HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Cliff Drive Groundwater Contamination

U.S. EPA ID No.: INN000510272

Contact Persons

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Pathways, Components, or Threats Not Scored

Surface Water Migration Pathway, Soil Exposure Pathway and Subsurface Intrusion, and Air Migration Pathway:

The Surface Water Migration Pathway, Soil Exposure Pathway and Subsurface Intrusion Pathway, and Air Migration Pathway were not scored as part of this Hazard Ranking System (HRS) evaluation. These pathways were not included because a release to these media does not significantly affect the overall score for this site and because the Groundwater Migration Pathway produces an overall score above the minimum requirement for the Cliff Drive Groundwater Contamination Site to qualify for inclusion on the National Priorities List (NPL).

HRS Documentation Record

Name of Site:	Cliff Drive Groundwater Contamination
Date Prepared:	September 2018
EPA Region:	5
Street Address*:	Cliff Drive (AKA River Road) and Ottawa Road (see Figure 3 of this HRS Documentation Record)
City, County, State, Zip Code:	Logansport, Cass County, Indiana, 46947
General Location in the State:	North-Central Indiana (Figure 1 of this HRS Documentation Record)
Topographic Map:	Clymers Quadrangles, Indiana-Cass County (7.5-Minute Series (Ref. 93, p. 1; Figure 2)
Latitude:	40.7432
Longitude:	-86.3803
Reference Point:	Center of Groundwater Plume (Figure 3 of this HRS Documentation Record)

Congressional District:

*The street address, coordinates, and contaminant locations presented in this HRS Documentation Record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Pathway Scores for Cliff Drive Groundwater Contamination

Air Migration Pathway:	Not Scored
Surface Water Migration Pathway:	Not Scored
Soil Exposure and Subsurface Intrusion Pathway:	Not Scored
Ground Water Migration Pathway[1]:	100.00
HRS Site Score:	50.00

[1] Ground water" and "groundwater" are synonymous; the spelling is different due to "ground water" being codified as part of the HRS, while "groundwater" is the modern spelling

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	100.00	10,000.00
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	NS	NS
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger or lines 2a and 2b as the pathway score	NS	NS
3.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		10,000.00
6.	**HRS Site Score** (divide the value on line 5 by 4 and take the square root)	50.00	

Notes: NS = Not Scored

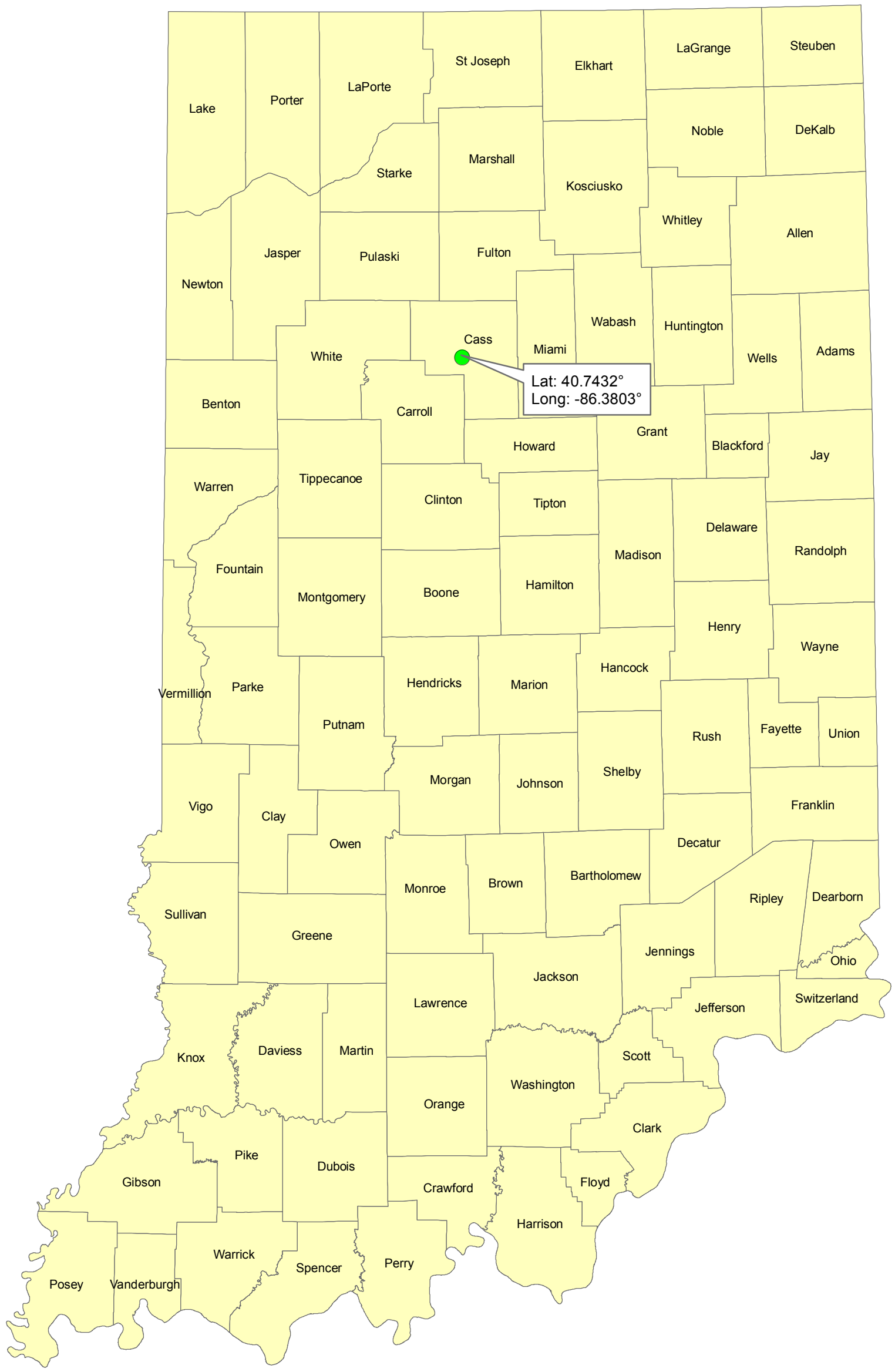
HRS Table 3-1 – Ground Water Migration Pathway Scoresheet

Factor Categories and Factors	Maximum Value	Value Assigned
Likelihood of Release to an Aquifer:		
1. Observed Release	550	550.00
2. Potential to Release:		
2a. Containment	10	NS
2b. Net Precipitation	10	NS
2c. Depth to Aquifer	5	NS
2d. Travel Time	35	NS
2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	NS
3. Likelihood of Release (higher of lines 1 and 2e)	550	550.00
Waste Characteristics:		
4. Toxicity/Mobility	(a)	1,000.00
5. Hazardous Waste Quantity	(a)	100.00
6. Waste Characteristics	100	18.00
Targets:		
7. Nearest Well	(b)	45.0
8. Population:		
8a. Level I Concentrations	(b)	0
8b. Level II Concentrations	(b)	14,695.2
8c. Potential Contamination	(b)	94
8d. Population (lines 8a + 8b + 8c)	(b)	14,789.2
9. Resources	5	0
10. Wellhead Protection Area	20	20.00
11. Targets (lines 7 + 8d + 9 + 10)	(b)	14,854.2
Ground Water Migration Score For An Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100	100.00
Ground Water Migration Pathway Score:		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100.00

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
[c] Do not round to nearest integer
NS - Not Scored

Fig. 1

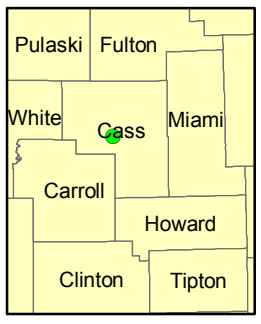
Cliff Drive Groundwater Contamination Site Location
Logansport, Cass County, Indiana

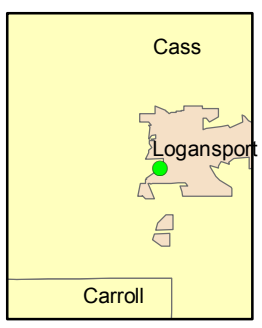


This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Shane Moore, Office of Land Quality
Date:07/24/2018

0 12.5 25 50Kilometers
0 12.5 25 50Miles



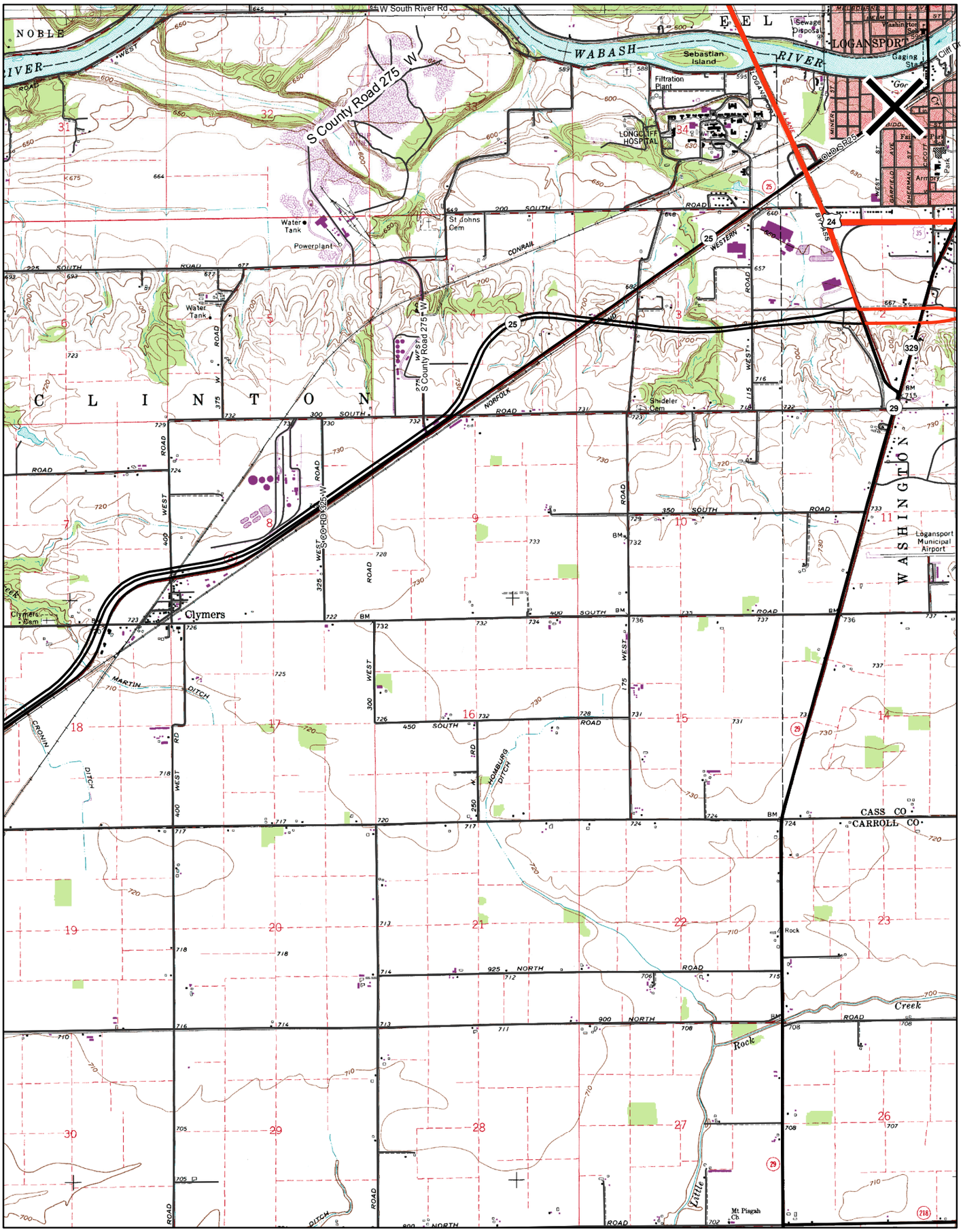


Site Location Center

N
W E
S

Sources:
Non Orthophotography Data - Obtained from the State of Indiana Geographical Information Office Library
-Site Latitude and Longitude based on center of plume
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

