2010. Eighteen, 11, and 20 species of fish were collected at US 51-09, US 51-46, and US 51-60, respectively. A mean of 15.3 and 5.0 benthic invertebrate taxa per sample were collected at US 51-46 and US 51-60, respectively. One species (western sand darter) of intolerant fish was collected in the Kaskaskia River at US 51-46 and US 51-60. The western sand darter is also listed as a state endangered species in Illinois (IL Endangered Species Board 2011).

The mean family level IBI for macroinvertebrates is 5.36 and 3.09 at US 51-46 and US 51-60 respectively, representing a “fair” and “excellent” rating for diversity and low organic pollution.. Mussel collection efforts yielded 11 species at US 51-60, of which five were living species, the remaining six species being represented by empty shells only. Mussel collection efforts at US 51-09 and US 51-46 yielded no live individuals. The IDNR has assessed the Kaskaskia River as D for Diversity and C for integrity.

Segment IL-O-08 of the Kaskaskia River has been assessed by IEPA (2014) and is listed on the 303(d) list of impaired streams as it does not support any of the following stream uses: aquatic life use, fish consumption, public and food processing water supplies, primary contact, secondary contact, and aesthetic quality. Impairments for this segment of the Kaskaskia River are listed by the IEPA as dissolved oxygen, total suspended solids (TSS), pH, phosphorus (Total), mercury, manganese, and fecal coliform bacteria. Sources of the impairments are listed by the IEPA as: source unknown, livestock (grazing or feeding operations), and atmospheric deposition (Toxics).

Limited historic water quality data were available on the IEPA STORET database for the Kaskaskia River. Seven water quality samples were collected at three sampling locations (US 51-09, US 51-46, and US 51-60) on the Kaskaskia River during 2008 (Wetzel & Phillips, Editors, 2009), 2009 (Wetzel, Editor, 2010) and 2010 (Wetzel, Editor, 2010). The dissolved zinc concentration in one sample exceeded the chronic General Use Water Quality standards. All other water quality parameters met the General Use Water Quality standard.

4.29 Fish Lake Ditch

Fish Lake Ditch is located in Fayette County with headwaters originating southwest of Vandalia, Illinois from which it flows south for approximately 5.3 miles to its confluence with the Kaskaskia River. Fish Lake Ditch in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 Build alternative crosses Fish Lake Ditch at one location, southwest of Vandalia. Fish Lake Ditch was assessed at County Road 750 East over Fish Lake Ditch, approximately 2.8 miles southwest of Vandalia (US 51-49) during 2009 (Wetzel, Editor, 2010). Fish Lake Ditch is channelized with substrate consisting of silt and sand. Fish Lake Ditch at the INHS sample station had a measured width of 0.32 feet and a depth of 0.16 feet. The riparian vegetation consisted of grasses and trees. The surrounding land use is forest and row crop agriculture.

The IDNR has not rated Fish Lake Ditch for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from Fish Lake Ditch.

Designated stream uses of Fish Lake Ditch were not assessed by the IEPA; no water quality data were available.

4.30 Unnamed Tributary to Raccoon Creek #1

Unnamed Tributary of Raccoon Creek #1 is located in Fayette County with headwaters beginning southwest of Vandalia, Illinois. The stream flows west for 2.3 miles to its confluence with Raccoon Creek. Unnamed Tributary of Raccoon Creek #1 in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 Build alternative crosses Unnamed Tributary to Raccoon Creek #1 at one location southwest of Vandalia. This stream was assessed at County Road 1375 North over Unnamed Tributary to Raccoon Creek #1 (US 51-48) (Wetzel, Editor, 2010). Stream characteristics include substrate of silt and sand and a width of 1.0 feet and a depth of 0.32 feet. The riparian vegetation consisted of grasses and herbaceous vegetation. The surrounding land use is row crop agriculture.

The IDNR has not rated Unnamed Tributary to Raccoon Creek #1 for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from the Unnamed Tributary to Raccoon Creek #1.

Designated stream uses of the Unnamed Tributary to Raccoon Creek #1 were not assessed by the IEPA. No historic water quality data were available.

4.31 Raccoon Creek

Raccoon Creek is located in Fayette County. Its headwaters begin in southwestern Vandalia, Illinois from which it flows west 10.5 miles to its confluence with Hurricane Creek. Raccoon Creek in the project area is depicted on the USGS topographic map as a perennial flow stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 Build alignment crosses Raccoon Creek at one location southwest of Vandalia. Raccoon Creek was assessed at County Road 1375 North over Raccoon Creek (US

51-47) (Wetzel, Editor, 2010). Substrate in Raccoon Creek consists of silt, sand, clay, and gravel. Raccoon Creek at the INHS survey site is a first order stream with a measured width of 2.6 feet and a depth of 0.33 feet. The riparian vegetation consisted of grasses and trees. The surrounding land use is row crop agriculture. The habitat assessment for Raccoon Creek is poor (See Table 4-1) (Wetzel, Editor, 2010).

Fish and macroinvertebrates were sampled by the INHS at Raccoon Creek in 2009. Two species of fish the mosquito fish at 83% of the collection and the largemouth bass at 17% were collected on Raccoon Creek. No threatened or endangered, and one intolerant fish species were collected in Raccoon Creek. Benthic invertebrates were also collected with a mean benthic invertebrate taxa of 11.0 and a mean family level IBI of 6.79 from Raccoon Creek (Wetzel, Editor, 2010). All samples achieved the General Use Water Quality standard.

Designated stream uses of Raccoon Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Raccoon Creek. Three water quality samples were collected at one sampling location (US 51-47) on Raccoon Creek during 2009 (Wetzel, Editor, 2010).

4.32 Unnamed Tributary to Raccoon Creek #2

Unnamed Tributary to Raccoon Creek #2 is located in Fayette County. Its headwaters begin in southwest Vandalia, Illinois from which it flows southwest approximately 4.0 miles to its confluence with Raccoon Creek. Unnamed Tributary to Raccoon Creek #2 in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day, 10-year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 Build alignment crosses Unnamed Tributary to Raccoon Creek #2 at one location southwest of Vandalia. The Unnamed Tributary to Raccoon Creek #2 was assessed at two locations; 1) at County Road 600 East over (US 51-45) and 2) at the Illinois Route 140 bridge (US 51-59) during 2009 (Wetzel, Editor, 2010). Substrate in Unnamed Tributary to Raccoon Creek #2 consists of silt, sand, and gravel. The stream has a measured width of 0.0 feet and 6.0 feet and a depth of 0.0 feet and 2.0 feet at US 51-45 and US 51-59, respectively. The riparian vegetation consisted of grasses, trees, and herbaceous vegetation. The surrounding land use is row crop agriculture, field/pasture, forest, livestock, and agricultural. The habitat assessment is poor (See Table 4-1) (Wetzel, Editor, 2010).

Fish, mussels, and macroinvertebrates were sampled in Unnamed Tributary to Raccoon Creek #2 at US 51-59 in 2009. Sixteen species of fish were collected, dominated by bluegill at 30 % of the collection Unnamed Tributary to Raccoon Creek #2. A mean of 17.3 benthic invertebrate taxa per sample were collected at US 51-59 and a mean family level IBI was 6.37 for Unnamed Tributary to Raccoon Creek #2. No threatened or endangered and one intolerant fish species were collected in Unnamed Tributary to Raccoon Creek #2. Mussel collection efforts at Unnamed Tributary to Raccoon Creek #2 yielded one live species, the giant floater, which is common and widespread in Illinois. The IDNR has not rated Unnamed Tributary to Raccoon Creek #2 for diversity, integrity, or biological significance.

Designated stream uses of the Unnamed Tributary to Raccoon Creek #2 were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Raccoon Creek #2. Three water quality samples were collected at one sampling location (US 51-59) during 2009 (Wetzel, Editor, 2010). All water quality parameters met the General Use Water Quality standard.

4.33 Unnamed Tributary to Raccoon Creek #3

The Unnamed Tributary to Raccoon Creek #3 is located in Fayette County. Its headwaters begin in west of Vandalia, Illinois from which it flows southwest approximately 1.8 miles to its confluence with Unnamed Tributary to Raccoon Creek #2. Unnamed Tributary to Raccoon Creek #3 in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day, 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Unnamed Tributary to Raccoon Creek #3 at one location west of Vandalia. The Unnamed Tributary to Raccoon Creek #3 was assessed at County Road 1700 North (US 51-42) during 2009 (Wetzel, Editor, 2010). Substrate in the stream consisted of silt and sand. Unnamed Tributary to Raccoon Creek #3 had a measured width of 0.0 feet and a depth of 0.0 feet during the survey. The riparian vegetation consisted of grasses and small trees. The surrounding land use is row crop agriculture.

No fish, aquatic macroinvertebrates, or mussels were collected from the Unnamed Tributary to Raccoon Creek #3. The IDNR has not rated this tributary for diversity, integrity, or biological significance.

Designated stream uses were not assessed by the IEPA. No water quality data were available for this stream.

4.34 Unnamed Tributary to Bear Creek

The Unnamed Tributary to Bear Creek is located in Fayette County. Its headwaters begin in a pond located in Vandalia, Illinois from which it flows north for approximately 1.1 miles to its confluence with Bear Creek. Unnamed Tributary to Bear Creek in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day, 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Unnamed Tributary to Bear Creek in northwestern Vandalia. The Unnamed Tributary to Bear Creek was assessed northwest of the northern terminus of Illini Avenue (US 51-43) during 2009 (Wetzel, Editor, 2010). Substrate in Unnamed Tributary to Bear Creek consisted of sand, silt, and gravel, and the stream has a measured width of 5.0 feet and a depth of 1.0 feet. The riparian vegetation consisted of grasses. The surrounding land use is forest, row crop agriculture, and residential.

The IDNR has not rated Unnamed Tributary to Bear Creek for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from the Unnamed Tributary to Bear Creek.

Designated stream uses of the Unnamed Tributary to Bear Creek were not assessed by the IEPA. No water quality data were available for the Unnamed Tributary to Bear Creek.

4.35 Bear Creek

Bear Creek is located in Fayette County. Its headwaters being northwest of Vandalia, Illinois from which it flows southeast 12.7 miles to its confluence with the Kaskaskia River. Bear Creek in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 alternatives cross Bear Creek at two locations north of Vandalia. Bear Creek was assessed at the US 51 Bridge of Bear Creek (US 51-08) during 2008 (Wetzel & Phillips, Editor, 2009). Substrate in Bear Creek consisted of sand and silt. Bear Creek has a measured width of 29.5 feet and a depth of 5.6 feet at site US 51-08. The stream width at site US 51-44 was 23 feet and depth was 6.7 feet. The riparian vegetation consisted of trees and grasses. The surrounding land use is agriculture, field/pasture, and forest.

A second site on Bear Creek (US51-62) was assessed during 2011 at the county road 2100N bridge (Wetzel et al., 2012). This site on Bear Creek is impounded by Vandalia Lake and is considered to be an intermittent stream. The runs of Bear Creek average 6 feet wide and 8 inches deep. The bottom substrates of Bear Creek at US51-62 are primarily sandy with small areas of gravel, silt and cobble. Streambanks of this site were unstable with extensive outcroppings of sand. Riparian vegetation at site US51-62 was a strip of light woods and grasses, with fallow and tilled agricultural fields beyond the strip of woods.

The IDNR has not rated Bear Creek for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from Bear Creek at site US51-08. At site US 51-44, 16 fish species were collected with the catch dominated by redshiner and green sunfish. Two mussel species were also collected. The benthic mean taxa richness of 11.0 was higher than site US51-62. Fish and macroinvertebrates were collected at site US51-62. Five fish species were collected at US51-62, dominated by bluegills at 62% of the catch. Macroinvertebrates yielded 22 taxa dominated by chironomid midges which comprised 77% of the catch. The mean taxa richness was 7.67. Two EPT taxa were found which comprised 1% of the collection. No mussels were encountered. At site US51-44 on Bear Creek, two common mussel species were found in 2009. The mussels encountered were the giant floater and the mapleleaf.

Designated stream uses of Bear Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Bear Creek. Three water quality samples were collected by the INHS at one sampling location (US 51-44) on Bear Creek during 2008 (Wetzel & Phillips, Editor, 2009). All water quality parameters met the General Use Water Quality standard with the exception of one sample that exceeded the chronic dissolved zinc standard. Water quality measurements were taken at site US51-62 in 2011 (Wetzel et al., 2012).

All water quality parameters met the General Use Water Quality standard with the exception of the chronic dissolved zinc standard.

4.36 Unnamed Tributary to Hurricane Creek

Unnamed Tributary to Hurricane Creek is located in Fayette County. Its headwaters begin south of the Vandalia Municipal Airport, west of Vandalia, Illinois from which they flow west approximately 1.6 miles to its confluence with Hurricane Creek. Unnamed Tributary to Hurricane Creek in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Unnamed Tributary to Hurricane Creek at one location west of Vandalia. The riparian vegetation consisted of grasses. The surrounding land use is agricultural.

