THE ELM GROUP

345 WALL STREET | RESEARCH PARK | PRINCETON NJ 08540
TEL 609.683.4848 FAX 609.683.0129
WWW.EXPLOREELM.COM

April 13, 2015

-- Via Federal Express --

Mr. Leonard Hotham, EPA Project Manager
U.S. Environmental Protection Agency Region 3
Mail Stop: 3LC30
1650 Arch Street
Philadelphia, PA 19103-2029

RE: Former BASF Huntington Works Facility (EPA Facility ID WVD000068601)
Response to April 4, 2013 EPA Letter Regarding the May 2010 RCRA Facility Investigation Phase II Report

Dear Mr. Hotham:

The ELM Group, Inc. (ELM), on behalf of The BASF Corporation (BASF), has prepared this letter and attachments in response to the EPA letter dated April 4, 2013. The EPA letter provided comments based on its review of the May 14, 2010 RCRA Facility Investigation (RFI) Phase II Report (May 2010 Phase II Report) for the former BASF Huntington Works Facility in Huntington, West Virginia (the site).

It is apparent, based on the comments, that the May 2010 Phase II Report did not adequately convey the overall understanding of site conditions that has been developed from the Initial Phase RCRA Facility Investigation (IRFI), the Supplemental Groundwater Investigation, and the Phase II investigation. It was not the intent of the May 2010 Phase II Report to restate all of the technical evaluations provided in the earlier reports. Rather, the report was intended primarily to present the results of the Phase II investigation, confirm that the Environmental Indicators (EIs) were achieved, and provide for EPA recommendations for further investigation. While summaries of the previous investigations and conclusions were provided in order to provide context for the Phase II investigation results, all of the data supporting the conclusions were not provided.

The comment letter, however, includes a number of questions regarding conclusions made and evaluations performed in the previous reports. These include the conclusions that the EIs for human exposure and groundwater migration are achieved, and the sources and fate and transport of constituents found in groundwater, among others. The Conceptual Site Model (CSM) presented in the May 2010 Phase II Report was also based on data and analyses developed over the course of the RFI.

Therefore, prior to providing the direct responses to the EPA comments on the May 2010 Phase II Report, this response to comments provides for EPA a summary of the key conclusions, and basis for those conclusions, that have been developed over the course of the RFI so that both EPA and BASF share a common understanding of site conditions. The earlier information along with the data presented in the May 2010 Phase II Report provide the support for the conclusion that the EIs have been achieved and maintained, and form the basis for the CSM presented in the May 2010 Phase II Report.

The EPA comments also include requests for additional data collection not proposed in the May 2010 Phase II Report:

1. Downgradient groundwater data to confirm the downgradient extent to which chlorinated Volatile Organic Compounds (VOCs) are present in groundwater;

2. Additional data to confirm the 2003 modeling conclusion that there is no unacceptable risk to receptors via the vapor intrusion pathway;

3. Investigation of the parking lot on the north side of the site and the 25th Street Landfill to determine if a source of the Trichloroethene (TCE) in groundwater is present; and

4. Investigation of the 25th Street Landfill to better characterize the constituents that are present.

As discussed in the specific responses to the EPA requests, BASF will, in the next workplan, provide a scope of work by which the downgradient extent of the TCE in groundwater, and the eastern extent of TCE in the parking lot (adjacent to Homestead Place) will be confirmed. Based on the groundwater data, additional evaluation of the vapor intrusion pathway will be conducted and, if necessary, additional data collection will be conducted. If, for example, it is determined that chlorinated VOC concentrations decline to less than the vapor intrusion screening level (VISL) prior to reaching a receptor, it may not be necessary to conduct a vapor intrusion investigation.

Additionally, BASF will conduct an additional investigation of the 25th Street Landfill to better characterize the constituents that may be present and, based on the results, evaluate the protectiveness of the current conditions.

However, as presented in greater depth in the CSM discussion, there is little likelihood that an investigation of the parking lot or the 25th Street Landfill specifically for the purpose of determining whether a source of TCE is present will provide information about a source of the TCE in groundwater or making remedial decisions regarding the TCE in groundwater.

Based on both theory (the predicted concentrations of TCE in soil that correspond to the TCE concentrations in groundwater) and experience (the 2003 investigation of the parking lot), it can be predicted that a soil investigation will fail to find any residual source of TCE in soil. Therefore, BASF requests that EPA review the information provided to determine if the investigations are required.

The following discussion begins with the information used to conclude that the EIs are achieved. This is followed by a description of the CSM and the specific responses to the EPA comments.

ENVIRONMENTAL INDICATORS

Environmental Indicator – Human Exposure Under Control

It was concluded in the August 2003 IRFI Report (see Section 6.2) that this EI was achieved based on the following:

- There was no complete direct contact pathway for constituents found in soil. Engineering controls consisting of buildings, concrete, asphalt or clean soil are present across the entire site, and, since the site is an active operating facility, these controls are maintained by site personnel.

- There was no groundwater use within a one-mile radius of the site. Therefore, there was no complete direct contact pathway with constituents in groundwater.

- Although there was a potentially complete vapor intrusion pathway, modeling conducted consistent with EPA guidance at the time supported a conclusion that, even if the pathway was complete, there would be no significant risk.

  Section 4.5 of the August 2003 IRFI Report documents the modeling that was conducted and provides the results. As discussed in the August 2003 IRFI Report, the Johnson and Ettinger model was used consistent with EPA's *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (2002) and December 2001 *"RCRA Draft Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (Vapor Intrusion Guidance)"*.

  The TCE concentrations in groundwater used in the model were the 2003 results from TMW-1D and several temporary well points installed in the parking lot. Based on the modeling, it was concluded that the hazard quotient (HQ) would be less than one, and the incremental risk factor (IRF) would approach the suggested 10^{-5} criterion. Since the nearest receptor was approximately 100 feet downgradient of TMW-1D, the TCE levels in groundwater, and therefore the IRF, at the receptor location would be predicted to be significantly lower. Based on this evaluation, and

provided in the August 2003 IRFI Report, it was concluded that there was no unacceptable risk via the vapor intrusion pathway.

At the time of the May 2010 Phase II Report, all conditions documented in the August 2003 IRFI Report in support of the conclusion that the human exposure EI was achieved were the same, or improved. The engineering controls remain in place, there is no groundwater use, and TCE levels in TMW-1D were less than one-half of those used in the modeling. Further, the TCE levels in downgradient TMW-12D were approximately one-tenth of levels used in the modeling. These considerations strongly support the conclusion that the human exposure EI continues to be achieved.

EI – Groundwater Migration Under Control

The conclusion that the groundwater migration was achieved was originally presented in Section 6.1 of the August 2003 IRFI Report. The conclusion was based on an initial assessment of groundwater conditions conducted in 2002 and 2003, and included the following:

- The extent of site-related constituents in groundwater was stable:
    - Concentrations of chlorinated VOCs (primarily TCE, the parent compound) remained stable or declined in the two most downgradient wells, TMW-1D and TMW-7D. If the concentrations in the most downgradient wells were stable, then it could be concluded, based on standard fate and transport considerations that the downgradient extent of the dissolved-phase plume was not expanding. It was acknowledged in the August 2003 IRFI Report that further groundwater monitoring would be needed to confirm this conclusion.
    - Similarly, concentrations of VOCs and Semi-Volatile Organic Compounds (SVOCs) in TMW-4S declined or were stable between 2002 and 2003. Again, however, additional groundwater monitoring was proposed.
- There was no predicted discharge of constituents in groundwater to surface water. The nearest surface water body is the Ohio River, and it is approximately 3,500 feet from the site. There is no reasonable mechanism by which constituents in groundwater could reach the river.
- The chlorinated VOCs were undergoing reductive dechlorination, a biodegradation process by which the more heavily chlorinated constituents were sequentially degraded to less chlorinated constituents. This evaluation was presented in Section 4.2.3 of the August 2003 IRFI Report, and the basis for the conclusion

included the presence of daughter compounds, and geochemical conditions that were amenable to reductive dechlorination.

- BTEX compounds (Benzene, Toluene, Ethylbenzene and Total Xylenes), and possibly some of the dye-related compounds, were undergoing anaerobic degradation via methanogenesis. This conclusion was not rigorously evaluated at the time since the conclusion was merely a supporting factor in the conclusion that the BTEX and dye compounds were not migrating. However, anaerobic degradation of BTEX is extensively documented in the literature, and the production of methane in TMW-11S supported the conclusion that methanogenesis was occurring.

- Constituent transport was relatively slow as a result of retardation. Based on site-specific organic carbon fraction and published values for the octanol/water partitioning coefficient, transport velocities for the majority of the VOCs and SVOCs were very low.

The issue of whether the EI for groundwater migration was achieved was revisited in the September 2005 Supplemental Groundwater Investigation Results Letter Report (September 2005 Report). This report also concluded that the EI for groundwater migration was achieved because:

- TCE concentrations in TMW-1D had declined further since the 2003 sampling, and the presence of daughter products continued to support a conclusion that reductive dechlorination was occurring;

- Concentration of TCE in TMW-7D had remained stable since the 2003 sampling and, similar to TMW-1D, degradation products were present in TMW-7D, supporting a conclusion that reductive dechlorination was occurring; and

- Aromatic VOC concentrations in TMW-4S had declined by almost an order of magnitude since 2003, and SVOC concentrations in TMW-4S had either declined or remained stable.

- Constituent transport rates were again calculated and, based on the observed conditions, found to be very low. Based on the estimated groundwater flow velocity, the site-specific organic carbon fraction and published octanol/water partitioning coefficients, the TCE transport rate was estimated to be between one and two feet per year, toluene, ethyl benzene and xylenes were estimated to travel at less than one foot per year, and benzene was estimated to travel at a rate of two to four feet per year.

Site conditions in 2009, when the Phase II investigation was conducted, were similar, or improved:

- TCE concentrations in TMW-1D, TMW-5D and TMW-7D had declined further from the levels in 2005.

- Although there was a slight increase in the concentrations of toluene, ethylbenzene and xylenes in TMW-4S, concentrations remained an order of magnitude below the levels found in 2002 and 2003.

Based on these observations, it was concluded in the May 2010 Phase II Report that the EI for groundwater migration had been achieved.

CONCEPTUAL SITE MODEL

Section 7 of the May 2010 Phase II Report provided a brief discussion of the CSM for constituents found in groundwater. Key observations from the CSM are summarized below.

Chlorinated VOCs

- There is no apparent source of the chlorinated VOCs in TMW-1D/TMW-12D or TMW-5D/TMW-7D.

- Concentrations of chlorinated VOCs are declining as a result of both biotic (reductive dechlorination) and abiotic (dispersion) processes.

- Although the dissolved-phase concentrations are declining, and will continue to decline, it will take time for the EPA Drinking Water Standard Maximum Contaminant Levels (MCLs) to be achieved because of the partitioning of organic constituents to the sorbed phase.

- There is no receptor impact under current or reasonably foreseeable conditions.

Aromatic Hydrocarbons and SVOCs

- A source of the aromatic hydrocarbons is present in the immediate vicinity of TMW-4S and TMW-11S.

- The extent of the dissolved-phase aromatic hydrocarbons and SVOCs is stable or declining.

- The dissolved-phase constituents in TMW-4S/TMW-11S are undergoing degradation by both biotic (anaerobic in the source zone area) and aerobic (in downgradient locations) and abiotic mechanisms.

- There is no threat to any receptor from the constituents in TMW-4S/TMW-11S.

Unstated in the May 2010 Phase II Report was the earlier conclusion that there was no complete direct contact pathway for constituents found in soil.

The May 2010 Phase II Report summarized the basis for the CSM, but did not provide an in-depth evaluation of each point, as the bases for the conclusions had been presented in earlier documents or in the May 2010 Phase II Report itself. Therefore, the following is provided for purposes of ensuring that EPA and BASF share an understanding of the data and analyses that support the CSM in the May 2010 Phase II Report.

Chlorinated VOCs

CSM Component – No Residual Source of Chlorinated VOCs

This conclusion is based on four observations:

1. The highest TCE concentrations observed in any well are one to two orders of magnitude less than those that would suggest the presence of residual non-aqueous phase liquid (NAPL).

2. TCE concentrations in TMW-1D and TMW-5D/7D have declined over the seven years of monitoring that has been conducted.

3. Estimates of the theoretical partitioning of TCE between the sorbed and dissolved-phase support a conclusion that the sorbed phase equilibrium concentration of TCE is less than 0.1 mg/kg.

4. The investigation of the parking lot area in 2003 found no evidence of a residual source, despite being conducted in the areas where the highest TCE concentrations in groundwater were observed.

<u>Discussion</u>

The aqueous solubility of TCE is approximately 1,100 mg/l. Using the generally accepted value of one percent of the aqueous solubility as an indicator of the presence of NAPL, a dissolved-phase TCE concentration in the range of 11 mg/l, or 11,000 ug/l, would suggest the presence of residual NAPL. Some researchers have suggested that 0.1 percent of the aqueous solubility should be used as an indicator of the presence of residual NAPL. Using this criterion, a concentration of 1,100 ug/l would indicate the presence of residual NAPL. The highest concentration of TCE detected in site groundwater was approximately 140 ug/l. This value is an order of magnitude less than the 0.1 percent indicator and two orders of magnitude less than the one percent indicator. This line of evidence supports a conclusion that residual NAPL is not present at the site.