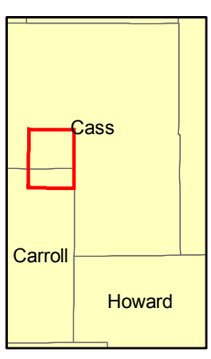
Cliff Drive Groundwater Contamination
Map Showing Northwest Corner of Clymers USGS Quadrangle, 7.5 Minute Series
Logansport, Cass County, Indiana

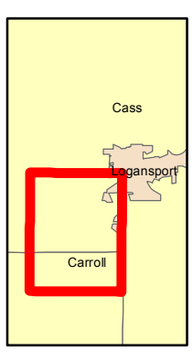


This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Shane Moore, Office of Land Quality
Date:08/08/2018

Sources:
Non Orthophotography Data
-Site Latitude and Longitude based on center of plume
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83





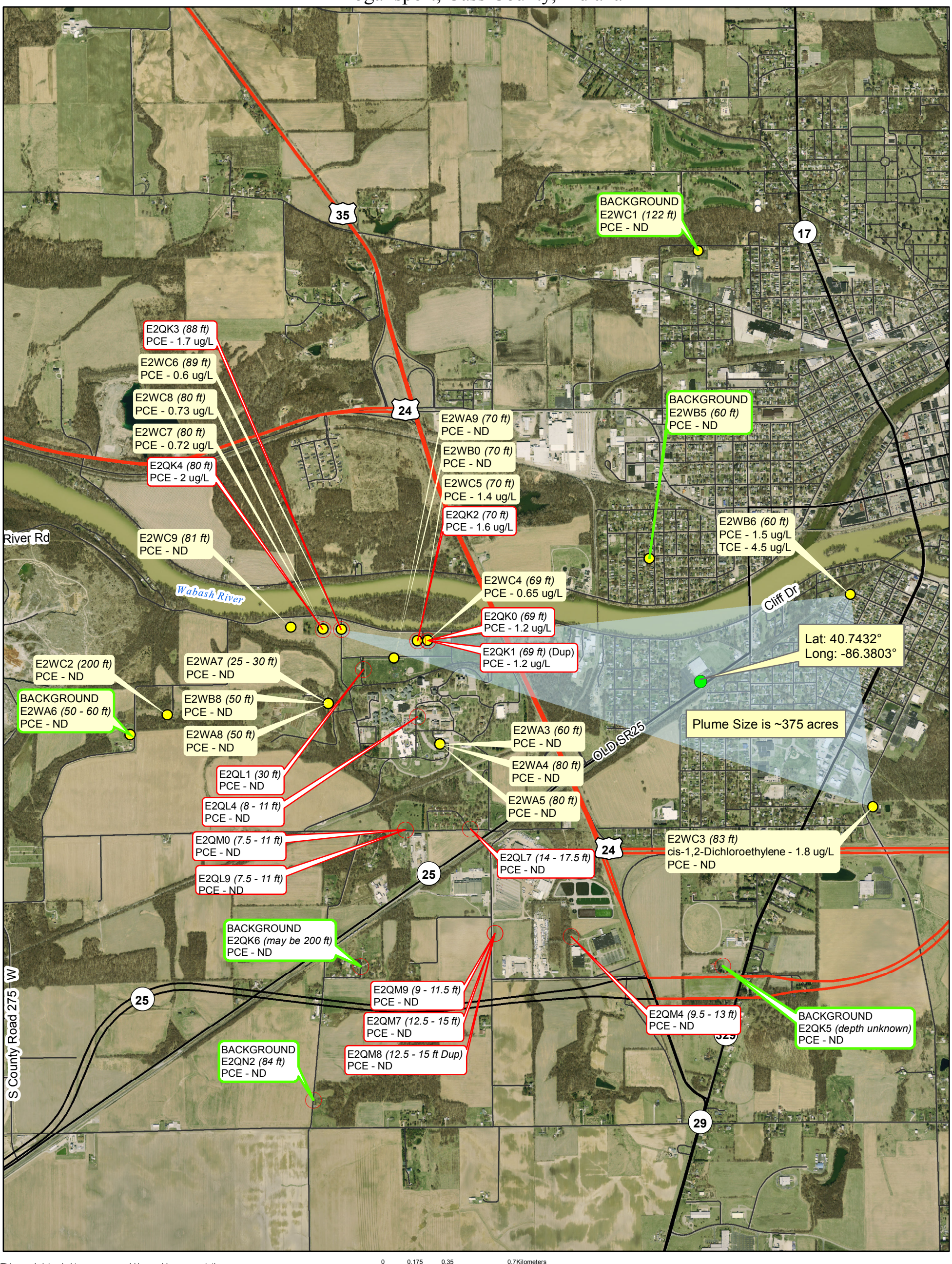
0 5 10 20Kilometers
0 5 10 20Miles

General Site Location

N
W E
S

Fig. 3

Cliff Drive Groundwater Contamination Sample Locations and Results (2008 and 2016) with Plume
Logansport, Cass County, Indiana



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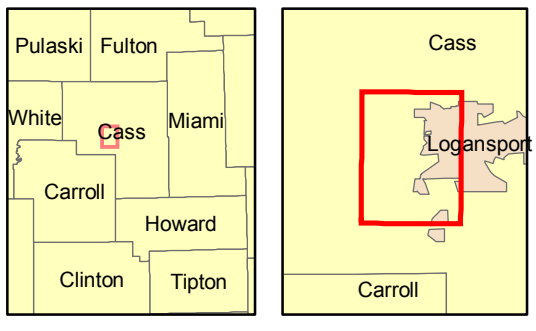
Mapped By:
Shane Moore, Office of Land Quality
Date:07/24/2018

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
Document
- Sampling Locations Results 2008, Reference 6, Pages 10-21
- Sampling Locations Results 2016, Reference 8, Pages 40-49
- Plume created based on results in Reference 8, Pages 40-49
- Sample Locations obtained from IDEM OLQ Sampling Database (SampDB)

Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

N W E S

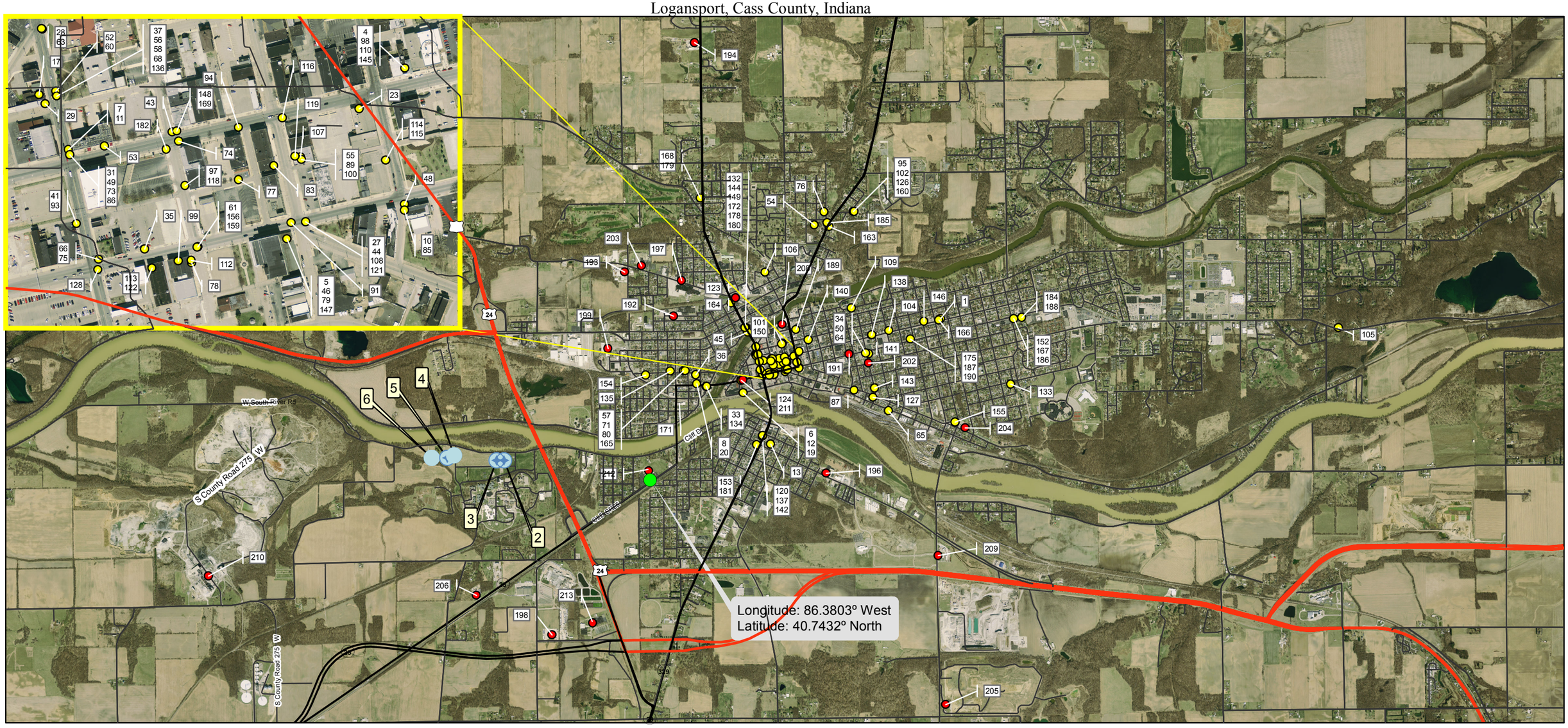
0 0.175 0.35 0.7 Kilometers
0 0.175 0.35 0.7 Miles



- Sample Locations and Results (2008 WHITE Background)
- Sample Locations and Results (2016 YELLOW Background)
- Site Location Center
- Plume

Cliff Drive Groundwater Contamination
Possible Sources Map
Logansport, Cass County, Indiana

Fig. 4



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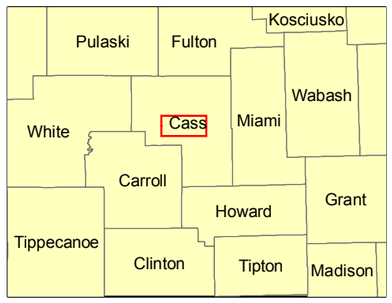
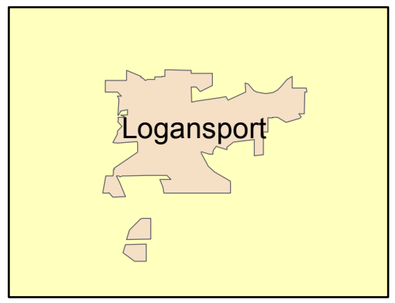
Mapped By:
Shane Moore, Office of Land Quality
Date:07/24/2018