The IDNR has not rated Unnamed Tributary to Hurricane Creek for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from the Unnamed Tributary to Hurricane Creek.

Designated stream uses of the Unnamed Tributary to Hurricane Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Hurricane Creek. No water quality samples were collected on Unnamed Tributary to Hurricane Creek.

4.37 Unnamed Tributaries to Vandalia Lake (#1, #2, #3, #4, and #5)

There are five unnamed tributaries to Vandalia Lake located in Fayette County that are crossed by US 51 alternatives. Their headwaters begin north of Vandalia, Illinois and all flow to Vandalia Lake. All of the tributaries are first or second order intermittent streams with a 7-day 10 year low flow of zero (Singh et al. 1988, Maps updated 2002).

The riparian vegetation of the unnamed tributaries consists of trees, grasses, and herbaceous vegetation. The surrounding land use is agricultural and forest.

The IDNR has not assessed these tributaries for diversity, integrity or biological significance. Fish and aquatic macroinvertebrates were collected from three of the unnamed tributaries to Vandalia Lake, sites US51-65, US51-66, and US51-68, but no mussels were encountered.

Unnamed Tributary #3 to Vandalia Lake is site US51-65. Three species of fish were collected; two species, the bluegill and creek chub each comprised 47.1% of the collection. Unnamed Tributary to Vandalia Lake #2, is INHS site US51-66. One species of fish was present, the bluegill. Unnamed Tributary to Vandalia Lake #1, is INHS site US51-68. One species of fish was present, the bluegill. Macroinvertebrates were sampled at the three fish stations. US51-65 had a mean taxa richness of 7.00 with a mean EPT richness of 1.0. US51-66 had a mean taxa richness of 5.67 with a mean EPT richness of 0.0. Site US51-68 had a mean taxa richness of 7.67 with a mean EPT richness of 0.0. The mean family level IBI scores were similar for the three unnamed tributaries (#1, #2, #3) with a range of 6.44 to 6.93. This indicated fairly poor to poor conditions. Fish and macroinvertebrate scores were relatively poor due in large part to the intermittent character of the streams

Designated stream uses were not assessed by the IEPA. No water quality data were available for these tributaries from the IEPA. INHS sampled selected water quality during June, 2011 (Wetzel et al., 2012). All water quality standards were achieved with the exception of the chronic zinc standard.

4.38 Unnamed Tributary to Kaskaskia River

Unnamed Tributary to Kaskaskia River is located in Fayette County. Its headwaters begin in Vera, Illinois. Unnamed Tributary to Kaskaskia River flows southeasterly for 2.4 miles to its confluence with the Kaskaskia River. Unnamed Tributary to Kaskaskia River in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 alternative crosses Unnamed Tributary to Kaskaskia River at one location within the town of Vera. The Unnamed Tributary to Kaskaskia River was assessed at County Road 2000 North bridge (US 51-41) during 2009 (Wetzel, Editor, 2010). Substrate in Unnamed Tributary to Kaskaskia River consists of sand, silt, gravel, and clay; the stream has a measured width of 6.0 feet and a depth of 0.1 feet. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is field/pasture and agriculture. The habitat assessment is classified as fairly poor to poor (See Table 4-1) (Wetzel, Editor, 2010).

Fish and macroinvertebrates were sampled in Unnamed Tributary to Kaskaskia River at US 51-41 in 2009. Seven species of fish were collected dominated by the orangethroat darter, which comprised 48% of the collection at Unnamed Tributary to Kaskaskia River. No threatened, endangered, or intolerant fish species were collected. Macroinvertebrates had a mean of 15.5 benthic invertebrate taxa with a mean family level IBI of 6.21 at Unnamed Tributary to Kaskaskia River. The IDNR has not assessed the Unnamed Tributary to Kaskaskia River for diversity, integrity or biological significance.

Designated stream uses of the Unnamed Tributary to Kaskaskia River were not assessed by the IEPA. Three water quality samples were collected at one sampling location (US 51-41) during 2009 (Wetzel, Editor, 2009). All water quality parameters met the General Use Water Quality standard with the exception of one dissolved zinc concentration that exceeded the chronic water quality standard .

4.39 Unnamed Tributaries to Hoffman Creek (#1 and #2)

Two unnamed tributaries to Hoffman Creek are located in Fayette County and crossed by the proposed US 51 alternative. These tributaries begin north of Vandalia, Illinois and flow 1.5 to 2.4 miles to a confluence with Hoffman Creek. Both tributaries are depicted on the USGS topographic map as intermittent streams. The 7-day, 10 year low flow values for both streams is zero (Singh et al. 1988, Maps updated 2002).

The riparian vegetation consists primarily of trees. The surrounding land use is agricultural.

The IDNR has not assessed these tributaries for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected.

Designated stream uses were not assessed by the IEPA (2014). No water quality samples were collected.

4.40 Hoffman Creek

Hoffman Creek is located in Fayette County. The headwaters of Hoffman Creek begin southwest of Ramsey, Illinois from which it flows southeasterly for 7.9 miles to its confluence with the Kaskaskia River. Hoffman Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day 10 year low flow value for this stream is zero (1988. Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Hoffman Creek at one location north of Vandalia. Hoffman Creek was assessed downstream of the old US Route 51 bridge over Hoffman Creek (US 51-07) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Hoffman Creek consists of sand, gravel, and silt. Hoffman Creek has a measured width of 23 feet and a depth of 3.3 feet. The riparian vegetation consisted of trees. The surrounding land use is agricultural. The habitat assessment for Hoffman Creek is classified as fairly poor to poor (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed Hoffman Creek for diversity, integrity or biological significance. Fish and macroinvertebrates were sampled in Hoffman Creek at US 51-07 during 2008. Fifteen species of fish were collected with the most abundant fish as red shiners comprising 24% of the collection at Hoffman Creek. No threatened, endangered or intolerant fish species were collected in Hoffman Creek. Macroinvertebrates had a mean taxa value of 18.2 with a mean family level IBI of 6.47 at Hoffman Creek.

Designated stream uses of Hoffman Creek, stream segment OZZA, were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Hoffman Creek. Three water quality samples were collected at one sampling location (US 51-07) on Hoffman Creek during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard.

4.41 Unnamed Tributary to Ramsey Creek #1

Unnamed Tributary to Ramsey Creek #1 is located in Fayette County. Its headwaters begin north of Vandalia, Illinois and south of Ramsey, Illinois from which it flows easterly approximately 1.5 miles to its confluence with Ramsey Creek. Unnamed Tributary to Ramsey Creek #1 in the project area is depicted on the USGS topographic map as an intermittent stream. The 7-day, 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridor crosses Unnamed Tributary to Ramsey Creek #1 at one location north of Vandalia and south of Ramsey. The riparian vegetation consists of trees. The surrounding land use is agricultural and forest.

The IDNR has not assessed Unnamed Tributary to Ramsey Creek #1 for diversity, integrity or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from the Unnamed Tributary to Ramsey Creek #1.
Designated stream uses of the Unnamed Tributary to Ramsey Creek #1 were not assessed by the IEPA (2012). No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Ramsey Creek #1. No water quality samples were collected on Unnamed Tributary to Ramsey Creek #1.

4.42 Ramsey Creek

Ramsey Creek is located in Fayette, Montgomery, and Shelby Counties. Its headwaters begin in eastern Montgomery County from which they flow southeast for 21.6 miles to its confluence with the Kaskaskia River. Ramsey Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day, 10 year low flow value for this stream is 0.05 cubic feet per second at a tributary to Ramsey Creek located 0.5 miles west of existing US 51 (Singh et al. 1988, Maps updated 2002).

Ramsey Creek is designated as an INAI stream (# 1435) as a category VI stream (47.25 acres). Category VI is defined as unique concentrations of flora or fauna and high quality streams. It is also considered a Biologically Significant Stream. A dam at Ramsey Creek approximately 1.9 miles west of existing US 51 forms Ramsey Lake. Ramsey Lake is a designated State Park located 1.8 miles west of existing US 51 on County Road 2900N. The Ramsey wastewater plant discharges to a tributary of Ramsey Creek that is located 0.5 miles west of existing US 51 and 0.4 miles south of 9th street in Ramsey.

The proposed US 51 corridor crosses Ramsey Creek at one location southeast of Ramsey, Illinois. Ramsey Creek was assessed downstream of the US. 51 bridge over Ramsey Creek (US 51-06) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Ramsey Creek consists of sand, gravel, boulders, and bedrock. Ramsey Creek has a measured width of 36.1 feet and a depth of 4.9 feet. The riparian vegetation consisted of trees. The surrounding land use is forest and agricultural. The habitat assessment for Ramsey Creek is classified as fair (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

The IDNR has assessed Ramsey Creek as A for diversity and B for integrity. Ramsey Creek is considered a Biologically Significant Stream (IDNR 2008) as well as an Illinois Natural Area Inventory (INAI) site in the project area. Fish, macroinvertebrates and mussels were sampled in Ramsey Creek at US 51-06 in 2008. Sixteen species of fish were collected dominated by the bluntnose minnow, which comprised 63% of the collection. No threatened, endangered, or intolerant fish species were collected in Ramsey Creek. Macroinvertebrates had a mean of 9.0 benthic invertebrate taxa with a mean family level IBI of 5.56 at Ramsey Creek. Mussel collection efforts yielded eight species of which four were living at Ramsey Creek. The mapleleaf, a relatively common mussel in Illinois, was the most abundant species representing five of the 9 specimens collected at Ramsey Creek.

The IEPA designates Ramsey Creek, stream segment OO_01, as fully supporting for aquatic life. Limited historic water quality data were available on the IEPA STORET database for Ramsey Creek. Three water quality samples were collected at one sampling location (US 51-06) on Ramsey Creek during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard.

4.43 Unnamed Tributary to Ramsey Creek #2

Unnamed Tributary to Ramsey Creek #2 is located in Fayette County. Its headwaters begin east of Ramsey, Illinois from which it flows southeasterly for 4.9 miles to its confluence with Ramsey Creek. Unnamed Tributary to Ramsey Creek #2 in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 corridors, R Alt 1 and R Alt 2, cross Unnamed Tributary to Ramsey Creek #2 east of Ramsey. The Unnamed Tributary to Ramsey Creek #2 was assessed downstream of County Road 2600 North Bridge over Unnamed Tributary to Ramsey Creek #2 (US 51-05) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Unnamed Tributary to Ramsey Creek #2 consists of sand and gravel. Unnamed Tributary to Ramsey Creek #2 has a measured width of 10.7 feet and a depth of 3.9 feet. The riparian vegetation consists of trees and herbaceous vegetation. The surrounding land use is field/pasture and forest. The aquatic habitat for Unnamed Tributary to Ramsey Creek #2 is classified as poor.

The IDNR has not assessed Unnamed Tributary to Ramsey Creek #2 for diversity, integrity or biological significance. Fish and macroinvertebrates were sampled in the Unnamed Tributary to Ramsey Creek #2 at US 51-05 in 2008. Seventeen species of fish were collected with the central stoneroller comprising 26% of the collection and being the most abundant fish present. No threatened or endangered fish species were collected in Unnamed Tributary to Ramsey Creek #2. One intolerant species (spotted sucker) was collected in Unnamed Tributary to Ramsey Creek #2. Macroinvertebrates had a mean of 15.7 benthic invertebrate taxa present with a mean family IBI score of 6.52 calculated for Unnamed Tributary to Ramsey Creek #2. No mussel collections were made on Unnamed Tributary to Ramsey Creek #2 (Wetzel & Phillips, Editors, 2009).

The designated stream uses of the Unnamed Tributary to Ramsey Creek #2 were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Ramsey Creek #2. Three water quality samples were collected at one sampling location (US 51-05) on Ramsey Creek during 2008 (Wetzel & Phillips, Editors, 2009). All water quality parameters met the General Use Water Quality standard, with the exception of two dissolved zinc samples that exceeded the chronic water quality standard.

4.44 Ash Creek

Ash Creek and its unnamed tributary are located in Fayette County. Ash Creek's headwaters begin south of the Fayette, Montgomery, and Shelby County boundary from which it flows southeasterly 8.7 miles to its confluence with the Kaskaskia River. Ash Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002). The unnamed tributary merges into Ash Creek in 2.2 miles.

The proposed US 51 crosses both Ash Creek and an unnamed tributary north of Ramsey. Ash Creek was assessed upstream of the US 51 bridge over Ash Creek (US 51-04) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Ash Creek consists of sand and gravel. Ash Creek has a measured width of 11.5 feet and a depth of 4.9 feet. The riparian vegetation consists of trees. The surrounding land use is field/pasture and forest. The habitat assessment for Ash Creek is classified as fair (See Table 4-1) (Wetzel & Phillips, Editors, 2009).