Figure 14 from the May 2010 Phase II Report documents the decline in TCE concentrations in TMW-1D and TMW-5D/7D (Attachment 1). As presented, TCE concentrations in TMW-1D have declined from 141 ug/l in 2002 to 43 ug/l in 2009, while TCE concentrations in TMW-5D and TMW-7D are essentially the same as observed in 2002, but are lower than those found in 2003. If there was a significant mass of residual source material, it would be predicted that the dissolved-phase concentrations of TCE would be greater than those found in TMW-1D, TMW-5D and TMW-7D, and the concentrations would not be declining.

The September 2005 Report calculated a retardation factor (R_f) for TCE using a site-specific organic carbon fraction (f_{oc}) obtained during the IRFI and the published octanol/water partitioning coefficient (k_{ow}). An estimated R_f of approximately 15 was obtained and used to estimate the transport velocity of TCE (approximate 2 to 4 ft/yr) and provide an estimate of the mass partitioning between soil and groundwater.

A similar calculation can be used to estimate the equilibrium concentration of TCE in soil that would correspond to the TCE concentration in groundwater. An estimated partitioning coefficient (K_D) of 1.49 mg/kg TCE in soil / mg/l TCE in groundwater is calculated by following:

$K_D = K_{oc} * f_{oc}$ where:

> K_{oc} = soil organic carbon partitioning coefficient = 0.63 * K_{ow}
>
> K_{ow} = octanol/water partitioning coefficient = 263 (Verschuren, 1996)
>
> f_{oc} = organic carbon fraction in the soil – 0.009 (site specific measurement, presented in the IRFI Report)

Therefore, the K_D for TCE at the site would be:

> K_D = 0.63 * 263 * 0.009 = 1.49 mg/kg TCE / mg/l TCE

Based on this, the concentration of TCE in soil at the location where the 45 ug/l of TCE in groundwater was observed would be predicted to be approximately 70 ug/kg. Based on this calculation, it can be concluded that no significant concentrations of TCE in soil are present.

Finally, a groundwater investigation of the parking lot was conducted as part of the IRFI. The investigation consisted of the installation of nine temporary well points to a depth of approximately 60 feet (approximately the top of bedrock) and a collection of a grab groundwater sample at each location. Figure 11 from the August 2003 IRFI Report is attached and provides the locations and the results of the groundwater analyses. Although no soil samples were collected as part of the investigation, the soil borings were continuously screened with a photoionization detector (PID). No elevated PID readings

were observed in any of the borings. The absence of elevated PID readings, even in the locations where the highest groundwater concentrations were found, provides another line of evidence that no residual source material is present.

CSM Component – Reductive Dechlorination is Occurring

It is assumed that EPA agrees that physical mechanisms, such as advection and dispersion, are active at the site. Therefore, this discussion will focus on the support for the conclusion that the chlorinated VOCs are undergoing reductive dechlorination. This conclusion is based on two primary observations:

1. The presence of daughter compounds

2. The presence of reducing conditions and low dissolved oxygen, which indicate conditions are amenable to reductive dechlorination

Discussion

Both cis-1,2-dichlorothene (cis-1,2-DCE) and vinyl chloride have been detected in TMW-1D/TMW-12D and TMW-5D/TMW-7D in every sampling event since 2002. As discussed extensively in literature, cis-1,2-DCE and vinyl chloride, are the sequential degradation products of TCE. Additionally, as presented in the May 2010 Phase II Report, both ethene and ethane were detected in TMW-12D, supporting a conclusion that the reductive dechlorination was completely degrading the chlorinated constituents. The presence of degradation products is a primary line of evidence to support the conclusion that reductive dechlorination is occurring.

Field measurements of dissolved oxygen have also been consistently low (less than 1 mg/l), and nitrate/nitrite have been non-detect in most wells. These results support a conclusion that electron donors, dissolved oxygen and nitrates have been depleted such that the chlorinated VOCs can be used as an electron donor. This is a secondary line of evidence, but combined with the presence of degradation products, it is apparent that reductive dechlorination is occurring.

CSM Component – Sorbed-Phase TCE will Interfere with Attainment of MCLs

As stated previously, the September 2005 IRFI Supplemental Ground Water Investigation Results Report estimated a retardation factor of approximately 15 for TCE. This value can be used to estimate the dissolved fraction of TCE (F_s):

$$F_s = 1/R_f = 1/15, \text{ or approximately } 7\%$$

That is, only about 7% of the TCE mass is in the dissolved phase, while the remaining TCE mass is sorbed to the organic carbon fraction of the soil matrix. Although the ongoing

decline in dissolved-phase TCE concentrations indicate that the sorbed fraction is being depleted, it can also be predicted that some additional time will be needed for the MCLs to be achieved.

CSM Component – There is No Receptor Risk

This conclusion is discussed in depth under the EI for human exposure. In summary:

- There is no groundwater use, so there is no complete direct contact pathway for exposure to groundwater.
- Although there is a potentially complete vapor intrusion pathway, the earlier modeling combined with the ongoing reduction in TCE concentrations and the distance to the nearest receptor support a conclusion that there is no unacceptable risk via the vapor intrusion pathway.

Aromatic Hydrocarbons and SVOCs

CSM Component – A Source of Aromatic Hydrocarbons is Present

Concentrations of ethylbenzene in TMW-4S and TMW-11S in July 2009 were 7,400 ug/l and 4,000 ug/l, respectively, and concentrations of xylenes were 11,000 ug/l and 19,000 ug/l, respectively (Figure 15, Attachment 1). Although lower than when groundwater monitoring was initiated, these concentrations support a conclusion that a residual source is present.

CSM Component - Dissolved-Phase Aromatic Hydrocarbons and SVOCs are Stable or Declining

As presented in the May 2010 Phase II Report, concentrations of all aromatic hydrocarbons and aniline in TMW-4S were significantly lower in the 2009 sampling event than they were in the 2002 sampling event. Additionally, as presented in the September 2005 IRFI Supplemental Ground Water Investigation Results Report, the retarded transport velocity of the aromatic hydrocarbons and all SVOCs except aniline were estimated to be less than one foot per year, supporting a conclusion that, even without the effects of degradation, these constituents are essentially stable in groundwater. Based on these considerations, it is concluded that the dissolved-phase extent of aromatic hydrocarbons and the SVOCs are stable or declining.

CSM Component - Dissolved-Phase Constituents in TMW-4S and TWM-11S are Undergoing Biotic Degradation

The literature documents the degradation of petroleum compounds, including aromatic hydrocarbons via both aerobic and anaerobic mechanisms. Although aerobic

mineralization is the mechanism most widely cited for degradation of aromatic hydrocarbons, degradation via anaerobic mechanisms also occurs.

TMW-4S has consistently contained elevated methane levels, ranging from 1,000 ug/l in the 2009 sampling to 5,000 ug/l in 2003. Based on the formation of methane, it can be concluded that methanogenesis is occurring in TMW-4S, and by extension, that degradation of the aromatic hydrocarbons is occurring as a result of this mechanism.

CSM Component - No Threat to Any Receptor

The dissolved-phase constituents in TMW-4S and TMW-11S are limited in extent, and there is no groundwater use.

RESPONSE TO COMMENTS

The following provides BASF's comment by comment response. For clarity the EPA comment is presented first in *italics*, with the response following. Please note that it is BASF's intent to incorporate EPA's comments into subsequent reports and workplans for the project. The May 2010 Phase II Report will not be revised and resubmitted at this time.

Comment 1. *Section 1.2, RFI Phase II Objective: In addition to human health endpoints, all Corrective Action sites should be evaluated for the potential for impacts on ecological receptors. The initial step in this process is determination of whether areas of sustainable habitat are present on the facility. This evaluation must be performed by a qualified wildlife biologist.*

Response: With the exception of the 25th Street Landfill, the entire property is covered by buildings, parking, product storage areas, or other concrete and asphalt surfaces. As such, there is no sustainable habitat present on the site. A qualified wildlife biologist will confirm this evaluation.

Comment 2. *Section 1.2, RFI Phase II Objective: WVDEP DeMinimis Standards for Industrial Soils and DeMinimis Standards for Groundwater are not universally equivalent to or lower than EPA Risk Screening Levels (RSLs). EPA industrial RSLs, for example, are based on a cancer risk of 1 x 10-6, not 1 x 10-5 as are the WVDEP DeMinimis standards. Therefore, sample results should be compared to the lower of the WV or EPA screening concentrations.*

Response: The comment is acknowledged. Future reports will compare results with both the RSLs and the WVDEP DeMinimis standards. As noted by EPA in subsequent comments, the RSLs are not in all cases lower than the WVDEP standards.

Comment 3. *Section 2.2, Background Arsenic Concentrations: Page 2-61 of the WV Voluntary Remediation and Redevelopment Act guidance manual lists an average background arsenic*

concentration of 8.64 mg/kg, with a maximum value of 13 mg/kg, slightly lower than the upper range cited in this section. Please revise this section.

Response: The USGS paper (Shacklette and Boerngen, 1984), which is discussed in Section 2.2 of the May 2010 Phase II Report, serves as the basis for the background levels cited in the WVDEP guidance manual. The values in the Shacklette and Boerngen paper, and the WVDEP guidance manual, were used as screening criteria in the August 2003 IRFI Report. However, the Shacklette and Boerngen analysis relied upon only 10 samples in all of West Virginia, so, when the May 2010 Phase II Report was prepared, additional sources of background levels of arsenic in West Virginia were looked for. The Vosnakias (2009) paper was found and, since its evaluation was based on more than 500 samples, it was selected as providing a more representative range of background arsenic levels in West Virginia.

As noted by EPA in its comment, however, the upper range of surficial arsenic concentrations presented in the guidance document (13 mg/kg) is only slightly less than the upper range cited in the Vosnakias paper (15 mg/kg). It is currently unclear as to whether this relatively small difference will be relevant to the overall evaluation of site conditions and selection of a remedy for soil. However, future reporting will cite the levels in the WVDEP guidance document.

Comment 4. *Heading 2. Section 2.7, Surrounding Land Use: It appears that residential properties are directly adjacent to the facility on two sides; the Homestead Court properties located east of the parking lot, and homes across 4th Avenue, to the north of the facility property. Please revise this section.*

Response: Comment acknowledged. Residential properties are located on Elaine Court, which is located north of 4th Avenue across from the facility main parking lot, and on Homestead Place, which is located immediately east of the parking lot. The surrounding land use section will be updated in future reports.

Comment 5. *Heading 2. Section 2.8, Regional Water Use: The results of the well search, which documented an absence of wells within one mile of the facility, has been confirmed by EPA. Although the groundwater drinking water pathway is not complete, cleanup of the groundwater to MCLs should still be a groundwater cleanup goal.*

Response: Comment acknowledged. It is noted that Section 2.8 reported on the results of the well search and did not discuss cleanup objectives. Cleanup objectives will be discussed in the Corrective Measures Study.

Comment 6. *Heading 2. Section 3.1.1 25th Street Landfill History - Reference is made to various historic air photos that were reviewed to evaluate the limits and history of the landfill.*

Please provide copies (preferably scanned electronic versions) of these aerial photos (unless already provided in previous documents).

Response: Electronic and hard copies of the aerial photographs used to evaluate the limits and history of the 25th Street Landfill are provided as Attachment 2 to this letter. A written summary of the aerial photograph review was provided as Attachment D of the June 27, 2000 Initial Phase RCRA Facility Investigation Workplan, Facility and Areas of Concern Historical Summary Volume I of IV. The aerials are photographic stereoscopic pairs that were reviewed using a mirror stereoscope, since the aerial scales are quite large.

Comment 7. *Heading 2. Section 3.2.3, RFI Phase I Investigation Results: Results in this section are described only as below WV DeMinimis industrial screening concentrations (but exceeding EPA RSLs), and this information is insufficient to assess whether the contaminated soil may represent a source area for groundwater contamination, or whether contamination present above EPA RSLs would prevent attainment of the EPA Environmental Indicator for human health. Furthermore, the WV DeMinimis screening concentration for industrial receptors for TCE is 0.92 mg/kg, while the current EPA RSL for industrial endpoints for TCE is 6.4 mg/kg, which is higher than the WV value.*

Response: All of the Phase I Investigation results were previously submitted to Region 3 in the August 2003 IRFI Report. The conclusion that the EI for human exposure was achieved was based on the absence of a complete exposure pathway to soil, based on the presence of engineering controls across the site. Section 6.2 of the August 2003 IRFI Report provided the initial assessment of the EI. This information is summarized in the discussion of the EIs at the beginning of this Response to Comments.