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographical Information Office Library
-Site Latitude and Longitude based on center of plume
Orthophotography
- Obtained from Indiana Map Framework Data
Document
- Affidavit of Dan Chesterson and Mark Jaworski Reference 67 (pages 7-16)
- DNR Water Withdraw Wells Reference 3 (pages 16-21)
(www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

N W E S

0 0.5 1 2 Miles
0 0.75 1.5 3 Kilometers





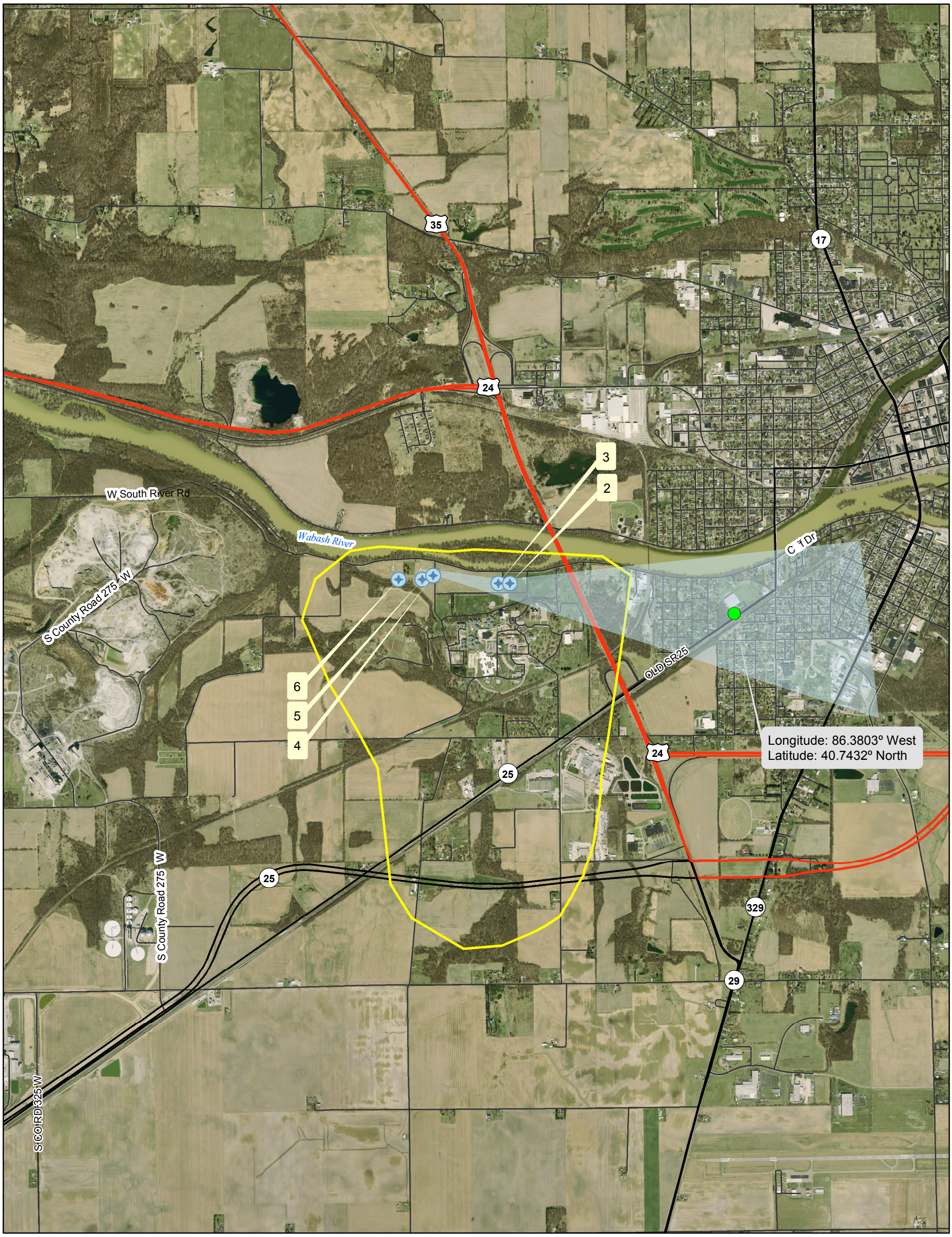
IDEM
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
EST. 1986

- Site Location Center
- Logansport Municipal Well

Source Type
- Dry Cleaner
- Non Dry Cleaner

Fig. 5

Cliff Drive Groundwater Contamination
Site Location Map Showing Groundwater Plume Boundary
Logansport, Cass County, Indiana



0 0.225 0.45 0.9 Kilometers
0 0.225 0.45 0.9 Miles

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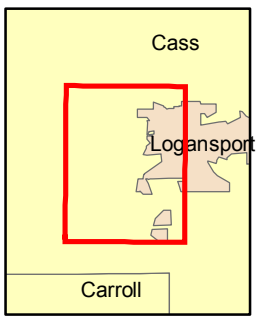
Mapped By:
Shane Moore, Office of Land Quality
Date:07/24/2018

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library
-Site Latitude and Longitude based on center of plume
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Document
- Wellhead Delineation Reference 69
- Logansport Municipal Wells Reference 3 (pages 16-21)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



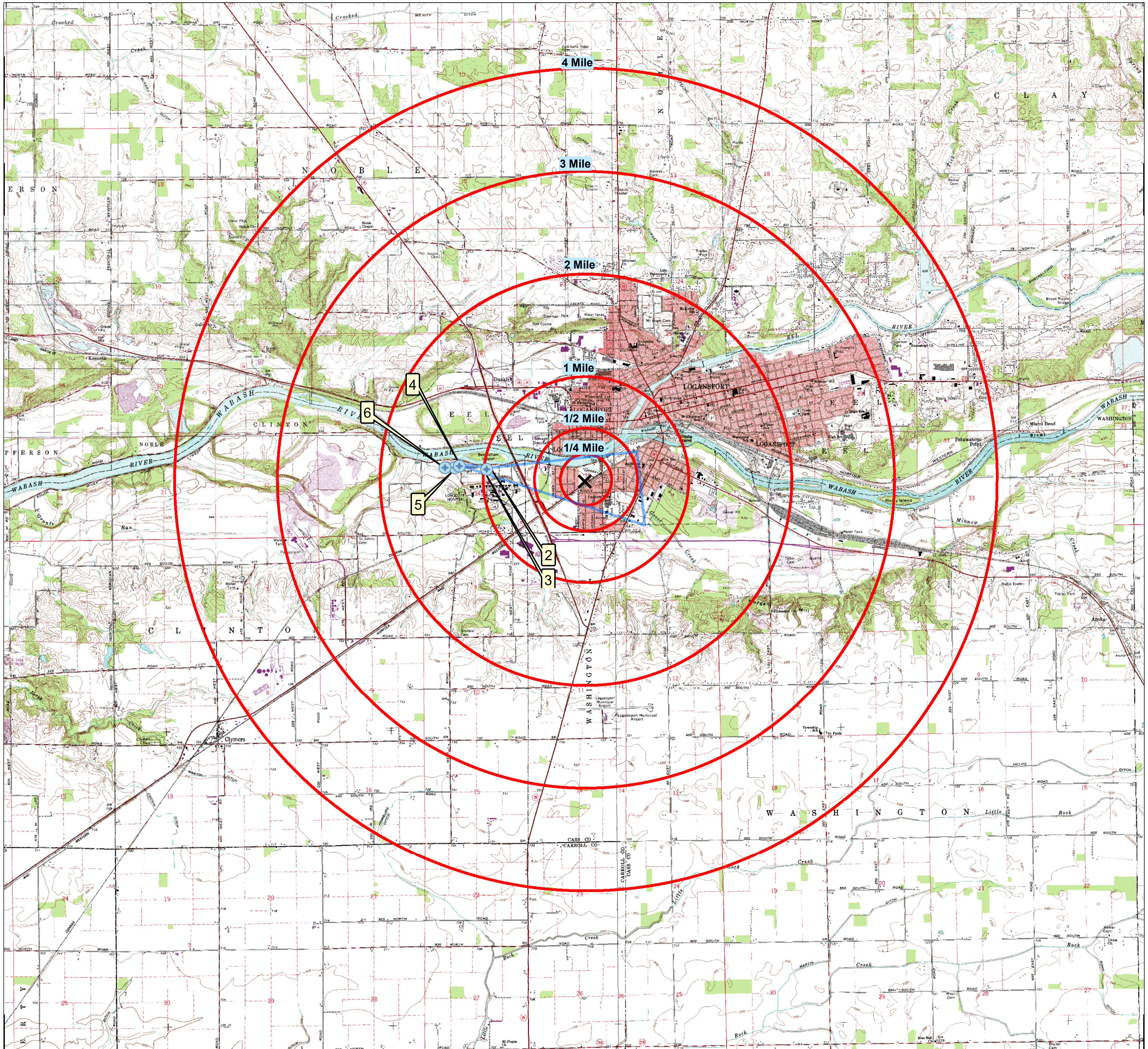
IDEM
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
EST. 1986

Logansport Municipal Well
General Site Location
Plume
Wellhead Protection Area
Wellhead 5 Year Delineation

Fig. 6

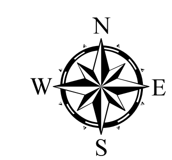
Four Mile Radius Map
Cliff Drive Groundwater Contamination

40.7432° N
86.3803° W
(Approximate Center of Site)



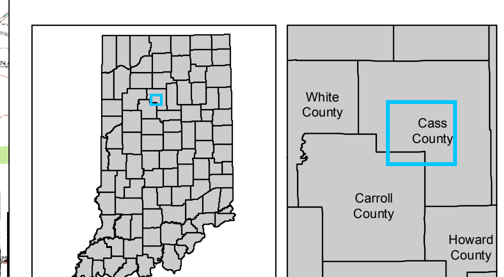
Buffer Distance	Adjusted Population
0.25 Mile	201
0.5 Mile	1181
1 Mile	2619
2 Mile	7790
3 Mile	5702
4 Mile	3643
Total Adjusted Population	**21136**

✕ Site Location
Logansport Municipal Well
Plume
Buffers



IDEM

0 1 2 Miles
0 1 2 3 Kilometers



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, July 24, 2018
Sources:
Non Orthophotography Data
-Site Latitude and Longitude based on center of plume
Topo
- Obtained from Indiana Map Framework Data
Document
- Plume created based on results in Reference 8, Pages 40-49
- DNR Water Withdraw Wells Reference 3 (pages 16-21)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

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SITE SUMMARY

The Cliff Drive Groundwater Contamination site consists of a groundwater plume with no identified source. Chlorinated solvents, specifically tetrachloroethylene (PCE), have been detected in the groundwater of the Logansport Municipal Wells #2, #3, #4, and #5 located in Logansport, Indiana (Refer to Table 2a of this HRS documentation Record). In addition, PCE, trichloroethylene (TCE), and/or Cis-1,2 Dichloroethylene (Cis-1,2-DCE) were detected in groundwater that was collected via rotosonic generated borings (Refer to Table 2b of this documentation record). Logansport Municipal Utilities (LMU) operates the groundwater wells that supplies drinking water to the Town of Logansport (Ref. 78, pp. 1, 2). LMU supplies drinking water to 18,369 people (Ref. 78, p. 2).