Fish, mussels, and macroinvertebrates were sampled in Ash Creek at US 51-04 in 2008. Fifteen species of fish were collected with silverjaw minnow and orangethroat darters each comprising 24% of the collection at Ash Creek. No threatened, endangered, or intolerant fish species were collected in Ash Creek. Ash Creek macroinvertebrates had a mean of 10.7 taxa with a mean family IBI of 6.65. Mussel collection efforts yielded one species of mussel, the fatmucket which was taken as empty shells but not as a live species at Ash Creek. The IDNR has not assessed Ash Creek or its tributary for diversity, integrity or biological significance.

Designated stream uses of Ash Creek, stream segment OZZD_02 were not assessed by the IEPA. Three water quality samples were collected at one sampling location (US 51-04) on Ash Creek during 2008 (Wetzel & Phillips, Editors, 2009). The dissolved zinc concentration for one sample exceeded the chronic water quality standard; all other water quality standards were achieved.

4.45 Unnamed Tributary to Little Creek

Unnamed Tributary to Little Creek is located in Fayette and Shelby Counties. Its headwaters begin east of the Shelby and Montgomery County boundary from which it flows easterly for approximately 5.1 miles to its confluence with Little Creek. Unnamed Tributary to Little Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 crosses Unnamed Tributary of Little Creek at one location north of Ramsey and south of Oconee. The Unnamed Tributary of Little Creek was assessed at the US 51 bridge (US 51-03) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Unnamed Tributary to Little Creek consists of silt, sand, and gravel. Ash Creek has a measured width of 9.8 feet and a depth of 2.3 feet. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is agricultural and field/pasture. The aquatic habitat for Ash Creek is classified as poor (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed Unnamed Tributary to Little Creek for diversity, integrity, or biological significance. No fish, macroinvertebrates or mussels were collected at the Unnamed Tributary to Little Creek.

Designated stream uses of the Unnamed Tributary to Little Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Unnamed Tributary to Little Creek. No water quality samples were collected on Unnamed Tributary to Little Creek.

4.46 Little Creek

Little Creek is located in Fayette and Shelby Counties. Its headwaters begin south of Oconee, Illinois from which it flows southeasterly for approximately 6.9 miles to its confluence with Becks Creek. Little Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 crosses Little Creek at one location north of Ramsey and south of Oconee. The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is agricultural.

The IDNR has not assessed Little Creek for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from Little Creek.

Designated stream uses of Little Creek were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Little Creek. No water quality samples were collected on Little Creek.

4.47 Unnamed Tributary to Matney Branch (#1, #2, and #3)

Three unnamed tributaries to Matney Branch #1 are located in Shelby County. These streams form south of Oconee, Illinois and flow for approximately 1 to 2 miles to their confluence with Matney Branch. These tributaries are depicted on the USGS topographic map as intermittent streams. The 7-day, 10-year low flow value is zero (Singh et al. 1988, Maps updated 2002).

The riparian vegetation consists of grasses and herbaceous vegetation. The surrounding land use is agricultural.

The IDNR has not assessed these tributaries for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected.

Designated stream uses of the unnamed tributaries were not assessed by the IEPA (2012). No water quality data were available.

4.48 Matney Branch

Matney Branch is located in Shelby County. Its headwaters begin north of Oconee, Illinois from which it flows southeast approximately 4.4 miles to its confluence with Opossum Creek. Matney Branch in the project area is depicted on the USGS topographic map as a perennial stream. The

7-day, 10 year low flow value for this stream is zero (1988. Singh et al. 1988, Maps updated 2002).

The proposed US 51 crosses Matney Branch at one location southeast of Oconee. Matney Branch was assessed at the US 51 bridge over Matney Branch (US 51-02) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Matney Branch consists of sand, silt, clay, and gravel. Matney Branch has a measured width of 7.2 feet and a depth of 1.6 feet. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is row crop agricultural. The aquatic habitat for Matney Branch is classified as poor (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed Matney Branch for diversity, integrity, or biological significance. No fish, aquatic macroinvertebrates or mussels were collected from Matney Branch.

Designated stream uses of Matney Branch, stream segment OQCB were not assessed by the IEPA. No historic water quality data were available on the IEPA STORET database for Matney Branch. No water quality samples were collected on Matney Branch.

4.49 Opossum Creek

Opossum Creek is located in Shelby and Christian Counties. Opossum Creek headwaters begin southwest of Pana, Illinois from which it flows southeast for 14.4 miles to its confluence with Beck Creek. Opossum Creek in the project area is depicted on the USGS topographic map as a perennial stream. The 7-day, 10 year low flow value for this stream is zero (Singh et al. 1988, Maps updated 2002).

The proposed US 51 crosses Opossum Creek at one location northeast of Oconee. Opossum Creek was assessed at the US 51 bridge over Opossum Creek (US 51-01) during 2008 (Wetzel & Phillips, Editors, 2009). Substrate in Opossum Creek consists of sand, silt, and gravel. Opossum Creek has a measured width of 13.1 feet and a depth of 5.7 feet. The riparian vegetation consists of trees, grasses, and herbaceous vegetation. The surrounding land use is field/pasture and forest. The aquatic habitat for Opossum Creek is classified as poor (Wetzel & Phillips, Editors, 2009).

The IDNR has not assessed Opossum Creek for diversity, integrity, or biological significance. No fish, macroinvertebrates or mussels were collected from Opossum Creek.

The IEPA has assessed Opossum Creek, stream segment OQC_01 as fully supporting for aquatic life. No historic water quality data were available on the IEPA STORET database for Opossum Creek. No water quality samples were collected on Opossum Creek.

4.50 Ponds and Lakes

Non-wetland ponds and lakes (referred to as lacustrine) habitat types were surveyed during 2008, 2009 and 2010. Table 4-5 summarizes the numbers and sizes of pond and lake habitats based upon INHS survey data. A total of 74 ponds and 4 lakes were present in the US-51 project area.

Carlyle Lake is a fifth lake that lies 14 miles southwest of the project area and downstream on the Kaskaskia River.

Table 4-5
Ponds and Lakes in the US51 Study Area

	Minimum Size Acres	Maximum Size Acres	Number Surveyed	Total Size Acres
Pond, (non-wetland)	0.20	4.93	74	143.08
Lake	1.34	925	4	70.91

Source: Wetzel 2008, Wetzel Editor 2010, Wetzel et al. 2010)

4.50.1 Ponds

Ponds varied in size from 0.20 acres to 4.93 acres. Ponds varied in origin from naturally occurring vernal ponds, which were associated with woodlots to man-made ponds such as borrow pits, farm ponds or water treatment ponds. The most common types of ponds in the project area are farm ponds. Some ponds appear to have been formed by damming small creeks to form ponded areas. Occasional ponds appear to be associated with residential areas for aesthetic purposes. Ponds are more abundant north of Vandalia Illinois and less abundant southward. (Wetzel et al. 2009, Wetzel 2010, Wetzel et al. 2010).

4.50.2 Lakes

Four lakes (Raccoon Lake, Vandalia Lake, and two oxbow lakes (Wetzel and Phillips, Editors. 2009), occur within the Route US-51 project area. The lakes ranged in size from 1.38 acres to 925 acres. The two significant lakes are Raccoon Lake and Vandalia Lake, which are used for recreational purposes. Vandalia Lake is also a secondary water supply source for Vandalia. Carlyle Lake is a 26,000 acre lake in Clinton County west of U.S. 51.

4.50.2.1 Raccoon Lake, Centralia IL

Raccoon Lake is located in Marion County Illinois on Raccoon Creek. Raccoon Lake is a reservoir formed in 1943 by damming Raccoon Creek with an earthen dam. Raccoon Lake has a surface area of 925 acres (1.1 square miles) and holds a maximum of 6700 acre feet of water. Raccoon Lake is owned by the City of Centralia and is used as a primary drinking water supply as well as for recreational purposes (FindLakes 2011, CityCentralia, 2011a, 2011b).

Raccoon Lake was surveyed for fish and water chemistry by the INHS at US51-56, the boat ramp cove area located on the south shore of Raccoon Lake.

Raccoon Lake has not been assessed for biological significance because the BSS only applies to streams in Illinois, and no lake evaluation of a similar nature exists. Biological sampling of

Raccoon Lake for fish was conducted in 2009. Thirteen species are present with 30 % of the catch as bluegills. Largemouth bass, crappie, and channel catfish were also present, and these fish are also sought after by anglers on the lake. No intolerant fish species were collected. Riparian vegetation was noted by the INHS as trees and herbaceous vegetation. Land use was noted as forest and residential. (Wetzel, Editor 2010).

Raccoon Lake is designated by the IEPA as segment IL_ROK, *Fully Supporting* aquatic life use but *Not Supporting* Fish Consumption (Table 4-5). The Illinois Department of Public Health has issued a fish consumption advisory that applies to common carp taken from Raccoon Lake due to PCB contamination. No other fish from Raccoon Lake have a consumption advisory associated. The carp consumption advisory is grounds for the IEPA to issue its *Not Supporting* fish consumption designation for Raccoon Lake. The IEPA (2014), further designates Raccoon Lake as *Not Supporting* public and food processing water use. The IEPA has not assessed Raccoon Lake for any other use such as secondary contact or esthetic quality

Water quality data were collected during June, August and October 2009 for Raccoon Lake. All water quality data met General Use Water Quality standards except for the October 2009 for Mercury which was 0.1 mg/L. This reading exceeded the IEPA recommendation for aquatic life. The June and August 2009 Mercury tests were within acceptable levels. (Wetzel, Editor, 2009).

4.50.2.2 Vandalia Lake, Vandalia, IL

Vandalia Lake , is located in Fayette County, four miles northwest of Vandalia IL. Vandalia Lake is a 660 acre lake with 12 miles of shoreline and has been proposed as a secondary drinking water supply for the City of Vandalia which normally obtains drinking water from the Kaskaskia River. Vandalia Lake supports a recreational fishery as well as a marina, campground and swimming beach (Vandalia, 2011a, 2011b).

Vandalia Lake has not been assessed for biological significance because the BSS rating system only applies to streams in Illinois, and no lake evaluation of a similar nature exists. Biological sampling of Vandalia Lake for fish was not done by the INHS. No macroinvertebrates were sampled on Vandalia by the INHS because the macroinvertebrate metrics are only calibrated for streams in Illinois. Riparian vegetation was not noted by the INHS (Wetzel 2009, Wetzel Editor 2010, Wetzel et al. 2010).

The IDNR (2012), sampled Vandalia Lake by electrofishing methods circa 1990. Fish taken in the samples included the black bullhead, bluegill, channel catfish, common carp, gizzard shad, golden shiner, green sunfish, hybrid striped bass, largemouth bass, longear shiner, redear sunfish, warmouth, white crappie and yellow bullhead. None of the fish species sampled are considered by the IEPA to be intolerant. The Vandalia Sport Fishing and Conservation Club stocks the lake with large mouth bass, channel catfish and bluegill (Vandalia, 2012).

The INHS has historic records of aquatic insects for aquatic locations around the City of Vandalia, Illinois, but none of the records are specifically for Lake Vandalia. All of the mayfly, stonefly, caddisfly and damselfly records are included in Table 4-6 for aquatic locations at Vandalia Illinois.

TABLE 4-6
Aquatic Insects of Vandalia, Fayette County Illinois
From the INHS Collection Database

INHS Number	Common Name	Genus	Species
Ephemeroptera 16161	Mayfly	Baetis	brunneicolor
Ephemeroptera 4425	Mayfly	Baetis	brunneicolor
Ephemeroptera 4625	Mayfly	Baetis	sp.
Ephemeroptera 4626	Mayfly	Baetis	sp.
Ephemeroptera 4664	Mayfly	Baetis	sp.
Ephemeroptera 5279	Mayfly	Caenis	sp.
Ephemeroptera 4961	Mayfly	Callibaetis	sp.
Insect Collection 4251	Mayfly	Leptophlebia	sp.
Odonata 8284	Damselfly	Calopteryx	sp.
Odonata 10006	Damselfly	Ischnura	sp.
Odonata 6516	Damselfly	Genus	sp.
Odonata 7891	Damselfly	Genus	sp.
Plecoptera 3531	Stonefly	Neoperla	clymene
Plecoptera 4049	Stonefly	Perlesta	sp.
Plecoptera 15047	Stonefly	Taeniopteryx	burksi
Plecoptera 18549	Stonefly	Taeniopteryx	lita
Trichoptera 46387	Caddisfly	Frenesia	missa
Trichoptera 37697	Caddisfly	Lepidostoma	libum
Trichoptera 37698	Caddisfly	Lepidostoma	libum
Trichoptera 9232	Caddisfly	Nectopsyche	candida

Source: INHS Insect Collection accessed 09-12-2012

The IEPA (2014), has designated Vandalia Lake as *Not Supporting* fish consumption, *Not Supporting* public and food processing water supply, and *Fully Supporting* aquatic life (Table 5). However, no fish consumption advisories are posted for Vandalia Lake by the Illinois Department of Public Health (IDPH 2012). No details are given by the IEPA as to why Vandalia Lake is rated as *Not Supporting* fish consumption. The IEPA (2004), approved a Total Maximum Daily Load (TMDL) for Phosphorus, ph and excess algae growth for Vandalia Lake.