The EPA's question regarding whether the TCE found in soil in AOC 3 (7.2 mg/kg at the 1.5 to 2.0 ft interval in AOC-3-04) could be a source of TCE in groundwater is best responded to by a review of the groundwater data from the wells installed in and downgradient of AOC 3. Figures 14 and 15 from the May 2010 Phase II Report (Attachment 1) summarizes the VOC results from the groundwater sampling conducted 2002 – 2009. As shown, neither of the TMW-4-series wells or TMW-11S, which are located immediately adjacent to the former AOC-3-04 location, has ever contained detectable levels of chlorinated VOCs. Similarly, TMW-3D, which is located downgradient of AOC 3, did not contain detectable levels of chlorinated VOCs.

Based on the absence of TCE in groundwater in wells adjacent to, or downgradient of, AOC 3, it can be concluded that the TCE found in soil in 2002 in AOC 3 is not a source of TCE in groundwater.

As presented in the discussion of the EI for human exposure, the TCE found in AOC 3 does not represent a risk to human health because there is no complete direct contact pathway for soil exposure.

Comment 8. *Heading 2. Section 3.4.3, RFI Phase I Investigation Results: The presence of PCBs, regardless of concentration, in a sample that is directly associated with a 50 ppm PCB transformer is cause for action pursuant to the TSCA statute. The status of the associated transformer (50 ppm or not) needs to be established, and the presence of Aroclor 1254 in sample AOC7-07 may warrant further action.*

Response: Section 5.7 of the June 2000 IRFI Workplan discussed the investigation of the PCB transformers, and Attachment N of the June 2000 IRFI Workplan provided a summary of the PCB concentrations in all known current and historic transformers at the site. No evidence of any release from any transformer during BASF's ownership of the plant was found. There was no information for either releases or the PCB content of transformers that pre-dated BASF's acquisition of the plant in 1979.

Based on the information presented in 2003, the PCB concentrations in the transformers that were present at the time of the IRFI were less than 50 mg/kg:

- "Main Sub – West Unit" (presumed to be the transformer between Buildings 56 and 60): PCB concentration of 37 mg/kg
- "Main Sub – East Unit (presumed to be the transformer east of Building 73): PCB concentration of 43 mg/kg

It is to be noted that EPA's comment that any release, regardless of concentration, from a transformer containing PCBs at a concentration greater than 50 mg/kg is cause for action pursuant to TSCA is only correct if the release occurred after July 2, 1979. For releases that occurred prior to April 18, 1978, the PCB concentration in the source is not considered. Rather, there is TSCA applicability only if the "as-found" concentration of the release is 50 mg/kg or greater. For releases that occurred on April 18, 1978 until July 2, 1979, there is TSCA applicability if the source of the release contained PCBs at a concentration of 500 mg/kg or more (see 40 CFR 761.3, "PCB Remediation Waste").

BASF acquired the plant in 1979. As noted, there were no reports of any discharge from any transformer during BASF's ownership of the plant. Therefore, any release, including the release that resulted in the 0.436 mg/kg of Aroclor 1254 in AOC7-07, would have occurred prior to 1979. Based on the release date, there would be no TSCA applicability unless the as-found concentration is 50 mg/kg or more, or the PCB concentration in the source of the release was 500 mg/kg or more. As presented in Attachment N of the June 2000 IRFI Workplan Volume I, no historic transformers contained PCBs at a concentration greater than 500 mg/kg. Therefore, it is concluded that there is no TSCA applicability for the PCBs found in AOC7-07.

Finally, regardless of the source of the PCBs found in AOC 7, no additional action with regard to the Aroclor 1254 is needed. As per 40 CFR 761.61, the cleanup level for high

occupancy use pursuant to a Self-Implementing Cleanup is 1 mg/kg. Therefore, even if there were TSCA applicability, there would be no need to undertake any remedial action.

Comment 9. *Heading 2. Section 3.6.3, RFI Phase I Investigation Results, fifth bullet: The extent of contamination plumes associated with TMW-1D and the 25th Street Landfill has not been established. Well TMW-12D, which is located off the facility property and is the farthest downgradient monitoring well, reveals higher concentrations of cis-1,2-dichloroethene, vinyl chloride, and 1, 1-dichloroethene than the most recent sample data from well TMW-1D. In the case of the 25th Street Landfill, the most heavily contaminated wells are also the farthest downgradient wells, suggesting that the plume may extend some yet undefined distance off the site property. Insufficient information is presented in the Phase II report to support the assumption of reductive dechlorination. No discussion of how chlorinated VOCs might have reached groundwater at the site is included in the Phase II report. It could be argued that the source of the chlorinated VOC contamination has not yet been discovered.*

Response: The comment refers to a section of the May 2010 Phase II Report in which conclusions from the August 2003 IRFI Report were summarized. It was not the intent of this section to restate all of the technical analyses conducted for, and provided in, the August 2003 IRFI Report, but rather to provide a summary of the conclusions so that the reviewer of the May 2010 Phase II Report had a context within which the Phase II Results were reported. However, the comments pertain to key conclusions for the site, and the following is provided in response to Comment 9.

The extent of contamination plumes associated with TMW-1D and the 25th Street Landfill has not been established.

Response: The comment is correct in that no monitoring wells have been installed at a downgradient location to define the extent of the chlorinated VOCs found in TMW-1D and the 25th Street Landfill. However, modeling conducted as part of the IRFI estimated that the MCL for TCE would be achieved at a distance of 125 – 500 feet downgradient of the site. It is expected that this overestimates the distance at which the MCL is achieved. Regardless, as discussed previously, the next workplan for the site will include a proposed scope of work by which the downgradient extent of the chlorinated VOCs in TMW-1D and the 25th Street Landfill will be established.

Higher concentrations of cis-1,2-DCE, vinyl chloride and 1,1 DCE are present in MW-12D than are in MW-1D.

Response: The differences in concentration between TMW-1D and TMW-12D are very small, as shown in the following table and do not support a conclusion that there are higher concentrations of chlorinated VOCs in TMW-12D than in TMW-1D.

Constituent	Monitoring Well Results (ug/l)	
	TMW-1D	TMW-12D
cis-1,2-DCE	21	28
VC	1.4	3.2
1,1-DCE	0.3	0.38

The differences in the results can be explained as either a result of localized variability during sampling or the ongoing degradation of the TCE in TMW-1D and downgradient transport to TMW-12D. In particular, the difference in the 1,1-dichloroethene (1,1-DCE) concentration in the two wells is so small as to essentially be insignificant. The results do not support a conclusion that there are higher concentrations of chlorinated VOCs in TMW-12D than in TMW-1D. It is also noted that the vinyl chloride concentration in TMW-12D (3.2 ug/l) is only slightly greater than the MCL (2 ug/l) and the cis-1,2-DCE (21 – 28 ug/l) and 1,1-DCE (0.3 – 0.38 ug/l) concentrations are well below the MCLs (70 ug/l and 7 ug/l, respectively).

In the case of the 25th Street Landfill, the most heavily contaminated wells are also the farthest downgradient wells, suggesting that the plume may extend some yet undefined distance off the site property.

Response: During the 2009 sampling event, TMW-7D contained TCE at a concentration (40 ug/l) that is greater than the MCL (5 ug/l). It was also higher than the concentration in TMW-5D (10 ug/l). Based on the relatively low concentration of TCE in MW-7D, the ongoing degradation of TCE and the slow transport rate, it is unlikely that the TCE extends a significant distance downgradient of TMW-7D. The next workplan for the site will include a scope of work to establish the downgradient extent of the chlorinated VOCs.

Insufficient information has been provided in the Phase II Report to support the assumption of reductive dechlorination.

Response: The basis for the conclusion that reductive dechlorination is occurring is presented in the discussion of the CSM.

No discussion of how chlorinated VOCs might have reached groundwater at the site is included in the Phase II report. It could be argued that the source of the chlorinated VOC contamination has not yet been discovered.

Response: A detailed evaluation of the site history was conducted as part of the IRFI. No evidence of any discharge of chlorinated VOCs, or even the use of chlorinated VOCs, was found. Therefore, as stated in the comment, there has been no discussion of how the chlorinated VOCs may have entered groundwater. However, as discussed in the CSM, all available data and previous experience with the investigation of the parking lot support a

conclusion that there is no residual source of the TCE. Rather, the TCE is present in the dissolved- and sorbed-phases.

Comment 10. *Heading 2. Section 3.6.3, RFI Phase I Investigation Results, seventh bullet: No information supporting the claim of low constituent transport velocity for semi-volatile contaminants based on a site-specific retardation factor is included in the Phase II report. A complete supporting discussion or reference to specific sections of prior submittals should be included in the Phase II report.*

Response: The analysis of the retarded constituent velocities was provided in the September 2005 Report. In this report, it was estimated that the retarded constituent velocities for SVOCs ranged from a low of 0.08 ft/yr for 3,3-dichlorobenzidine to a high of 18.9 ft/yr for aniline.

Comment 11. *Heading 2. Section 3.6.3, RFI Phase I Investigation Results, eighth bullet: Current EPA policy recommends that potential vapor intrusion threats not be ruled out by modeling alone. Given the proximity of apparent residential areas directly east and north of the facility, as well as concentrations of chlorinated VOCs measured in monitoring wells TMW-1D and TMW-12D and in well points beneath the parking lot, additional information is needed to determine whether a vapor intrusion threat to residents exists. This work may consist of subslab vapor samples, indoor air samples, or deep soil gas samples. It is further noted that the only groundwater samples from the northern downgradient border of the site are described as deep monitoring well samples. BASF should address the possibility that contaminated groundwater may be present above this deep groundwater layer because contaminated shallow groundwater is a better predictor of the potential for vapor intrusion.*

Response: As discussed previously, the modeling conducted as part of the IRFI was consistent with EPA guidance that existed at the time the IRFI was conducted. Additionally, the 2013 "OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)" continues to reference the Johnson and Ettinger model. However, EPA's comment that there is now a preference for using multiple lines of evidence in the vapor intrusion evaluation is acknowledged. The next workplan will include a proposal to define the extent of chlorinated VOCs in the directions of the nearest residences and, based on those results, additional evaluation of the vapor intrusion pathway will be conducted. As necessary, based on the groundwater data, additional data collection may be performed.

Comment 12. *Heading 2. Section 3.7, Summary of Initial RFI Conclusions and Recommendations, first bullet: As noted previously, the possible extent of contaminated groundwater in two directions, east and north, has not been determined, and contaminated groundwater is documented off the site property in the northerly direction and may extend off site in the easterly direction. The groundwater migration under control Environmental Indicator is therefore in question. The contaminant reduction trends cited in the Phase II*

report are based on single sample results in some cases, notably, wells TMW-7D, TMW-5D, TMW-12D, TMW-11S. A single sample result does not establish a verifiable trend. Wells TMW-4S and TMW-11S show higher results for most or all detected VOCs and SVOCs in 2009 than in 2005. In addition, the generally higher chlorinated VOC concentrations reported in well point samples obtained beneath the parking lot suggest that contaminated groundwater may extend off the site property beneath residences located directly adjacent to this area. Additional information is needed to definitively establish the extent of contaminated groundwater at this site.

Response: As presented in the discussion of the EI for groundwater migration, the data support a conclusion that this EI has been achieved and maintained. The conclusion is not based on a single round of data, but rather on multiple rounds and analyses of the fate and transport of the groundwater contaminants. Without repeating the entire analysis discussed previously, the conclusion that the EI for groundwater migration is achieved and maintained is based on:

- No apparent residual source area mass of TCE in either the 25th Street Landfill or the parking lot;
- A consistent downward trend in TCE concentrations between 2002 and 2009 in TMW-1D;
- A decline in TCE concentrations of approximately 75% between TMW-1D and TMW-12D, a distance of approximately 80 feet;
- Declining TCE concentrations in TMW-7D between 2003 and 2009;
- Stable or declining TCE concentrations in TMW-5D, 2009 concentrations were half of those in 2003 and 2005);
- Concentrations of aromatic hydrocarbons in TMW-4S were significantly lower in 2009 than in 2002. Toluene and benzene met the WVDEP de minimis values for groundwater in 2009.
- Aniline concentrations in TMW-4S approached the WVDEP de minimis value for groundwater in 2005 and was at only twice the value in 2009; and
- No significant transport of n-nitrosodiphenylamine is predicted based on its estimated transport velocity of approximately 0.2 – 0.4 ft/yr.

There appears to be some confusion with regard to the results of the February 2003 investigation of the parking lot. "Generally higher VOC concentrations" were not found in

the well points, but rather the highest VOC concentrations were found in TMW-1D (Figure 11, Attachment 1). WP-4 contained VOCs at levels that were generally comparable to those found in TMW-1D, but total VOCs and TCE concentrations were lower in all other well points. Tetrachloroethene (PCE), which was not detected in TMW-1D, was found in some well points, but TCE concentration (7.5 ug/l) in the most downgradient well point (WP-3) was very near the WVDEP de minimis value (5 ug/l). The well point investigation supported the conclusion that TMW-1D represented the correct location to monitor to assess potential downgradient transport. It is acknowledged that additional data are necessary to assess whether TCE is present to the east.

As discussed previously, the next workplan will include a scope of work to establish the extent of the chlorinated VOCs in groundwater.