LMU operates five (5) wells in (1) well field, and four (4) of those five (5) wells have been contaminated by a groundwater plume of chlorinated solvents, principally PCE (Ref. 78, p. 2; 79, p. 8; Table 2a and Figure 5 of this HRS Documentation Record). The five (5) wells in LMU's well field are known as Well #2, Well #3, Well #4, Well #5, and Well #6 (Ref. 78, p. 2). Well #2 has a total depth of 69 feet below ground surface (bgs) (Ref. 9, pp. 26, 120, 121). Well #3 has a total depth of 70 feet bgs (Ref. 9, pp. 26, 120, 122). Well #4 has a total depth of 88 feet bgs (Ref. 9, pp. 26, 120, 123). Well #5 has a total depth of 80 feet (Ref. 9, pp. 26, 120, 124). Well #6 has a total depth of 82 feet (Ref. 9, p. 120, 125). Refer to Figure 5 for a location of the LMU wells. LMU wells #2, #3, #4, and #5 have been impacted by PCE. TCE and Cis-1,2-DCE, degradation products of PCE, were also documented in additional non-municipal wells in the groundwater plume.

This site is being scored as a groundwater plume with no identifiable source due to not being able to demonstrate attribution of the release of solvents to a possible source. All groundwater samples discussed in Section 3.1.1 under the Background and Contaminated Samples and Attribution sections of this HRS Documentation Record are all located in equivalent geologic materials (sand and gravel) (Section 3.1.1 of this HRS documentation record; Ref. 67, p. 6). Groundwater contamination identified in non-municipal well samples collected during the Site Inspection (SI) and Expanded Site Inspection (ESI) were collected from the same aquifer at similar depths as the contamination identified in the LMU wells (Ref. 67, pp. 6-8; Section 3.1.1 of this HRS documentation record; Figure 3).

Groundwater is pumped from Logansport Municipal Wells #2, #3, #4, #5, and #6. The water is treated with chlorine at the wellhead, and then the water is distributed to the residents served by the municipality (Ref. 83, p. 1). The Logansport municipal well system has a water main running parallel along West Cliff Drive. All of the wells attach to this water main and then supply east or west at the water distribution system, and south to serve the Logansport State Hospital (Ref. 91. p. 1).

The extent of the groundwater plume as depicted by samples from the Logansport municipal wells and other samples collected during the SI and ESI investigations meeting observed release criteria is shown in Figure 3 of this HRS

Documentation Record. The approximate acreage of the plume, as measured by samples that meet the criteria for an observed release, is 375 acres (Figure 3 of this HRS Documentation Record). The plume is measured by connecting sample locations that contain concentrations of PCE and its degradation products (Table 2 and Figure 3 of this HRS Documentation Record). The plume has not been completely delineated at this time.

Site History

The City of Logansport provides water to its residents through the LMU and the five (5) groundwater supply wells (Ref. 78, pp. 1, 2). According to historical sampling results submitted by the City to IDEM, PCE has been detected in the municipal wells' finished water since March 1994 (Ref. 9, p. 11). The U.S. EPA Maximum Contaminant Level (MCL) for PCE is 5.0 micrograms per liter (µg/L) (Ref. 52, p. 2). LMU sampled for contaminants annually from 1994 to 1999 and sampled quarterly from 1999 to 2009, and annually again from 2009 to 2016 (Refs. 8, p. 6; 49. p. 11). Sample detections from the Logansport Wellfield have ranged from non-detect to 4.0 µg/L and PCE has been detected during every sampling quarter except for four (4) during the 1999 to 2009 time period (Ref. 8, p. 6, 32).

Past Investigations

The Pre-CERCLIS Screening (PCS) and the Preliminary Assessment (PA) were conducted in January 2008 and May 2008, respectively, to provide a basic overview of the Site and the PCE contamination (Refs. 3, p. 1; 49, p. 1). No samples were collected, but it was noted in the PA that the former laundry building and former landfill on the Logansport State Hospital property may be potential sources due to their proximity to the wellfield (Ref. 49, pp. 10, 16). Several other potential sources were documented in the PA (Ref. 49, pp. 10, 11).

The Site Inspection for this site was completed by IDEM in March 2009 (Ref. 9, p. 1). A sampling event was performed in August 2008, and both groundwater and subsurface soil samples were obtained (Ref. 9, p. 13). Twenty-two groundwater and 12 subsurface soil samples were all collected south of the Wabash River and wellfield, near the hospital and several businesses (Ref. 9, p. 13-17). The deepest groundwater sample, E2QL1, not including the municipal wells and residential wells, was gathered at approximately 30 feet below ground surface (bgs) (Ref. 9, pp. 26 and 27). The deepest subsurface soil sample was collected at approximately 25 feet bgs (Ref. 9, p. 28). The rest of the samples were shallower, with some as shallow as seven (7) feet bgs for groundwater and three (3) feet bgs for soil (Ref. 9, pp. 26 through 28). Borings 1 and 6 were abandoned due to refusal of the drilling equipment prior to reaching groundwater (Ref. 9, p. 13). PCE concentrations were detected in only the municipal well

groundwater samples that were collected for the SI (Ref. 9, p. 29). All other samples collected during the SI were non-detect for PCE (Ref. 9, pp. 100 through 119).

Additional sampling was completed in December 2014 by IDEM staff to verify that contamination was still present in the municipal wells. Raw water samples exhibited PCE detections ranging from 0.65 to 1.7 µg/L (Ref. 8, p. 34).

Sampling for the Expanded Site Inspection was conducted in July and August 2016 (Ref. 8, p. 8). IDEM staff collected a total of 46 groundwater samples. This included 16 groundwater samples, four (4) duplicate groundwater samples, two (2) equipment blanks, 14 water supply samples, and 10 water trip blanks (Ref. 8, p. 8). Raw groundwater samples were collected from five (5) municipal wells to confirm that the wells were still being impacted by PCE and no other VOCs (Ref. 8, p. 8). Additionally, 10 groundwater samples were collected utilizing a sonic drill rig to complete borings. The samples were collected at various intervals within each boring (Ref. 8, p. 9). The Sampling Work Plan for the Site specified that a total of eight (8) borings were planned throughout the Logansport area (Ref. 8, p. 9). However, due to time restrictions and several mechanical issues, only five (5) boring locations were completed with many extra modifications, including a second boring at one location due to tooling breaking downhole (Ref. 8, p. 9). Concentrations of PCE were detected in all groundwater samples that were collected from the municipal wells (Ref. 8, p. 11, 29, 43, 44). PCE was also detected in only one (1) other groundwater sample, E2WB6 (Ref. 8, p. 43). This sample was obtained approximately one (1) mile east of the municipal wells (Ref. 8, p. 29). Trichloroethylene was also detected in this sample (Ref. 8, p. 43). Cis-1,2-DCE was also detected in sample E2WC3 at 1.8 µg/L (Ref. 8, pp. 68-69, 173-175).

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of Source: 1

Source Type: Other

Source Name: Groundwater Plume with No Identified Source

Description and Location of Source: Figure 3 of this HRS Documentation Record

The source is a groundwater plume with no identified source. The Cliff Drive Groundwater Contamination Site is a contaminated groundwater plume originating from unknown sources where hazardous substances have been released and seeped through the ground to the aquifer.

Investigations (SIs and ESIs) conducted under CERCLA by IDEM staff could not identify a source (Refer also to Ref. 67). Groundwater samples (E2WC2 and E2WA6) collected to the west of the municipal wells in an area where chlorinated VOCs were identified (at a cement plant) revealed no detections of hazardous substances (Figure 3). A groundwater flow direction for the cement plant provided in a report issued in April 2016 (Ref. 89, p. 11) shows a groundwater flow direction at the closed landfill going to the west/northwest away from the city well field. In addition, the cement facility is outside the five (5)-year time-of-travel (TOT) for the well field. No potential sources lie north of the municipal wells (Figure 4). Numerous potential sources lie east, northeast, and southeast of the municipal wells. Only two (2) grab samples (E2WB6 and E2WC3, located east and southeast) were found to contain VOCs, indicating that these samples may lie downgradient from source(s) areas located to the east. The WHPA report for the Logansport well field (Ref. 69) only provides a five (5)- TOT. A 10-year TOT was not provided to the State of Indiana. This data supports the existence of one (1) plume and not multiple plumes.

The plume is identified where PCE was detected in the groundwater of Logansport Municipal Wells #2, #3, #4, and #5. In addition, a release of PCE and TCE to groundwater was also observed in a groundwater sample collected from a sonic drill rig (sample E2WB6) located east of the municipal wells, and a detection of Cis-1,2-DCE from a residential well (sample E2WC3) located southeast of the municipal wells (Table 2a, Table 2b, and Figure 3 of this HRS Documentation Record). The groundwater plume is depicted by groundwater samples having concentrations of PCE and its degradation products meeting observed release criteria (Table 2a, Table 2b, and Figure 3 of this HRS Documentation Record).

All of the groundwater samples collected to outline the plume were collected from similar depths of the same surficial sand and gravel aquifer and are considered representative of water entering the city supply wells (Ref. 90, pp. 1 and 2). The

municipal wells are all screened at the bottom of the sand and gravel aquifer (just above the bedrock) (Ref. 88, p. 1). The grab water sample was collected at 60 feet (a depth representative of the aquifer), and from a residential well screened at an interval upgradient to the municipal wells. Groundwater samples were collected from the sand and gravel aquifer directly above bedrock. Since the LMU wells are screened in the bottom 20 feet of the sand and gravel aquifer and the ESI groundwater samples were collected from the same interval, the ESI samples are representative of water entering the city supply wells (Ref. 90, p. 1). It should be noted that due to the lack of a consistent clay between the sand and gravel aquifer above and the bedrock below, the two aquifers are interconnected. Refer to References 8 and 9 for a more detailed description of where in the aquifer the groundwater samples were collected.

The plume encompasses approximately 375 acres and part of the plume resides in the LMU Wellhead Protection Area (WHPA) (Ref. 8, p. 24; Figure 5 of this HRS Documentation Record). The well field is located in a large field on the western edge of the Logansport; approximately 50 feet south of the Wabash River (Figure 5 of this HRS Documentation Record).

The specific sources of the contamination impacting the LMU wells cannot be determined with the currently available information. A description of possible facilities containing possible sources that have been identified during the SI and ESI investigations can be found in in Reference 67. Refer to Section 3.1.1 (Attribution) for a further discussion of the sampling events conducted to locate a source of the groundwater contamination. IDEM staff have conducted an SI and an ESI to document a release of PCE and its degradation products to LMU Wells #2, #3, #4, #5. In addition, a release to groundwater was also observed in a groundwater sample collected from a sonic drill rig (sample E2WB6) east of the municipal wells, and from a residential well (sample E2WC3) located southeast of the municipal wells. Refer to Reference 67 for a detailed narrative discussing the level of effort to find a possible source. This reference also discusses attribution related to possible sources based on the sample results.