TABLE 4-7
Illinois EPA Impairments and Causes for Vandalia Lake (IL_ROD), 2014

<table>
<tr><th>Designated Use Descriptor</th><th>Designated Use Category</th><th>Impairments Cause</th><th>Impairment Source</th></tr>
<tr><td>Fish Consumption</td><td>Not Supporting</td><td rowspan="2">Mercury,
Manganese,
Total Suspended Solids (TSS),
Phosphorus (Total),
Aquatic Algae</td><td rowspan="2">Atmospheric Deposition – Toxics,
Source Unknown,
Littoral/Shore Modification,
Other Recreational Pollution Sources,
Crop Production,
Urban Runoff/Storm Sewers,
On-Site Treatment Systems (Septic & Decentralized Systems)</td></tr>
<tr><td>Public & Food Processing Water Supply</td><td>Not Supporting</td></tr>
<tr><td>Aquatic Life</td><td>Fully Supporting</td><td>.....</td><td>.....</td></tr>
</table>

Source: IEPA

4.50.2.3 Carlyle Lake, Carlyle, IL

Carlyle Lake is a reservoir formed in 1966 by damming the Kaskaskia River near Carlyle, Illinois, in Clinton County. Carlyle Lake is approximately 15 miles long, 2 to 3 miles wide, and a total area of 24,580 acres with 85 miles of shoreline. Carlyle Lake has an average depth of 11 feet with a maximum depth of 35 feet. Carlyle Lake is regularly used as a recreational lake and is considered a good fishing lake (IDNR 1998).

Recent fish records for Carlyle Lake Reservoir are not available as INHS did not collect fishery resource information directly from Carlyle Lake. However, historic fishery records exist in the INHS database (INHS, 2012), with the most recent records being from 2006. IDNR listed gamefish species present in Carlyle Lake (Cruse and Wight, 1998). Combined fishery resource records are presented in Table 4-8 for Carlyle Lake. One fish species, the smallmouth bass, is considered an intolerant species by the IEPA.

TABLE 4-8
Fish of Carlyle Lake Reservoir, Clinton County, Illinois
From INHS and IDNR Records

Record	Common name	Genus species	Year
IDNR	yellow bullhead	*Ameiurus natalis*	1998
INHS 16451	bowfin	*Amia calva*	1962
IDNR	black bullhead	*Amieurus melas*	1998
IDNR	freshwater drum	*Aplodinotus grunniens*	1998
INHS 16460	brook stickleback	*Culaea inconstans*	1967
INHS 16453	red shiner	*Cyprinella lutrensis*	1962
IDNR	common carp	*Cyprinus carpio*	1998
INHS 16452	gizzard shad	*Dorosoma cepedianum*	1962
INHS 16459	slough darter	*Etheostoma gracile*	1962
INHS 16454	blackstripe topminnow	*Fundulus notatus*	1962
INHS 16455	mosquitofish	*Gambusia affinis*	1962
INHS 16461	channel catfish	*Ictalurus punctatus*	1968
INHS 101913	brook silversides	*Labidesthes sicculus*	2006
IDNR	green sunfish	*Lepomis cyanellus*	1998
INHS 16457	hybrid sunfish	*Lepomis cyanellus x L. gibbosus*	1962
INHS 101914	warmouth	*Lepomis gulosus*	2006
IDNR	bluegill	*Lepomis macrochirus*	1998
INHS 16605	smallmouth bass	*Micropterus dolomieu*	1968
IDNR	largemouth bass	*Micropterus slmoides*	1998
IDNR	yellow bass	*Morone mississippiensis*	1998
IDNR	white bass	*Morone chrysops*	1998
INHS 101915	shorthead redhorse	*Moxostoma macrolepidotum*	2006
INHS 101916	logperch	*Percina caprodes*	2006
INHS 16458	black crappie	*Pomoxis annularis*	1962
IDNR	flathead catfish	*Pylodictus olivaris*	1998
IDNR	walleye	*Stizostedion canadense*	1998
IDNR	sauger	*Stizostedion vitreum*	1998

Source: IDNR 2012 and INHS 2012 Records

Macroinvertebrate data have not been collected by the INHS for Carlyle Lake during the US51 study. However, historic aquatic insect data is available from the INHS database for Clinton County, Illinois with several records from Carlyle Lake. Table 4-9 presents the aquatic insect data available for Clinton Co. and Carlyle lake. Two stonefly genera reported in the INHS records, *Allocapnia* and *Taeniopteryx* are considered to be intolerant genera by the IEPA, and were found near Carlyle Lake at Marydale, IL. One mussel species, the paper pondshell, (utterbackia imbecillis), is recorded from Carlyle lake in the INHS records from 1986.

The IEPA (2014), has designated Carlyle Lake as *Not Supporting* fish consumption, *Not Supporting* public and food processing water supply, and *Fully Supporting* aquatic life (Table 4-9). However, no fish consumption advisories are posted for Carlyle Lake by the Illinois Department of Public Health. (IDPH 2012). No details are given by the IEPA as to why Carlyle Lake is rated as *Not Supporting* fish consumption. There is no IEPA TMDL scheduled for Carlyle Lake.

TABLE 4-9
Aquatic Insects of Clinton County, Illinois Near Carlyle Lake

Catalog Number	Common Name	Genus	Species	Locality	Year
Ephemeroptera 10030	Mayfly	*Stenacron*	*interpunctatum*	0.6 mi S Carlyle Lake dam.	1946
Ephemeroptera 12678	Mayfly	*Isonychia*	*sp.*	0.6 mi S Carlyle Lake dam.	1943
Ephemeroptera 14096	Mayfly	*Callibaetis*	*sp.*	Trenton	1956
Ephemeroptera 6395	Mayfly	*Pentagenia*	*vittigera*	0.6 mi S Carlyle Lake dam.	1943
Ephemeroptera 6398	Mayfly	*Pentagenia*	*vittigera*	0.6 mi S Carlyle Lake dam.	1943
Ephemeroptera 6472	Mayfly	*Stenacron*	*interpunctatum*	Carlyle Lake	1975
Ephemeroptera 9609	Mayfly	*Stenonema*	*femoratum*	New Memphis	1948
Ephemeroptera 9875	Mayfly	*Stenacron*	*interpunctatum*	0.6 mi S Carlyle Lake dam.	
Ephemeroptera 9876	Mayfly	*Stenacron*	*interpunctatum*	Carlyle Lake	1975
Ephemeroptera 9878	Mayfly	*Stenacron*	*interpunctatum*	Carlyle Lake	1975
Odonata 10603	Damselfly	*Genus*	*sp.*	Wodon Bridge-Keyesport, IL	1920
Odonata 11535	Damselfly	*Tramea*	*sp.*	Trenton	1956
Odonata 2704	Damselfly	*Ischnura*	*hastata*	0.6 mi S Carlyle Lake dam.	1955
Odonata 3583	Damselfly	*Ischnura*	*positum*	0.6 mi S Carlyle Lake dam.	1955
Odonata 3595	Damselfly	*Ischnura*	*positum*	0.6 mi S Carlyle Lake dam.	1955
Odonata 3804	Damselfly	*Ischnura*	*verticalis*	0.6 mi S Carlyle Lake dam.	1955
Odonata 6336	Dragonfly	*Anax*	*sp.*	Trenton	1956
Odonata 6502	Dragonfly	*Genus*	*sp.*	Trenton	1956
Odonata 6504	Dragonfly	*Genus*	*sp.*	Trenton	1956
Odonata 7863	Damselfly	*Genus*	*sp.*	Trenton	1956
Plecoptera 147	Stonefly	*Taeniopteryx*	*burksi*	New Memphis	1928
Plecoptera 15048	Stonefly	*Taeniopteryx*	*burksi*	2.5 km SE Germantown	1994
Plecoptera 18411	Stonefly	*Allocapnia*	*vivipara*	3.2 Km N Marydale	1998
Plecoptera 18412	Stonefly	*Taeniopteryx*	*burksi*	3 Km S Carlyle	1998
Plecoptera 18413	Stonefly	*Taeniopteryx*	*burksi*	3.2 Km N Marydale	1998
Plecoptera 207	Stonefly	*Taeniopteryx*	*burksi*	New Memphis	1928
Trichoptera 12439	Caddisfly	*Ironoquia*	*kaskaskia*	New Memphis	1939
Trichoptera 22827	Caddisfly	*Ironoquia*	*kaskaskia*	New Memphis	1939
Trichoptera 23748	Caddisfly	*Hydropsyche*	*rossi*	0.6 mi S Carlyle Lake dam.	1943
Trichoptera 28790	Caddisfly	*Cheumatopsyche*	*pasella*	0.6 mi S Carlyle Lake dam.	1943
Trichoptera 30439	Caddisfly	*Cheumatopsyche*	*analis*	0.6 mi S Carlyle Lake dam.	1943
Trichoptera 32414	Caddisfly	*Hydropsyche*	*bidens*	New Memphis	
Trichoptera 32436	Caddisfly	*Hydropsyche*	*bidens*	0.6 mi S Carlyle Lake dam.	1943

TABLE 4-9
Aquatic Insects of Clinton County, Illinois Near Carlyle Lake

Catalog Number	Common Name	Genus	Species	Locality	Year
Trichoptera 44336	Caddisfly	*Oecetis*	*cinerascens*	New Memphis	
Trichoptera 56051	Caddisfly	*Genus*	*sp.*	Bartelso	1898
Trichoptera 9128	Caddisfly	*Nectopsyche*	*sp.*	0.6 mi S Carlyle Lake dam.	1943
Ephemeroptera 10030	Mayfly	*Stenacron*	*interpunctatum*	0.6 mi S Carlyle Lake dam.	1946
Ephemeroptera 12678	Mayfly	*Isonychia*	*sp.*	0.6 mi S Carlyle Lake dam.	1943

Source: INHS 2012

5. POTENTIAL STREAM AND WATERSHED IMPACTS

5.1 Impact Methodology

The impact methodology is broken down by the phases of the highway life cycle: construction, operation, and maintenance. The impacts of construction involve the clearing of vegetation, grading, and building of structures over, within, and adjacent to water resources. Operational impacts are those that occur after a roadway is open to traffic and include the effects of storm water runoff on adjacent water resources. Maintenance impacts are those that occur as part of normal highway operations to keep the roadway free of hazards (snow/ice removal), maintain the vegetated rights-of-way, and maintain the roadway drainage system. The potential impacts of construction, operation, and maintenance on these streams are described in this section.

The IEPA anti-degradation assessment is utilized to identify and characterize each of the major affected bodies of water in the project area. The discussion of each stream crossing with a special designation begins with the identification and characterization of the affected water body. Each of the streams in the project area falls under the General Use water quality standards. Stream flow is characterized as either permanent or intermittent and is based on USGS topographic maps. The construction, operation, and maintenance subsections focus on describing project impacts on each of the major streams within the project area. This includes the identification of potential pollutant load increases and potential impacts on the aquatic life uses. More specific details on the methodologies employed are given below.

5.1.1 Construction Impacts

The discussion of construction impacts is based on the activity that is occurring at each of the major stream crossings. These activities generally include the vegetation removal and soil disturbance that are required for the construction of bridges, box culverts, and drainage structures. Generally, the larger the structure size within the stream, the greater the potential for impact on the aquatic environment. The major potential impact of construction is the release of sediment into streams, particularly during rainfall events.

Proposed project impacts to each stream crossing are described. The specific site conditions around the crossing are presented. These include the following: 1) the flow regime (permanent or intermittent) of each stream crossing as depicted on the USGS topographic maps; 2) the drainage area upstream of the project site; 3) the predominant cover types around the stream crossing; 4) the width and type (grasses, trees, etc.) of riparian habitat; and 5) the size and length of the structure (box culvert, bridge) being installed within or over the stream at this location. Impacts that are considered include the permanent loss of stream bottom and riparian habitats (in square feet) due to structure placement and the temporary disturbance due to increases in suspended solids (sediment) during construction. The bottom of the culvert and/or the bridge pier displaces stream substrate on a permanent basis. In addition, the riparian vegetation at the crossing is also removed and replaced with either paved or vegetated areas. The temporary impacts of total suspended solids will be minimized by the implementation of soil erosion and sediment control practices required under the NPDES permit

The impacts of construction are localized effects with suspended solids (sediment) and studies indicate a difference in impact for sites depending upon practices used for sediment control. The magnitude of the impact will vary according to site specific conditions such as the type of crossing structure, bank profile, stream size, soil type, and stream substrate. In untreated construction runoff the concentration of TSS could possibly exceed 3,000 mg/L after storm events. A study revealed that a five-fold increase in suspended solids (from 35 to 179 mg/L) occurred during highway construction (Barrett, Malina, Charbeneau, and Ward, 1995). No permanent changes to the channel were reported and the observed effects were temporary. Other studies (Wheeler et al, 2003) indicated increases of 5 to 12 times more fine sediment suspended in streams impacted by road construction and increases in suspended sediment were detected up to 16 miles downstream. Some of the sites included erosion control measures; however, the storm events, site conditions, and erosion control measures all affected the stream quality. Reductions of 54 to 86 percent in abundance and of 12 to 40 percent in the number of species of macroinvertebrates downstream have been reported in four Virginia streams 30 days after construction (Wheeler, Rosenberger, and Angermeir, 2003). The same study also noted similar reductions in fish species in the same streams studied. IDOT has implemented a variety of erosion control measures since 2003 to reduce sediment to streams. These methods will be included in the evaluation of impacts to the project area streams.

