

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Franklin Street Groundwater Contamination

U.S. EPA ID No.: INN000510959

Contact Persons

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Pathways, Components, or Threats Not Scored

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

The Surface Water Migration Pathway, Soil Exposure 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 Ground Water Pathway produces an overall score above the minimum requirement for the Franklin Street Groundwater Contamination site to qualify for inclusion on the National Priorities List (NPL).

HRS Documentation Record

Name of Site: Franklin Street Groundwater Contamination

Date Prepared: January 2018
Date Modified: May 2018

EPA Region: 5

Street Address*: Intersection of S. Montgomery Street and W. Market Street
(based on plume center point)
(see Figure 4 of this HRS Documentation Record)

City, County, State, Zip Code: Spencer, Owen County, Indiana, 47460

General Location in the State: South-Central Indiana (Figure 1 of this HRS Documentation Record)

Topographic Map: Spencer Quadrangle, Indiana-Owen County (7.5-Minute Series (Ref. 3))

Latitude: 39.2849° N Longitude: 86.7645° W

Reference Point: Center of Groundwater Plume
(Figure 4 of this HRS Documentation Record)

Congressional District: 8

*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 Franklin Street Groundwater Contamination

Air Migration Pathway:	Not Scored
Surface Water Migration Pathway:	Not Scored
Soil Exposure and Subsurface Intrusion Pathway:	Not Scored
Ground Water ¹ Migration Pathway:	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

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	<u>100.00</u>	<u>10,000.00</u>
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	<u>NS</u>	<u>NS</u>
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	<u>NS</u>	<u>NS</u>
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score	<u>NS</u>	<u>NS</u>
3. Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	<u>NS</u>	<u>NS</u>
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	<u>NS</u>	<u>NS</u>
5. Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		<u>10,000.00</u>
6. HRS Site Score (divide the value on line 5 by 4 and take the square root)		<u>50.00</u>

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	0
3. Likelihood of Release (higher of lines 1 and 2e)	550	550.00
Waste Characteristics:		
4. Toxicity/Mobility	(a)	100.00
5. Hazardous Waste Quantity	(a)	100.00
6. Waste Characteristics	100	10.00
Targets:		
7. Nearest Well	(b)	45.00
8. Population:		
8a. Level I Concentrations	(b)	0
8b. Level II Concentrations	(b)	4,951.50
8c. Potential Contamination	(b)	349.00
8d. Population (lines 8a + 8b + 8c)	(b)	5,300.50
9. Resources	5	0
10. Wellhead Protection Area	20	20.00
11. Targets (lines 7 + 8d + 9 + 10)	(b)	5,365.50
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

Franklin Street Groundwater Contamination EPA ID INN000510959

Figure 1

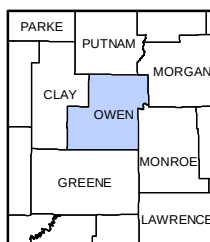
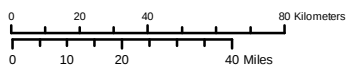


This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Shane Moore, Office of Land Quality
Date: 11/07/2016

Sources:
Non Orthophotography
Data - Obtained from the State of Indiana Geographical Information Office Library

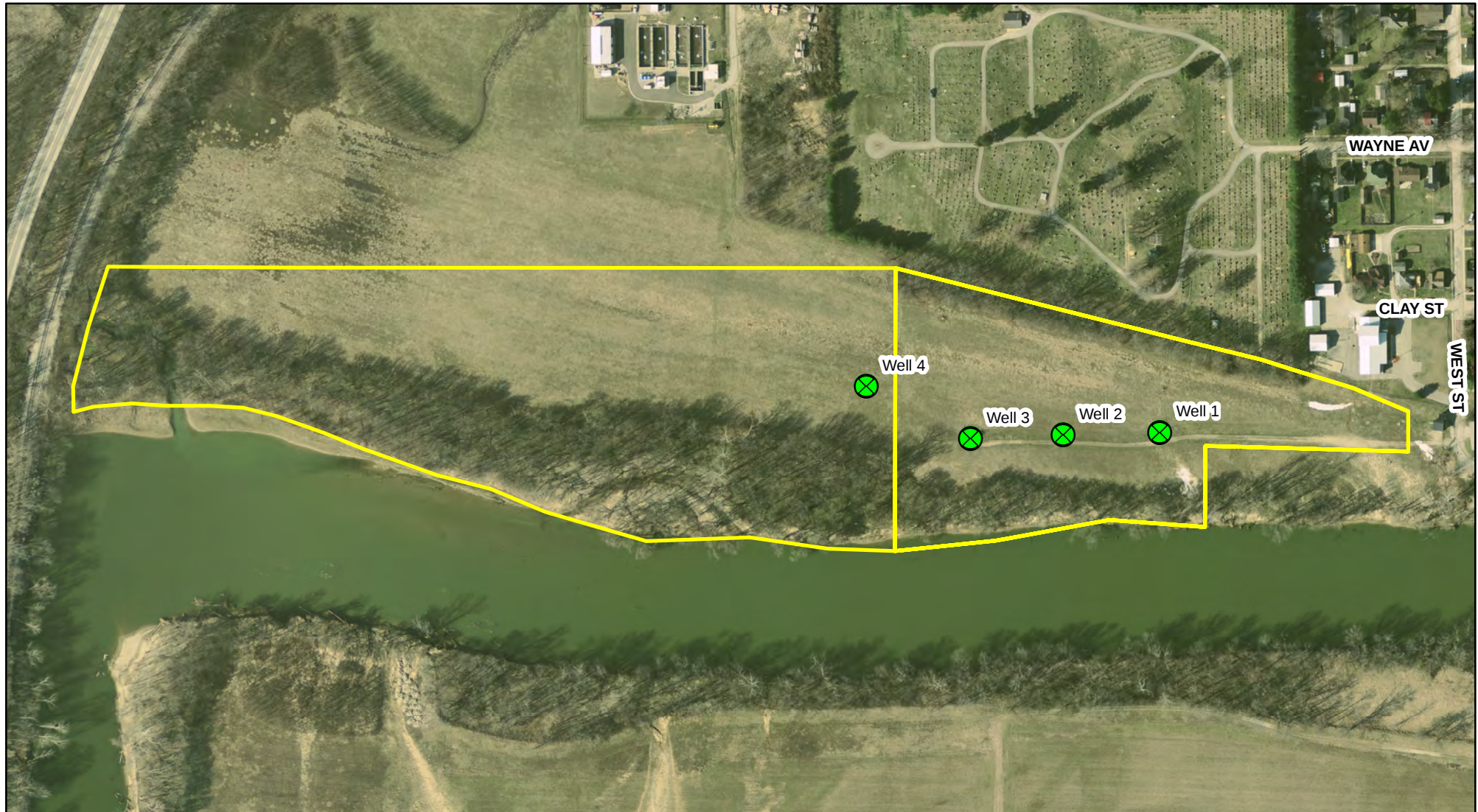
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



- + Site Location
- Cities and Towns
- County Boundaries

Franklin Street Groundwater Contamination BBP Water Corp. Well Locations

Figure 2

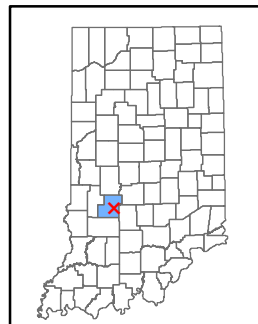


This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

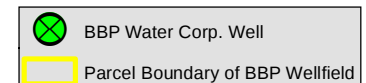
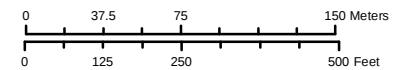
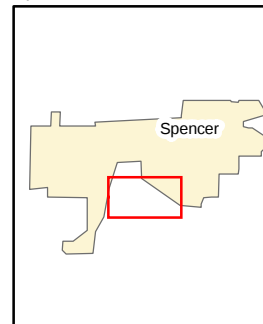
Mapped By:
Shane Moore, Office of Land Quality
Date:06/13/2017

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library
Orthophotography
- Obtained from Indiana Map Framework Data (www.indianamap.org)