Comment 13. *Heading 2. Section 3.7, Summary of Initial RFI Conclusions and Recommendations, second bullet: The 2009 sample from well TMW-4S showed higher concentrations of all notable contaminants. Therefore, additional rounds of data would be required to definitively establish a downward trend in this well.*

<u>Response:</u> As discussed previously, the current data are adequate to support a conclusion that the EI for groundwater migration is achieved for the aromatic hydrocarbons and SVOCs in TMW-4S. Despite the increase between 2005 and 2009, concentrations of all aromatic hydrocarbons were substantially lower in 2009 than during the 2002 and 2003 sampling, and the WVDEP de minimis values for groundwater are achieved for both benzene and toluene. The presence of methane in TMW-4S supports a conclusion that biodegradation via methanogenesis is occurring. The aniline concentration was very close to the WVDEP de minimis value in 2005, and remained near the value in 2009. Finally, no significant transport of n-nitrosodiphenylamine is predicted based on its very slow transport velocity (0.2 – 0.4 ft/yr).

However, it is acknowledged that some residual source mass remains in the vicinity of TMW-4S and TMW-11S. As a result, further fluctuations in dissolved-phase concentrations can be predicted. Additional monitoring will be performed, and the Corrective Measures Study will include an evaluation of the best mechanism by which to address the residual source mass.

Comment 14. *Heading 2. Section 3.7, Summary of Initial RFI Conclusions and Recommendations, third and fourth bullets: As previously noted, no data supporting transport velocities, site-specific retardation factors, and the lack of potable use of groundwater is included in the Phase II report. Review of prior reports where such documentation is included or independent submission of supporting information is required for concurrence with these conclusions in the Phase II report. Furthermore, as noted in Comment No. 11, a conclusion of no vapor intrusion risk cannot be made without additional information.*

Response: As discussed previously, it was not the intent of the May 2010 Phase II Report to restate all of the analyses and conclusions presented in either the August 2003 IRFI Report or the September 2005 Report. It was assumed that these documents had been reviewed by EPA when they were originally submitted and, unless comments to the contrary were received, that EPA concurred with the conclusions in those documents. Since the conclusions in the earlier documents provide support for the understanding of site conditions, summaries were provided in the May 2010 Phase II Report to provide context for the review of the Phase II results. In direct response to the comment:

- The analysis of constituent retardation and transport velocities was presented in the September 2005 Supplemental Groundwater Investigation Results letter report.

- EPA, in comment No. 5, states, "*The results of the well search, which documented an absence of wells within one mile of the facility, has been confirmed by EPA.*" It is assumed that this comment indicates that EPA concurs with the conclusion that there is no potable water use.

- The results of the Johnson and Ettinger modeling were presented in Section 4.5 of the August 2003 IRFI Report.

Comment 15. *Heading 2. Section 5.1.4, Conclusion and Recommendations: The source for groundwater VOC contamination in the vicinity of the parking lot has not been established, and soil samples from this area should be considered as part of the next phase of work.*

Response: As discussed in the CSM, there is little likelihood that conducting an investigation of the parking lot or the 25th Street Landfill will provide useful information regarding the source of the TCE. This is supported by the results of the 2003 investigation of the parking lot where borings were installed to depths of approximately 60 feet and the soil continuously screened with a PID. No elevated PID readings were obtained or evidence of impacted soil observed. If there was any residual source mass of TCE in the unsaturated or saturated zone, some indication of that source would have been found by the soil screening.

Comment 16. *Heading 2. Section 5 .1.4, Conclusion and Recommendations, first bullet: Additional sampling in the vicinity of sample AOC2-04 should also include VOCs, since the results for the entire VOC fraction of the 2009 sample were flagged "R" (unusable).*

Response: VOCs will be included as an analytical parameter for any additional soil sampling in the vicinity of sample AOC2-04.

Comment 17. *Section 5.1.4, Conclusion and Recommendations, third bullet: Additional sampling in the vicinity of sample AOC2-18 should also include SVOCs, since the entire SVOC fraction of the 2009 sample revealed significantly elevated quantitation limits.*

Response: SVOCs will be included as an analytical parameter for any additional soil sampling in the vicinity of sample AOC2-18.

Comment 18. *Section 5.3.3, Soil Investigation Results: It is noted that on Table 25 the result for o-toluidine in sample AOC6-10 of 13 mg/kg is compared to an EPA RSL for industrial soil of 9.6 mg/kg. However, there is no RSL for o-toluidine, and a related compound, p-toluidine reveals an industrial RSL of 2.6 mg/kg. This exceedance of the EPA RSL may indicate the need for additional sample data in the vicinity of AOC6-10.*

Response: The comment is correct. The residential RSL for p-toluidine is 2.6 mg/kg, and the nonresidential RSL is 9.1 mg/kg. The WVDEP industrial risk-based value is 300 mg/kg. The need for additional sampling in the vicinity of AOC6-10 will be evaluated in the workplan.

Comment 19. *Section 5.3.4, Conclusion and Recommendations: In addition to the proposed soil investigation for aniline, investigation of potential impacts of the aniline spill referred to in Section 4.1 is integral to a final site disposition.*

Response: The comment is acknowledged. However, the responsibility for the aniline spill is that of the current property owner, not BASF. BASF will obtain from the owner the information it has regarding the spill and the cleanup and provide that information to the EPA.

Comment 20. *Section 6.2, Groundwater Results July 2009, and 6.3, Discussion of Groundwater Results: Comments nos. 9, 10, 11 and 12, above, also apply to this section.*

Response: Detailed responses have been provided to the comments cited. The documents in which the previous conclusions were presented have been referenced, and BASF has stated that it will provide in the next workplan a proposal to establish the downgradient extent of chlorinated VOCs in groundwater. The discussion of the EIs includes the bases for the conclusion that the EIs are achieved.

Comment 21. *Section 6.3, Discussion of Groundwater Results, second bullet: As a result of the elevated turbidity level and notable arsenic concentration reported, resampling of this well should be considered.*

Response: BASF agrees with the recommendation. If the turbidity cannot be reduced to acceptable levels, consideration will be given to filtering the sample. Details will be provided in the workplan.

Comment 22. *Section 6.3.1, Nature and Extent of Contamination: As noted previously, the extent of groundwater contamination in the northern and eastern directions from the site boundary has not been established. Trends supporting a pattern of reduction in VOC*

contamination in certain wells cannot be established based on results from one round of data. The absence of chlorinated VOCs in well nos. TMW-6D and TMW-8D do not confirm an assertion of limited extent of groundwater VOC contamination beneath the 25th Street Landfill, since these wells are not downgradient of contaminated well nos. TMW-5D and TMW-7D. Additional monitoring wells are needed to determine the extent of groundwater contamination for the 25th Street Landfill, and possibly for the northern groundwater VOC plume.

Response: BASF agrees that the downgradient extent of the chlorinated VOCs has not been established, and the next workplan will include a scope of work to achieve this objective. However, as discussed previously, the declining trend in concentrations is not based on one single round of results. There has been an ongoing decline in TCE concentrations in TMW-1D since the initial sampling in 2002, and a decline in TCE concentrations in TMW-7D since 2003. TCE concentrations in TMW-5D in 2009 (10 ug/l) approached the MCL (5 ug/l).

The May 2010 Phase II Report did not state that TMW-6D and TMW-8D provided downgradient definition of the extent of chlorinated VOCs. The reference in the report to TMW-6D and TMW-8D specifically stated that they were located on the western side of the landfill. Based on the absence of chlorinated VOCs in these wells, it can be concluded that the extent of the chlorinated VOCs to the west has been determined.

Comment 23. *Section 6.3.2, Contaminant Fate and Transport, and 6.4, Conclusion and Recommendation: Comment nos. 9, 10, 11 and 12, above, also apply to this section.*

Response: The intent of this comment is unclear. Section 6.3.2 primarily presents the results of the 2009 sampling and compares them to previous results. All of the previous sampling results are summarized in the figures.

The first bullet in Section 6.3.2 references the presence of degradation products and the decline in TCE concentrations in TMW-1D, and the second bullet references similar information for TMW-5D and TMW-7D. If these are the objective of the comment, the CSM discussion provides a more detailed evaluation of the lines of evidence for reductive dechlorination.

Comment 24. *Section 7.0 Conclusions and Recommendations - This section proposes additional soil investigation in several areas to complete the RFI, which are acceptable. Additional investigation should also be proposed for AOC1. Section 7.3 (Ground Water) proposes no additional groundwater monitoring wells. However, the furthest downgradient wells (TMW-1D, TMW-12D, TMW-7D) exceed screening values, so the extent of contaminated groundwater has not been defined. Further delineation of both chlorinated VOC plumes is needed to below MCLs (or the RBC for 1,1,2,2-Tetrachloroethane).*

Response: The workplan will propose a scope of work to define the downgradient extent of the chlorinated VOCs in groundwater.

Comment 25. *Section 7.1.1, Chlorinated VOCs in Downgradient Wells: The absence of a source mass in the northern parking lot area is not ruled out because the concentrations of chlorinated VOCs reported in groundwater samples are not insignificant. Results from soil samples if obtained at the time of well point sampling, combined with the groundwater VOC results, may have confirmed the absence of a source mass. However, no soil samples were obtained, and the potential source for VOC groundwater contamination in the parking lot area remains unclear.*

Response: Although no soil samples were collected during the investigation in the parking lot, the soil samples from the borings were field screened with a PID, and no elevated PID readings were observed. If TCE was present in soil in the parking lot, elevated PID readings would have been observed. The absence of TCE in soil is consistent with the theoretical equilibrium concentrations of TCE in soil based on the measured groundwater concentrations. Although greater than the MCL, the concentration of TCE (approximately 45 ug/l) in TMW-1D is not consistent with a significant mass of TCE in the unsaturated or saturated zone soil.

Comment 26. *Section 7.1.1, Chlorinated VOCs in Downgradient Wells, and 7.1.2, Chlorinated VOCs in 25th Street Landfill: Details of the estimate of partitioning of chlorinated VOCs to soil and the reduction by biotic and abiotic processes are needed to confirm assertions of the fate of VOCs in downgradient wells. While groundwater is not used presently, the goal for final site disposition is restoration of groundwater to its ultimate beneficial use, which is drinking water. In addition, as noted in Comment No. 11, vapor intrusion risk cannot be ruled out by modeling alone.*

Response: The calculations of the site-specific retardation factors and solute transport velocities are provided in the September 2005 Report. The next workplan will include a proposal to complete the delineation of chlorinated VOCs in groundwater. Based on the groundwater data, further evaluation of the vapor intrusion pathway will be conducted and, as necessary, additional data collection to assess the vapor intrusion pathway will be conducted.

Comment 27. *Section 7.1.3, Aromatic VOCs and SVOCs in Upgradient Portion of Site: Assertions that dissolved-phase constituents are undergoing degradation by both biotic and abiotic pathways and the effectiveness of anaerobic mechanisms should be supported. In addition, the possibility of vapor intrusion in the vicinity of this contamination should be examined.*

Response: The degradation of aromatic hydrocarbons in groundwater is apparent based on the reductions in concentrations from 2002 to 2009. Additionally, the presence of

elevated methane levels in TMW-4S supports the conclusion that methanogenesis is occurring. The workplan will evaluate the potential for vapor intrusion in the vicinity of TMW-4S.

Comment 28. *Section 7.1.4, Other Potential Sources to Groundwater: Refer to prior comments addressing additional investigation proposed for these areas.*

Response: Comment acknowledged. Responses have been provided to the previous comments.

Comment 29. *Section 7.2.1, Delineation of Constituents Found at Levels Greater than WVDEP ISDMS: In this section it is proposed that soil samples will be sequentially analyzed starting with the shallowest sample. There is no detail in the conceptual site model (section 7.1) which describes the nature of the VOC release (surface vs. subsurface). Therefore, deeper samples should be submitted for analysis if other indicators (elevated PID readings, for example) suggest the presence of VOC contamination*.

Response: If evidence of contamination such as staining, odors or elevated PID levels is observed in a deeper soil interval sampled, then the sample will be analyzed.

Comment 30. *Section 7.3, Groundwater: Temporary wells were used for delineation of the TCE plume in the parking lot area, but there does not appear to be a similar effort conducted in the area of the 25th Street Landfill (AOC1). There is a significant distance between wells TMW-6D and TMW-7D (600') along the downgradient edge of the 25th Street Landfill area that has not been investigated. The soil investigation for the landfill (RFI Phase I) consisted of 4 soil borings to 4' depth in the southern area of the unit. The Phase I RFI recommended no further action for soils for AOC1 and no further investigation was conducted in Phase II. In the Phase II Report, Section 7.1.2 (Chlorinated VOCs in 25th Street Landfill) states (first bullet) that there is no apparent source of the chlorinated VOCs, but the shallow soil investigation conducted in Phase I was not designed to characterize the nature or extent of waste in the unit. Further characterization of AOC1 is needed to determine the volume and chemical characteristics of waste in the landfill, and whether the landfill is an ongoing source to groundwater.*

Response: The comment is correct in that no investigation of the landfill similar to that conducted in the parking lot was performed. The data that have been collected provide a basis to conclude that constituents are not present in groundwater on the western end of the landfill, and that there is no significant source mass in the eastern end of the landfill. Additionally, the soil investigation found only one location, AOC1-01, where constituents were present at levels above either the RSLs or background.