A Tennessee study analyzed effects on fish diversity and sediment deposition for 43 bridges and culverts constructed or replaced. Three reaches (one upstream and two downstream at 328 feet and 656 feet) were analyzed for fish diversity and sediment deposition. The study concluded that fish diversity, abundance, and richness did not differ between streams with culverts and those with bridges, nor among sample reaches. Sediment depth and percent silt clay were greater at streams with culverts than at streams with bridges. The study indicated that culverts, not bridges, caused sediment accumulation. However, this accumulation was not sufficient to impact fish communities (Wellman, Combs, Cook, 2000).

Specific factors, such as erosion control measures, magnitude of project, storm intensity, and size of receiving stream all affect the concentrations of suspended solids reported. Potential construction impacts to the study area streams are described assuming a 5- to 12-fold increase in suspended sediment on a temporary basis.

5.1.2 Operational Impact

The discussion of operational impacts is based on the following factors: 1) the quality of the receiving water; 2) the location of the receiving water in relationship to roadway features; 3) the current average daily traffic (ADT) if it is an existing route; and 4) the proposed (2040) ADT. FHWA studies indicate that pollutants in highway runoff are not present in amounts that threaten surface water or groundwater quality when the ADT is less than 30,000 vpd.

If the 2040 ADT is under 30,000 vehicles per day (vpd), it is concluded that water quality impacts on receiving waters from stormwater runoff are minor. If the 2040 ADT is over 50,000 vpd, a pollutant loading analysis is needed. Additionally, for streams on the 303(d) list or projects where anti-degradation analysis is needed, the pollutant loading analysis is a tool that may be used. See Appendix B. The methods employed for this analysis are described below.

The operational impact discussion is based upon FHWA research into the relationship between precipitation events and the ADT that a roadway carries (Young, et al., 1996). The model developed by Driscoll, Shelley, and Strecker estimates the magnitude and frequency of occurrence of in-stream concentrations of a pollutant under variable and intermittent highway runoff discharges (Driscoll, et al., 1990).

This analysis is specific to highway projects and predicts concentrations and loads for roadways. Table 5-1 summarizes the input variables used for this analysis.

Table 5-1
Model Input Variables

Drainage Area	Total highway right-of-way
	Highway pavement
	Total upstream drainage area
Rainfall Characteristics	Volume (mean and coefficient of variation)
	Intensity (mean and coefficient of variation)
	Duration (mean and coefficient of variation)
	Interval (mean and coefficient of variation)
Stream Flow	Annual average stream flow
	Coefficient of variation of daily flow rates

The Driscoll et al. (1990) methodology allows for the estimating of waterbody concentrations for 10 constituents and provides the highway runoff concentrations based upon the ADT. Driscoll et al. (1990) developed a probability function for pollutant concentrations and stream flow to assess a “maximum” (i.e., expected once in three years) instream concentration. Table 5-2 lists the constituents that were evaluated to represent storm water from transportation-related facilities where the ADT is greater than 30,000 vpd. For lower traffic volumes, the pollutant concentrations are approximately three times lower than the values in Table 5-2 and typically do not pose water quality issues. The constituents in Table 5-2 represent those pollutants that have the greatest concentrations and are frequently encountered in highway storm water runoff.

Table 5-2
Summary of Median Storm Water Runoff Concentrations

Constituent	Median Concentration, mg/l
Total suspended solids (TSS)	142
Copper (Cu)	0.054
Lead (Pb)	0.400
Zinc (Zn)	0.329

Stream impacts are ascertained by comparing the Illinois General Use Water Quality standards to a calculated stream concentration. The water quality standards for copper, lead, and zinc include chronic and acute standards. The acute standard is not to be exceeded at any time. The chronic standard applies to the arithmetic mean of four samples collected over four days. The Driscoll estimated stream concentrations represent concentrations incurred once every three years. These stream concentrations are compared to the applicable acute water quality standards.

Stream concentrations are calculated using the median concentration of the pollutant, the soluble fraction of the pollutant, and the ratio of the annual average stream flow to the highway runoff flow rate associated with the mean storm event.

5.1.3 Maintenance Impacts

The discussion of maintenance impacts includes the use of deicing salt for snow and ice control and herbicide usage for control of noxious/invasive plant species. Where available, the existing chloride content of the stream is given, based on the chemical data collected for this project in 2005 and 2007. Chlorides are found in all natural waters. Sources of chlorides include those of natural mineral origin, human and animal wastes, and industrial effluents. The chloride content of various waters of interest in parts per million (ppm) are as follows: rain water (2 ppm), unpolluted river water (up to 15 ppm), and weak sewage (70 ppm).

Maintenance of highway facilities contributes chlorides to area streams during the winter months. In northern climate areas, deicing chemicals, such as sodium chloride and calcium chloride salts, are used during freezing conditions and need to be included when analyzing water quality impacts. Highway runoff during these conditions may contain chlorides. The chloride concentrations need to be evaluated for potential impacts.

Deicing salt, along with plowing and sanding, are seasonal tools for highway snow and ice control. Deicing salt produces public mobility and safety benefits by rapidly and reliably providing more drivable and less hazardous road conditions during the winter months. The benefits are difficult to quantify but are widely acknowledged to be valuable to society (Transportation Research Board, 1991). It is acknowledged that deicing salt (sodium chloride) has unintended side effects. These effects are summarized by Jones and Jeffery (1992) and the Transportation Research Board (1991). The only generalization that can be made on the basis of the literature is that road salt impacts tend to diminish rapidly with distance from the roadway.

Deicing salt is applied to roadways to lower the freezing point of water and to free the snow and ice from the pavement. Salt is applied to roadways during and after snow and/or ice storms. Most of the salt is plowed along with snow and ice to the shoulder and adjacent right-of-way. The deicing salt then moves through the environment as runoff, splash, and spray. As the snow or ice melts, the salt moves through to the drainage system until it enters a stream as runoff or percolates into the soil profile. Salt also is transported via the splash or spray generated by moving vehicles coming into contact with brine or slush. Studies indicate that 60 to 80 percent of the salt runs off into the surface water, 15 to 35 percent occurs as splash, and up to 3 percent occurs as spray (Frost, et al, 1981; Diment, et al, 1973; Lipka and Aulenback, 1976; Sucoff, 1975). Chloride infiltration is estimated at 25 to 50 percent or 10 to 60 percent depending upon the roadway drainage design and site characteristics (McConnell and Lewis, 1972; Environment Canada, 2001).

The quantitative analysis of deicing chemical (chloride) concentrations in receiving waters was completed using a methodology developed by the United States Geological Survey (Frost, et al., 1981). The USGS estimating equations were developed from linear and multiple regression techniques on data collected over a five-year period from nine monitoring sites in the northeastern United States (Massachusetts, Vermont, and New Hampshire). Chloride concentrations in receiving streams were found to be statistically related to basin characteristics: drainage area, slope, depression storage, quantity of salt applied, precipitation in the basin, length of the highway, and number of lanes within the basin. This methodology estimates the incremental change in annual mean and annual daily maximum chloride concentrations in streams. Tables in Appendix B present the estimating equations and summarize the estimated chloride concentrations for streams in the project area. In the winter, salt would move through the environment adjacent to the detailed study alternatives as runoff into streams, runoff that percolates into the soil profile, splash, and spray.

Surface Runoff

Surface runoff is the primary mode of road salt removal (60 to 80 percent). Runoff from the roadway and adjacent right-of-way would be directed to the highway drainage system (a series of ditches and detention basins) before outletting into a stream. The potential impacts of deicing salt from highway runoff include its effects on stream water quality and aquatic biota. Infiltration would reduce the peak concentrations reaching the stream via groundwater discharges; however, infiltration into the groundwater table has the potential to affect sensitive seep or wetland communities relying upon groundwater. There are seep areas located near the Build Alternative south of Vandalia and near the Vandalia alternatives for which this is a consideration.

Salt impacts on soils are usually confined to 15 feet from the roadway, although greater distances have been reported. Long-term salt accumulation in the soil increases soil density and diminishes permeability and fertility, which could adversely affect moisture retention and soil structure characteristics that are important for plant growth and erosion control. The accumulation of salt in soils depends on many factors, including soil type, precipitation, and topography (Transportation Research Board, 1991).

In Illinois, the General Use Water Quality Standard for chloride is 500 mg/L, as per 35 Illinois Administrative Code Section 302. There is no standard for sodium. Based on the methodology of the USGS, increases in chloride concentrations have been projected for each stream.

There are many laboratory studies (summarized in USEPA, 1987) of the effect of salt (sodium chloride) on aquatic biota, including acute and chronic toxicity studies. Field studies indicate that salt does not have substantial deleterious impacts on aquatic biota (fish, invertebrates, aquatic plants) in large or flowing bodies of water where dilution takes place quickly (Jones and Jeffrey, 1992). In the project corridors, most of the streams are categorized as perennial or flowing streams, with the exception of the small tributaries of Aux Sable Creek, West Aux Sable Creek and Hollenbeck Creek that merge into the main streams.

Splash/Spray

Splash is the liquid brine consisting of larger salt solution drops that fall out near the roadway (Stensland, 1975). Splash lands directly on vehicles, soil, and vegetation, although some of it ends up in the roadway drainage system and is transported away as runoff. Vegetation (trees, shrubs, and grasses), soils, and erosion would potentially be impacted by splash from the detailed study alternatives.

Trees and other roadside vegetation can be injured by salt through changes in soil chemistry and by splash and spray on foliage and branches. The symptoms of salt injury are similar to those of drought: inhibited growth, browning, falling of leaves and needles, and sometimes dying limbs and premature plant death. Under extreme conditions, roadside vegetation can be exposed to salt as far as 500 feet from the roadway, although the impact is seldom substantial beyond 100 feet. Tree damage is likely to be greatest along high-traffic highways with heavy salt use and steep side slopes. Approximately 5 to 10 percent of roadside trees in forests along heavily traveled highways exhibit signs of salt-related decline. Roadside shrubs, grasses, and wetland vegetation are generally more salt tolerant than trees (Transportation Research Board, 1991).

An assessment of 10 studies of roadside soils indicated that elevated sodium and chloride levels (greater than 500 ppm) occurred within 30 feet of the roadway. The study concluded that the effects on soil drops quickly beyond the 30 to 60 feet of land bordering roadways (Transportation Research Board, 2007).

5.2 Water Quality Impacts by Stream and Watershed

The discussion on water quality impacts include construction, operational, and maintenance impacts by stream crossing. US 51 will cross 42 streams and their tributaries. The nine special designation streams are discussed in detail; however, all stream impacts are assessed. Construction impacts relates to the stream crossings and the types of in-stream work (pier placement, bank shaping, and haul roads). Nine streams within the project area were identified as priority streams: Sewer Creek, Crooked Creek, Prairie Creek, Lost Creek, East Fork Kaskaskia River, North Fork Kaskaskia River, Hickory Creek, Kaskaskia River and Ramsey Creek. (See Table 5-3). The construction impacts for all stream crossings are provided in Appendix C. The highly erodible soil locations are also identified in Appendix D.

Operating impacts result from traffic and maintenance activities. The accumulation of pollutants on highway surfaces, median areas, and adjoining right-of-ways may result in acute loadings and chronic effects within the receiving waters. Operational impacts of runoff from the proposed US 51 were evaluated using the DRISCOLL model for 10 special designated streams. The remaining streams will have minimal impacts as projected traffic volumes of 10,000 to 12,000 ADT are associated with minor impacts. Table 5-4 summarizes the estimated maximum concentrations of lead, copper, zinc, and total suspended solids concentrations. Maintenance operations utilize deicing materials that contribute chlorides to streams. The projected chloride concentrations for all streams were also estimated.