Map Projection: UTM Zone 16 N **Map Datum:** NAD83

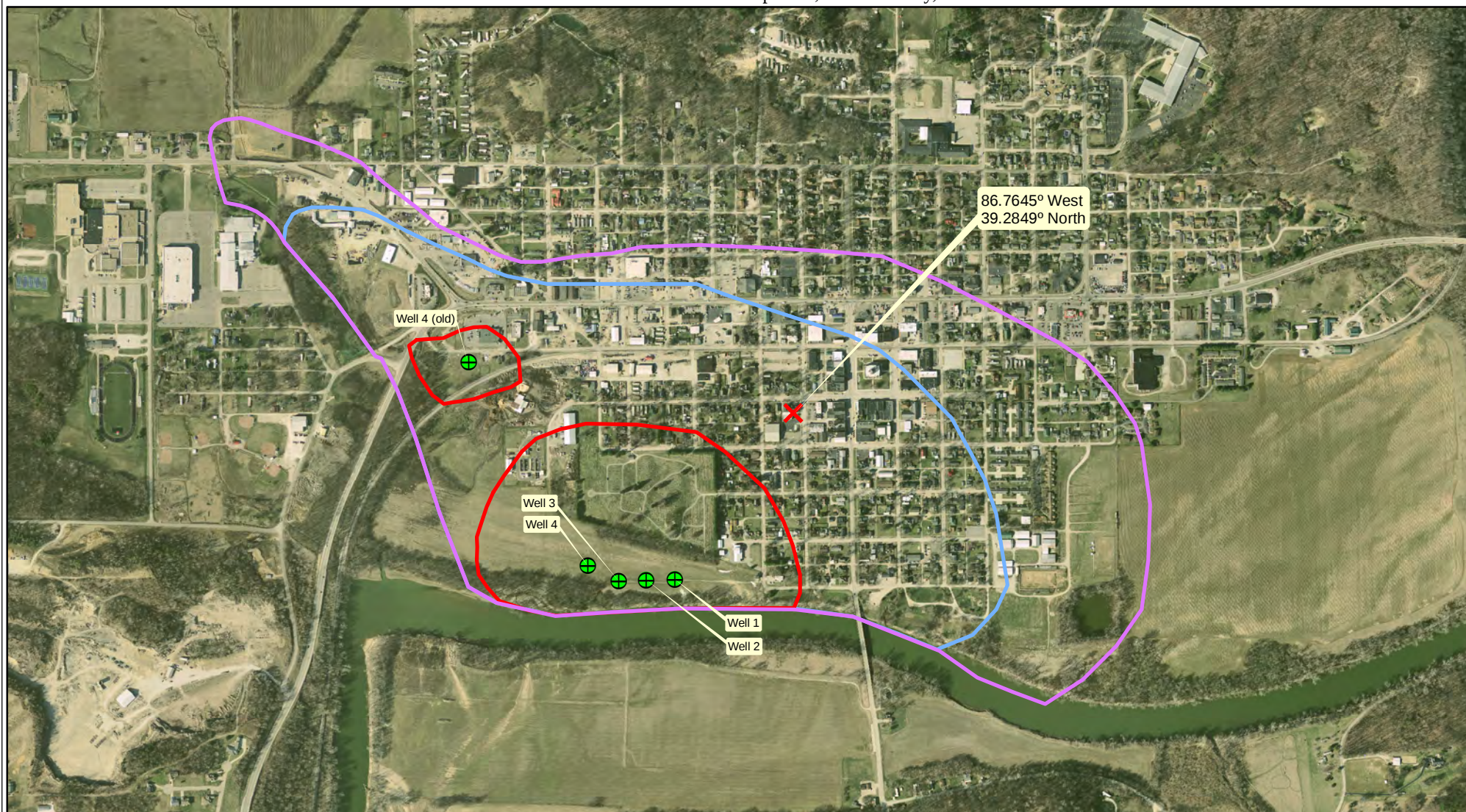


Owen County



Franklin Street Groundwater Contamination Wellhead Protection Area - Spencer, Owen County, Indiana

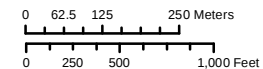
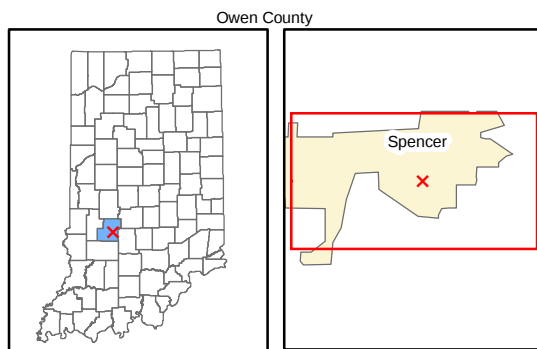
Figure 3



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

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Shane Moore, Office of Land Quality
Date:06/12/2017

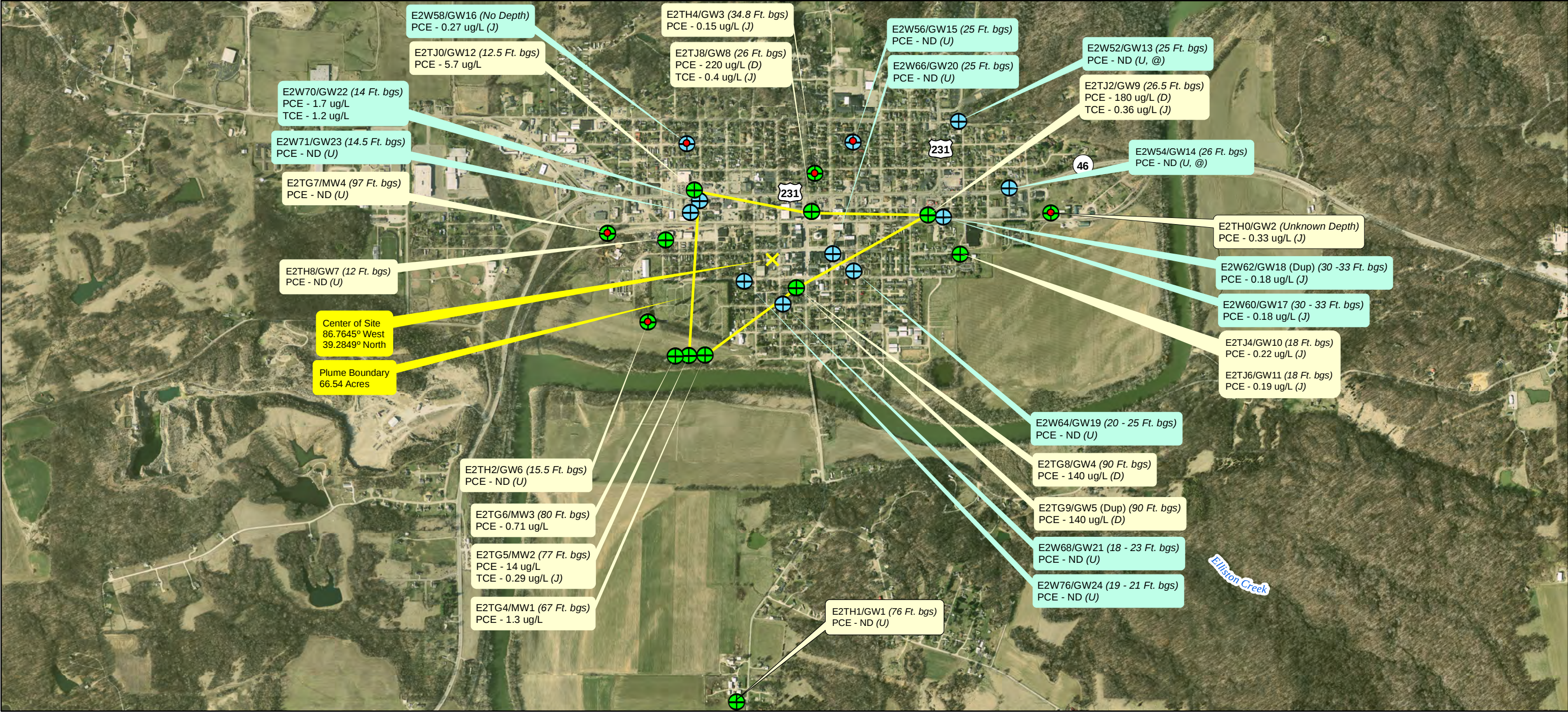
Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library
Orthophotography
- Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



- + Well
- X Site Center
- Wellhead 1 Year Delineation
- Wellhead 5 Year Delineation
- Wellhead 10 Year Delineation

Franklin Street Groundwater Contamination
SI and ESI Groundwater Sample Locations and Results

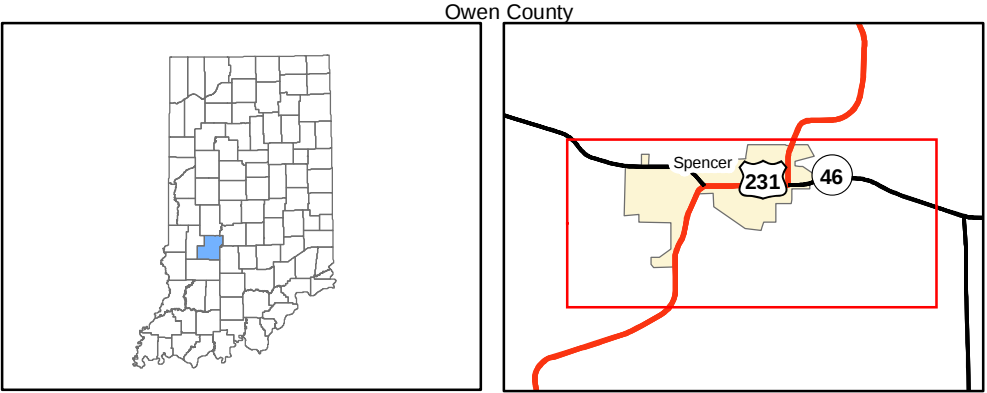
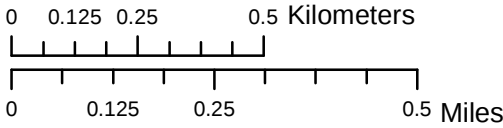
Figure 4



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: 06/12/2017

Sources:
Non Orthophotography
Data
- Obtained from the State of Indiana Geographic Information Office Library
- Sampling locations and results taken from IDEM's SampDB Database
Document
- IDEM Site Inspection Report, Bean Blossom/Patricksborg Water Corp., Ground Water Contamination, March 15, 2016, Table 3, pp. 40-43
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



- X Site Center (approx.)
- Background Sample
- ⊕ 2016 Sampling Location
- ⊕ 2015 Sampling Location
- Approximate Ground Water Plume Boundary