However, the 2002 soil investigation was limited in scope, and the intent was to assess whether the EIs were achieved. Therefore, a supplemental investigation of the landfill will

be proposed to assess the constituents that may be present and whether any additional actions are needed to address those constituents.

Comment 31. *Table 1 and Table 5 include WV State Plane NAD83 coordinates for sampling points and monitoring wells. Table 6 includes lat/lon of the monitoring wells. Several coordinates appear to be incorrect, based on plotting in ArcGIS and comparing to figures in the report. For example, using either the coordinates from Tables 1, 5, or 6, TMW-6D plots about 1,300 feet southeast of where the well is shown in the report figures. TMW-4S and D plot about 350 feet SSE of where shown in the figures. TMW-2D plots about 410 feet south of where shown in the figures. In Tables 1 and 5, TMW-9D and TMW-11S have identical coordinates, with TMW-11D plotting about 1200 feet NW of where shown in the figures. In Table 6, wells TMW-9D and TMW-11S have different coordinates, but TMW-11S plots about 330 feet SSE of where shown in the figures, and TMW-9D plots about 125 feet east of where shown in the figures. The coordinates from Table 6 for TMW-12D plot about 50 feet south of where the coordinates from Table 5 indicate the well to be. Please correct the coordinate data in the tables, and resurvey if necessary.*

Response: The WV State Plane South NAD83 coordinates were checked and reviewed based on GPS field data. The following table provides the correct coordinates for wells TMW-2D, TMW-4S, TMW-4D, TMW-6D, TMW-11S and TMW-12D. Future figures and tables will utilize and include the correct coordinates.

Well	Easting	Northing	Latitude	Longitude
TMW-2D	1563209.89	521350.37	38°25'23.68"N	82°24'53.18"W
TMS-4S	1563498.88	521428.75	38°25'24.49"N	82°24'49.57"W
TMS-4D	1563500.60	521429.58	38°25'24.50"N	82°24'49.55"W
TMW-6D	1564240.86	521774.31	38°25'28.02"N	82°24'40.31"W
TMW-11S	1563514.62	521403.98	38°25'24.25"N	82°24'49.37"W
TMW-12D	1563073.84	522241.60	38°25'32.47"N	82°24'55.07"W

Comment 32. Tables and Figures: The following errors and inconsistencies were noted:

- *The WV screening concentration for ethylbenzene in groundwater is listed incorrectly as 1300 ug/1 on Table 2, and in Figure 5.*
- *Virtually all of the detected 1,1,2,2-tetrachlorethane concentrations listed in Figure 7 exceed the WV screening concentration and should be in bold font.*
- *The title of Figure 6 states 'total PCBs and metals results,' yet no PCB results appear on this table. The title states that 'analytical results' appear on Figure 10, yet no contaminant concentrations are listed in this figure.*
- *According to laboratory supporting documentation, the July 2009 xylenes results that appear on Table 36 for well nos. 4S and 11S have been transposed.*

Response: Comment noted. Future figures and table will be revised to ensure that the comment is addressed and typographic errors are corrected.

Based on the comments, it would appear that the most beneficial next step is for BASF to prepare and submit a workplan that includes the items presented in the May 2010 Phase II Report and those identified by the EPA. It does not seem as though resubmission of the May 2010 Phase II Report will provide a project benefit. Therefore, unless EPA disagrees, BASF will proceed with preparation of the workplan, and not resubmit the May 2010 Phase II Report.

It may also be beneficial to discuss any areas where our understanding of site conditions differs from that of the EPA. The comments included a number of questions regarding conclusions that had been made based on the data that have been collected, and if the responses to the comments are insufficient, a call would be the best method by which to work through any differences.

If you have any questions, please contact Lauren LaPort at 609-683-4848 or Hank Martin at (973) 263-5820.

Sincerely,

THE ELM GROUP, INC.

Lauren LaPort, P.E.
Associate

Hank Martin, P.E.
Principal

LJL/lk

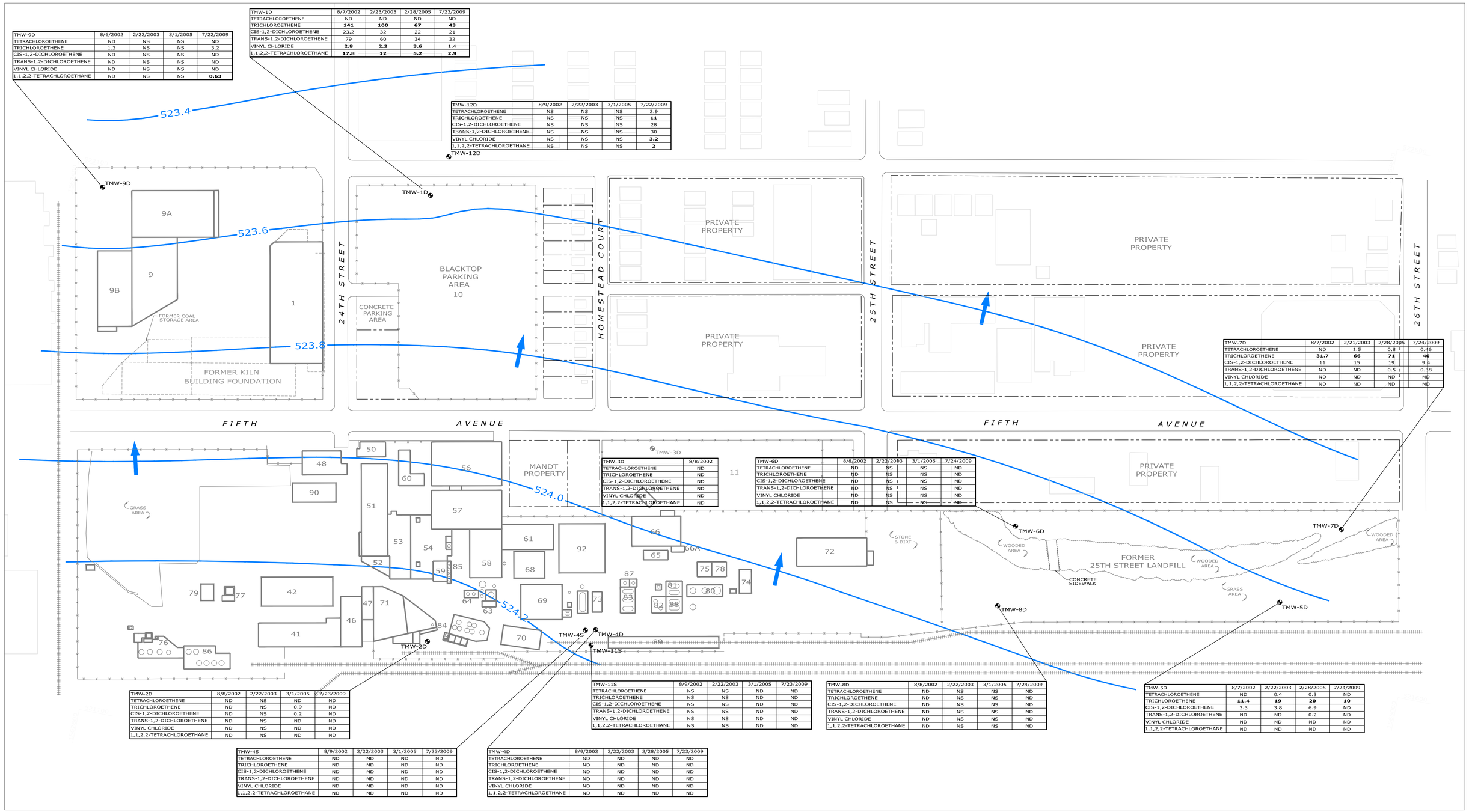
Attachments

c: V. Burrows, BASF Corporation
R. Norris, ELM Site Solutions

ATTACHMENT 1

Figures from Prior Reports

Figure 14	**Chlorinated Volatile Organic Compound Concentrations in Ground Water 2002-2009, May 2010 RFI Phase II Report**
Figure 11	**Ground Water Volatile Organic Results for the Parking Lot and TMW-1D – February 2003, August 2003 IRFI Report**
Figure 15	**Volatile and Semi-Volatile Ground Water Results for TMW-4S, TMW-4D and TMW-11S July 2009, May 2010 RFI Phase II Report**



TMW-9D	8/6/2002	2/22/2003	3/1/2005	7/22/2009
TETRACHLOROETHENE	ND	NS	NS	ND
TRICHLOROETHENE	1.3	NS	NS	3.2
CIS-1,2-DICHLOROETHENE	ND	NS	NS	ND
TRANS-1,2-DICHLOROETHENE	ND	NS	NS	ND
VINYL CHLORIDE	ND	NS	NS	ND
1,1,2,2-TETRACHLOROETHANE	ND	NS	NS	**0.63**

TMW-1D	8/7/2002	2/23/2003	2/28/2005	7/23/2009
TETRACHLOROETHENE	ND	ND	ND	ND
TRICHLOROETHENE	**141**	**100**	**67**	**43**
CIS-1,2-DICHLOROETHENE	23.2	32	22	21
TRANS-1,2-DICHLOROETHENE	79	60	34	32
VINYL CHLORIDE	**2.8**	**2.2**	**3.6**	1.4
1,1,2,2-TETRACHLOROETHANE	**17.8**	**12**	**5.2**	**2.9**

TMW-12D	8/9/2002	2/22/2003	3/1/2005	7/22/2009
TETRACHLOROETHENE	NS	NS	NS	2.9
TRICHLOROETHENE	NS	NS	NS	**11**
CIS-1,2-DICHLOROETHENE	NS	NS	NS	28
TRANS-1,2-DICHLOROETHENE	NS	NS	NS	30
VINYL CHLORIDE	NS	NS	NS	**3.2**
1,1,2,2-TETRACHLOROETHANE	NS	NS	NS	**2**

TMW-7D	8/7/2002	2/21/2003	2/28/2005	7/24/2009
TETRACHLOROETHENE	ND	1.5	0.8	0.46
TRICHLOROETHENE	**31.7**	**66**	**71**	**40**
CIS-1,2-DICHLOROETHENE	11	15	19	9.4
TRANS-1,2-DICHLOROETHENE	ND	ND	0.5	0.38
VINYL CHLORIDE	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND

TMW-3D	8/8/2002
TETRACHLOROETHENE	ND
TRICHLOROETHENE	ND
CIS-1,2-DICHLOROETHENE	ND
TRANS-1,2-DICHLOROETHENE	ND
VINYL CHLORIDE	ND
1,1,2,2-TETRACHLOROETHANE	ND

TMW-6D	8/8/2002	2/22/2003	3/1/2005	7/24/2009
TETRACHLOROETHENE	ND	NS	NS	ND
TRICHLOROETHENE	ND	NS	NS	ND
CIS-1,2-DICHLOROETHENE	ND	NS	NS	ND
TRANS-1,2-DICHLOROETHENE	ND	NS	NS	ND
VINYL CHLORIDE	ND	NS	NS	ND
1,1,2,2-TETRACHLOROETHANE	ND	NS	NS	ND

TMW-2D	8/8/2002	2/22/2003	3/1/2005	7/23/2009
TETRACHLOROETHENE	ND	NS	ND	ND
TRICHLOROETHENE	ND	NS	0.9	ND
CIS-1,2-DICHLOROETHENE	ND	NS	0.2	ND
TRANS-1,2-DICHLOROETHENE	ND	NS	ND	ND
VINYL CHLORIDE	ND	NS	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	NS	ND	ND

TMW-11S	8/9/2002	2/22/2003	3/1/2005	7/23/2009
TETRACHLOROETHENE	NS	NS	ND	ND
TRICHLOROETHENE	NS	NS	ND	ND
CIS-1,2-DICHLOROETHENE	NS	NS	ND	ND
TRANS-1,2-DICHLOROETHENE	NS	NS	ND	ND
VINYL CHLORIDE	NS	NS	ND	ND
1,1,2,2-TETRACHLOROETHANE	NS	NS	ND	ND

TMW-8D	8/8/2002	2/22/2003	3/1/2005	7/24/2009
TETRACHLOROETHENE	ND	NS	NS	ND
TRICHLOROETHENE	ND	NS	NS	ND
CIS-1,2-DICHLOROETHENE	ND	NS	NS	ND
TRANS-1,2-DICHLOROETHENE	ND	NS	NS	ND
VINYL CHLORIDE	ND	NS	NS	ND
1,1,2,2-TETRACHLOROETHANE	ND	NS	NS	ND

TMW-5D	8/7/2002	2/22/2003	2/28/2005	7/24/2009
TETRACHLOROETHENE	ND	0.4	0.3	ND
TRICHLOROETHENE	**11.4**	**19**	**20**	**10**
CIS-1,2-DICHLOROETHENE	3.3	3.8	6.9	ND
TRANS-1,2-DICHLOROETHENE	ND	ND	0.2	ND
VINYL CHLORIDE	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND

TMW-4S	8/9/2002	2/22/2003	3/1/2005	7/23/2009
TETRACHLOROETHENE	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND
TRANS-1,2-DICHLOROETHENE	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND

TMW-4D	8/9/2002	2/22/2003	2/28/2005	7/23/2009
TETRACHLOROETHENE	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND
TRANS-1,2-DICHLOROETHENE	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND

LEGEND

- PROPERTY LINE (APPROX.)
- 70 EXISTING BUILDING AND BUILDING ID
- RAILROAD TRACK
- FENCELINE
- GROUND WATER ELEVATION CONTOUR (FEET) CONTOUR INTERVAL = 0.2 FOOT DASHED WHERE INFERRED
- INTERPRETED GROUND WATER FLOW DIRECTION
- TMW-2D MONITORING WELL LOCATION AND ID
- TMW-3D MONITORING WELL LOCATION AND ID (ABANDONED)

VOCs	WVDEP GW
TETRACHLOROETHENE	5
TRICHLOROETHENE	5
CIS-1,2-DICHLOROETHENE	70
TRANS-1,2-DICHLOROETHENE	100
VINYL CHLORIDE	2
1,1,2,2-TETRACHLOROETHANE	0.055
NOT DETECTED	ND
NOT SAMPLED	NS

NOTES:

1. ALL CONCENTRATIONS ARE IN ug/L.
2. **BOLDED VALUES EXCEED THE WVDEP 60CSR3 TABLE 60-3B DE MINIMIS VALUES FOR GROUND WATER, EFFECTIVE JULY 2008.**
3. TMW-3D WAS ABANDONED IN FEBRUARY 2003.
4. EPA LOW-FLOW PURGING AND SAMPLING METHOD WAS USED FOR ALL SAMPLING EVENTS.
5. GROUND WATER POTENTIOMETRIC CONTOURS ARE FOR JULY 2009.