Table 5-3 Construction Impacts for Special Designation Streams

Stream	Alternative	Structure	Stream Impacts
Sewer Creek	US 51 Build	1 -70 ft bridge	One pier
Crooked Creek	US 51 Build	1 -130 ft bridge	Two piers in floodplain but not in creek
Prairie Creek	CS Alt 2	1 -100 ft bridge	Two piers
Lost Creek	CS Alt 1	1 –40 ft bridge	No piers in stream
Lost Creek	CS Alt 2	1 –40 ft bridge	No piers in stream
E. Fork Kaskaskia River	US 51 Build	1 -120 ft bridge	Two piers
N. Fork Kaskaskia River	US 51 Build	1 -400 ft bridge	Four piers in stream
Hickory Creek	US 51 Build	1 culvert, 1 -510 ft bridge	Four piers in stream
Kaskaskia River	US 51 Build	1 -700 ft bridge, 10 culverts	New structure with 7 piers in river and substrate loss
Ramsey Creek	RCOA/RCOB	1 -235 ft bridge	4 piers

.

Table 5-4

Results of Pollutant Loading Analysis[1] for Special Designation Streams

Stream	Alignment	Total Lead (mg/L)	Total Zinc (mg/L)	Total Copper (mg/L)	Total Suspended Solids (mg/L)	Chloride Annual Daily Max (mg/L)
Sewer Creek	US 51 Build Alt	0.024	0.096	0.026	123	46
Crooked Creek	US 51 Build Alt	0.007	0.030	0.008	38	27
Prairie Creek	CS Alt 2	0.021	0.085	0.023	108	49
Lost Creek	CS Alt 1	0.027	0.108	0.030	139	62
Lost Creek[2]	CS Alt 2	0.024	0.095	0.026	122	47
East Fork Kaskaskia River	US 51 Build Alt	0.005	0.019	0.005	25	27
North Fork Kaskaskia River	US 51 Build Alt	0.009	0.035	0.010	45	117
Hickory Creek [2]	US 51 Build Alt	0.007	0.027	0.008	35	27
Kaskaskia River	US 51 Build Alt	0.001	0.004	0.001	5	26
Ramsey Creek	RCOA	0.008	0.033	0.009	42	28
	RCOB	0.008	0.031	0.009	40	28
Ash Creek	US 51 Build Alt	0.025	0.101	0.028	130	43

[1] Pollutant and chloride concentration before stormwater enters BMP train.
[2] Measured hardness was unavailable, hardness was calculated based on the average hardness of all the streams within the project area

5.2.1 Sewer Creek

Sewer Creek is listed as a 303(d) stream due to sedimentation/siltation and total phosphorus. Sources of impairment include, municipal point source discharges, crop production, and urban runoff/storm sewers (IEPA). Water quality sampling was collected three times in 2008. All General Water Quality standards were achieved, except dissolved zinc level exceeded chronic and acute standards. Existing chloride concentrations met General Use Water Quality standard of 500 mg/L at Sewer Creek.

5.2.1.1 Construction Impacts

At the project location, Sewer Creek has an approximate upstream drainage area of 3.6 square miles. Existing US 51 does not cross the mainstem of Sewer Creek; however, the proposed US 51 Build Alignment does cross the creek. The US Build Alignment crossing will be a bridge, 70 feet in length. One pier will be placed within the stream. The soils adjacent to Sewer Creek are highly erodible, and remain highly erodible downstream of US 51 Build Alternative.

Fish collections in 2008 included 86 per cent of blacknose topminnow as the dominant fish species. There was no intolerant fish species in Sewer Creek. In addition, neither EPT taxa nor mussels were found. EPT taxa are macroinvertebrates that are sensitive to pollution.

In this area, no channel excavation or changes will occur. Therefore, the stream hydrology will not be impacted permanently. Construction impacts would be limited to temporary impacts. Erosion control measures during construction for highly erodible soils will be used to avoid sedimentation. Fish and macroinvertebrate are comprised of pollution tolerant species. Species diversity is anticipated to be affected only on a temporary basis.

5.2.1.2 Operational Impacts

US 51 Build Alternative introduce a new source of potential highway pollutants into Sewer Creek. Table 5-4 summarizes the estimated concentrations in total suspended solids, lead, zinc, and copper within Sewer Creek. Maximum concentration of suspended solids concentrations in a three year period is 123 mg/L. These concentrations increase in Sewer Creek, and without storm water treatment the lead, zinc, and copper concentrations meet the General Use Water Quality Standards.

5.2.1.3 Maintenance Impacts

Deicing is the primary maintenance activity that affects water quality in Sewer Creek. Existing chloride levels in Sewer Creek in 2008 varied from 65.8 mg/L to 111.0 mg/L. The annual daily maximum chloride concentration is estimated at 46 mg/L for US 51 Build Alternative (See Table 5-4). This incremental increase in concentration remains within the General Use Water Quality Standards.

5.2.2 Crooked Creek

Crooked Creek is 303(d) listed stream and flows into the Kaskaskia River. The stream is 72.7 miles in length with a total drainage area of 465 square miles. The stream is depicted on the USGS topographic map (Newark Quadrangle) as having perennial flow throughout much of its length, and the 7-day 10-year flow is two cubic feet per second (Singh, 1988; map updated 2002). Land use in the watershed is industrial, residential, field/pasture, and forest. Crooked Creek is found on the 2014 Illinois 303(d) list for impairments in manganese and total phosphorus. According to IDNR, upstream of proposed and existing US 51, Crooked Creek has been rated C for diversity and B for integrity.

5.2.2.1 Construction Impacts

Crooked Creek has an approximate upstream drainage area of 173 square miles. Only US 51 Build Alternative crosses Crooked Creek. The riparian areas at some of the tributary crossings consist of wooded vegetation and grasses; as wells as highly erodible soils in the area of US 51 Build Alternative crossing.

To minimize impact, the stream will be crossed by a 130-ft bridge and two piers at the US 51 Build Alternative crossing. Two piers will be placed in the stream and erosion control measures along the bank will avoid potential impacts due to erosion. No culverts will be placed in the stream.

Fish collections included one intolerant fish, the spotted sucker, at Station US 51-28. In addition, eight species of mussels were found at Stations US 51-54 & US 51-28; however, no mussels were found at station US 51-58. All mussels species collected at US 51-28 are common, except the rocket pocketbook. The rocket pocketbook is not designated as threatened or endangered in Illinois (IDNR, 2005).

Temporary impacts will be an increase in turbidity and sedimentation during instream work. Fish and macroinvertebrate species are limited in this stream due to their flow and available habitat. The impacts caused by instream work are anticipated to affect species diversity only on a temporary basis.

5.2.2.2 Operational Impacts

US 51 Build Alternative introduces a new source of potential highway pollutants into Crooked Creek. Table 5- 4 summarizes the estimated total suspended solids, lead, copper, and zinc concentrations within Crooked Creek. These concentrations achieve the General Use Water Quality Standards for future US 51 roadway conditions.

5.2.2.3 Maintenance Impacts

Existing chloride levels in Crooked Creek in 2008 and 2009 varied from 18.9 mg/L to 81.9 mg/L. The annual daily maximum increase in chloride concentration is estimated to be 27 mg/L for US 51 Build Alternative. See Table 5-4. This projected increase will not exceed the General Use Water Quality Standards for Chloride.

5.2.3 Prairie Creek

Prairie Creek is listed as a 303 (d) impaired stream with impairments listed as dissolved oxygen and total phosphorus. Sources of impairment include, loss of riparian habitat, streambank modifications/destabilization, livestock (grazing or feeding operations), agriculture, pesticide application, and urban runoff/storm sewers (IEPA). This stream has also been affected by the Sandoval Zinc site based upon US EPA sampling. Land use in the watershed is field/pasture, residential, and forest. The stream is not rated under the IEPA BSC System. According to the INHS, the Mean Family Level IBI was 8.26 at station US 51-27, indication of a "very poor" water quality with substantial organic pollution likely.

5.2.3.1 Construction Impacts

Prairie Creek's land use within the drainage area primarily consists of field/pasture, residential, and forest lands. The proposed CS Alt 1 alternative crosses the main stem of Prairie Creek. The mainline road crossing will include one 100-ft bridge and two piers at the Prairie Creek crossing.

5.2.3.2 Operational Impacts

CS Alt 1 introduces a new source of potential highway pollutants into Prairie Creek. The estimated concentrations of total suspended solids, lead, copper, and zinc all remain below General Use Water Quality Standards. The increase in suspended solids concentrations at CS Alt 1 is 108 mg/L. The suspended solids concentrations represent the maximum annual incremental increase for a three-year occurrence.

5.2.3.3 Maintenance Impacts

Deicing is the primary maintenance activity that affects water quality in Prairie Creek. Existing chloride levels in Prairie Creek in 2009 varied from 19.0 mg/L to 58.8 mg/L. There was a 49 mg/L estimated annual incremental daily maximum increase in chloride concentration for Alternative CS Alt 1 (See Table 5-4).

5.2.4 Lost Creek

Lost Creek flows an estimated 25.8 miles to its confluence with Crooked Creek and has a total drainage area of 78.5 square miles. Lost Creek is a perennial stream, however the 7-day 10-year flow is not assigned by the ISWS (Singh, 1988; map updated 2002). Lost Creek is listed as a 303 (d) impaired stream due to impairments of dissolved oxygen, sedimentation/siltation, total phosphorus, and aquatic algae. Sources of impairment include loss of riparian habitat, crop production, and agriculture (IEPA). Land use is predominantly row crop agriculture and residential. The stream is listed as a biologically significant water body in the INHS publication Biologically Significant Illinois Streams. According to the IDNR, the Mean Family Level fish IBI in 2002 and 2007 was 47 and 40, an indication of a "good" water quality. The IDNR also designated Lost Creek, within the project area, as C for diversity and integrity. No threatened or endangered species or natural areas were identified within the vicinity of the project during recent sampling events.

5.2.4.1 Construction Impacts

Lost Creek has an approximate upstream drainage area of 6.5 square miles, consisting primarily of forest and agriculture. The proposed alternatives CS Alt 1 and CS Alt 2 both cross the main stem of Lost Creek. The CS Alt 1 & 2 crossings can be summarized as follows:

Alternative	Number of Bridges	Bridge Length, ft
CS Alt 1	1	40
CS Alt 2	1	40

The proposed bridges for alternatives CS Alt1 and CS Alt 2 will each be 40 feet in length and one pier located outside of the stream. Although the bridge impacts are similar, there are differences in the total ROW required for each alternative.

Temporary impacts will be an increase in turbidity and sedimentation during stream bank work for bridge construction. The impacts of bridge section are anticipated to affect species diversity only on a temporary basis.

5.2.4.2 *Operational Impacts*

Alternatives CS Alt 1 and 2 introduce a new source of potential highway pollutants into Lost Creek. Table 5- 4 summarize the estimated concentrations of total suspended solids, lead, copper, and zinc within Lost Creek without any storm water treatment and after storm water treatment, respectively. The suspended solids concentrations CS Alt 1 & 2 are 139 mg/L and 122 mg/L, respectively.

Concentrations of heavy metals remain within the active General Use Water Quality Standards. See Table 5-4 for the expected concentrations.

5.2.4.3 *Maintenance Impacts*

Deicing is the primary maintenance activity that affects water quality in Lost Creek. The estimated annual incremental daily maximum increase in chloride concentration for CS Alt 1 and CS Alt 2 is 62 mg/L and 49 mg/L, respectively.

5.2.5 East Fork Kaskaskia River

East Fork Kaskaskia River is a 303(d) listed stream and flows into the Kaskaskia River. The stream is 43.3 miles in length with a total drainage area of 128 square miles. The stream is depicted on the USGS topographic map as having perennial flow throughout much of its length; however, the 7-day 10-year flow was not given (Singh, 1988; map updated 2002). Land use in the watershed is forest and agriculture. East Fork Kaskaskia River is found on the 2014 Illinois 303(d) list for impairments in dissolved oxygen and total phosphorus. According to IDNR, at the stream crossing of proposed and existing US 51, East Fork Kaskaskia River has been rated C for diversity and for integrity.

5.2.5.1 *Construction Impacts*

East Fork Kaskaskia River has an approximate upstream drainage area of 112.2 square miles. Only US 51 Build Alternative crosses East Fork Kaskaskia River. The riparian areas at some of the tributary crossings consist of trees and vegetation; however, several areas are highly erodible soils. The US 51 Build Alternative crossing consists of one 120-ft bridge at the mainline and two piers in the river.

Temporary impacts will be an increase in turbidity and sedimentation during instream work. Twenty-one species of fish, including the pollution intolerant (spotted sucker), were collected at the proposed crossing. Benthic collections indicated a “Good” mean family IBI score. Only temporary impacts are anticipated to the aquatic species in the stream.

5.2.5.2 *Operational Impacts*

US 51 Build Alternative introduce a new source of potential highway pollutants into East Fork Kaskaskia River. Table 5- 4 summarizes the estimated total suspended solids, lead, copper, and zinc concentrations in the East Fork Kaskaskia River. Future concentrations of heavy metals remain within the General Use Water Quality Standards.

5.2.5.3 Maintenance Impacts

Existing chloride levels in East Fork Kaskaskia River in 2008 varied from 10.6 mg/L to 31.1 mg/L. The annual incremental daily maximum increase in chloride concentration is estimated to be 27 mg/L for US 51 Build Alternative. See Table 5-4. This increase would not exceed the General Use Water Quality Standards of 500 mg/L for chloride.