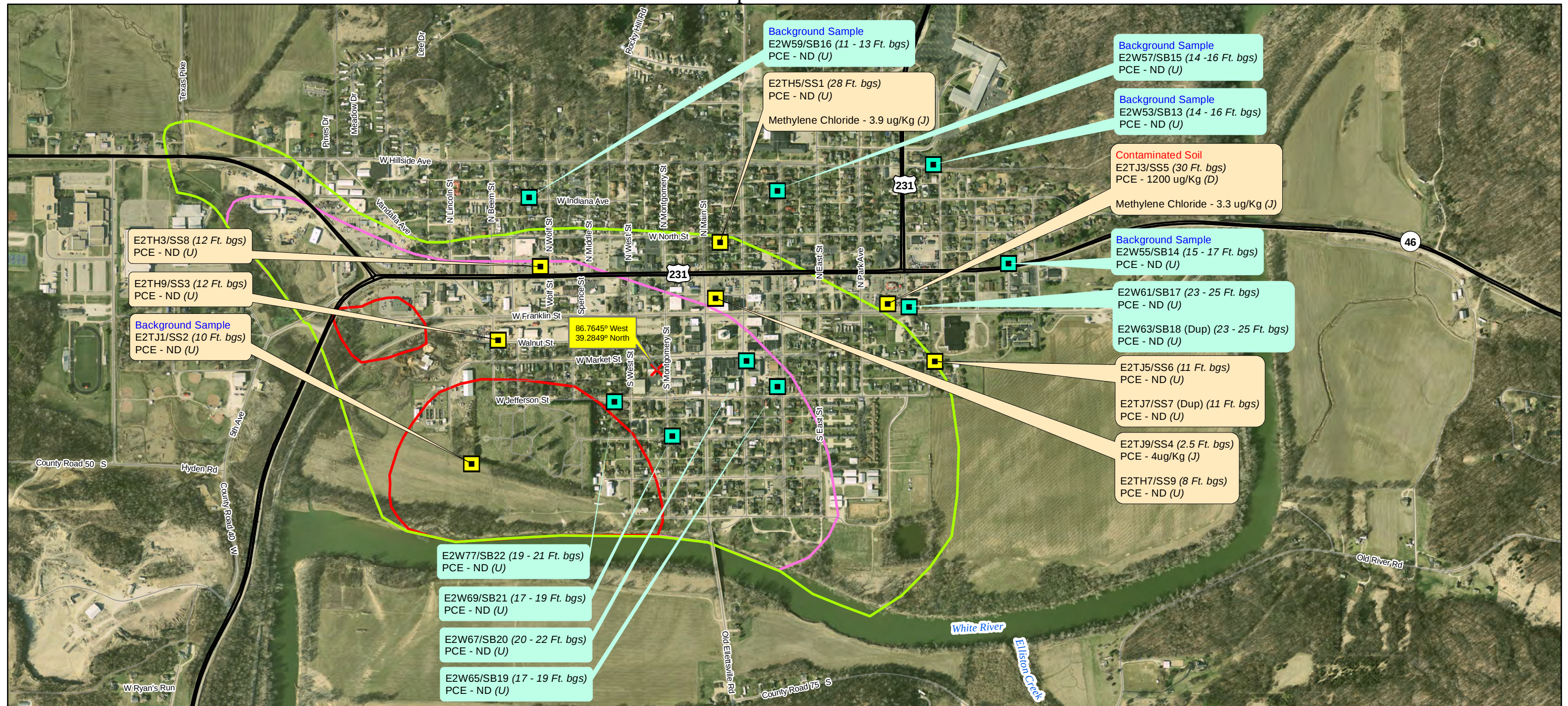
The plume polygon was generated by connecting the sample points with detected contamination. This polygons area was calculated by ESRI ArcGIS software via a command in table view "Calculate Geometry...."

Note: All VOCs were analyzed, but only contaminants of concern for this site are depicted on this map

Dup	Duplicate
ND	Non-Detect
	Please see Table 1 and 3 of this HRS Documentation Record for Data Qualifier Definitions
ug/L	microgram/Liter

Franklin Street Groundwater Contamination SI and ESI Soil Sample Locations and Results

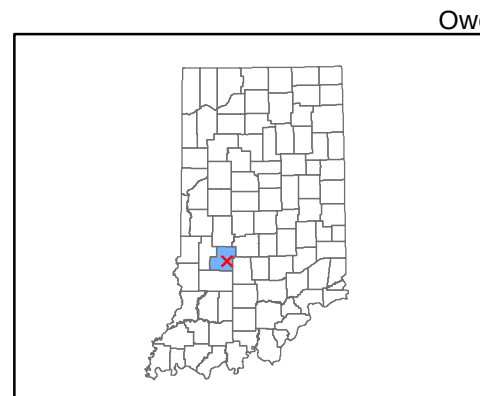
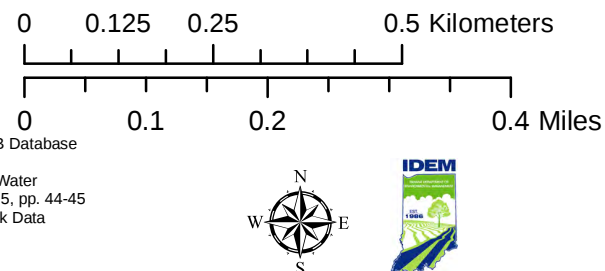
Figure 5



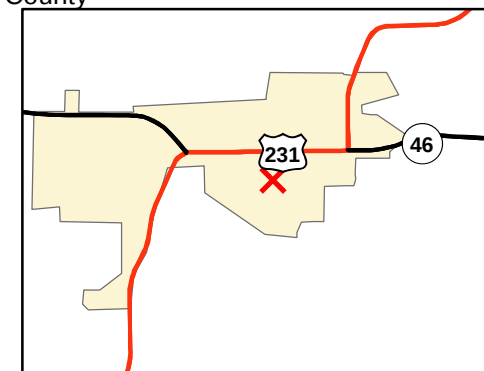
This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Shane Moore, Office of Land Quality
Date: 06/12/2017

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library
- Sampling locations and results taken from IDEM's SampDB Database
Document
- IDEM Site Inspection Report, Bean Blossom/Patricksborg Water Corp., Ground Water Contamination, March 15, 2016, Table 5, pp. 44-45
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



Owen County



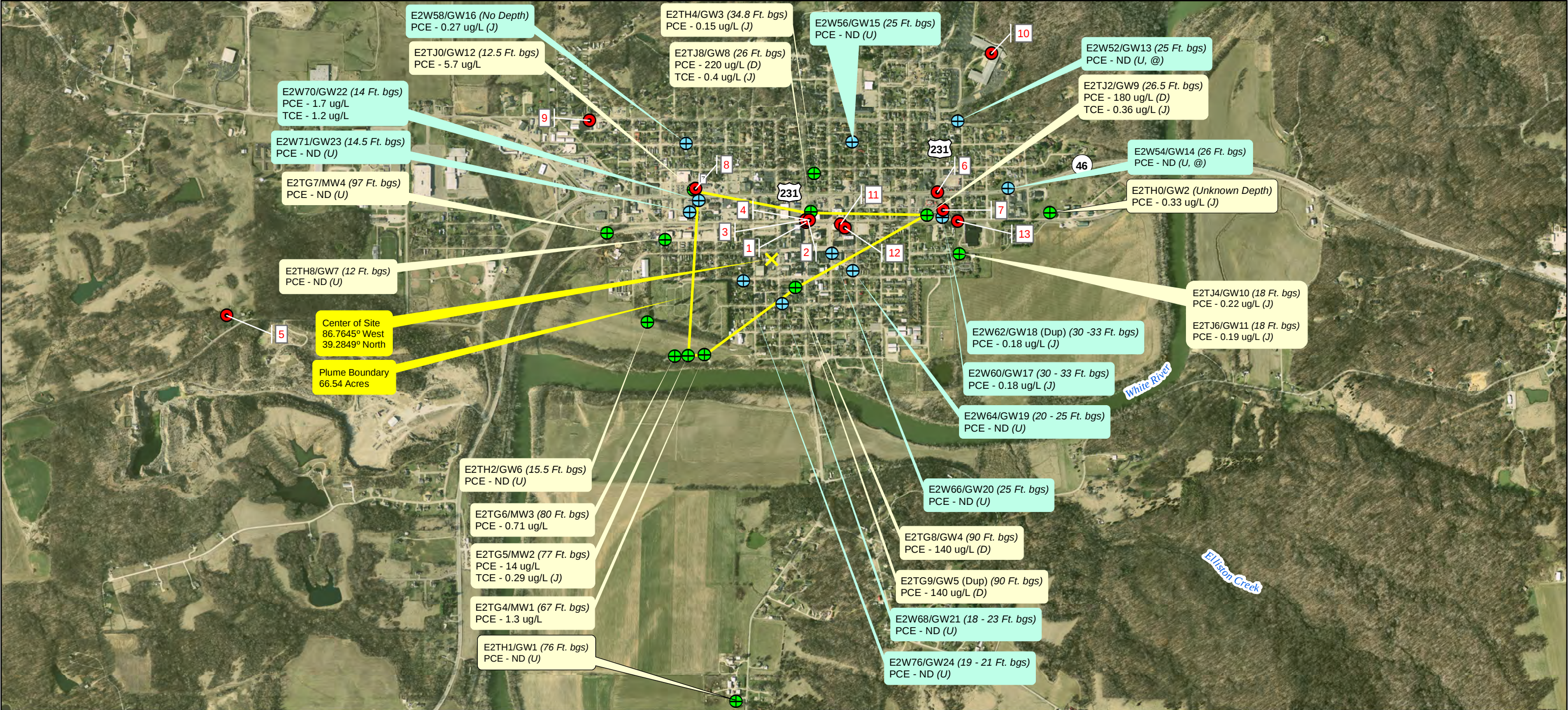
- ✗ Site Center (approx.)
- 2016 Sample Location
- 2015 Sample Location
- Wellhead 1 Year Delineation
- Wellhead 5 Year Delineation
- Wellhead 10 Year Delineation

Note: All VOCs were analyzed, but only contaminants of concern for this site are depicted on this map