2.2.2 Hazardous Substances Associated with the Source

PCE, TCE, and Cis-1,2-DCE are the hazardous substances associated with the source (see Section 3.1.1 of this HRS Documentation Record). Concentrations of PCE were detected in the Logansport Municipal Wells #2, #3, #4, and #5 (Table 2 and Figure 3 of this HRS Documentation Record). In addition, a release to groundwater was also observed in a groundwater sample collected from a sonic drill rig (sample E2WB6) east of the municipal wells, and from a residential well (sample E2WC3) located southeast of the municipal wells.

The plume is depicted and measured by connecting locations of groundwater samples that contain concentrations of PCE, TCE, and Cis-1,2-DCE (Figure 3 of this HRS Documentation Record). See Table 1 of this HRS Documentation Record for a full summary of background groundwater samples collected during the SI and ESI

investigations. See Tables 2a and 2b of this HRS Documentation Record for a full summary of groundwater samples collected during the SI and ESI investigations that had detections of PCE and its degradation products meeting observed release criteria. These tables also depict the concentrations of PCE and its degradation products.

2.2.3 Hazardous Substances Available to a Pathway

Containment Description	Containment Factor Value	References
Gas release to air: The air migration pathway was not evaluated; therefore, gas containment was not evaluated.	Not Scored	-
Particulate release to air: The air migration pathway was not evaluated; therefore, gas containment was not evaluated.	Not Scored	-
Release to ground water: The containment factor of 10 is assigned based on analytical evidence of hazardous substances in groundwater samples from municipal and residential wells and from grab groundwater samples (see Table 2b of this HRS Documentation Record). Therefore, based on evidence of release (evidence of hazardous substance migration from a source area), the highest Groundwater Migration Pathway Containment Factor Value of 10 was assigned to Source No. 1.	10	Ref. 1, Section 3.1.2.1, Table 3-2. See Section 3.1.1 of this HRS Documentation Record
Release via overland migration and/or flood: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated.	Not Scored	-

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The Hazardous Constituent Quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source and releases from the sources is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, possible responsible party (PRP) records, state records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 1 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of Tier B, Hazardous Wastestream Quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Assigned Value: Not Scored

2.4.2.1.2. Hazardous Waste stream Quantity (Tier B)

The Hazardous Waste stream Quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of the hazardous waste streams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source are not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, state records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of the hazardous waste streams plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the Hazardous Waste Stream Quantity for Source No. 1 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Waste Stream Quantity Assigned Value: Not Scored

2.4.2.1.3. Volume (Tier C)

Since the vertical extent of the plume could not be determined based on available sampling data, the source volume is unknown but greater than zero (0) (Ref. 1, Section 2.4.2.1.3).

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
Other	Unknown	-	Ref. 1, Table 2-5

Sum (yd^3/gal): > 0
Equation for Assigning Value (Ref. 1, Table 2-5): Volume (V) / 2.5 > 0

Volume Assigned Value: Unknown, but > 0

2.4.2.1.4. Area (Tier D)

The area measure (Tier D) is not evaluated for source type “Other” (Ref. 1, Table 2-5).

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Volume of ground water plume: Unknown, but > 0.
Highest assigned value assigned from Ref. 1, Table 2-5: > 0.
Source Hazardous Waste Quantity Value: > 0. (Ref. 1, Section 2.4.2.1.5)

SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Haz. Waste Quantity Value	Source Haz. Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Ref. 1, Table 3-2)	Surface Water (SW)		Air	
				Overland/ flood (Ref. 1, Table 4-2)	GW to SW (Ref. 1, Table 3-2)	Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	> 0	NS	10	NS*	NS*	NS*	NS*

*NS (Not Scored)

3.0 GROUNDWATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Groundwater Migration Pathway Description:

Since all of the LMU wells are screened in the unconsolidated materials above bedrock (Ref. 9, p. 124; Refs. 72 to 76; Ref. 88, pp. 1 and 2) the bedrock aquifer was not used for HRS scoring purposes.

Regional Geology/Aquifer Description:

The study area is within the central Indiana Tipton Till Plain physiographic unit of the Upper Wabash River Basin (Ref. 71, pp. 74, 75; Figure 3 of this HRS Documentation Record). Soils along the Wabash River consist of the Gilford loam, gravelly substratum, New Glarus silt loam, Rush Silt Loam, and Sleeth silt loam. These soils are nearly level along outwash plains to moderately sloping (2 to 6%) on terraces and within flood plains formed in medium-textured glacial drift (Ref. 68, pp. 68, 73, 76, 77). The unconsolidated surficial sand and gravel was deposited in outwash plains and valley trains where sediment was deposited by glacial meltwater (Ref. 71, p. 81). Unconsolidated deposits are nonexistent at bedrock outcrops to the south and west of Logansport, to several hundred feet thick (ancient “Teays” valley north of Logansport (Ref. 69, p. 17). The bedrock in the area near Logansport consists of Silurian age dolomite and limestone (Refs. 69, p. 14; 71, p. 19). The model for evaluating the WHPA for the Logansport municipal well field used a saturated thickness of 80 feet (Ref. 69, p. 17).

Site Geology/Aquifer Description:

The study area is along the south bank of the Wabash River, west of the City of Logansport, Cass County, Indiana (Ref. 69, Figure 1; Figure 2). There are five (5) public water supply wells (Figure 5) in Township 27N, Range 1E, Sections 34 and 35 (Figures 2, 4, 5; Ref. 9, p. 124; Refs. 72 to 76) that supply water to the City of Logansport, Indiana (Ref. 69, p. 42; Ref. 78, p. 2). The study area is underlain by two (2) aquifers: (1) an unconfined glacial outwash sand, gravel, and boulder aquifer (Ref. 69, p. 17), and (2) an underlying bedrock aquifer. More specifically, the two (2) aquifers are defined as (1) the surficial sand and gravel aquifer, and (2) the Silurian Carbonate Aquifer System (Ref. 71, p. 81, 89).

- Aquifer/Stratum 1 (uppermost): The surficial sand and gravel aquifer

Description

In much of the Wabash River floodplain near Logansport, only small localized surficial sand and gravel deposits are present (Ref. 69, p. 15). North of Logansport, unconsolidated deposits increase in thickness gradually. However, south of Logansport, bedrock outcrops just south of the Wabash River and no permeable unconsolidated

deposits are present in most places (Ref. 69, p. 15). However, bedrock outcrops just south of the Wabash River south of Logansport and no permeable unconsolidated deposits are present in most places (Ref. 69, p. 15). The local aquifer containing the wellfield is one notable exception. Drilling logs from the production wells indicate the presence of 50-80 feet of gravel and boulders (Ref. 69, p. 15). These deposits appear to lie in a small bedrock valley that trends from north–to-south, narrowing and thinning at the southern end (Ref. 69, p 15).

Well logs for the impacted LMU wells show that screens are all set at the base of the surficial sand and gravel aquifer that overlays the Silurian Carbonate Aquifer System (Ref. 9, p. 124; Refs. 72 to 76; Ref. 88, p. 1). The LMU well logs all list "limestone" as the last material encountered at completion (Ref. 9, p. 124; Refs. 72 to 76). In most cases only the top 1 to 5 feet of the Silurian Carbonate Aquifer System was drilled (Refs. 72 to 76). Since the LMU wells are screened in the surficial sand and gravel aquifer, the surficial sand and gravel aquifer is the one being evaluated.

Well logs (Refs. 72, 74, 76) show that there is no clay unit at the base of the surficial sand and gravel aquifer, therefore, a confining unit capable of isolating the bedrock aquifer is not present. Since the surficial sand and gravel aquifer and the bedrock aquifer are interconnected, samples collected from the top of the bedrock aquifer are considered representative of groundwater found in the surficial sand and gravel aquifer. Since the LMU wells are screened at the base of the surficial sand and gravel aquifer, under pumping conditions there is a possibility that groundwater could be drawn up from the underlying bedrock aquifer.

Well logs from the five (5) LMU water supply wells (Ref. 9, p. 124; Ref. 72 to 76) show that there are one or two zones that contain "boulders". Boulders are classified as any particle greater than 256 mm (10.07 inches) (Ref. 70, p. 17). Well screens for three (3) of the five (5) water supply wells are set between 49 and 81 ft-bgs (Refs. 72 to 76). The well logs in References 72, 74, and 76 show two distinct boulder zones. The well log in Reference 75 shows one boulder zone that is 69 feet thick. The well log in Reference 73 shows one boulder zone. The well logs in References 72 and 74 show a clay layer between the boulder zones and the other logs do not.

Groundwater contamination identified in samples collected during SI and ESI were collected from the same aquifer at similar depths as the contamination identified in the LMU wells Refs. 67, pp. 6-8; 88, p.1, Figure 3).

- Aquifer/Stratum 2 (deepest): Silurian Carbonate Aquifer System

Description

Drilling logs for the LMU wells indicate the presence of up to 81 feet of glacial deposits covering limestone bedrock (Ref. 9, p. 124; Ref. 72 to 76). Bedrock outcrops at the surface to the south and west of Logansport (Ref. 69, p. 17). Groundwater flow in the carbonate bedrock aquifer is through vertical fractures, horizontal bedding planes, and solution openings (Ref. 71, p. 89). Karstification of the carbonate bedrock aquifer

by surface water entering the groundwater system has further enhanced the secondary permeability of the carbonate bedrock aquifer throughout the basin (Ref. 71, p. 89).

- Aquifer Interconnections/Distance from Source

Description

Under natural conditions, the aquifer near Logansport is recharged by infiltration precipitation (Ref. 69, p. 15). This water naturally discharges from the aquifer as base flow into the Wabash River (Ref. 69, p. 15). Pumping in the Logansport well field changes the flow system, capturing some infiltrated water, and inducing recharge from the Wabash River (Ref. 69, p. 15). The LMU supply wells provide water to the City of Logansport (Ref. 69, p. 12) and based on the screened intervals shown on the well logs, draw water from the base of the unconsolidated surficial sand and gravel aquifer (Ref. 9, p. 124; Refs. 73, 74, and 75). Do to the lack of clay, the base of the outwash aquifer and the bedrock aquifer are connected (Ref. 9, p. 124; Refs. 72 to 76). Water flows from the unconfined outwash aquifer into the carbonate aquifer through vertical fractures, horizontal bedding planes, and solution openings (Ref. 71, p. 89).

The logs provided for the LMU wells show a lack of a clay layer of sufficient thickness to control vertical migration of groundwater and/or contamination. Clay identified in the well logs were:

LMU #2 (Ref. 75, pp. 1, 2) DNR Well Permit # 103834
The well log for LMU #2 did not identify any clay. The screen for this well is set from 69 to 49 ft bgs which is below the clay unit (Ref. 90, p. 1).

LMU #3 (Ref. 76, pp. 1, 2) DNR Well Permit # 103839
The well log for LMU #3 shows the presence of two clay layers at 13 and 33 ft bgs. The base of the sand and gravel aquifer is 68 ft bgs (Ref. 88, p. 1).

LMU #4 (Ref. 74, pp. 1, 2) DNR Well Permit # 103824
The well log for LMU #4 shows the presence of one clay layer at 47 to 50 ft bgs. The screen for this well is set from 65 to 85 ft bgs (Ref. 88, p. 1; Ref. 90, p. 1).

LMU #5 (Ref. 9, p. 124) DNR Well Permit # 103829
The well log for LMU #5 shows the presence of one clay layer at 1 to 18 ft bgs. The screen for this well is set from 61 to 81 ft bgs (Ref. 88, p. 1).