5.2.6 North Fork Kaskaskia River

North Fork Kaskaskia River is a 303(d) listed stream and flows into the Kaskaskia River. The stream is 27.1 miles in length with a total drainage area of 77.6 square miles. The stream is depicted on the USGS topographic map as having perennial flow throughout much of its length (Singh, 1988; map updated 2002). North Fork Kaskaskia River is on the 2014 Illinois 303(d) list for impairments in atrazine, terbufos, and total phosphorus.. According to IDNR, upstream of proposed US 51, North Fork Kaskaskia River has been rated C for diversity and for integrity.

5.2.6.1 Construction Impacts

North Fork Kaskaskia River has an approximate upstream drainage area of 39.6 square miles and the riparian areas consist of trees and vegetation. Only US 51 Build Alternative crosses North Fork Kaskaskia River with one bridge of 400 feet and four piers in the stream.

Temporary impacts will be an increase in turbidity and sedimentation during instream work. The aquatic habitat is classified as "poor" and no intolerant fish species were collected. The temporary impacts are not anticipated to adversely affect the fish, mussels, or benthic organisms in the stream.

5.2.6.2 Operational Impacts

US 51 Build Alternative introduces a new source of potential highway pollutants into North Fork Kaskaskia River. Table 5- 4 summarizes the estimated total suspended solids, lead, copper, and zinc concentrations North Fork Kaskaskia River. Future concentrations of heavy metals remain within the General Use Water Quality Standards.

5.2.6.3 Maintenance Impacts

Existing chloride levels in North Fork Kaskaskia River in 2008 varied from 5.8 mg/L to 23.9 mg/L. The annual incremental daily maximum increase in chloride concentration is estimated to be 117 mg/L for US 51 Build Alternative. This project increase does not exceed the General Use Water Quality Standards for chloride.

5.2.7 Hickory Creek

Hickory Creek is 24.3 miles in length with a total drainage area of 142 square miles. The stream is depicted on the USGS topographic map as having perennial flow throughout much of its length, however the 7-day 10-year flow is zero (Singh, 1988; map updated 2002). Land use in the watershed is forest and row crop agriculture. The stream is on the 2014 Illinois 303(d) list with impairments listed as fecal coliform bacteria; however, the sources are unknown. According to IDNR, Hickory Creek was rated as B for diversity and C for integrity.

5.2.7.1 Construction Impacts

Hickory Creek has an approximate upstream drainage area of 85.3 square miles. Only US 51 Build Alternative crosses Hickory Creek. The riparian areas at some of the tributary crossings consist of trees and vegetation. The US 51 Build Alternative crossings will be one culvert, a bridge of 510 feet in length, and four piers.

Temporary impacts of sedimentation will occur. Nineteen fish species were collected in 2008 and only one intolerant species, the slenderhead darter, was found in this stream.

5.2.7.2 Operational Impacts

US 51 Build Alternative introduce a new source of potential highway pollutants into Hickory Creek. Table 5- 4 summarizes the estimated total suspended solids, lead, copper, and zinc concentrations in Hickory Creek.

The concentrations of heavy metals remain within the General Use Water Quality Standards for future roadway conditions.

5.2.7.3 Maintenance Impacts

Chloride levels were not previously collected. The annual incremental daily maximum increase in chloride concentration is estimated to be 27 mg/L for US 51 Build Alternative. See Table 5-6. This project increase will not exceed the General Use Water Quality Standards for Chloride.

5.2.8 Kaskaskia River

Kaskaskia River is 303(d) listed stream and flows into the Kaskaskia River. The stream is 279.9 miles in length with a total drainage area of 5,801 square miles. The stream is depicted on the USGS topographic map as having perennial flow throughout much of its length. The 7-day 10-year flow varies by location form 24 cubic feet per second to 28 cubic feet per second (Singh, 1988; map updated 2002). Land use in the watershed is forest, row crop agriculture, residential, urban, and field/pasture. Kaskaskia River is found on the 2014 Illinois 303(d) list for impairments listed include dissolved oxygen, total suspended solids (TSS), pH, total phosphorus, mercury, manganese, and fecal coliform bacteria. According to IDNR, at the stream crossing of proposed and existing US 51, Kaskaskia River has been rated as D for diversity and C for integrity.

5.2.8.1 Construction Impacts

The Kaskaskia River has an approximate upstream drainage area of 1,944 square miles. Only US 51 Build Alternative crosses Kaskaskia River. The riparian areas at some of the tributary crossings consist of trees and grasses. The US 51 Build Alternative crossings include 10 culverts, one 700-ft bridge, and seven piers.

Temporary impacts will be an increase in turbidity and sedimentation during instream work. Fish and macroinvertebrate species are primarily pollution tolerant; however, the intolerant state endangered western sand darter occurs near the crossing. Instream work will halt from approximately June 16 to August 16 in order not to harm potential spawning sites of the western sand darter.

5.2.8.2 Operational Impacts

US 51 Build Alternative introduce a new source of potential highway pollutants into Kaskaskia River. Table 5- 4 summarizes the estimated total suspended solids, lead, copper, and zinc concentrations, respectively.

Concentrations of heavy metals reflect the proposed US 51 Build Alignment. These concentrations remain within the General Use Water Quality Standards for future roadway conditions. Temporary impacts will be an nominal increase in sedimentation and turbidity during instream work. Temporary construction impacts will be minimized through the use of erosion control measures. All measures will be in compliance with the National Pollutant Discharge Elimination System (NPDES) program of the Federal Clean Water Act. Appropriate measures will be in place prior to starting construction. The Kaskaskia River is currently impaired for total suspended solids. Although a small increase (5 mg/L) is calculated, this does not include TSS removed associated with the construction of ditches and other stormwater systems. Additionally, the conversion of agricultural land to paved area will results in a net reduction of TSS loading from land use conversion.

5.2.8.3 Maintenance Impacts

Existing chloride levels in Kaskaskia River during 2008-2010 varied from 13.4 mg/L to 27.2 mg/L. The annual incremental daily maximum increase in chloride concentration is estimated to be 26 mg/L for US 51 Build Alternative. This increase will not exceed the General Use Water Quality Standards for chloride.

5.2.9 Ramsey Creek

Ramsey Creek flows an estimated 21.6 miles to its confluence with the Kaskaskia River and has a total drainage area of 106 square miles. Ramsey Creek is a perennial stream and the 7-day 10-year flow is 0.05 cubic feet per second by the ISWS (Singh, 1988; map updated 2002). Land use is forest and agriculture. The stream is listed as a biologically significant water body in the INHS publication Biologically Significant Illinois Streams and is an INAI site. The Mean Family Level IBI in 2008 was 5.56, an indication of a “fair” water quality. The IDNR also designated Ramsey Creek, within the project area, as A for diversity and B for integrity. No threatened or endangered species were identified within the proposed stream crossing during 2009 through 2012.

5.2.9.1 Construction Impacts

Ramsey Creek has an approximate upstream drainage area of 95.9 square miles, consisting primarily of forest and agriculture. The RCOA and RCOB crossings will be one 235-ft bridge with four piers placed in the stream.

There will be temporary increases in sedimentation and turbidity. No intolerant fish species were collected at the proposed US 51 Build crossing and blunt nose minnows comprised 63 percent of the catch. Only temporary impacts would occur due to construction. Bridging will minimize stream impacts.

5.2.9.2 Operational Impacts

Alternatives RCOA & B introduce a new source of potential highway pollutants into Ramsey Creek. Table 5-4 summarize the estimated concentrations of total suspended solids, lead, copper, and zinc within Ramsey Creek. The suspended solids concentrations associated with RCOA will be 42 mg/L and RCOB is 40 mg/L. Concentrations of heavy metals remain within the General Use Water Quality Standards.

5.2.9.3 Maintenance Impacts

Deicing is the primary maintenance activity that affects water quality in Ramsey Creek. Existing chloride levels in Ramsey Creek in 2008 varied from 13.5 mg/L to 16.8 mg/L. The estimated annual incremental daily maximum increase in chloride concentration for Alternatives RCOA and RCOB are less than 28 mg/L.

5.2.10 Webster Creek

Webster Creek is not a special designation stream. However, approximately 1,100 linear feet of the north tributary to Webster Creek is expected to be realigned by the US 51 Build Alternative. Webster Creek begins south of the City of Centralia from which it flows 8.9 miles southwest where it joins with Sewer Creek west of Wamac. The north tributary to Webster Creek joins Webster Creek within the proposed location of the interchange between the existing US 51 and the US 51 Build Alternative, south of the City of Centralia.

Direct impacts would result from grading, excavation, placement of fill, and vegetation removal to construct the realignment. In addition to the realignment, new roadway crossings of Webster Creek and its north tributary with the proposed interchange ramps will also affect the hydrology.

Mitigation for stream re-alignment will be needed per 33 CFR part 332 and IDOT may use the Illinois Stream Mitigation Guidance. Meanders will be incorporated as part of the mitigation, to the extent feasible.

Webster Creek does not have a special designation and is not a stream that is above average quality for this region of Illinois. Special designations include navigable waters, streams that have “outstandingly remarkable” natural or cultural values, streams that are listed on the Nationwide Rivers Inventory, Illinois Natural Areas, Biological Stream Rating System (BSRS) High Quality Streams, or as impaired streams.

Webster Creek was assessed upstream of the existing US 51 bridge over Webster Creek during 2008. The streambed of Webster Creek consists of sand, silt, clay and gravel. Webster Creek has a measured width of 11.5 feet wide and a depth of 3.6 feet. The vegetation adjacent to the creek consists of trees and grasses. The surrounding land use is industrial and forest. The INHS habitat assessment for Webster Creek classified the stream as poor.

Fish, mussels, and macroinvertebrates were sampled at Webster Creek in 2008. Eight species of fish were collected with bluegills dominating 59 percent of the collection. In addition to the habitat assessment of the stream the INHS also did a water quality assessment of the stream which resulted in a rating of “poor” water quality. No intolerant fish species were collected in Webster Creek. Mussel collection efforts yielded no live specimens. The IDNR has not assessed Webster Creek for diversity, integrity or biological significance.

5.3 Lakes and Ponds

Two lakes, Vandalia Lake and Carlyle Lake, potentially would receive storm water runoff from the build alternatives. The only Vandalia alternative with storm water draining to Vandalia Lake is V Alt 1. V Alt 1 crosses four small tributaries that drain to Vandalia Lake. The pollutant loading from V alt 1 will not cause any water quality violations in Vandalia Lake and will not affect the sport fishery. Additionally all of the streams in the US 51 area drain ultimately to the Kaskaskia River and then to Carlyle Lake. The water quality of these two lakes will not be affected by runoff from US 51 based on the size of these lakes and small contributions of US 51

5.4 Highly Erodible (HEL) Soils

Highly erodible soils would be altered as a result of construction activities, such as grading, filling, compaction, and excavation. Table 5-5 summarizes the acres of highly erodible soils for each alternative. Appendix E contains a figure depicting the locations of HEL soils.

TABLE 5-5: HIGHLY ERODIBLE SOILS

County	Acres of Highly Erodible Soils
US 51 Build Alternative	122.6
CS Alt. 1	19.0
CS Alt. 2	13.0
V Alt. 1	98.7
V Alt. 2	131.3
V Alt. 3	94.1
V Alt. 4	71.9
Ramsey Creek Option A	16.8
Ramsey Creek Option B	11.1
Ramsey Alt. 1	13.8
Ramsey Alt. 2	26.1

5.5 Impact Minimization, Best Management Practices, and Mitigation

Design, construction, and operational features would be included in the design of the detailed build alternatives to minimize highway impacts upon receiving streams. These measures would include the use of vegetated drainage ditches, erosion control features, and deicing control management.

5.5.1 Minimization/Mitigation of Construction Impacts

Mitigation measures identified in the IDOT *Standard Specifications for Road and Bridge Construction* IDOT, 2002) and "Construction Memorandum No. 06-60, Erosion and Sediment Control" (IDOT, May 2006) would be used to reduce the effects of roadway construction.

Soil erosion control measures in these areas would involve special consideration to minimize sedimentation in the stream during construction. River and stream banks disturbed by construction would be revegatated immediately following construction. Raw (unvegetated) banks would be mulched or protected with blankets until the vegetation is established.

Also, construction methods would maintain for fish passage in at least 50 percent of the river. Construction methods would minimize the placement of temporary fill into the river for haul roads or equipment access.

5.5.2 Minimization/Mitigation of Operational Impacts

Storm water management includes a variety of methods to reduce pollutant concentrations prior to discharge to area streams. Drainage from the right-of-way would be controlled and treated via a series of vegetated ditches.

For Alternatives V Alt 2 and V Alt 3 the potential for groundwater contamination near shallow private wells in the Vandalia area was considered. Clay-lined ditches will be used in this area to minimize potential impacts to water supplies.