Dup	Duplicate
ND	Non-Detect
	Please see Table 2 and 4 of this HRS Documentation Record for Data Qualifier Definitions
ug/Kg	microgram/kilogram

Franklin Street Groundwater Contamination
SI and ESI Groundwater Sample Locations and Results with Possible Sources

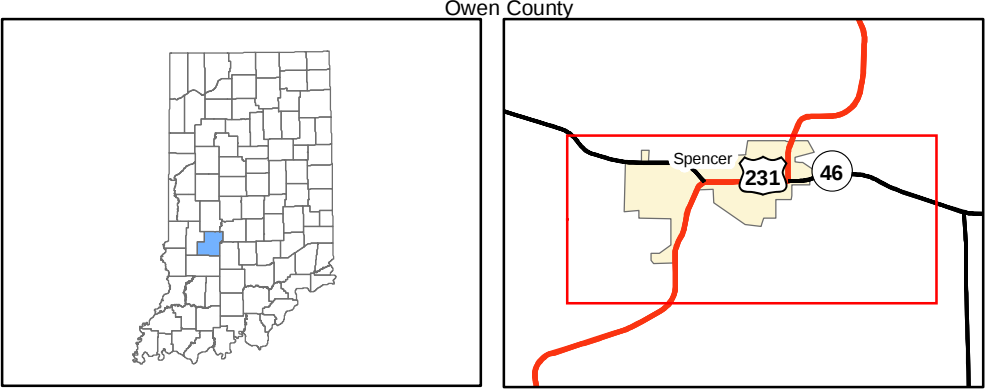
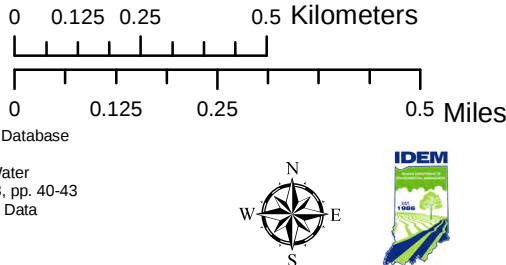
Figure 6



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: 6/7/2017

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library
- Sampling locations and results taken from IDEM's SampDB Database
Document
- IDEM Site Inspection Report, Bean Blossom/Patricksburg Water Corp., Ground Water Contamination, March 15, 2016, Table 3, pp. 40-43
Orthophotography - Obtained from Indiana Map Framework Data (www.indianamap.org)
Map Projection: UTM Zone 16 N **Map Datum:** NAD83



- Possible Sources
- ✕ Site Center (approx.)
- ⊕ 2016 Sampling Location
- ⊕ 2015 Sampling Location
- Approximate Ground Water Plume Boundary

The plume polygon was generated by connecting the sample points with detected contamination. This polygons area was calculated by ESRI ArcGIS software via a command in table view "Calculate Geometry...."

Note: All VOCs were analyzed, but only contaminants of concern for this site are depicted on this map

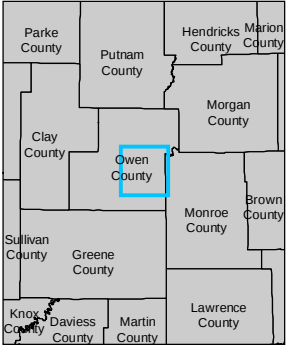
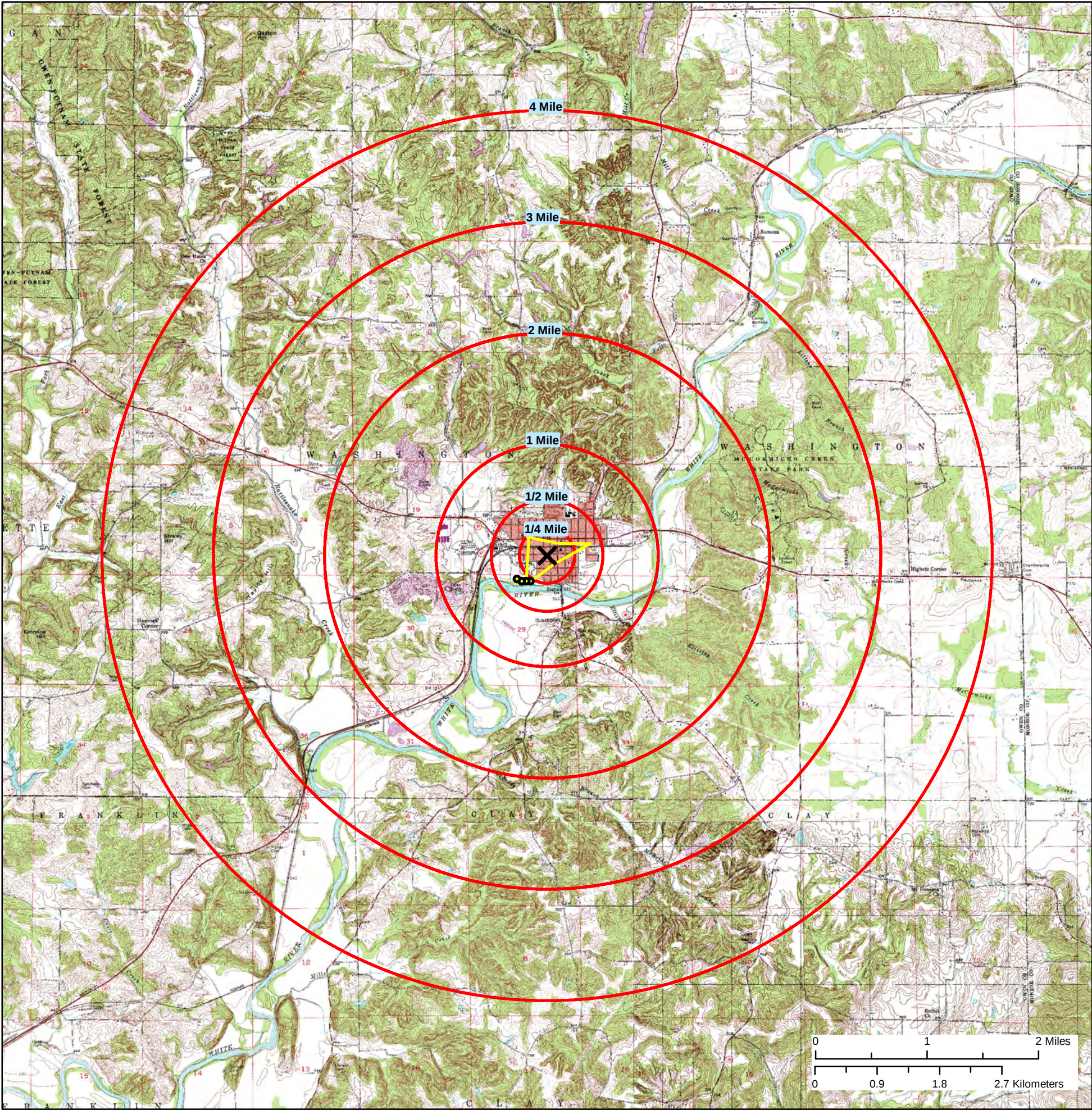
Dup	Duplicate
ND	Non-Detect
	Please see Table 1 and 3 of this HRS Documentation Record for Data Qualifier Definitions
ug/L	microgram/Liter

Figure 7

Four Mile Radius Map
Franklin Street Groundwater
Contamination
Spencer, Owen County, IN

39.284871 N
86.764356 W
(Approximate Center of Site)

- Municipal Well
- ✕ Calculated Plume Center
- Plume Boundary (estimated)
- Buffers



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services
Branch, Engineering and GIS Services, Sept. 13, 2017.

Sources:
- Plume boundary created from sample locations obtained from IDEM OLQ Sampling Database (SampDB)
- Well locations obtained from IDEM OLQ Sampling Database

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Orthophotography
- 2011-2013 Statewide Orthophotography Program

Map Datum and Projection
NAD83 UTM Zone 16N

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

REFERENCES

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|-----|--|
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65. IDEM. SI and ESI Possible Source Investigation. 3 pages.

SITE SUMMARY

The Franklin Street Groundwater Contamination site as scored consists of a contaminated groundwater plume with no identified source and is located in Spencer, Owen County, Indiana (Figure 1 and Figure 4 of this HRS Documentation Record). Tetrachloroethylene (PCE) has been detected at observed release concentrations in the groundwater samples delineating the contaminated plume (Section 3.1.1 of this HRS Documentation Record). Bean Blossom-Patricksborg (BBP) Water Corporation operates the groundwater wells and treatment plant that supplies drinking water to the Town of Spencer, Stinesville, Patricksborg, and Bowling Green which include portions of rural Owen, Monroe, and Clay Counties (Ref. 4, p. 2). Three BBP municipal wells have observed release concentrations of PCE. BBP supplies drinking water to approximately 9,903 people (Ref. 5, p. 2).

BBP operates four (4) wells, and three (3) of the four wells have been contaminated by a groundwater plume of chlorinated solvents, principally PCE (Ref. 42, p. 1; Table 3 and Figure 4 of this HRS Documentation Record). The four (4) wells in BBP's main well field are known as Well 1, Well 2, Well 3, and Well 4 (Ref. 10, p. 12-13, 45-47, 73-283, 697-710; Ref. 38, p. 1). Well 1, installed in 1987, has a total depth of 67 feet below ground surface (bgs), with bedrock at 68 feet bgs (Ref. 10, p. 12-13, 697-703; Ref. 7, p. 2). Well 2, installed in 1989, has a total depth of 77 feet bgs with bedrock at 77 feet bgs (Ref. 10, p. 12-13, 697, 704-708; Ref. 7, p. 2). Well 3, installed in 2000, has a total depth of 80 feet bgs and depth to bedrock is unknown (no original well record exists for Well 3 (Ref. 10, p. 12-13, 697, 709-710; Ref. 7, p. 2). Well records, pump installation/repair reports, and a cross sectional drawing of wells and soil in Spencer from the Wellhead Protection Plan (WHPP) can be seen in Ref. 10, p. 697-723. BBP drilled and completed a fourth well, Well 4, in the main active well field; prior to proposal Well 4 was brought online (post EPAs most recent expanded site inspection (ESI)). Upon being brought online and consistent with the Town of Spencer's comments on the proposed NPL listing, BBP Wells #3 and #4 now provide the vast majority of water to the drinking water system. The location of Well 4 can be seen in Figure 2 and Figure 3 of this HRS Documentation Record.