SOURCE:

1. "GENERAL PLANT MAP HUNTINGTON WORKS", DRAWING NUMBER 0110-HUN-W1-GEN-001, BY BASF CORPORATION, DATED FEBRUARY, 1996, REVISION 13
2. "HYDROLOGIC INVESTIGATION FOR LANDFILL CLOSURE 25TH STREET LANDFILL PLAN", PLAN NO. 8243, BY SMC MARTIN, INC., DATED JUNE, 1981

0 80 160

SCALE: 1"=80'

TITLE:

FIGURE 14
CHLORINATED VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUND WATER 2002 - 2009

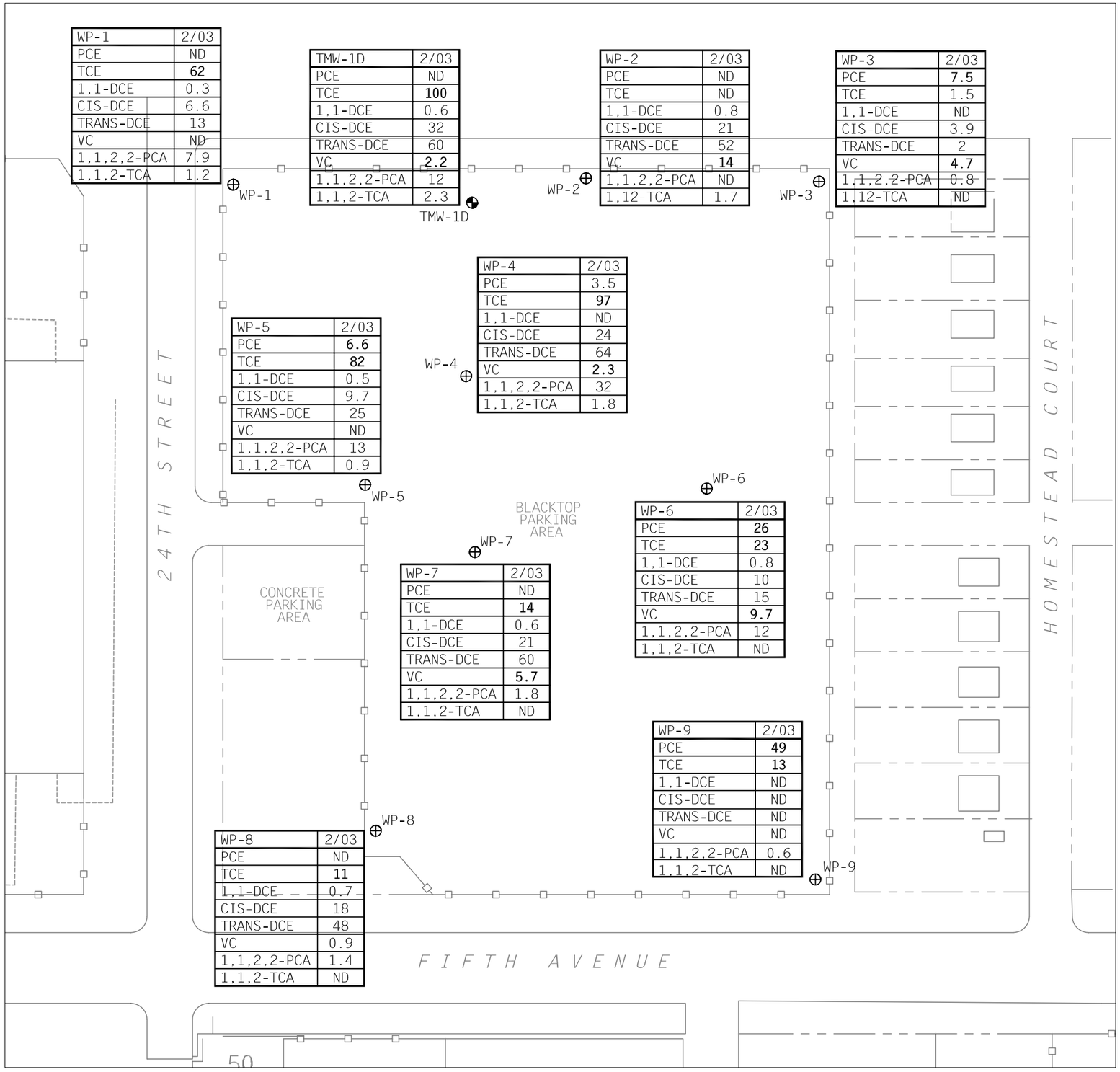
LOCATION:
FORMER BASF HUNTINGTON WORKS
5TH AVENUE AND 24TH STREET
HUNTINGTON, WEST VIRGINIA

DATE: 5/13/10

FILENAME: 99184_GWDATA_2009

LAYOUT: HIST_VOCS

The ELM Group
218 WALL STREET, PRINCETON, NEW JERSEY 08540
4920 YORK ROAD, SUITE 290, HOLICONG, PENNSYLVANIA 18928
612 MAIN STREET, BOONTON, NEW JERSEY 07005
267 BROADWAY, FIFTH FLOOR, NEW YORK, NEW YORK 10007
2475 BAGLYOS CIRCLE, BETHLEHEM, PENNSYLVANIA 18020
www.ExploreELM.com



WP-1	2/03
PCE	ND
TCE	**62**
1,1-DCE	0.3
CIS-DCE	6.6
TRANS-DCE	13
VC	ND
1,1,2,2-PCA	7.9
1,1,2-TCA	1.2

TMW-1D	2/03
PCE	ND
TCE	**100**
1,1-DCE	0.6
CIS-DCE	32
TRANS-DCE	60
VC	**2.2**
1,1,2,2-PCA	12
1,1,2-TCA	2.3

WP-2	2/03
PCE	ND
TCE	ND
1,1-DCE	0.8
CIS-DCE	21
TRANS-DCE	52
VC	**14**
1,1,2,2-PCA	ND
1,12-TCA	1.7

WP-3	2/03
PCE	**7.5**
TCE	1.5
1,1-DCE	ND
CIS-DCE	3.9
TRANS-DCE	2
VC	**4.7**
1,1,2,2-PCA	0.8
1,12-TCA	ND

WP-4	2/03
PCE	3.5
TCE	**97**
1,1-DCE	ND
CIS-DCE	24
TRANS-DCE	64
VC	**2.3**
1,1,2,2-PCA	32
1,1,2-TCA	1.8

WP-5	2/03
PCE	**6.6**
TCE	**82**
1,1-DCE	0.5
CIS-DCE	9.7
TRANS-DCE	25
VC	ND
1,1,2,2-PCA	13
1,1,2-TCA	0.9

WP-6	2/03
PCE	**26**
TCE	**23**
1,1-DCE	0.8
CIS-DCE	10
TRANS-DCE	15
VC	**9.7**
1,1,2,2-PCA	12
1,1,2-TCA	ND

WP-7	2/03
PCE	ND
TCE	**14**
1,1-DCE	0.6
CIS-DCE	21
TRANS-DCE	60
VC	**5.7**
1,1,2,2-PCA	1.8
1,1,2-TCA	ND

WP-9	2/03
PCE	**49**
TCE	**13**
1,1-DCE	ND
CIS-DCE	ND
TRANS-DCE	ND
VC	ND
1,1,2,2-PCA	0.6
1,1,2-TCA	ND

WP-8	2/03
PCE	ND
TCE	**11**
1,1-DCE	0.7
CIS-DCE	18
TRANS-DCE	48
VC	0.9
1,1,2,2-PCA	1.4
1,1,2-TCA	ND

LEGEND

WP-1	TEMPORARY WELLPOINT LOCATION AND ID
TMW-1D	MONITORING WELL LOCATION AND ID
— — —	PROPERTY LINE
—□—	FENCE LINE
NS	NO STANDARD
ND	NOT DETECTED

WP-7	2/03	SAMPLING ID AND SAMPLING DATE
PCE	ND	TETRACHLOROETHENE RESULT IN ug/L (WVDEP=5 ug/L)
TCE	**14**	TRICHLOROETHENE RESULT IN ug/L (WVDEP=5 ug/L)
1,1-DCE	0.6	1,1-DICHLOROETHENE RESULT IN ug/L (WVDEP=7 ug/L)
CIS-DCE	21	CIS-1,2-DICHLOROETHENE RESULT IN ug/L (WVDEP=70 ug/L)
TRANS-DCE	60	TRANS-1,2-DICHLOROETHENE RESULT IN ug/L (WVDEP=100 ug/L)
VC	**5.7**	VINYL CHLORIDE RESULT IN ug/L (WVDEP=2 ug/L)
1,1,2,2-PCA	1.8	1,1,2,2-TETRACHLOROETHANE RESULT IN ug/L (WVDEP=NS)
1,1,2-TCA	ND	1,1,2-TRICHLOROETHANE RESULT IN ug/L (WVDEP=5 ug/L)

NOTES:

1) ALL RESULTS ARE IN ug/L.
2) ONLY DETECTED VOLATILE ORGANIC COMPOUNDS ARE SHOWN.
3) **BOLD RESULTS EXCEED APPLICABLE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION 46CSR12.**
4) CHLOROBENZENE WAS DETECTED AT WP-6 AT 0.6 ug/L (WVDEP = 100).
5) ACETONE WAS DETECTED AT WP-6 AT 15 ug/l (WVDEP = NS).
6) CHLOROFORM WAS DETECTED AT WP-1 (0.4 ug/L), WP-2 (0.2 ug/L), WP-4 (0.5 ug/L), WP-5 (0.4 ug/L), AND WP-6 (1.2 ug/L). (WVDEP = NS).