5.5.3 Minimization/Mitigation of Maintenance Impacts

Deicing applications represent the primary activity that affects water quality in the area streams. The application rates needed to maintain safe roadways must be maintained; however, IDOT is continuing to develop additional management and maintenance strategies to reduce salt application rates.

5.6 Indirect and Cumulative Impacts

<u>Historical Conditions</u>

Historic water quality conditions in the Kaskaskia River watershed, which include the main stem and associated tributaries, are described by the IEPA use assessment process. The IEPA characterizes stream quality according to its ability to sustain aquatic life, primary contact, and general use. The Kaskaskia River watershed has remained rural in nature compared to the rest of

Illinois. In 120 years the population in this watershed has only grown by 30 percent compared to a state population increase of over 300 percent. The water quality in this watershed has been primarily affected by agricultural practices rather than development. Historic water quality is described by the IEPA use assessment completed since 1986. In 1986 59.4 percent of the watershed supported all potential water uses, and this percentage held relatively constant over the next 30 years. In 2010 IEPA did not evaluate as many streams and changed the evaluation criteria. The Kaskaskia River is reported to support all uses in only 27 percent of the watershed with 44.7 percent not assessed and 28 percent not supporting human and aquatic uses. The lower Kaskaskia River is impaired due to nutrients and siltation; the upper Kaskaskia where the project is located does not support human or aquatic uses due to a variety of pollutants including low dissolved oxygen level, sedimentation, phosphorus, and metals.

The state and federal regulations require that water quality improvements occur in this watershed and studies are underway to develop plans for improvement. Future water quality should improve with these requirements for treatment of storm water and wastewater.

References

Barrett, M.E., J. F. Malina, R.J. Charbeneau, and G.H. Ward. 1995. Water Quality and Quantity Impacts of Highway Construction and Operation: Summary and Conclusions.

Bertrand, W.A., R.L. Hite, and D.M. Day. 1996. Biological Stream Characterization: Biological Assessment of Illinois Stream Quality through 1993. IEPA/BOW/96-058.

CityCentralia 2011a http://www.city.centralia.il.us/index.pl?iid=3780 accessed 3-24-11.

CityCentralia 2011b http://www.city.centralia.il.us/index.pl?id=3894 accessed 3-24-11.

Driscoll, E.D., Shelley, P.E., and Strecker, E.W., 1990, Pollutant loadings and impacts from highway stormwater runoff volume I: design procedure: Federal Highway Administration Final Report FHWA-RD-88-006, 67 p

Driscoll, E.D., Shelley, P.E., and Strecker, E.W., 1990, Pollutant loadings and impacts from highway stormwater runoff, volume II: user's guide for interactive computer implementation of design procedure: Federal Highway Administration Final Report FHWA-RD-88-007, 23 p.

Driscoll, E.D., Shelley, P.E., and Strecker, E.W., 1990, Pollutant loadings and impacts from highway stormwater runoff volume III: analytical investigation and research report: Federal Highway Administration Final Report FHWA-RD-88-008, 160 p.

Driscoll, E.D., Shelley, P.E., and Strecker, E.W., 1990, Pollutant loadings and impacts from highway stormwater runoff volume IV: research report data appendix: Federal Highway Administration Final Report FHWA-RD-88-009, 143 p.

FindLakes. 2011 http://findlakes.com/raccoon_lake_illinois~il00242.htm accessed 3-24-11.

Healy, R.W. 1979. River Mileages and Drainage Areas for Illinois Streams – Volume 2, Illinois River Basin. USGS Water Resources Investigations 79-11.

Hilsenhoff, W.L. 1987. An improved biotic index of organic stream pollution. Great Lakes Entomology. 20:31-39.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic Index. J. N. Am. Benthological Soc. 7(1):65-68.

Hite, R.L. and W.A. Bertrand. 1989. Biological Stream Characterization (BSC): A Biological Assessment of Illinois Stream Quality. Special Report #13 of the Illinois State Water Plan Task Force. IEPA/AC/89-275.

IAC. 2002. Title 35 of the Illinois Administrative Code; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302: Water Quality Standards' Subpart A: General Water Q uality Provisions; Section 302.105: Antidegradation
http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx Accessed 01-14-2014
Illinois Department of Natural Resources. 2008. Integrating Multiple Taxa in a Biological Stream Rating System. Office of Resource Conservation. 42 p.

Illinois Department of Natural Resources 2004. Critical Trends Assessment Program 2003-04 Report. Office of Realty and Environmental Planning. Springfield IL. 98 p.

IDNR 2005. Illinois Comprehensive Wildlife Conservation Plan. Illinois Department of Natural resources. Version 1.0 Springfield, IL.

IDNR 2001. Illinois Department of Natural Resources. Critical Trends in Illinois Ecosystems. Critical Trends Assessment Program. Office of Realty and Environmental Planning. Springfield, IL.

IDNR 2012.
http://www.ifishillinois.org/profiles/lakes/individual_lakes/vandalia.html Accessed 09-12-2012.
http://www.ifishillinois.org/pdf/2012-13-FishingInfoGuide_Web.pdf Accessed 09-12-2012.

IDPH 2011. Illinois Department of Public health. 2011 Fish consumption Advisory. http://www.co.mchenry.il.us/departments/health/Press%20Releases/2011/01%20 21%2011%20IDPH%20Sport%20Fish%20Consumption%20Advisory.pdf accessed 4-8-11.

IDPH 2012. Illinois Department of Public health. 2012 Fish Consumption Advisory.
http://www.idph.state.il.us/envhealth/fishadvisory/index.htm accessed 09-12-2012.

IEPA 2004. Vandalia Lake TMDL Report. Illinois Environmental Protection Agency. Bureau of Water. Springfield, IL. IEPA/BOW/03-012.

IEPA 2012. Illinois Integrated Water Quality Report and Section 303(d) List, 2012. Clean Water Act Sections 303(d), 305(b) and 314 Water Resource Assessment Information and List of Impaired Waters Volume I: Surface Water, March 16, 2012.
http://www.epa.state.il.us/water/tmdl/303-appendix/2012/iwq-report-surface-water.pdf
http://www.epa.state.il.us/water/tmdl/303-appendix/2012/appendix-b2.pdf.

IEPA. 2010. Illinois Integrated Water Quality Report and Section 303(d) LIST – 2010. Clean Water Act Sections 303(d), 305(b) and 314 Water Resource Assessment Information and Listing of Impaired Waters. Appendix B. Draft. http://www.epa.state.il.us/water/tmdl/303-appendix/2010/2010-ir-volume-i-surfacewater-draft-3-26-10.pdf.

Illinois Environmental Protection Agency. 2006. Illinois Integrated Water Quality Report and Section 303(d) List. Illinois Environmental Protection Agency. 2000. Draft Manual for Calculating Index of Biotic Integrity Scores for Streams in Illinois.

Illinois Environmental Protection Agency. 2004. Illinois Water Quality Report. IEPA/BOW/04-006.

IEPA 2004. Vandalia Lake TMDL Report. Illinois Environmental Protection Agency. Bureau of Water. Springfield, IL. IEPA/BOW/03-012.

Jones, P.H. and B.A. Jeffrey. 1992. Environmental Impact of Road Salt. In: Chemical Deicers and the Environment. Ed. Frank M. D'Itri. Lewis Publishers, Chelsea, Michigan.

Page, L.M., K.S. Cummings, C.A. Mayer, S.L. Post, and M.E. Retzer. 1992. Biologically Significant Illinois Streams. INHS, F-110-R.

Miller, Karen (Editor), 2001. The Kaskaskia River Basin: An Inventory of the Region's Resources. Illinois Department of conservation. Critical trends Assessment Program (CTAP). Springfield, IL.

NHDES 2003. New Hampshire Department of Environmental Services. http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb- 49.pdf accessed 4-8-11.

Singh, K.P., and J.B. Stall. 1973 The 7-Day 10-Year Low Flows of Illinois Streams. Maps updated 2002. Illinois State Water Survey.

Smogor, R. 2000 (draft, annotated 2006). Draft manual for calculating Index of Biotic Integrity scores for streams in Illinois. Illinois Environmental Protection Agency, Bureau of Water, Division of Water Pollution Control. Springfield, Illinois.

Smogor, R. 2005 (draft). Interpreting Illinois fish-IBI scores. Illinois Environmental Protection Agency, Bureau of Water, Division of Water Pollution Control. Springfield, Illinois

Stensland, G.J. 1975. The Flow of Deicing Salt into the Atmosphere. USEPA Report EPA-600/2-76-105, Illinois State Water Survey, Urbana, Illinois.

Sucoff, E. 1975. Effect of Deicing Salts on Woody Vegetation Along Minnesota Roadways, Investigation No. 636, Tech. Bulletin 303.

Szafoni, R.E. 2002. Freshwater Mussel Classification Index. In Illinois Natural Areas Inventory - Approved Standards and Guidelines. pp. 66-71.

Transportation Research Board. 1991. Highway Deicing, Comparing Salt and Calcium Magnesium Acetate. Special Report 235, Washington, D.C.

Transportation Research Board. 2007. Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts. Special Report 577, Washington, D.C.

United States Department of Interior. 1982. National Wild and Scenic River System Components. http://www.rivers.gov/guidelines.html

United States Department of Transportation. 1996. Evaluation and Management of Highway Runoff Water Quality. USDOT #FHWA-PD-96-032.

United States Environmental Protection Agency STORET Database. 2010. http://www.epa.gov/storpubl/legacy/gateway.htm

United States Environmental Protection Agency. 1985. Planning Considerations for Roads, Highways and Bridges. Office of Water. EPA-841-F-95-008b.

United States Department of the Interior, U.S. Geological Survey (USGS). 1969. 7.5 Minute Topographic Map Illinois. Centralia West and Boulder Quadrangles.

United States Department of the Interior, U.S. Geological Survey (USGS). 1970. 7.5 Minute Topographic Map Illinois. Fairman, Centralia East and Quadrangles.

United States Department of the Interior, U.S. Geological Survey (USGS). 1974. 7.5 Minute Topographic Map Illinois. Irvington, Walnut Hill, Vandalia, Hagarstown, Bingham, and Patoka Quadrangles.

United States Department of the Interior, U.S. Geological Survey (USGS). 1982. 7.5 Minute Topographic Map Illinois. Vera, Ramsey, and Oconee Quadrangles.

Vandalia. 2011a http://www.vandaliaillinois.com/vanlake.html accessed 3-24-11.

Vandalia. 2011b. http://www.vandaliaillinois.com/waterdept.html accessed 3-24-11.

Vandalia, 2012. http://www.vandaliaillinois.com/lake_fishing.html accessed 09-12-2012.

Watson, J.S. and A.T. Der. 1986. Turbidity: A Literature Review of Its Impacts on Aquatic Resources.

Weber, W.G., and L.A. Reed. 1976. Sediment runoff during highway construction. Civil Engineering-ASCE 46(3):76-79.

Wellman, J.C., Combs, D.L., and Cook. 2000. Long Term Impacts of Bridges and Culvert Construction or Replacement on Fish Communities and Sediment Characteristics of Streams. Journal of Freshwater Ecology 15(3): 317-328.

Wetzel, Mark J. and Christopher A. Phillips, Editors. 2009. An Assessment of the Biological Resources Associated with the IDOT U.S. Route 51 Study Area in Clinton, Fayette, Jefferson, Marion, Shelby, and Washington Counties, Illinois – 2008. Illinois Natural History Survey. Champaign IL. INHS Technical Report 2009 (16). 12 June 2009

Wetzel, Mark J., Editor. 2010. An Assessment of the Biological Resources Associated with the IDOT U.S. Route 51 2009 Study Area in Christian, Clinton, Fayette, Marion, Shelby, and Washington Counties, Illinois. Illinois Natural History Survey. Champaign IL. INHS Technical Report 2010 (10). 15 February 2010.

Wetzel, Mark J., et al. 2010. A Limited Assessment of Aquatic Resources (Fishes, Freshwater Mussels, other Aquatic Macroinvertebrates, and Water Quality) Associated with the Kaskaskia River in the IDOT U.S. Route 51 (2010) Study Area, Fayette County, Illinois. Illinois Natural History Survey. Champaign IL. INHS Technical Report 2010 (39). 30 September 2010.

Wetzal, Mark J., Steven J. Taylor, Jeremy S. Tiemann, and Kevin S. Cummings. 2012. A Limited Assessment of Aquatic Resources (Fishes, Unionid Mussels, other Aquatic Macroinvertebrates, and Water Quality) Associated with Streams in the IDOT U.S. Route 51 (FA 322) Addendum B Project Area, Fayette County, Illinois. INHS/IDOT Statewide Biological Survey & Assessment Program Report 2012(1). 15 January 2012 – Revised 26 March 2012.

Young, G.K., S. Stein, P. Cole, T. Kammer, F. Graziano, and F. Bank. 1996. Evaluation and Management of Highway Runoff Water Quality. FHWA, Washington, D.C.