This site is being scored as a groundwater plume with no identifiable source due to not being able to unequivocally demonstrate attribution to possible sources. All of the possible sources identified by groundwater sampling discussed in Section 3.1.1 under the Contaminated Samples and Attribution sections of this report are all located in the same unconsolidated, undifferentiated outwash valley aquifer (Ref. 15, p. 2-3). The PCE groundwater plume, depicted by samples from the BBP wells and other samples collected during the Site Inspection (SI) and Expanded Site (ESI) investigations, meeting observed release criteria is shown in Figure 4 of this HRS Documentation Record. PCE is a manufactured chemical and does not occur naturally in the environment (Ref. 16, p. 1). Common breakdown products of PCE include trichloroethylene (TCE), vinyl chloride (VC), and cis-1,2-dichloroethene (Ref. 18, pp. 1, 2; 44, p. 2, 3; Ref. 44, p. 2). The total acreage of the plume, as measured by samples that meet the criteria for an observed release, is 66.54 acres (Figure 4 of this HRS Documentation Record). Wells that have exhibited levels of PCE, TCE, and other PCE degradation solvents that do not meet observed release criteria are not delineated in the approximate plume boundary.

Raw groundwater is pumped from BBP Wells 1, 2, 3, and 4 to the BBP treatment plant located at 256 W. Clay Street (Ref. 4, p. 2). Water from each of the wells is then blended before it begins to go through the treatment process. After treatment, the blended water is then distributed to the residents served by BBP.

HISTORY

The Franklin Street Groundwater Contamination site is located in Spencer, Owen County, Indiana (Figure 1 of this HRS Documentation Record). Finished water collected from BBP's treatment plant on June 6, 2011, as part of regularly scheduled required testing for the Indiana Department of Environmental Management (IDEM), had a detection of PCE at 1.2 micrograms per liter ($\mu\text{g/L}$) (Ref. 6, p. 47). A second detection of PCE in the finished water occurred at a concentration of 1.4 $\mu\text{g/L}$ in February 2012 (Ref. 6, p. 53-54).

Due to the detections of PCE in finished water, IDEM's Drinking Water Branch notified the Site Investigation Program, which conducted a Pre-CERCLA Screening (PCS) on January 6, 2013 (Ref. 13, pp. 1- 7). The PCS recommended that a Preliminary Assessment (PA) be conducted, which was completed on December 8, 2014 (Refs. 13, p. 2; 14, p. 1). The raw water was sampled from the three (3) municipal drinking water wells during the PA, which identified the presence of PCE in the raw water of each of the three (3) wells (Ref. 14, p. 32, 48-59). The PA report indicated the need for a Site Inspection (SI) (Refs. 6, p. 1; 13, p.1).

A Site Inspection (SI) sampling event was conducted on June 23 and 24, 2015, with the report composed on November 23, 2015 (Ref. 6, pp. 7, 14). Groundwater samples were collected from the four (4) municipal wells and from other wells located north and northeast of the well field (Ref. 6, p. 35). The groundwater samples were collected down-gradient and up-gradient from possible sources (Ref. 58, pp. 1-12; Figure 6 of this HRS Documentation Record). PCE was detected in the groundwater samples north and northeast of the municipal wells (Ref. 6, p. 35; Table 3 of this HRS Documentation Record). The PCE detected in these groundwater samples were found to be located down gradient and up-gradient to possible sources (Ref. 58, pp. 1-12; Figure 6 of this HRS Documentation Record). Subsurface soil samples were also collected as an attempt to identify possible sources. One soil sample E2TJ3, was found to have a concentration of 1200 $\mu\text{g/Kg}$ of tetrachloroethylene, however, groundwater had come in contact with this sample and may have contaminated the subsurface soil sample. No possible source(s) of groundwater contamination was identified after reviewing the groundwater and subsurface soils collected for the SI.

Analysis of samples collected during the SI confirmed the raw water detections discovered during the PA (Table 3 of this HRS Documentation Record; Ref. 6, p. 15-16). Monthly raw water samples collected by BBP since September 2014 have continued to show detections of PCE in the raw water in Wells 1, 2, and 3 (Ref. 10, pp. 45-46, 58-283).

An ESI sampling event was conducted on April 18 and 19, 2016. PCE concentrations were detected in municipal Wells #1, #2, and #3 (Table 2 of this HRS Documentation Record). PCE was also detected in groundwater samples collected at various locations down and up-gradient to possible sources (Ref. 58, pp. 1-12; Figure 6). No possible source(s) of groundwater contamination was identified after reviewing the groundwater and subsurface soils collected for the SI. Refer to Reference 58 for a detailed narrative discussing the level of effort to find a possible source. This reference also discusses attribution related to possible sources.

Additional Investigations

Additional direct push drill rig sampling was completed in the BBP well field by IDEM's Drinking Water Branch on June 25 and August 5, 2015 (Ref. 6, p. 778-1275; Ref. 36, p. 3-4; Ref. 37, p. 1-6). The sampling included a total of six (6) soil borings ranging in depth of 29 to 64 feet below ground surface (ft bgs) from which 12 total groundwater samples were collected (Ref.

6, p. 778-1275; Ref. 36, p. 3-4; Ref. 37, p. 1-6). See Reference 6, p. 778 for a figure of soil boring locations.

These soil borings were completed to help determine which direction the groundwater plume was entering the well field. Shallow and deep groundwater samples were collected from each boring (Ref. 6, p. 779; Ref. 36, p. 3). However, there were no detections of chlorinated solvents, and specifically PCE, in any of the groundwater samples. The full analytical results from these samples can be found in Reference 6, pp. 778-1275. In addition to collecting samples from the soil boring locations, one (1) sample was collected from a test well that was installed by BBP and their contractors during the summer of 2015 (Well 4 in Figure 1 of this HRS Documentation Record). This test well was installed as part of the installation of the new Well 4.

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of Source: 1

Name of Source: Groundwater Plume with No Identified Source

Source Type: Other

Description and Location of Source: (Figure 4 of this HRS Documentation Record)

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

The groundwater plume is depicted as by all groundwater samples having concentrations of PCE meeting observed release criteria. Observed release concentrations of PCE range from 0.71 to 220 µg/L (Table 2 and Figure 4 of this HRS Documentation Record). Wells that have exhibited levels of PCE, TCE, and other PCE degradation products that do not meet observed release criteria are not delineated in the approximate plume boundary. The plume is located within the Bean Blossom-Patricksborg (BBP) Wellhead Protection Area (WHPA) and the Town of Spencer and encompasses approximately 66.54 acres (Ref. 8, p. 120; Figure 3 HRS Documentation Record). The well field is located in a large field on the western edge of the Town of Spencer; approximately 200 feet north of the White River (Figure 2 of this HRS Documentation Record). Based on the WHPA and the location of the BBP wells in relation to the White River, groundwater flow direction is generally in the southwest direction from the Town of Spencer southwest towards the BBP wells (Figure 4 of this HRS Documentation Record; Ref. 15, p. 2).

There are multiple known current and historical users of chlorinated solvents in the Town of Spencer. The specific sources of the contamination impacting the BBP 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 Reference 58. IDEM staff have conducted an SI and an ESI to document a release of PCE to BBP #1, #2, and #3 municipal wells. Refer to Reference 58 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

Tetrachloroethylene (PCE) is associated with the source (see Section 3.1.1 of this HRS Documentation Record). Concentrations of PCE were detected in the BBP Wells #1, #2, and #3 and other wells delineating the plume (Ref. 6, pp. 163-164, 334-343, 720-721; Ref. 9, p. 6; Figure 4 of this HRS Documentation Record). The plume boundary is depicted and measured by connecting locations of groundwater samples that contain concentrations of PCE meeting observed release criteria (Figure 4 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 observed release concentrations of PCE used to delineate the plume.

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 groundwater: The containment factor of 10 is assigned based on analytical evidence of hazardous substances in groundwater samples from municipal, direct push, and residential geothermal wells (see Table 2 of this HRS Documentation Record). Therefore, based on evidence of release (evidence of hazardous substance migration from a source area), the highest Ground Water 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, potentially 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 Wastestream Quantity (Tier B)

The Hazardous Wastestream Quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of the hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is 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 wastestreams 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 Wastestream 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 Wastestream Quantity Assigned Value: Not Scored

2.4.2.1.3. Volume (Tier C)

Because 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 (yd³/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). HRS, Section 2.4.2.1.3, Volume, indicates that if the volume of the source can be determined, do not evaluate the area measure; instead, assign the area measure a value of zero (0) and proceed to Section 2.4.2.1.5.