SOURCE:

"GENERAL PLANT MAP HUNTINGTON WORKS", DRAWING NUMBER 0110-HUN-W1-GEN-001, BY BASF CORPORATION, DATED FEBRUARY, 1996. REVISION 13

0 60 120

SCALE: 1" = 60'

TITLE:

FIGURE 11

GROUND WATER VOLATILE ORGANIC RESULTS FOR THE PARKING LOT AREA AND TMW-1D - FEBRUARY 2003

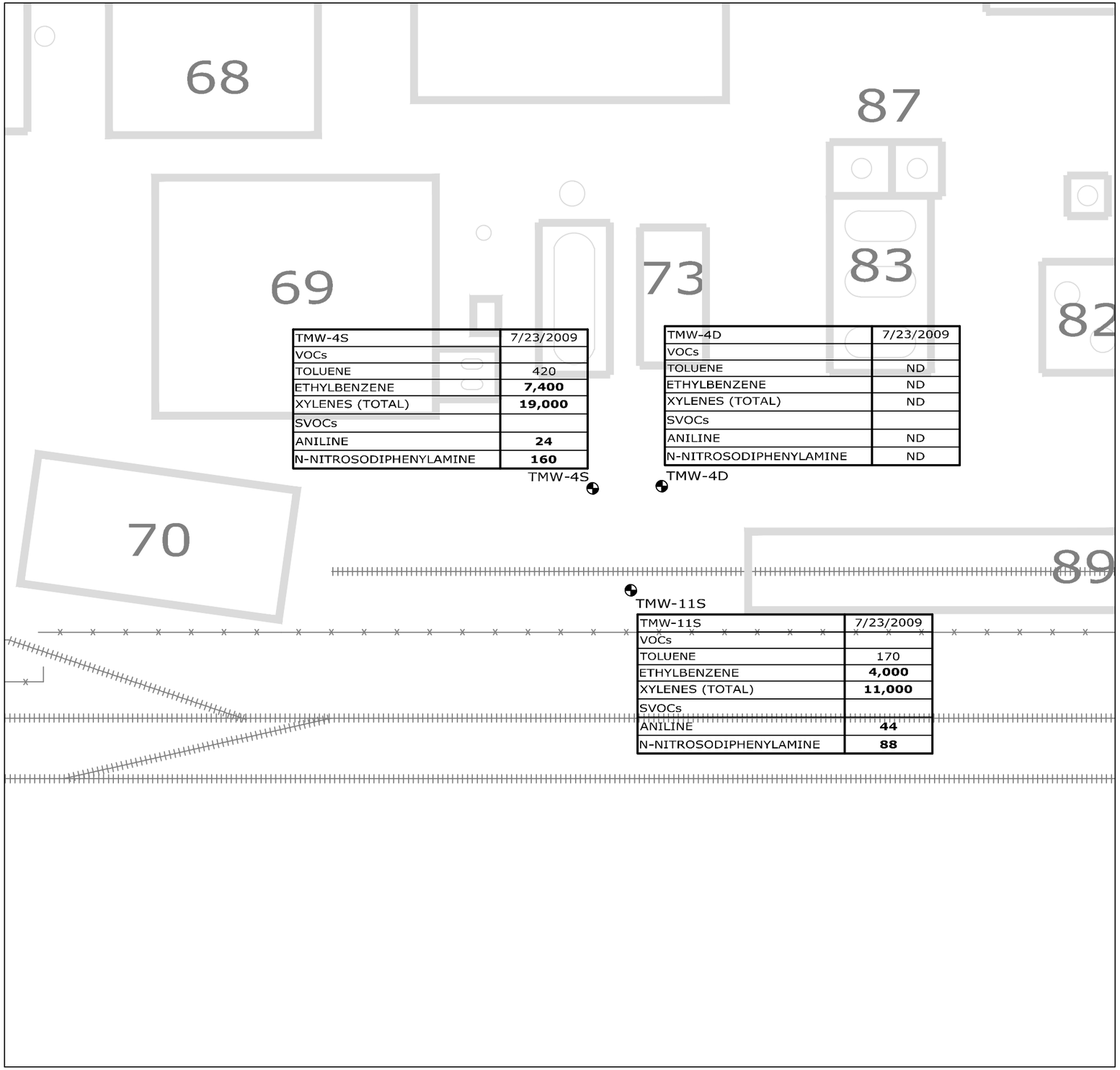
LOCATION: BASF CORPORATION HUNTINGTON, WEST VIRGINIA

DATE: 7/23/03

FILENAME: 99184_DATA

LAYOUT: VOC_DATA

ENVIRONMENTAL LIABILITY MANAGEMENT, INC.
218 Wall Street, Research Park, Princeton, NJ 08540
4920 York Road, Ste. 2CC2, P.O. Box 306, Holicong, PA 18928
612 Main Street, 2nd Floor, Boonton, NJ 07005



TMW-4S	7/23/2009
VOCs	
TOLUENE	420
ETHYLBENZENE	**7,400**
XYLENES (TOTAL)	**19,000**
SVOCs	
ANILINE	**24**
N-NITROSODIPHENYLAMINE	**160**

TMW-4D	7/23/2009
VOCs	
TOLUENE	ND
ETHYLBENZENE	ND
XYLENES (TOTAL)	ND
SVOCs	
ANILINE	ND
N-NITROSODIPHENYLAMINE	ND

TMW-11S	7/23/2009
VOCs	
TOLUENE	170
ETHYLBENZENE	**4,000**
XYLENES (TOTAL)	**11,000**
SVOCs	
ANILINE	**44**
N-NITROSODIPHENYLAMINE	**88**

LEGEND

TMW-4D MONITORING WELL LOCATION AND ID

PROPERTY LINE

FENCELINE

RAILROAD

VOCs	WVDEP GW
TOLUENE	1,000
ETHYLBENZENE	700
XYLENES (TOTAL)	10,000
SVOCs	
ANILINE	12
N-NITROSODIPHENYLAMINE	14

NOT DETECTED ND

NOTES:

1. ALL CONCENTRATIONS ARE IN ug/L.
2. **BOLDED VALUES EXCEED THE WVDEP 60CSR3 TABLE 60-3B DE MINIMIS VALUES FOR GROUND WATER, EFFECTIVE JULY 2008.**

0 30 60

1" = 30'

TITLE:

FIGURE 15

VOLATILE AND SEMI-VOLATILE GROUND WATER RESULTS FOR TMW-4S, TMW-4D AND TMW-11S JULY 2009

LOCATION:
FORMER BASF HUNTINGTON WORKS
5TH AVENUE AND 24TH STREET
HUNTINGTON, WEST VIRGINIA

DATE: 5/13/10

FILENAME: 99184_GWDATA_2009

LAYOUT: 2009_TMW-4S

The ELM Group
218 WALL STREET, PRINCETON, NEW JERSEY 08540
4920 YORK ROAD, SUITE 290, HOLICONG, PENNSYLVANIA 18928
612 MAIN STREET, BOONTON, NEW JERSEY 07005
267 BROADWAY, FIFTH FLOOR, NEW YORK, NEW YORK 10007
2475 BAGLYOS CIRCLE, BETHLEHEM, PENNSYLVANIA 18020
www.ExploreELM.com

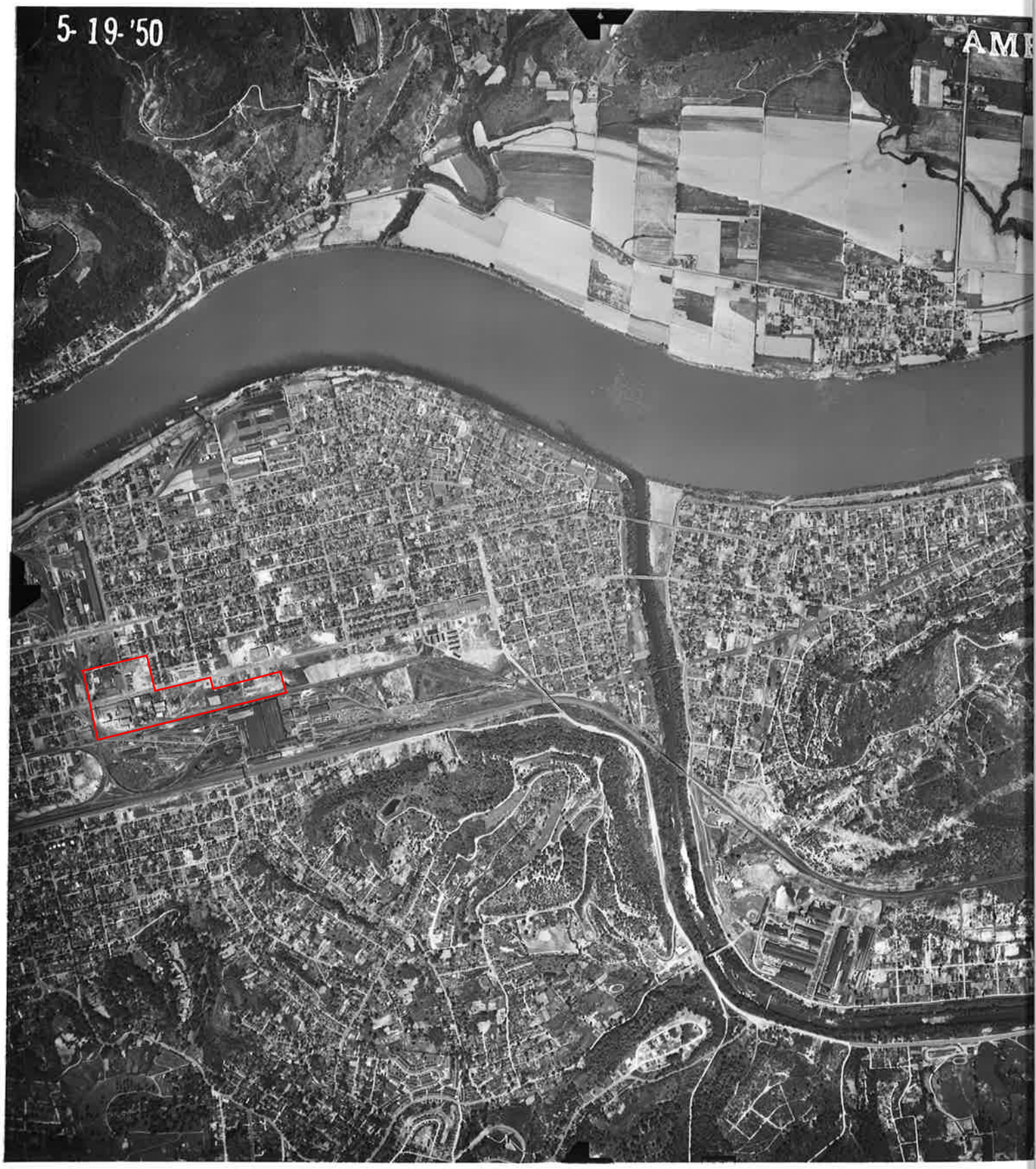
ATTACHMENT 2

Aerial Photographs – 1938, 1950, 1957, 1959, 1966, 1969, 1974, 1980, 1983, and 1988

4 - 38
AMB-46-26

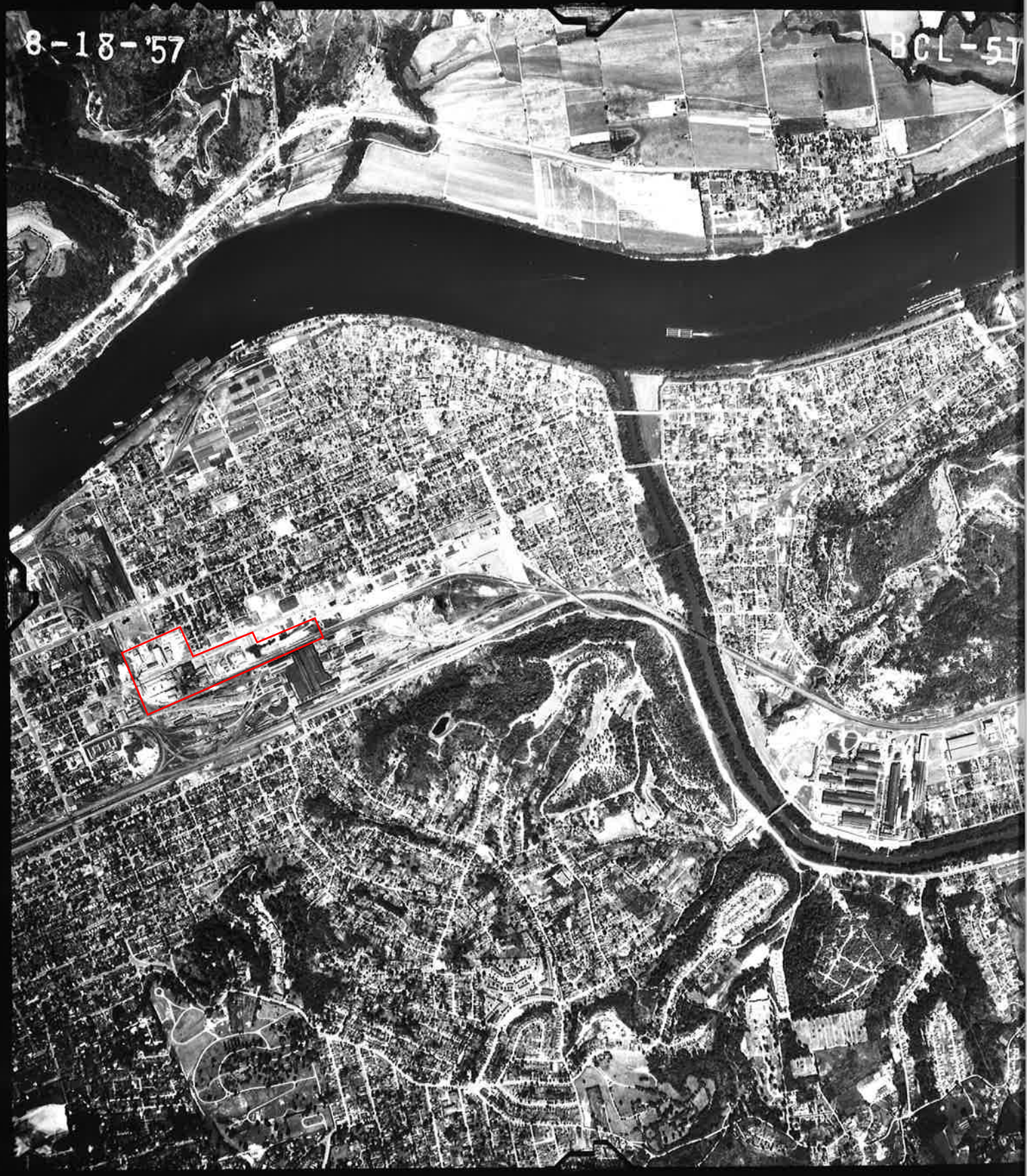
NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=1667'
DATE 9.4.38
SN# 228F 00-0145A