LMU #6 (Ref. #73, pp. 1, 2) DNR Permit # 103814
The well log for LMU #6 shows the presence of clay layers at 36 to 37 ft bgs and 57 to 60 ft bgs. The screen for this well is set from 60 to 80 ft bgs. The base of the sand and gravel is 82 ft bgs (Ref. 88, p. 1; Ref. 90, p. 1).

LMU Test Well (Ref. 72, pp 1,2) DNR Permit #103794
The well log for the LMU test well shows the presence of five foot thick clay layer at 36 to 41 ft bgs. The screen depth for this well is not provided and the depth to bedrock is 81 ft bgs.

The LMU well logs show that clay is present but there is no consistent depth where the clay is encountered. Since there is no laterally extensive clay (a clay layer is not present at a consistent depth and there is insufficient thickness, (10 foot thickness recorded in one boring) it was concluded the aquifer is interconnected to the bedrock aquifer and there are no barriers to vertical flow (Ref. 87, p. 5).

- Aquifer Discontinuities within Target Distance Limit

Description

Cross-section 5C-5C' from the USGS Hydrogeologic Atlas of Aquifers in Indiana (Ref. 71, p. 83) through the area of the site (Ref. 71, p. 74) shows that the Wabash River does not fully transect the surficial sand and gravel aquifer. Therefore, the water from the aquifer naturally discharges from the aquifer as base flow into the Wabash River (Ref. 69, p. 15). There are no other aquifer discontinuities or boundaries, such as a mountain range, ocean, etc., within a 4-mile radius of the site (Ref. 1, Section 3.0.1.2.2).

SUMMARY OF AQUIFER(S) BEING EVALUATED

Aquifer No.	Aquifer Name	Is Aquifer Interconnected with Upper Aquifer within 2 miles? (Y/N/NA)	Is Aquifer Continuous within 4-mile TDL? (Y/N)	Is Aquifer Karst? (Y/N)
1	The surficial sand and gravel aquifer	This is the Upper Aquifer	No	No
2	Silurian Carbonate Aquifer System	Yes	Yes	Yes

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer Being Evaluated: Sand and gravel aquifer

Establishing an observed release by chemical analysis requires analytical evidence of a hazardous substance in the media significantly above background level (Ref. 1, Section 2.3). If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds its own Sample Quantitation Limit (SQL) and that of the background sample. If the SQL cannot be established, the U.S. EPA Contract-Required Quantitation Limit (CRQL) is used in place of the SQL (Ref. 1, Table 2-3).

All samples noted in this HRS documentation record were analyzed for volatile organic compounds (VOCs) using Contract Laboratory Program (CLP) Statement of Work (SOW) SOM01.2 (Trace Volatiles) or SOM02.2 (Trace Volatiles) analysis procedure (Refs. 6, p. 3; 8, pp. 10 and 788; 9, p. 10).

Chemical Analysis

During the week of August 11, 2008, IDEM staff collected samples for a Site Inspection. Staff collected 22 groundwater samples including three (3) duplicate samples, one (1) MS/MSD sample, three (3) trip blanks, one (1) rinsate blank, one (1) equipment blank, and two (2) background samples (Ref. 9, p. 13). Between July 25 and August 8, 2016, IDEM staff mobilized for the Expanded Site Inspection (Ref. 8, p. 8). IDEM staff collected a total of 46 groundwater samples. This included 16 groundwater samples, four (4) duplicate groundwater samples, two (2) equipment blanks, 14 water supply samples, and 10 water trip blanks. A full summary of all sampling procedures can be viewed in Ref. 9, pp. 14, 15 and Ref. 8, pp. 8, 9.

- Background Concentrations

A total of 68 groundwater samples were collected during the SI and ESI investigations. Six (6) of these groundwater samples were identified as background samples (Table 1 of this HRS Documentation Record). Five (5) background groundwater samples were collected from a sonic drill (Table 1 of this HRS Documentation Record). The other background, sample E2QK5, was collected a residential well; however, the depth of the residential well is unknown. All background groundwater samples are outside of the identified groundwater plume (Figure 3 of this HRS Documentation Record).

All sample locations and associated PCE concentrations can be seen in Figure 3 of this HRS Documentation Record.

Sample E2QK5 was collected from a private well from the Cass County Animal Hospital (Table 1; Figure 3 of this HRS Documentation Record). No well log is present for this well. A confining layer was not consistently present in well logs from nearby private wells (Ref. 9, pp. 126 to 146); therefore, the unconsolidated and bedrock aquifers are interconnected and data are considered similar to data from the LMU well samples (Ref. 9, p. 124; Refs. 72 to Ref 76).

Background groundwater sample E2QK6 was obtained from a private well. The depth of this well is approximately 200 feet, however, no well log is present for this well. A confining layer was not consistently present in well logs from nearby private wells (Ref. 9, pp. 126 to 146); therefore, the unconsolidated and bedrock aquifers are interconnected and data are considered similar to data from the LMU well samples (Ref. 9, p. 124; Refs. 72 to Ref 76).

Groundwater sample E2QN2 was collected from a private well located on South County Road 175 West. The depth of the well extends 84 feet below ground surface per well log 116561 (Ref. 95, pp. 1, 2). No confining layer was noted in nearby private wells (Ref. 9, pp. 126 to 146); therefore, the unconsolidated and bedrock aquifers are interconnected and data are considered similar to data from the LMU well samples (Ref. 9, p. 124; Refs. 72 to Ref. 76).

Groundwater sample E2WB5 was collected at the corner of Park Avenue and Helm Street. The sample was collected utilizing a Rotosonic drill (Ref. 8, p. 12). This sample was collected from a depth between 55 and 60 feet bgs. Since samples were collected from similar depth below ground surface in the bedrock unit and the above sand and gravel unit is connected, due to the lack of a clay confining layer (Ref. 9, p. 124; Ref. 72 to Ref. 76), this groundwater sample is considered similar to the samples collected from the LMU wells (Ref. 9, p. 124; Refs. 72 to Ref 76).

Groundwater sample E2WC1 was collected from a private well from a depth of 122 feet. The sample was obtained using similar methods but from different depths (Ref. 8, p. 601) from the contaminated wells (Ref. 9, p. 124; Refs. 72 to Ref. 76).

Groundwater sample E2WA6 was a grab sample that was obtained from a residential well from a depth of 50 to 60 feet (Ref 8, pp.13 and 14). The sample was obtained using similar methods from near the same depths to the contaminated LMU wells (Ref. 9, p. 124; Refs. 72 to 76).

All background groundwater samples were non-detect (below the CRQL) for PCE, TCE, and Cis-1,2-DCE (Table 1 of this HRS Documentation Record). The samples were obtained from equivalent materials (sand and gravel), the interconnected bedrock aquifer, or near the same depths to the contaminated wells.

Table 1
Background Groundwater Samples Results for the SI and ESI Inspections

EPA CLP #	Date Collected	Depth (ft bgs)	Type of Grab Sample	Haz. Substance	Haz. Substance Concen-tration (µg/L)	CRQL (µg/L)	Reference
E2QK5	08/11/08	Unknown	Residential Well	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Refs. 4, p. 4-8; 5, p. 6; 6, pp. 1-8, 12-13, 24, 59-61; 9, p. 26; 94
E2QK6	08/11/08	200	Residential Well	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Refs. 4, pp. 4-8; 5, p. 7; 6, p. 1-8, 12-13, 24, 62-64; 9, p. 26; 94
E2QN2	08/13/08	84	Residential Well	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Refs. 4, pp. 4-8; 5, p. 30; 6, pp. 1-8, 18-19, 28, 107-109; 7, p. 25; 87, pp. 1, 2; 9, p. 27; 94; 95, pp. 1, 2
E2WB5	07/26/16	Screened Interval 55-60	Rotosonic Drill	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Ref. 8, pp. 50-57, 58-59, 125, 160-162, 587; 94
E2WC1	07/25/16	122	Residential Well	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Ref. 8, pp. 50-57, 62-63, 127, 166-168, 601; 94
E2WA6	08/01/16	50-60	Residential Well	Tetrachloroethene Trichloroethene Cis-1,2-Dichloroethene	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	Ref. 8, pp. 13, 380-386, 394-395, 451, 486-488, 607; 94

U Compound not detected above the CRQL.
ft - Feet
CLP - Contract Laboratory Program
Haz. - Hazardous
CRQL - Contract Required Quantitation Limit
µg/L - micrograms per liter
bgs - Below ground surface

Contaminated Samples

The background groundwater samples collected from residential wells and from a sonic drill rig were not found at or above the CRQL for PCE, TCE, and Cis-1,2-DCE (Table 1 of this HRS Documentation Record). Since four (4) Logansport municipal wells (#2, #3, #4, and #5) had detections above the CRQL, they meet the observed release criteria with PCE concentrations (Table 2 of this HRS Documentation Record).

Six (6) groundwater samples were collected from the Logansport Municipal Wellfield's five (5) wells. The samples were identified as E2WC4, E2WC5, E2WC6, E2WC7, and E2WC9 (municipal wells #2, #3, #4, #5 and #6 respectively with E2WC8 being a duplicate of E2WC7) (Ref. 8, p. 10).

Samples shown in Tables 2a and 2b were obtained using similar methods from equivalent geologic materials (sand and gravel) and / or near the same depths (Ref. 8, pp. 560 to 564) to the contaminated LMU wells (Ref. 9, p. 124; Ref. 72 to Ref. 76).

The extent of the groundwater plume as depicted by samples from the Logansport municipal wells and other samples collected during the SI and ESI investigations meeting observed release criteria is shown in Figure 3 of this HRS Documentation Record. The acreage of the plume, as measured by samples that meet the criteria for an observed release, is approximately 375 acres (Figure 3 of this HRS Documentation Record). The plume is depicted and measured by connecting sample locations that contain concentrations of PCE and its degradation products that meet observed release criteria (Table 2; Figure 3 of this HRS Documentation Record; Ref. 1 Section 3.1.1). The plume has not been completely delineated at this time.

The following table depicts the samples that meet the observed release criteria (Ref. 1, Table 2-3). This table lists the organic hazardous substance with their concentrations and CRQLs for each sample. The locations are depicted on Figure 3 of this HRS Documentation Record. All groundwater samples collected from the Logansport municipal wells were obtained from the same portion of the aquifer as evidenced by the similar well depths that are shown in this table and discussed above.