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Volume of groundwater 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	N	10	NS*	NS*	NS*	NS*

*NS (Not Scored)

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Ground Water Migration Pathway Description

The Bean Blossom-Patricksborg Water Corporation Wellfield (PWSID #526001) sits along the north bank of the White River on the western edge of the Town of Spencer in Owen County, Indiana. Wells #1, #2, #3, and #4 are either currently active or are used on a regular basis and completed in the uppermost unconsolidated White River and Tributaries Outwash Aquifer System (Ref. 57, p. 13). The primary aquifer system is composed of thick glacial outwash sands and gravels capped by recent alluvial deposits (Ref. 54, p. 1). The underlying bedrock of the Mississippian Blue River and Sanders Groups consists of mostly limestones containing significant amounts of gypsum, anhydrite, shale, chert, and calcareous sandstone. The Blue River and Sanders Groups Aquifer System is not regarded as a major groundwater resource in the county (Ref. 55, p. 1). The bedrock aquifer was not used for HRS scoring purposes.

Regional Geology/Aquifer Description:

Spencer lies within the Mitchell Plain physiographic unit (Ref. 52, p. 126). A series of ice-age events formed the landscape in this study area. Pre-Wisconsinan Age glacial deposits cover the surrounding till plain. The aquifer is in sand and gravel outwash that fills the bedrock valley below the river. Modern alluvium, through which the White River has cut its channel, caps the sand and gravel outwash. The upland area is a dissected till plain where most of the bedrock is covered by fine grained glacial deposits. White River has removed and reworked some of the glacial deposits from the ancient floodway (Ref. 57, p. 13).

Site Geology/Aquifer Description:

Soils in the study area consist of Gessie silt loam and Stonelick sandy loam. Both soil series are generally found on flood plains in areas of Wisconsinan glaciation and consist of very deep (more than 60 inches), well drained soils that formed in calcareous, loamy alluvium. Slope ranges from 0 to 2 percent. The Stonelick series generally has a seasonal high water table greater than 6 feet. The potential for surface runoff is negligible or very low. Saturated hydraulic conductivity is high. Permeability is moderately rapid. This soil is subject to occasional or frequent flooding for brief durations (Ref. 56, p. 26).

- Aquifer/Stratum 1 (uppermost):

Description

The sand and gravel deposits in the buried bedrock valley under the wellfield form the groundwater aquifer. The natural direction of groundwater flow is primarily south-southwest at the wellfield. Depositional structures in the sand and gravel and modern flow directions are expected to follow the axis of the main buried bedrock valley. The areas away from the main buried bedrock valley contain groundwater, but that flow is only a small fraction of the total available groundwater. The thick glacial and alluvial fine grained deposits above the aquifer, and the deep unweathered hard limestone below, are not capable of supporting the volume of water

obtained from the buried outwash at the Bean Blossom-Patricksborg wellfield. Groundwater in the wellfield essentially is unconfined in the buried sand and gravel, with some recharge from precipitation and some induced as recharge from the White River during heavy pumping (Ref. 57, p. 37).

- Aquifer/Stratum (deepest):

Description

The bedrock beneath the Bean Blossom-Patricksborg wellfield consists of Mississippian Blue River and Sanders Groups limestone and dolomite and extends below 400 feet mean sea level. Drilling at the wellfield stopped prior to encountering bedrock so the depth is not confirmed (Ref. 57, p. 39). Both the Blue River and Sanders Groups can be highly karstic (Ref. 52, p. 127). The bedrock aquifer was not used for HRS scoring purposes.

- Aquifer Interconnections/Distance from Source

Description

The White River and Tributaries Outwash Aquifer System aquifer is in sand and gravel outwash and the contaminated plume is in this aquifer (Ref. 15, pp. 2-3; Ref. 54, p. 1; Section 3.1.1 of this HRS Documentation Record). The direction of groundwater flow is primarily south-southwest. Groundwater in the wellfield is unconfined in the buried sand and gravel, with some recharge from precipitation and some recharge from the White River during heavy pumping. The White River flows southwesterly in a broad outwash filled, alluvium capped channel at the wellfield. The river was found to have significant control on the groundwater flow system and the most productive wells are closest to the river. The regional drainage flows southwest toward the Wabash River, except where modified by ice age deposits and differences in erosional surface of the bedrock. Tributaries to the Wabash River, such as the White River, flow toward the trunk stream (Ref. 57, p. 37).

- Aquifer Discontinuities within Target Distance Limit

Description

Cross-sections of the Bean Blossom-Patricksborg wellfield show the White River does not fully transect the White River and Tributaries Outwash Aquifer System (Ref. 8, pp. 19-20). Therefore, the White River is not considered an aquifer boundary or discontinuity. There are no other aquifer discontinuities or boundaries, such as a mountain range, ocean, etc., within a 4-mile radius of the site (Ref. 52, p. 137).

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	White River and Tributaries Outwash Aquifer System	This is the Upper Aquifer	Yes	No
2	Mississippian Blue River and Sanders Groups	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, 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 hazardous substance is detected in the background sample, an observed release is established when the sample measurement is 3 times the background concentration. 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). Samples were analyzed for volatile organic compounds (VOCs) using Contract Laboratory Program (CLP) Statement of Work (SOW) SOM02.2 (Trace Volatiles) analysis procedure (Ref. 6, pp. 148, 514; Ref. 10, pp. 18, 288, 520).

Chemical Analysis

On June 24 and 25, 2015 IDEM's Site Investigation Program staff conducted sampling for the SI (Ref. 6, p. 14). A total of 19 groundwater samples were collected during this investigation. This total included two (2) duplicate groundwater samples and three (3) water trip blanks (Ref. 6, p. 14). Additional volume was collected from one (1) groundwater sample (Ref. 6, p. 14). On April 18 and 19, 2016 IDEM Site Investigation Program staff conducted sampling for the ESI (Ref. 10, p. 17). A total of 15 groundwater samples were collected during this investigation. This total includes one (1) duplicate groundwater sample, one (1) equipment blank, and two (2) water trip blanks (Ref. 10, p. 17). Additional volume was collected from one (1) groundwater and one (1) subsurface soil sample for MS/MSD purposes (Ref. 10, p. 17). A full summary of all sampling procedures can be viewed in Ref. 6, pp. 14-15 and Ref. 10, pp. 17-18. Table 2 of this HRS Documentation Record lists those groundwater samples where an observed release has been documented.

- Background Concentrations

A total of 34 groundwater samples were collected during the SI and ESI investigations. Six (6) of these groundwater samples were identified as background samples (Table 1a, Table 1b and Table 1c of this HRS Documentation Record). One (1) of the background groundwater samples (E2TG7) was collected from BBP's old Well 4 located at 770 W. Franklin Street (Table 1c and Figure 4 of this HRS Documentation Record). Five (5) background groundwater samples were collected using direct push probe sampling (Table 1a and Table 1b of this HRS Documentation Record). The other background, sample E2TH0 was collected from a residential well. However, the depth of the residential well is unknown. All background groundwater samples are outside of the identified groundwater plume boundary (Figure 4 of this HRS Documentation Record).

As previously stated, the sand and gravel outwash aquifer is interconnected throughout all of the samples collected during the SI and ESI investigations, and all samples are considered from the same aquifer (Ref. 15, pp. 2-3). All sample locations and associated PCE concentrations can be seen in Figure 4 of this HRS Documentation Record. Sample E2TG7 was collected from BBP's old Well 4 located at 770 W. Franklin Street (Table 1c and Figure 4 of this

HRS Documentation Record). The well log for this well in is Ref. 10, p. 712, and a cross section depiction of this well in relation to the active BBP municipal wells can be seen in Ref. 10, p. 716. This well has a total depth of 97.7 feet bgs and a screened interval from 87.3 to 97.7 feet bgs (Ref. 10, p. 712). This well also appears to lie just on top of bedrock, similar to the active BBP wells adjacent to the White River (Ref. 10, pp. 712, 716). Thus, sample E2TG7 is in the same aquifer and at a similar depth as the active BBP municipal wells. Therefore, groundwater sample E2TG7 is similar to the groundwater samples collected in the impacted BBP's #1, #2, and #3 municipal wells because 1) the sample is from a municipal well, 2) the depth of the well is similar to BBP's impacted wells, and 3) the sample is obtained from the same aquifer. The background level used to establish an observed release of PCE in the contaminated municipal wells is presented in Table 1c of this HRS Documentation Record. PCE was not detected above the CRQL in the municipal background well (Table 1c of this HRS Documentation Record).

Background groundwater samples E2W56, E2TH2, E2TH4, and E2W58 were obtained utilizing a direct push probe, and background groundwater sample E2TH0 was collected from a residential well; these samples were collected on the southwest, northeast, and east sectors of the town of Spencer (Figure 4). These samples were collected from depths between 15 and 34.8 feet or an unknown depth as was the case for residential well sample E2TH0. Since a) these samples were collected from the sand and gravel outwash aquifer which is interconnected throughout the area, and b) that these samples were obtained utilizing a direct push probe, these groundwater samples are considered similar samples. The background levels used to establish an observed release of PCE using direct push probe and residential well samples are presented in Tables 1a and 1b of this HRS Documentation Record. The highest of the PCE concentrations (0.33 µg/L) detected from a direct push probe and residential well sample is used as the background level for the direct push and residential well samples. The samples were obtained from wells in the same wellfields, screened in equivalent materials, and near the same depths to the contaminated wells.

Samples E2W52 and E2W60 that were collected for the ESI are not considered background groundwater samples for this HRS Documentation Record. These samples were analyzed outside holding times (Ref. 11, p. 2).