5-19-'50
AM

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=1667'
DATE 5-19-50
SN# 228F 00-0145A


8-18-'57
BCL-5T

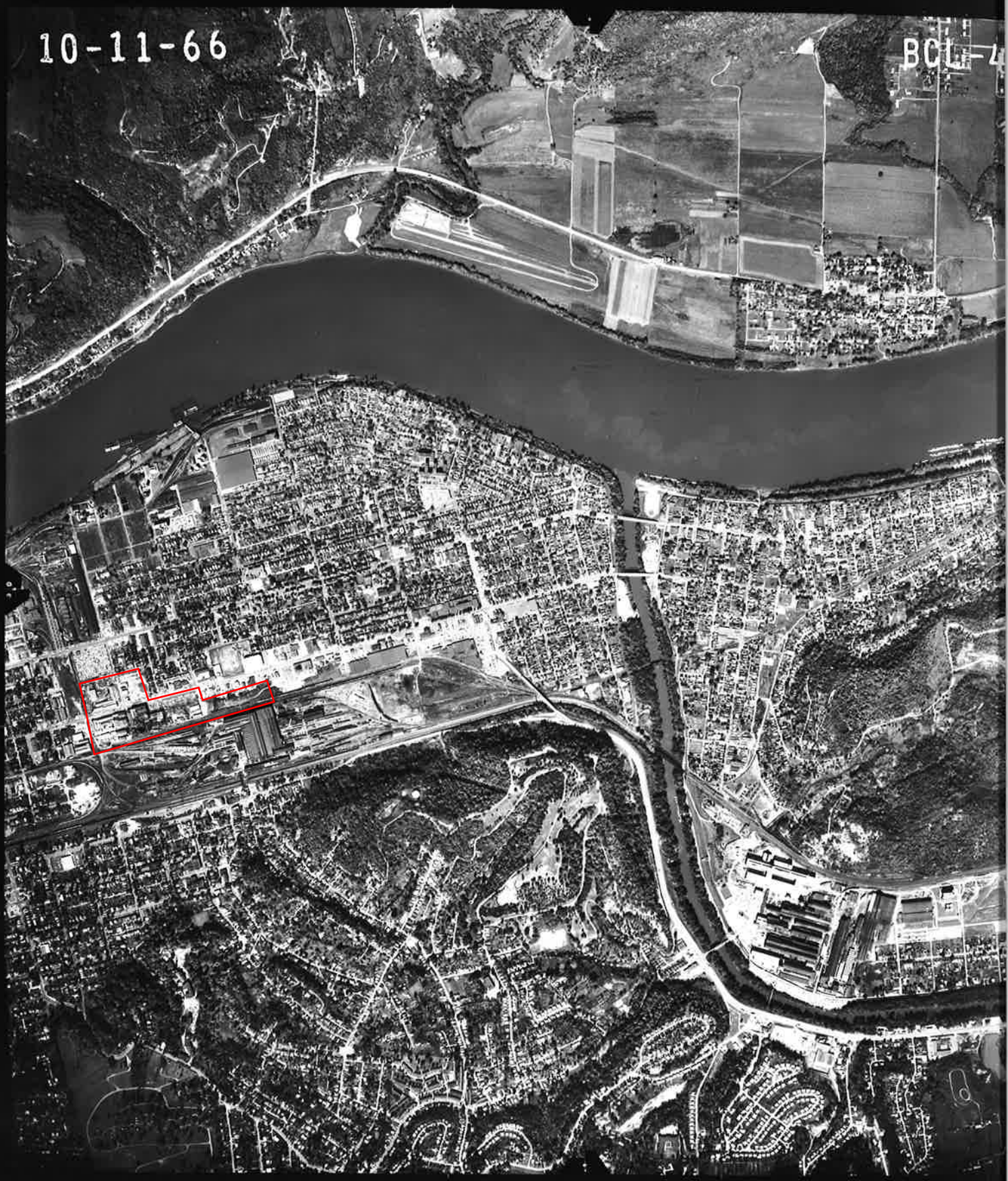
NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=1667'
DATE 8.18.57
SN# 33F CO-0145B

10-12-59
AMB - 6

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=1667'
DATE 10·12·59
SN# 313F CO·0145B


10-11-66
BCL-4

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=1667'
DATE 10.11.06
SN# 313F 00.0145B

757623
9-29-69
AMB-5JJ- 17

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1" = 1207'
DATE 9.29.69
SN# 313F 00.0145B

10-17-74
A 40
39087 174 - 287

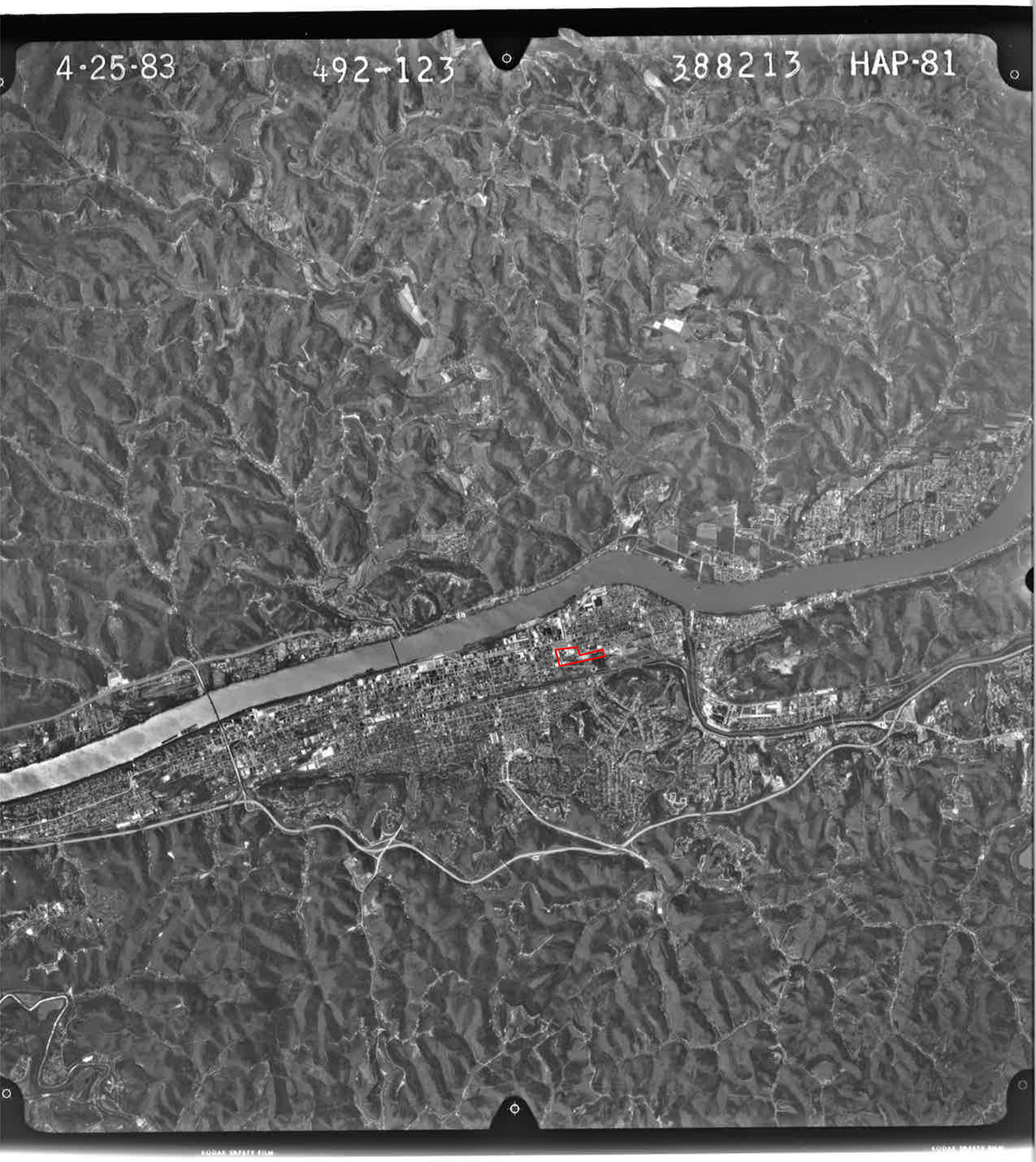
NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1" = 3300'
DATE 10·17·74
SN# 313F 00·0145B

10-31-80
USDA
40 54011 179
8741

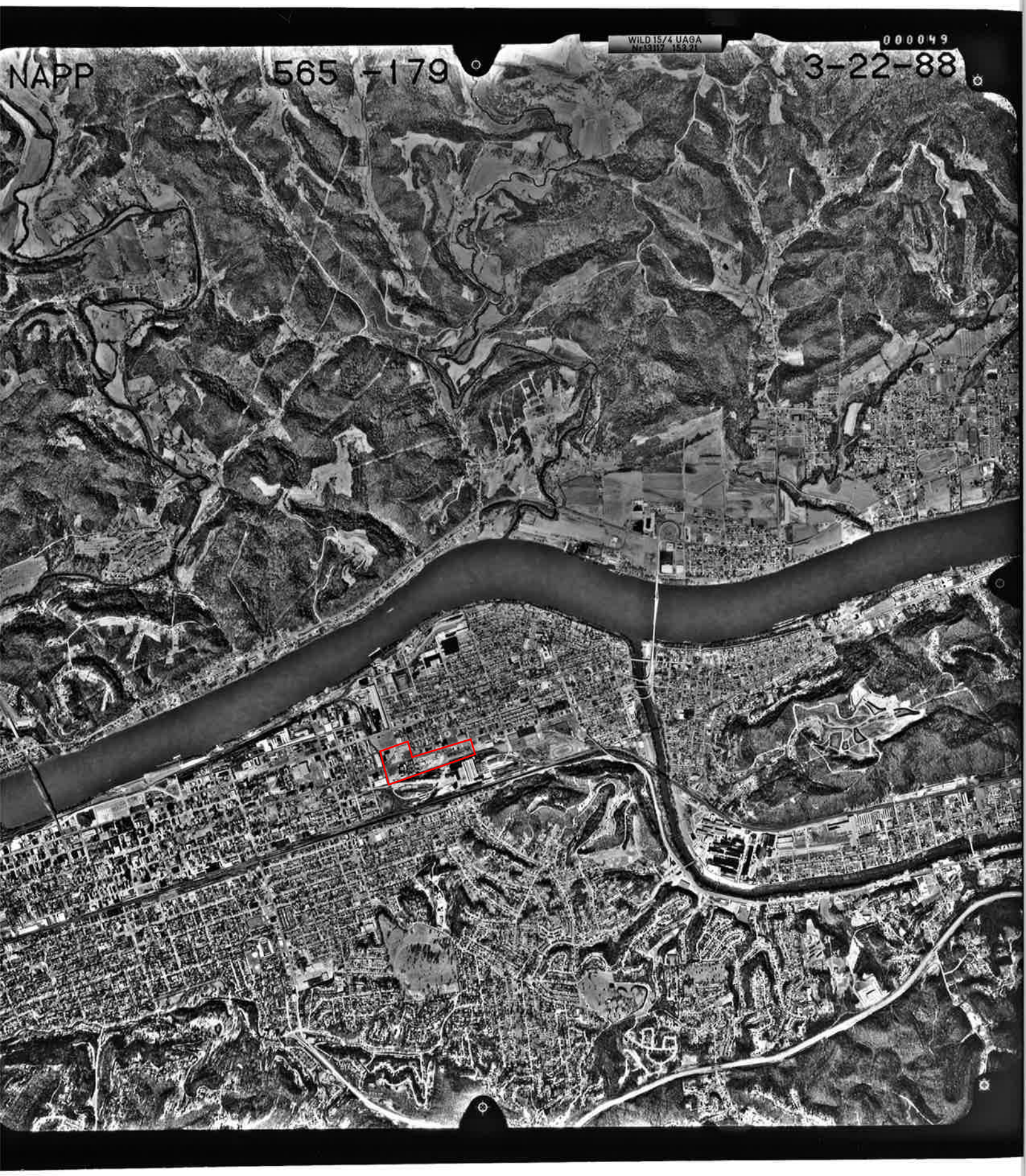
NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE
SCALE 1"=3300'
DATE 10·31·80
SN# 33F CO·0145B


4-25-83
492-123
388213
HAP-81

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE Huntington
SCALE 1"=6700'
DATE 4-25-83
SN# 122F 00-0145A


NAPP
565 -179
3-22-88
000049
WILD 15/4 UAGA

NATIONAL AERIAL RESOURCES
Rensselaer Technology Park
385 Jordan Road
Troy, NY 12180 1-800-827-2994

STATE WV
COUNTY Cabell
TOWN(SHIP) OF Huntington
USGS QUADRANGLE Huntington
SCALE 1"=3300'
DATE 3-22-88
SN# 122F 00-0145A