Table 2a
Municipal Well Groundwater Samples with Detections of PCE
(Observed Release Samples)

EPA CLP #	Date Collected	ESI or SI	Total Depth (ft bgs)	Screened Interval (ft bgs)	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2QK2	8/11/08	SI	70	Not Provided on well log	Tetrachloroethene	1.6	0.50	Refs. 4, pp. 4-8; 5, p. 3; 6, pp. 1-8, 10-11, 24, 50-52; 9, pp. 26; 76; 94
E2QK3	8/11/08	SI	89	65 to 85	Tetrachloroethene	1.7	0.50	Refs. 4, pp. 4-8; 5, p. 4; 6, pp. 1-8, 10-11, 24, 53-55; 74, p. 1; 88, pp. 1; 94
E2QK4	8/11/08	SI	80	61 to 80	Tetrachloroethene	2.0	0.50	Refs. 4, pp. 4-8; 5, p. 5; 6, pp. 1-8, 10-11, 24, 56-58; 9, p. 124; 88, p. 1; 94
E2QK1	8/11/08	SI	69	49 to 69	Tetrachloroethene	1.2	0.50	Refs. 4, pp. 4-8; 5, p. 2; 6, pp. 1-8, 10-11, 24, 47-49; 88, pp. 1, 75; 94
E2QK0	8/11/08	SI	69	49 to 69	Tetrachloroethene	1.2	0.50	Refs. 4, pp. 4-8; 5, p. 1; 6, pp. 1-8, 10-11, 24, 44-46; 88, pp. 1, 75; 94
E2WC4	7/25/16	ESI	69	49 to 69	Tetrachloroethene	0.65 J-	0.50	Ref. 8, pp. 8, 10, 50-57, 70-71, 127, 176-178, 609; 75, p. 1; 88, pp. 1; 75; 94
E2WC5	7/25/16	ESI	70	Not Provided on well log	Tetrachloroethene	1.4 J-	0.50	Ref. 8, pp. 8, 10, 50-57, 76-77, 127, 186-188, 611; 76, p. 1; 88, p. 1; 94
E2WC6	7/25/16	ESI	89	65 to 85	Tetrachloroethene	0.6 J-	0.50	Ref. 8, pp. 8, 10, 50-57, 78-79, 127, 192-194, 613; 74, p. 1; 88, p. 1; 94
E2WC7	7/25/16	ESI	80	61 to 80	Tetrachloroethene	0.72 J-	0.50	Ref. 8, pp. 8, 10, 50-57, 80-81, 127, 198-200, 615; 9, p. 124; 88, p. 1; 94
E2WC8	7/25/16	ESI	80	61 to 80	Tetrachloroethene	0.73 J-	0.50	Ref. 8, pp. 8, 10, 50-57, 82-83, 127, 204-206, 617; 9, p. 124; 88, p. 1; 94

ft - Feet
CLP - Contract Laboratory Program
Haz. - Hazardous
CRQL - Contract Required Quantitation Limit
µg/L - micrograms per liter
bgs - Below ground surface

J- Surrogate recoveries were out of control, low in samples E2WC4, E2WC5, E2WC6, E2WC7, and E2WC8 and associated compounds are qualified bias low (Ref. 8, pp. 53, 57). Results for release samples require no adjustment according to procedures in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

An Expanded Site Inspection (ESI) was conducted in July and August 2016 (Ref. 8, p. 8). One (1) groundwater sample, E2WB6, was collected in the right-of-way on the north side of Day Street near the intersection with Main Street (Ref. 8, p. 12). The sample was collected using a sonic drill rig. This boring was completed to determine if any contamination is migrating to this location from the area north of the Wabash River where former and current dry cleaners and other businesses are located. Dry cleaners utilize PCE in their cleaning process (Ref. 51, p. 1). This sample was obtained at approximately 60 feet bgs. TCE and PCE were detected in this sample at 4.5 µg/L, and 1.5 µg/L, respectively (Ref. 8, p. 12).

Also during the ESI, a groundwater sample was collected from a residential well located on South Humphrey Street. The sample ID is designated as E2WC3 (Ref. 8, p. 13). The DNR well log dictates a total well depth of 83 feet (Ref. 8, p. 13). The sampled water also produced a very strong sulfur smell that did not lessen throughout the 15-minute purge period. The property owner stated that they have been connected to municipal water and have not used the well in several years. Results of the ESI sampling indicated that Cis-1,2-DCE was present at a concentration of 1.8 µg/L (the U.S. EPA MCL for Cis-1,2-dichloroethylene is 70 µg/L). The residential well was non-detect for all other VOCs (Ref. 8, p. 13).

The table below, Table 2b, depicts those samples that were collected for the ESI where VOCs were detected in groundwater other than from Logansport municipal wells.

Table 2b
Other Groundwater Samples with Detections of VOCs

EPA CLP #	Date Collected	Well Type	ESI or SI	Depth (ft BGS)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2WB6	7/28/16	Sonic Drill Rig	ESI	60	Trichloroethene Tetrachloroethene	4.5 1.5	0.5 0.5	Ref. 8, pp.12, 50-57, 60-61, 126,163-165, 597-600; Ref. 94, p. 4
E2WC3	7/28/16	Residential Well	ESI	83	Cis-1,2-dichloroethylene	1.8	0.5	Ref. 8, pp. 13, 50-57, 68-69, 126, 173-175, 704; Ref. 94, p. 4

Sample E2WB6 was collected from 60 ft bgs in the limestone bedrock unit (Ref. 8, pp. 12, 597-600) that exists below the sand and gravel interval found in the contaminated LMU wells (Ref. 9, p. 124; 73, p. 1; 74, p. 1; and 75, p. 1).

Sample E2WC3 was collected using similar methods from equivalent geologic materials (sand and gravel) and near the same depths (Ref. 8, pp. 13, 704) to the contaminated wells (Ref. 9, p. 124; Ref. 72 to Ref. 76).

Attribution:

The Cliff Drive Groundwater Contamination Site has a release of PCE, TCE, and Cis-1,2-DCE to the groundwater (Table 2 of this HRS Documentation Record). The PCE that has been discovered in the Logansport municipal wells and at other locations in Logansport is a human-made manufactured chemical (Ref. 81, p. 1). Chlorinated solvents, specifically PCE, are a manufactured chemical that is widely used for dry cleaning of fabrics and solvent used to clean machinery, electronic parts, and clothing (Refs. 86, p. 1; 51, p. 1). Common breakdown products of PCE include TCE, vinyl chloride, and Cis-1,2-DCE (Ref. 53, pp. 2, 3). The background groundwater samples shown in Table 1 of this HRS Documentation Record demonstrate that PCE was not detected in those samples, and that PCE is not ubiquitous throughout the study area (Table 1 and Figure 4 of this HRS Documentation Record).

During the PA, SI, and ESI activities, staff conducted an extensive level of effort by searching IDEM, county, and EPA records to identify additional possible sources of groundwater contamination. Figure 4 of this HRS documentation record shows the location of facilities identified during the search. Groundwater samples and subsurface soil samples were collected for the SI and ESI to determine possible source areas. Figure 3 of this HRS documentation record shows where groundwater samples were obtained.

During the Site Inspection Staff collected groundwater and soil samples on or downgradient from source areas around the Logansport Municipal Wellfield (Ref. 9, pp. 26 through 29). The wellhead protection area for the Logansport Municipal Wells that was provide to the IDEM Drinking Water Branch, shows that the capture zone is located south of the municipal wells (Figure 5). Since the capture zone was shown to be south of the municipal wells, IDEM staff concentrated in collecting groundwater and soil samples from potential sources located south of the municipal wells. Fourteen soil samples and twenty-two groundwater samples were collected (Ref. 9, pp. 26 through 29). Five (5) of the 22 groundwater samples obtained were collected from Logansport municipal wells #2, #3, #4, and #5. One of the five (5) was a duplicate of Well #2 (Ref. 9, p. 26). Municipal Well #6 was not sampled because the well was out of operation at the time of the sampling event. The groundwater samples (other than the municipal and residential well samples) and soil samples were obtained utilizing a direct push rig (Ref.

9, p 12). Due to the limitations of the direct push rig, groundwater samples were collected from 7.5 feet to a refusal depth of 30 feet. Soil samples were collected from 3 to 25 feet (Ref. 9, pp. 26 through 29). Since no soil or groundwater samples (other than the groundwater from the municipal wells) were found to contain any detection of VOCs, no sources were identified (Ref. 67, pp. 3 and 4). Refer to Reference 67, pages 2 through 4 for a detail narrative where each sample was collected. Refer to Reference 9, the Site Inspection report, for further details regarding the Site Inspection.

Since no sources were identified during the Site Inspection, an Expanded Site Inspection was conducted in 2016 (Ref. 8, p. 8). Since no groundwater or soil samples were found to contain VOCs at the shallow depths obtained by the direct push rig for the Site Inspection, staff obtained a larger drill rig to collect samples from deeper depths (Refs. 8, p. 9; 67, p. 5). Once again, utilizing the wellhead protection area-five year time of travel map, deeper groundwater samples (near the depths of the municipal wells) were collected at and near potential sources located south of the municipal wells (Ref. 67, p. 5).

In addition to potentially identified sources to the south of the wellfield within the capture zone of the wellfield that may be attributable to the groundwater contamination, three (3) additional groundwater samples were collected; one (1) northeast of the wellfield (sample E2WB5), one (1) east of the wellfield (sample E2WB6), and one southeast of the wellfield (sample E2WC3) (Ref. 8, pp. 12, 13; Figure 3). Since no possible sources were identified south west of the municipal wells, one (1) groundwater sample was collected southwest of the wellfield as a background sample. The three (3) groundwater samples located northeast, east and southeast were collected in areas downgradient of numerous possible sources and located outside the capture zone shown by the wellhead protection five (5)-year time-of-travel (Refer to Figure 3 for a location of the samples and Figure 4 which illustrates the location of possible sources.) Since the Wabash River is flowing east to west (Ref. 92, p. 1) and groundwater flow is to the north south of the river (Ref. 69, p. 40) these three (3) samples were collected to determine if any contaminated groundwater located in these areas may be flowing to the municipal wells. Therefore, a possibility exists that sources could be present to the east of the municipal wells (Ref. 92, p. 1).

As a result, one (1) groundwater sample (E2WB6) located east of the municipal wells was found to contain concentrations of TCE and PCE and one (1) sample (E2WC3) located southeast was found to contain Cis-1,2-DCE (Table 2b of this HRS Documentation Record). These were the only groundwater samples other than the groundwater samples from the municipal wells that were found to contain VOCs for the SI and ESI sampling vents. This finding indicates that a possible unidentified source is located east of the municipal wells. Since groundwater flow is to the north on the south side of the river (Ref. 69, p. 40) and the river flows from east to west (Ref. 92, p. 1), samples E2WB6 and E2WC3 were collected to the east of the municipal well field to evaluate potential sources to the east. Figure 3 shows the concentration of VOCs and the location of all samples collected for the ESI and Figure 4 shows all the location of possible sources of groundwater contamination that may be attributed to the

groundwater contamination. Additional groundwater and soil sampling will need to be conducted east of the municipal wells to determine which facilities identified in Figure 4 may be attributable to the groundwater contamination in the municipal wells.

Refer to Ref. 67 for a list of all identified facilities that may be possible sources. Reference 67 of this HRS documentation record explains in detail how an ESI level of effort has been made in the attempt to document the origin of the groundwater plume with no identified sources. This reference explains how possible sources were identified during the Preliminary Assessment, where groundwater and soil samples were collected for the SI and ESI in relation to identified possible sources that may be attributable to the groundwater contamination, the results obtained, and any conclusions regarding possible sources or attribution at each sample location. In conclusion, a specific source(s) for the contamination found in the impacted Logansport municipal wells could not be identified (Ref. 67, pp. 16). Note that Reference 67 contains References 11 through 48, 55 through 66, and 77.