Table 1a. Background Groundwater Samples Results For The SI Inspection That Were Collected From a Direct Push Probe or Residential Well							
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	Depth (ft bgs)	Haz Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TH2 (GW-6)	6/24/2015	W. Cooper St. (BBP well field)	15-16	PCE	0.5 U	0.5	Ref. 6, pp. 521-522, 571, 587-590, 772-773
E2TH4 (GW-3)	6/24/2015	156 N. Main St.	34.8	PCE	0.15 J	0.5	Ref. 6, pp. 40, 523-524, 571, 591-594, 759-764; 10, p. 50

Table 1a. Background Groundwater Samples Results For The SI Inspection That Were Collected From a Direct Push Probe or Residential Well							
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	Depth (ft bgs)	Haz Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TH0 (GW-2) (residential well)	6/23/2015	851 E. Franklin St.	Unknown	PCE	0.33 J	0.5	Ref. 6, pp. 40, 171-172, 261, 361-364, 726-727; 10, pp. 48, 50

- BGS - Below Ground Surface
ft - Feet
CLP - Contract Laboratory Program
Haz. - Hazardous
CRQL - Contract Required Quantitation Limit
µg/L - micrograms per liter
U - This flag indicates the compound was analyzed for but not detected. The Contract Required Quantitation Limit (CRQL), or reporting limit, will be adjusted to reflect any dilution (Ref. 6, pp. 155, 519; Ref. 10, pp. 294, 524).
J - Samples have analyte concentrations below the quantitation limit (CRQL) and detected compounds are qualified as J values. The result is an estimated quantity. The associated numerical value is approximate concentrations of the analyte in the sample. However, these results are associated with no bias, and therefore, adjustment is not necessary (Ref. 6, pp. 150, 152; Ref. 10, pp. 48, 50, 54).

Table 1b. Background Groundwater Samples Results For The ESI Inspection Samples Were Obtained Utilizing a Direct Push Probe							
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	Depth (ft bgs)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2W58 (GW-16)	4/18/2016	W. Indiana Ave.	25	PCE	0.27 J	0.5	Refs. 10, pp. 54, 315-316, 377, 419-422, 749-750, 753; 11
E2W56 (GW-15)	4/18/2016	N. Harrison St. (west side of street)	25	PCE	0.50 U	0.50	Refs. 10, pp. 311-312, 377, 415-418, 744-745, 748; 11

Table 1c. Background Groundwater Sample Collected For The SI from BBP's Old Municipal Well #4 (Comparable to BBP Municipal Wells #1, #2 and #3)							
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	Depth (ft bgs)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TG7 (MW-4)	6/23/2015	BBP Old Well 4	97.7	PCE	0.5 U	0.5	Refs. 6, pp. 163-164, 261, 334-343, 697, 720-721; 7, p. 2-3; 8, pp. 4, 18-20, 26; 10, p. 712

BGS - Below Ground Surface

ft - feet

CLP - Contract Laboratory Program

Haz. - Hazardous

CRQL - Contract Required Quantitation Limit

µg/L - micrograms per liter

U - This flag indicates the compound was analyzed for but not detected. The Contract Required Quantitation Limit (CRQL), or reporting limit, will be adjusted to reflect any dilution (Ref. 6, pp. 155, 519; Ref. 10, pp. 294, 524).

- Contaminated Samples

Raw water samples collected on June 23, 2015, during the SI investigation, from the BBP municipal Wells 1, 2, and 3 were found to be contaminated with the chlorinated VOC PCE (Table 2a of this HRS Documentation Record). Each BBP well had detections of PCE above the CRQL, demonstrating an observed release (Table 2a of this HRS Documentation Record). Since three (3) BBP municipal wells (#1, #2, and #3) had detections above the CRQL, they meet observed release criteria with PCE concentrations of 1.3, 14, and 0.71 µg/L, respectively (Table 2a of this HRS Documentation Record). The background groundwater sample collected from old BBP #4 (groundwater sample E2TG7) was found to be non-detect for PCE.

Six (6) other groundwater samples that were collected by a direct push probe or from a residential geothermal well during the SI and ESI sampling events, demonstrated observed release criteria of PCE in the aquifer (Figure 4 and Table 2b of this HRS Documentation Record).

The Franklin Street Groundwater Contamination site consists of a groundwater plume with no identified source. Chlorinated solvents, specifically tetrachloroethylene (PCE), have been detected in the groundwater in the municipal drinking water wells (specifically BBP municipal Wells #1, #2, and #3) in Spencer, Indiana. BBP supplies drinking water to approximately 9,903 people (Ref. 5, p. 2). The extent of the groundwater plume as depicted by samples from the BBP wells and other ground water samples collected during the SI and ESI investigations meeting observed release criteria is shown in Figure 4 of this HRS Documentation Record. The estimated acreage of the plume, as measured by samples that meet the criteria for an observed release, is 66.54 acres (Figure 4 of this HRS Documentation Record). The plume boundary is depicted and measured by connecting sample locations that

contain concentrations of PCE that meet the criteria for an observed release (Tables 2a, 2b and Figure 4 of this HRS Documentation Record). The plume has not been completely delineated at this time.

Table 2a. Observed Release Municipal Well Groundwater Samples With Detections of PCE								
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	ESI or SI	Depth (ft BGS)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TG4 (MW-1)	6/23/2015	BBP Well 1	SI	67	PCE	1.3	0.5	Refs. 6, pp. 157-158, 261, 322-325, 682-687, 714-715; 7, pp. 1-2
E2TG5 (MW-2)	6/23/2015	BBP Well 2	SI	77	PCE	14	0.5	Refs. 6, pp. 158-159, 261, 326-329, 688-692, 716-717; 7, pp. 1-2
E2TG6 (MW-3)	6/23/2015	BBP Well 3	SI	80	PCE	0.71	0.5	Refs. 6, pp. 161-162, 261, 330-333, 693-694, 718-719; 7, pp. 1-2

BGS - Below Ground Surface
 ft - Feet
 CLP - Contract Laboratory Program
 Haz. - Hazardous
 CRQL - Contract Required Quantitation Limit
 µg/L - micrograms per liter

Table 2b. Observed Release Groundwater Samples Collected From Direct Push Probe or Residential Geothermal Wells With Detections of PCE								
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	ESI or SI	Depth (ft BGS)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TJ0 (GW-12)	6/23/2015	401 W. Morgan St.	SI	12.5	PCE	5.7	0.5	Ref. 6, pp. 183-184, 261, 377-380, 733-734
E2TJ8 (GW-8)	6/24/2015	17 E. Franklin St.	SI	26	PCE	220	50	Ref. 6, pp. 531-532, 571, 595-602, 765-766
E2TJ2 (GW-9)	6/23/2015	7 Fletcher Ave.	SI	26.5	PCE	180	10	Ref. 6, pp. 185-186, 262, 381-388, 749-750
E2TG8 (GW-4) (residential geothermal well)	6/23/2015	203-211 S. Main St.	SI	90	PCE	140	10	Ref. 6, pp. 167-168, 261, 344-351, 722-723

Table 2b. Observed Release Groundwater Samples Collected From Direct Push Probe or Residential Geothermal Wells With Detections of PCE								
EPA CLP # (IDEM Sample #)	Date Collected	Location Description	ESI or SI	Depth (ft BGS)	Haz. Substance	Haz. Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2TG9 (GW-5) (residential geothermal well)	6/23/2015	203-211 S. Main St.	SI	90	PCE	140	10	Ref. 6, pp. 169-170, 261, 352-360, 701, 724-725
E2W70 (GW-22)	4/18/2016	404 W. Morgan St.	ESI	14	PCE	1.7	0.50	Ref. 10, pp. 323-324, 378, 427-438, 759-761, 719

COC - Contaminant of Concern
 BGS - Below Ground Surface
 ft - Feet
 CLP - Contract Laboratory Program
 Haz. - Hazardous
 CRQL - Contract Required Quantitation Limit
 µg/L - micrograms per liter
 Ref. 6, pp. 722-766: Concentration of PCE in samples E2TJ8, E2TJ2, E2TG8, and E2TG9 exceeded the instrument's calibration range. Samples E2TJ8, E2TJ2, E2TG8, and E2TG9 reanalyzed using dilution factor and the results and CRQLs for PCE are reported from the diluted analysis.

Attribution:

The Franklin Street Groundwater Contamination has a confirmed documented release of PCE to the groundwater that has contaminated the BBP municipal wells (Table 2 of this HRS Documentation Record). The PCE that has been discovered in the BBP wells and at other locations in the Town of Spencer is a human-made manufactured chemical, which is not naturally occurring in the environment (Ref. 16, p.1). Chlorinated solvents, specifically PCE, are a manufactured chemical that is widely used for dry cleaning of fabrics and as a solvent used to clean machinery, electronic parts, and clothing (Ref. 16, p. 1; 18, p.1; 60, p.1). Common breakdown products of PCE include trichloroethylene (TCE), vinyl chloride (VC), and cis-1,2-dichloroethene (Ref. 17, pp. 1-2; 18, pp. 1, 2; 44, p. 2, 3). The background groundwater samples shown in Table 1c of this HRS Documentation Record demonstrate that PCE was not detected in the samples used to evaluate an observed release to the BBP wells, and that PCE is not ubiquitous throughout the study area (Table 1c and Figure 4 of this HRS Documentation Record). The background groundwater samples in Tables 1a and 1b of this HRS Documentation Record are used to demonstrate a significant increase in PCE in the direct push probe and residential well samples evaluated in the contaminated groundwater plume (Tables 1a and 1b 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 (Refs. 19-33; Refs. 45, 47-50; Refs. 58, 59, 65). The location of facilities identified during the search is shown in Reference 65. Groundwater samples and subsurface

soil samples were collected for the SI and ESI to determine possible source areas. Figure 6 of this HRS Documentation Record shows where groundwater and soil samples were obtained in relation to the identified facilities (Ref. 65).

Reference 58 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 facilities, 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 BBP municipal wells could not reasonably be determined (Ref. 58, p.12; Ref. 59).

Hazardous Substances Released:

Tetrachloroethylene (PCE) is a manufactured chemical used for dry cleaning and degreasing (Ref. 16, p. 1; Ref. 43, p. 1). Concentrations of PCE were detected in the BBP wells #1, #2, and #3 and several other wells (Ref. 6, pp. 163-164, 334-343, 720-721; Ref. 9, p. 6). 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 observed release concentrations of PCE.

Ground Water Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, 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 Haz. Substance Meet Observed Release by chemical analysis? (Y/N)	Toxicity/Mobility (Ref. 1, Table 3-9)	References
PCE	1, Observed Release	100	1.0*	Y	100	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 10

*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: 100
(Ref. 1, Table 3-9)

3.2.2 Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	Other	Unknown, but > 0
Sum of Values: Unknown but >0, rounded to 1 (HRS Section 2.4.2.2, HRS Table 2-6)		

The Franklin Street 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 I and Level II concentrations were present in a drinking water well (Table 2 of this HRS Documentation Record; see Sections 3.3 and 3.3.2.2 of this HRS Documentation Record), a hazardous waste quantity factor value of 100 is assigned for the ground water 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 100, resulting in a product of 10,000. Based on this product, a Waste Characteristics Factor Category Value of 10 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

Toxicity/Mobility Factor Value: 100

Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value (100) x Hazardous Waste Quantity Factor Value (100): 10,000

Waste Characteristics Factor Category Value: 10
(Ref. 1, Table 2-7)

3.3 GROUND WATER PATHWAY TARGETS

Bean Blossom-Patricksborg (BBP) Water Corporation operates the groundwater wells and treatment plant that supplies drinking water to the Town of Spencer, Stinesville, Patricksborg, and Bowling Green which include portions of rural Owen, Monroe, and Clay Counties (Ref. 4, p. 2). Prior to proposal to the NPL, BBP Well #4 was brought into operation and the Town of Spencer identified that BBP Wells #3 and #4 currently provide the vast majority of the water to the drinking water system. BBP Wells #1 and #2 are HRS eligible standby wells since they are maintained on a regular basis so that water can be withdrawn (Ref. 1, p. 51603). However, it is unclear how frequent these standby wells are used and data has not been provided by the Town of Spencer to determine their relative contribution to the system when they are in operation; therefore, BBP Wells #1 and #2 are not being included in the HRS scoring of this site and, consistent with the HRS, the population associated with the municipal drinking water supply are assigned to BBP Wells #3 and #4 (Ref. 1, p. 51603). BBP Well #3 is evaluated as actually contaminated with Level II concentrations in the HRS scoring of this site and BBP Well #4 has not had a detection of VOC concentrations (Table 2a) and is considered to be a potentially contaminated well. BBP supplies drinking water to approximately 9,903 people (Ref. 5, p. 2; Ref. 51, p. 1). Tables 3 and 4 below show which samples exhibit Level I and Level II concentrations, respectively, in BBP wells evaluated as actually contaminated target wells.

Numerous private wells are located within 4 miles of the site. Potentially contaminated targets are based on the number of people not served within the service area by the BBP municipal well system. A 4-mile radius was drawn, on a topographic map, over the BBP service area (Refs. 61; 62; 64; Figure 7 of the HRS Documentation Record).

Level I Concentrations

The tables below show which samples exhibit Level I and Level II concentrations (Table 3 and 4, respectively). For Level I concentration the benchmark used is the drinking water maximum contaminant level (MCL) because the MCL benchmark is the lowest HRS eligible benchmark for PCE. Level I concentration of PCE is established in BBP Well #2 (Table 3 of this HRS Documentation Record).

Table 3.						
Level I Concentrations						
EPA CLP #	Sample Description	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Health Based Benchmark	Reference for Benchmark
E2TG5	BBP Well 2 (Standby Well)	PCE	14	5.0	MCL	Ref. 2, p. 10 Table 3 of this HRS Documentation Record

Level II Concentrations

Level II concentration is established when the hazardous substance meets observed release criteria but is below an HRS eligible benchmark (HRS Section 2.5). Level II concentrations of PCE are established in BBP Wells #1 and #3 (Table 4 of this HRS Documentation Record).

Table 4. Level II Concentrations						
EPA CLP #	Sample Description	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Health Based Benchmark	Reference for Benchmark
E2TG4	BBP Well 1 (Standby Well)	PCE	1.3	5.0	MCL	Ref. 2, p. 10; Table 3 of this HRS Documentation Record
E2TG6	BBP Well 3	PCE	0.71	5.0	MCL	Ref. 2, p. 10; Table 3 of this HRS Documentation Record

3.3.1 Nearest Well

Because documentation on the frequency of use of the standby wells has not been provided by the Town of Spencer, it is not clear that the standby wells (BBP Wells #1 and #2) qualify for use in assigning the Nearest Well factor value. Therefore, the nearest well factor value is based on BBP Well #3.

Well ID: E2TG6 (BBP Well 3)

Level of Contamination (I, II, or potential): Level II

If potential contamination, distance from source in miles: N/A

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 BBP Well 3 (Table 2a and Table 4 of this Documentation Record).

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

3.3.2 Population

BBP Wells #1, #2, #3, and #4 serve drinking water to a total of 9,903 individuals (Ref. 5, p.2; 42, p. 1; 51, p.1). However, as mentioned above, with the addition of BBP Well #4 to the drinking water system, BBP Wells #1 and #2 now are used as standby wells. The Town of Spencer did not provide sufficient documentation on the frequency of use of these standby wells and therefore, consistent with the HRS, are not being considered in the targets factor category scoring at this site (Ref. 1, p. 51603). BBP supplies drinking water to the Town of Spencer, Stinesville, Patricksburg, and Bowling Green which include portions of rural Owen, Monroe, and Clay Counties (Ref. 4, p. 2). Since BBP Wells #3 and/or #4 must supply greater than 40 percent of the water supply, the population served is calculated based on well capacity (Ref. 1, Section 3.3.2). Table 5 below shows the population that was apportioned to each well along with other pertinent information needed for the calculation.

The following documents the level of contamination (Level I or Level II) in each BBP well, well capacities, the 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.

Table 5. Population Per Well Calculations							
Well ID	Well Capacity (gpm) ¹	Calculation (well capacity / total capacity of all wells)	% of Total Capacity	Total Population Served by BBP	Population per Well Calculation (based on capacity)	Population per Well (based on capacity)	Level of Contamination
BBP Well 3	1,400 ¹	=1,400 / 2,800	50%	9,903 ^{2, 5}	=9,903 x 50%	4,951.50	Level II ³
BBP Well 4	1,400 ⁴	=1,400 / 2,800	50%	9,903 ^{2, 5}	=9,903 x 50%	4,951.50	Potential
Total	2,800	-	100%	9,903 ^{2, 5}	-	9,903	-

¹ Ref. 34

² Ref. 5

³ Table 4 of this HRS Documentation Record (references cited in each table)

⁴ Ref. 38

⁵ Ref. 51

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

Level I Population Targets

Private residential and municipal water wells in which observed releases are established and the contamination levels are above HRS health based benchmarks are subject to Level I contamination. Because, insufficient information has been provided by the Town of Spencer to determine the frequency of use of BBP Well #2 (subject to Level I concentrations), this well is not included in the assignment of Target values.

Level I Concentrations Factor Value: 0

3.3.2.3 Level II Concentrations

Level II Population Targets

See Table 5, Population Per Well Calculations, of this HRS Documentation Record which depicts the population calculated for BBP Well 3. Table 4, Level II Concentrations, shows the benchmark used and the groundwater sample result for BBP Well 3 that documents the Level II concentrations of PCE. PCE concentration in BBP Well 3 is not above an HRS eligible PCE benchmark. The population served by the BBP Level II contaminated wells is: 4,951.5.

Sum of Population Served by Level II Wells: 4,951.5
Sum of Population Served by Level II Wells x 1: 4,951.5

Level II Concentrations Factor Value: 4,951.5

3.3.2.4 Potential Contamination

The potential contamination value is based on the population apportioned to BBP Well #4 and the number of people not served within the service area by the BBP municipal well system. A 4-mile radius was drawn, on a topographic map, over the BBP service area (Refs. 61; 62; 64; Figure 7). The number of dwellings (represented by solid black squares) was counted within each distance ring that was not found within the service area. The table below shows the number of dwellings within each distance ring that are not served by the BBP municipality. According to the Census, the number of people per household in Owen County is 2.46 people (Ref. 63, p.1). The number of people per each distance ring was calculated by multiplying the number of dwellings by 2.46. The value assigned for each distance ring was obtained from HRS Table 3-12 (Ref. 1, Section 3.3.2.4). In addition to the 24 dwellings located in the ¼ to ½ mile radius, BBP Well #4 is also located in the ¼ to ½ mile radius (Figure 7). The population apportioned to BBP Well #4 (4,951.5) is added to the population associated with the 24 dwellings (59.04) in the population value for this distance ring (See Table 5, Population Per Well Calculations).

Table 6. The Number of People Per Distance Ring (Figure 7)			
Distance Ring (miles)	Number of Dwellings/Wells	Population	Value
0-0.25	0	0	0
>0.25-0.5	24 + Well #4	5,010.54 ¹	3,233
>0.5-1	73	179.58	52
>1-2	167	410.82	94
>2-3	174	428.04	68
>3-4	227	558.42	42
Total	665		3,489

¹ – 24 dwellings * 2.46 = 59.04; 59.04 + 4,951.5 = 5,010.54

The value assigned total of 3,489 is multiplied by 0.1 which equals 348.9.
348.9 is rounded to 349 according to the directions of HRS Section 3.3.2.4

The Potential Contamination Factor Value: 349

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 BBP Wellhead Protection Area (Figures 3 and 4 of this HRS Documentation Record; Ref. 35, p. 1). Wellhead Protection Areas are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 35, 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