Hazardous Substances Released:

Cis-1,2-DCE
PCE
TCE

PCE is a manufactured chemical used for dry cleaning and degreasing (Ref. 81, p. 1). TCE is a degradation product of PCE (Ref. 53, p. 2). TCE is used as a solvent for cleaning metal parts and is not thought to occur naturally (Ref. 80, p. 1). Cis-1,2-DCE is also a degradation product of PCE (Ref. 53, p. 2). Cis-1,2-DCE was detected in one (1) groundwater sample (E2WC3). Concentrations of PCE were detected in Logansport Municipal Wells #2, #3, #4, and #5 (Table 2 of this HRS Documentation Record). See Table 1 of this HRS Documentation Record for a full summary of background groundwater samples collected during the SI and ESI investigations. See Table 2 of this HRS Documentation Record for a full summary of groundwater samples collected during the SI and ESI investigations that had detections of PCE, TCE, and Cis-1,2-DCE above CRQLs.

Ground Water Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, the Toxicity/Mobility Table, depicts the toxicity, mobility, and combined toxicity/mobility factor values that have been assigned to those substances present in the observed release and have a containment value greater than 0.

Toxicity/Mobility Table						
Hazardous Substance	**Source No. (and/or Observed Release)**	**Toxicity Factor Value**	**Mobility Factor Value**	**Does Hazardous Substance Meet Observed Release by chemical analysis? (Y/N)**	**Toxicity/ Mobility (Ref. 1, Table 3-9)**	**References**
PCE	Observed Release	100	1.0*	Y	100	Ref. 2, p. 12
TCE	Observed Release	1000	1.0	Y	1,000	Ref. 2, p. 22
Cis-1,2-DCE	Observed Release	1000	1.0	Y	1,000	Ref. 2, p. 7

*Ref. 1, Section 3.2.1.2 – Mobility factor of 1.0 was assigned based on Section 3.2.1.2. "For any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more aquifers underlying the sources at the site, regardless of the aquifer being evaluated, assign a mobility factor value of 1.

Toxicity/Mobility Factor Value: 1,000
(Ref. 1, Table 3-9)

3.2.2 Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	Other	Unknown, but > 0

The Cliff Drive Groundwater Contamination has been scored as consisting of a groundwater plume with no identified source. According to Section 2.4.2.2 in the HRS (Ref. 1), if any target for that migration pathway is subject to Level I or Level II concentrations and the hazardous constituent quantity is not adequately determined, assign a value from Table 2-6 or a value of 100 whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level II concentrations were present in a drinking water well (Table 2 of this HRS documentation record, see Section 3.3.2.2 of this HRS documentation record), a hazardous waste quantity factor value of 100 is assigned for the groundwater pathway.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Table 2-6)

3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Value of 1000, resulting in a product of 100,000. Based on this product, a Waste Characteristics Factor Category Value of 18 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1; 1a, Section 2.4.3).

Toxicity/Mobility Factor Value: 1,000
Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value (1,000) x Hazardous Waste Quantity Factor Value (100): 100,000

Waste Characteristics Factor Category Value: 18
(Ref. 1, Table 2-7)

3.3 GROUND WATER PATHWAY TARGETS

Drinking water is supplied to the residents of Logansport, Indiana by groundwater obtained from the municipal well system. (Ref. 91, p. 1). The municipal well system consists of five (5) groundwater wells, #2, #3, #4, #5, and #6. Each of the five (5) wells has its own well house. Each well house has its own 150-pound tank of chlorine to treat the groundwater. The groundwater from the five (5) wells is chlorinated then manifolded from one (1) well to the next prior to distribution to the public (Ref. 83, p. 1). The Logansport Municipal Well system has a water main and all of the wells attach to this main and then supply east or west at the water distribution system, and south to serve the Logansport State Hospital (Ref. 91. p. 1). Since all municipal wells supply water to the same water main, no one (1) well provides more than 40% of the water distributed (Refs. 83, p. 1; 91, p. 1). These five (5) wells are the primary source of drinking water for residents of Logansport (Ref. 91, p. 1).

3.3.1 Nearest Well

Well ID: Municipal Well 2 (Sample E2QK1)
Level of Contamination (I, II, or potential): II
If potential contamination, distance from source in miles: N/A

Well ID: Municipal Well 3 (Sample E2QK2)
Level of Contamination (I, II, or potential): II
If potential contamination, distance from source in miles: N/A

Well ID: Municipal Well 4 (Sample E2QK3)
Level of Contamination (I, II, or potential): II
If potential contamination, distance from source in miles: N/A

Well ID: Municipal Well 5 (Sample E2QK4)
Level of Contamination (I, II, or potential): II
If potential contamination, distance from source in miles: N/A

Well ID: Municipal Well 6 (Sample E2WC9)
Level of Contamination (I, II, or potential): Potential
If potential contamination, distance from source in miles: Greater than 1 mile; less than two miles

As specified in the HRS (Ref. 1, Section 3.3.1, Table 3-11), if one or more drinking water wells are subject to Level II concentrations, a Nearest Well Factor Value of 45 is assigned. Level II concentrations of PCE have been documented in the groundwater of Logansport Municipal wells #2, #3, #4, and #5 (Table 2 of this documentation record; Section 3.3.2.1 of the HRS Documentation Record).

Nearest Well Factor Value: 45
(Ref. 1, Table 3-11)

3.3.2 Population

Logansport Municipal Wells #2, #3, #4, #5, and #6 serves drinking water to a total of 18,369 individuals (Ref. 78, p. 2). The water from the municipal wells is not blended with surface water (Ref. 83, p. 1). Each of the municipal wells have a well capacity of 1,400 gpm (Refs. 79, p. 8; 85, p. 1). Since each well has a capacity of 1,400, then the population served for each wells is apportioned equally at 20%. The waters from the five wells are treated with chlorine and then manifolded from one well to the next prior to distribution to the public (Ref. 83, p. 1). The Logansport Municipal Well system has a water main and all of the wells attach to this main and then supply east or west at the water distribution system, and south to serve the Logansport State Hospital (Ref. 91. p. 1).

The following table documents the level of contamination (Level I or Level II) in each Logansport municipal well, well capacities, calculations used to determine the total population served by each well based on their respective well capacities, and subsequently the total population served by each well.

Population Per Well Calculations Table

Well ID/ Well Log #	Well Capacity (gpm)	Calculation (well capacity / total capacity of all wells)	% of Total Capacity	Total Population Served by Logansport Municipal Wells	Population per Well Calculation (based on capacity)	Population per Well (based on capacity)	Level of Contamination (Level I, Level II, Potential
Municipal Well 2/ 103834	1,400[2]	=1,400 / 7,000	20%	18,369[1]	=18,369 x 20%	3,673.8	Level II
Municipal Well 3/ 103839	1,400[2]	=1,400 / 7,000	20%	18,369[1]	=18,369 x 20%	3,673.8	Level II
Municipal Well 4/ 103824	1,400[2]	=1,400 / 7,000	20%	18,369[1]	=18,369 x 20%	3,673.8	Level II
Municipal Well 5/ 103829	1,400[2]	=1,400 / 7,000	20%	18,369[1]	=18,369 x 20%	3,673.8	Level II
Municipal Well 6/ 103814	1,400[2]	=1,400 / 7,000	20%	18,369[1]	=18,369 x 20%	3,673.8	Potential
Total	7,000	-	100%	18,369[1]	-	18,369	-

[1] Ref. 78, p. 2
[2] Refs. 79, p. 8; 88; Figures 2 and 5 of this HRS documentation record

3.3.2.1 Level of Contamination

The level of contamination per each municipal well is determined by concentration of contaminants found in the drinking water at each well. If the concentration of a contaminant meets observed release criteria and exceeds an HRS

eligible drinking water benchmark as shown in the Superfund Chemical Data Matrix then the Level of concentration is Level I (Ref. 1, Section 2.5 and HRS Table 3-10; Ref. 2). If the concentration of a contaminant is below an HRS eligible benchmark as shown in the Superfund Chemical Data Matrix (Ref. 2) and the concentration and meets observed release criteria, then the Level of concentration is Level II. If the hazardous substance does not meet observed release criteria, then the well is evaluated under potential contamination in section 3.3.2.4 of this HRS documentation record.

Level of Concentrations
(Table Lists only Municipal Wells)

EPA CLP #	Sample Description	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Health based Benchmark	Level of Contamination	Reference for Benchmark
E2QK2	Groundwater	PCE	1.6	5.0	MCL	II	Ref. 2, p. 12
E2QK3	Groundwater	PCE	1.7	5.0	MCL	II	Ref. 2, p. 12
E2QK4	Groundwater	PCE	2.0	5.0	MCL	II	Ref. 2, p. 12
E2QK1	Groundwater	PCE	1.2	5.0	MCL	II	Ref. 2, p. 12
E2QK0	Groundwater	PCE	1.2	5.0	MCL	II	Ref. 2, p. 12
E2WC4	Groundwater	PCE	0.65 J-	5.0	MCL	II	Ref. 2, p. 12
E2WC5	Groundwater	PCE	1.4 J-	5.0	MCL	II	Ref. 2, p. 12
E2WC6	Groundwater	PCE	0.6 J-	5.0	MCL	II	Ref. 2, p. 12
E2WC7	Groundwater	PCE	0.72 J-	5.0	MCL	II	Ref. 2, p. 12
E2WC8	Groundwater	PCE	0.73 J-	5.0	MCL	II	Ref. 2, p. 12

3.3.2.2 Level I Concentrations

Level I Population Targets
No Level I Populations were identified.

Sum of Population Served by Level I Wells: Not Scored
Sum of Population Served by Level I Wells X 10: Not Scored

Level I Concentrations Factor Value: 0

3.3.2.3 Level II Concentrations

Level II Population Targets

See “Population Per Well Calculations Table” of this documentation record which depicts the population calculated for Logansport Municipal Wells #2, #3, #4, and #5. Table 3 shows the benchmark used and the groundwater sample results for Logansport Municipal Wells #2, #3, #4, and #5 that were used to obtain the Level II concentrations. The population served by the Level II contaminated wells is (3,673.8 + 3,673.8 + 3,673.8 + 3,673.8 = 14,695.2).

Sum of Population Served by Level II Wells: 4 times 3,673.8 = 14,695.2

Sum of Population Served by Level II Wells X 1: 14,695.2

Level II Concentrations Factor Value: 14,695.2

3.3.2.4 Potential Contamination

There has not been an observed release of VOCs in the groundwater of Municipal Well #6. Therefore, potential contamination exists for Municipal Well #6. As shown in the Population per Well Calculations Table, Municipal Well #6 serves 3,673.8 people. Well #6 is in the greater than 1-to-2 mile distance category of the Target Distance Limit (Figure 6). Since Municipal Well #6 is in the greater than 1-to-2 mile distance category of the Target Distance Limit, a distance-weighted population value of 939 is obtained from the Other Than Karst category in HRS Table 3-12.

The value assigned total of 939 is multiplied by 0.1 which equals 93.9 and is rounded to 94 (HRS Section 3.3.2.4).

Potential Contamination Factor Value: 94

3.3.3 Resources

Resource use of the aquifer within the target distance limit does not include any of the Resource Factors. Therefore, a Resource Factor value of 0 is assigned (Ref. 1, Section 3.3.3).

Resources Factor Value: 0

3.3.4 Wellhead Protection Area

The groundwater plume lies within the Logansport Wellhead Protection Area (Ref. 8, pp. 24, 25; Figure 5 of this HRS Documentation Record and Ref. 69). Wellhead Protection Areas are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 84, p. 1). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20